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Length-weight relationship and Condition factor of Five Fish Species from Kafin Gana Reservoir in Birnin Kudu, Jigawa, Nigeria

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Abstract
Study on length-weight relationship and condition factor of five fish species i.e. Bagrus bayad, Schilbe mystus,Oreochromis niloticus, Petrocephalus bovie and Sarotherodon galilaeus from Kafin Gana reservoir in Birnin Kudu, Jigawa was conducted from March to July, Two hundred and fifty (250) fish samples were collected by artisanal fishermen using various fishing gears, the fish samples were preserved in formalin and taken to laboratory of Department of fisheries and Aquaculture, Faculty of Agriculture, Federal University Duste for identification and measurement of length and weight. Growth coefficient b of the length-weight relationship ranged from 1.3 to 3.3, B. bayad, and S. mystus, showed negative allometric growth pattern while P. bovie and S. galilaeus had positive allometric growth and O. niloticus had isometric growth pattern. The maximum condition factor (K) of 2.3 was recorded during the study period from S. mystus. Effective management actions to control high accumulation of sand, silt and other sediments especially during raining season in the water body was highly recommended.

Keywords: *Length-weight relationship, Condition factor, Kafin Gana reservior,*

Introduction
Fishes are highly important in the development of Nigeria both economically and healthwise as source of protein with low cholesterol level in the diets of many populace as well as an intermediate host to some parasites. The increasing production is not able to meet the increasing rate of consumption because of the wide gap between fish demand and supply, which is on the rise as a result of population explosion in the country in the recent years (Falaye and Jenyo-Oni, 2009).

Knowledge of some quantitative aspects such as length-weight and condition factor (K) or ponderal index of fishes is an important tool for the study of fish biology. The condition factor in fish serves as an indicator of physiological state of the fish in relation to its welfare (Le Cren, 1951). K also provides information when comparing two populations living in certain feeding density, climate and other conditions (Weatherly and Gills1987). Thus, condition factor is important in understanding the life cycle of fish species and it contributes to adequate management of these species, hence, maintaining the equilibrium in the ecosystem. Length and weight measurements in conjunction with age data have been found to give information on the stock composition, age maturity lifespan mortality, growth and production in the relationships between the length and the weight are related with

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metabolism in each species and the environment where they live. (Claro and Gracia-Arteaga 1994; Fafioye 2005).
When fishes are kept in lentic water, their feeding capacity tends to be negatively affected, more especially polluted water. Dams and/or reservoirs have downstream effects on riverine environments and subsequently block nutrient flow along the strata of the ecosystem, thus, telling on fisheries production in downstream reservoirs and river channels. Such patterns reflected dams acting as nutrient traps.

Growth of fish is subject to natural environmental changes particularly climate. However, some problems are caused by human activities including fishing where more fish are taken than are replaced by birth and subsequent new fish recruitment and growth.

In Nigeria over 80% of reservoirs or dams that are in existence in the country are located in the northern region which produced up to 410, 000 metric tons of fish annually.
This study aimed at length-weight relationship and condition factor analysis of five fish species (i.e.*B. bayad, S. mystus, O. niloticus*, *P. bovie* and *S. galilaeus*) from Kafin gana reservoirs in Birnin kudu, Jigawa, Nigeria.

Materials and Methods

Study Area

Kafin Gana Reservoir is located at kafin Gana town Birnin kudu local government area of Jigawa state. Kafin Gana is located between Birnin kudu and Dutse local government at a latitudes 11º 30ºN and 9º 21ºE. It is in Sudan savannah as ecological zone of Nigeria. The dam was established primarily for irrigation purposes. It has a surface area of 121ha while fishing and irrigation are the only secondary activities.

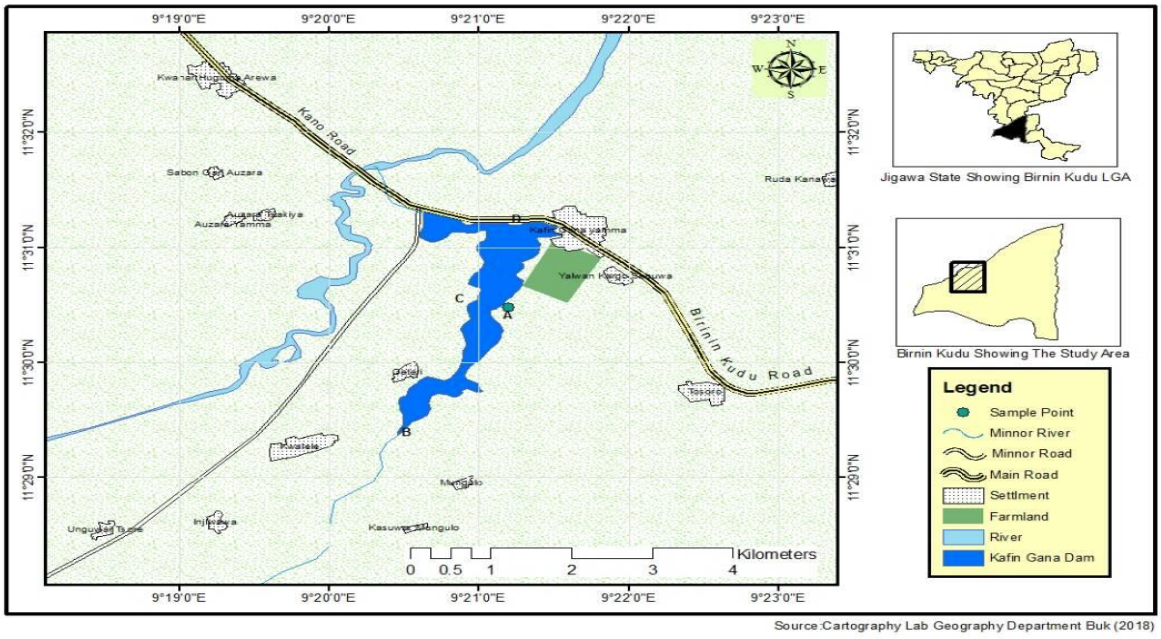

Figure 1: The map showing the Kafin gana Reservoir in B/Kudu Local Government Area, Jigawa State.

Collection of Fish Samples

Two hundred and fifty fish samples were collected by artisanal fishermen, using various fleet of gill net made up of six (6) mesh sizes: 1inch,2inch,21/2inch,3inch,31/2, and 4inch. The nets were set at approximately 2 hours before sunset and lifted two hours after sunrise.

Two hundred and fifty (250) samples were collected within the study period from March to July, 2018.

Fish identification

The sampled fish were identified in the laboratory of Fisheries and Aquaculture Department, Federal University, Dutse up to the specie level with the aid of standard reference texts of Olasebikan and Raji (2013).Confirmation of the identified species was performed by fisheries experts in the department.

Total Length (TL) and Weight Measurements

Fish total length (cm) was measured using measuring board as described by Lagler (1970), while weight was measured using OKI weighing balance with sensitivity of 0.1g after identification of the sampled species.

Length-Weight Relationship and Condition Factor

Estimation of species length-weight relationship was done using the formula $W=aLb$ (Ricker,1978), which is transformed into natural logarithmic form $lnW=ln\ a+b\ (lnL)$. While condition factor (K) was computed using the
formula: $K=100W/L3$ (Pauly,1983).
Where: W=weight of fish; L=total fish length.

Statistical Analysis

Length-weight data obtained were tested statistically for significance within species and between species using one-way analysis of variance (ANOVA)followed by post hock multiple comparison (Tukey) were calculated to compare the mean values of the parameters based on the species. Differences in mean values obtained were considered significant if calculated P- values were <0.05. Correlation analysis was done to test the association between length and weight.

Results

A total of 250 specimens belonging to 5 species (4 families) were analysed during the study. Which composed of fifty each of *O. Niloticus* and *S. galilaeus* which are in the family of Cichlidae; fifty species of *S. mystus* which is in the family Schilbeidae; fifty species of *P. bovie* which is in the family Mormyridae and fifty species of *B. bayad* which is in the family Bagrdae as presented in Table 1.

Table 1: Length and weight of five species of fishes sampled from Kafin Gana Reservoir.

Family	Species	N*	Length (cm) Min – max	Mean ±SD	Weight (g) Min – max	Mean ±SD
Cichlidae						
	O. niloticus	50	8.1 – 18.2	12.74±2.49^{a}	10 – 143	42.66±28.19^{a}
	S. galilaeus	50	10.7 – 13.5	11.70±0.28^{a}	20 – 50	30.00±2.83^{b}
Schilbedeidae	*S.mystus*	50	9.0 – 18.7	12.18±2.73^{a}	6 – 39	16.13±9.57^{c}
Mormyridae	*P. bovie*	50	8.5 – 11.2	9.54±0.73^{a}	6 – 12	8.44±1.82^{c}
Bagrdae	*B. bayad*	50	22.4 -50.1	32.26±49.70^{b}	67 – 162	109.25±35.77^{d}

Values in the same column and with the same superscript are not significantly different (P>0.05)
*N=number of fish sampled. P - value < 0.0001

The results of Length-weight relationship and Condition factor K of selected species from Kafin Gana Reservoir during the period of study indicated that the b value range 1.3 – 3.3 showing the various growth pattern and the K value range 2 – 2.3 as shown in (Table 2).

Table 2: Length-weight relationships and condition factors of five fish species sampled From Kafin Gana Reservoir.

Species	K	b	r^2	Type of growth
O. niloticus	2	3	0.799	Isometric
S. galilaeus	2	3.3	0.601	+allometry
S. mystus	2.3	2.4	0.038	- allometry
P. bovie	2	3.3	0.771	+allometry
B. bayad	2.2	1.3	0.023	- allometry

K= condition factor; b = growth coefficient and r^2= Coefficient of determination

The result of mean water quality parameters are shown in Table 3. Temperature ranges between 28.25±0.5- 28.5±0.58; pH ranges between 6.95±0.1- 6.97±0.05; DO ranges between 5.75±0.5–6.25±0.5 and the mean turbidityin all the sampling stations is 24.5±1.73. These are within the range recommended for Aquaculture except turbidity. Statistically no significant differences of these parameters between the sampling stations (P – value >0.05).

Table 3: Some water quality parameters of the Reservoir.

Stations	Temperature OC Mean ± SD	pH Mean ± SD	DO Mean ± SD	Turbidity Mean ± SD
A	28.25±0.5	6.97±0.05	6.25±0.5	24.5±1.73
B	28.25±0.5	6.97±0.05	6.25±0.5	24.5±1.73
C	28.5±0.58	6.95±0.1	5.75±0.5	24.5±1.73
D	28.25±0.5	6.97±0.05	5.75±0.5	24.5±1.73

P – value >0.05

Discussion

Management of any fishery requires considerable knowledge of population parameters such as length-weight relationship. This is very important in fish biology because it allow estimation of average weight of the fish of a given length group (Beyer, 1987), assess the well-being of individuals and to determine possible differences between separate unit stocks of the same species (King, 2007). The relationship is also important in fisheries management for comparative growth studies. (Moutopoulos and Stergious, 2002).

The result of the present study showed that the growth of the species in the Reservoir was allometric except in *O. niloticus* with isometric growth (b=3). This mean that the fishes do not grow symmetrically (Tresh, 1968) or the fish becomes thinner with increase in length (King, 1996).This is similar to b values obtained from studies of Haruna (2006) and Bala *et al* (2009), 2.79 for *Tilapia guineensis* and 2.81 for *C. gariepinus* showed that the rate of increase in body length is not Proportional to the rate of increase in body weight, these are negative allometric growth when compared with the mean exponent b = 3 for isometric growth. Ibrahim *et al*. (2009) observed allometric growth pattern in Kontagora Reservoir while Ude *et al*. (2011) made similar findings in an evaluation of length-weight relationship of fish species of Ebonyi River.

Condition factor is a useful index for monitoring of feeding intensity, age and growth rates in fish (Ndimele, *et al*., 2010). It is strongly influence by both biotic and abiotic

environmental conditions and can be used as an index to assess the status of the aquatic ecosystem in which fish live (Anene, 2005). The condition factor in the present study was similar to what was obtained in other tropical water bodies. The condition factor (k) values obtained in this study were generally low and lesser than the documented values by Bagenel (2.9 to 4.8) and Tesh (1978) for mature freshwater fish. The low condition factor value k obtained for the fish population showed that the population was not in good condition, an indication of the unhealthy status of the population with less tissue energy reserves, depressed reproductive potential and low survival, also an indication of the inability of the study area to sustain the population. The difference in the fish species in body weights may be due to individual condition factor as it relates to the wellbeing and degrees of fatness (Pauly, 1993).

The overall growth parameter, r^2 values of the length weight relationship of the fish species ranges from 0.023for *B. bayad* to 0.799for *O. niloticus*, these values indicate negative and positive correlation between the length and weight. *B. bayad* (0.023) and *S. mystus*(0.038) indicated negative correlation between the length and weight. *O. niloticus*(0.799*), S. galilaeus* (0.601) and *P. bovie* (0.771) indicated positive correlation between the length and weight with r^2>0.60 between and body weight measurements. The LWR parameters maybe affected by age maturity and sex (Duleic *et al,* 1996) feeding and reproduction and fishing activities (Bayham *et al*, 2008).

The water quality parameters analysed are within the range recommended for aquaculture except the turbidity with mean of 24.5 cm. Dupree and Hunner (1993); Martinez-Placious *et al.,* 1993 suggested temperature range of 20^{o}C to 30^{o}C for fish, while the lethal levels are far less than 2^{o}C and higher than 42^{o}C for tropical fishes but cold water fishes can survive a temperature range of 5^{o}C-15^{o}C.). It is recommended that fish in the tropics be kept in water whose temperature range is between 25^{o}C and 30^{o}C (Auta, 1993). Dissolved Oxygen the ideal range of dissolved oxygen in water which must be at least 5mg/l is required to sustain fish and other aquatic life (Kutty, 1968). The hydrogen ion concentration pH freshwater with a pH of 6.5-9.0 is known to be productive and recommended as suitable for fish culture Auta, (1993). Adekole *et al.,*(2008) reported that turbidity reading of 30 – 60 cm is obtain, when clay particles remain suspended for long time, they interfere with light penetration, and hamper photosynthetic activities which reduce the level of dissolved oxygen in the water. Silt and clay particles are well known in clogging the gills of fish their by interfering with respiratory activities.

Conclusion

The result obtained in this study showed negative allometric growth among *B. bayad* and *S. mystus*. *S. galilaeus* and *P. bovie* showed positive allometric growth. But *O. niloticus* showed isometric growth. This study shows that the condition factor value K obtained (2.0-2.3) for the fish population was lower to the ideal range 2.9-4.8 for normal growth in fresh water fish which is an indication of the unhealthy status of the population. All the water quality parameters are within the range recommended for aquaculture except the turbidity with mean of 24.5 cm.

The following recommendations can be made:

a) The condition factor of the fishes in the water body indicated unhealthy status of the population, effective management action should be taken to ensure the wellbeing of the fishes in the water body.

b) Appropriate measures should be put to control the high accumulation of sand, silt and other sediments especially during the raining season.

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