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Length-weight relationships and growth pattern of some selected fish species in Kubanni reservoir, Kadauna state Nigeria

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Abstract
This study was carried out to determine the length-weight relationship and growth pattern of some selected fish species in Kubani Reservoir Kaduna State Nigeria: (*Oreochromis niloticus* (Linnaeus, 1758), *Clarias gariepinus* (Burchell, 1822), *Pollimyrus petricolus* (Daget, 1954), *Schibe mystus* (Linne, 1766) and *Lates niloticus* (Linnaeus, 1758) Kubanni Reservoir. A total of 439 freshly caught fish species were collected between (July and October 2018). Data on length and weight were subjected to ANOVA to determine statistical significance ($P<0.05$). The results revealed that *Oreochromis niloticus* had the highest number of fish species sampled from Kubanni Reservoir with the weight ranging from 4.70 to 173.60 (g); total length ranging from 6.50 to 21.50cm; *Clarias gariepinus* weight ranging from 2.90 to 414.70g; total length ranging from 7.40 to 38.80cm; *Pollimyrus petricolus* weight ranges from 2.80 to39.10g; total length from 6.30 to 20.20 cm; *Schibe mystus* weight ranging from 5.30 to 225.0g; total length 8.20 to 30.3cm; *Lates niloticus* weight ranges 17 to 310.0g; total length ranges between 12.3 and 29.5cm. The growth coefficient (b) obtained from the five species in Kubani reservoir for (*Oreochromis niloticus* (Linnaeus, 1758), *Clarias gariepinus* (Burchell, 1822), *Pollimyrus petricolus* (Daget, 1954), *Schibe mystus* (Linne, 1766) and *Lates niloticus* (Linnaeus, 1758) was 0.3283, 0.3364, 0.3205, 0.3191, and 0.3028, respectively. The b value across the species in both location differs significantly from 3 ($P<0.05$) indicating negative allometric growth for all the fish species. Therefore, there is strong positive correlation Length-Weight Relationship across the five major species in the location and growth pattern of the selected fish species showed negative allometric value in the location indicating the growth coefficient is ($b < 3$).

Keywords: Growth, length, kubani, relationship, reservoir, ans weight

Introduction
Fish are aquatic organisms which consist of gill bearing cranium but lack limbs with digits and are cold-blooded animals [1]. Fish are obtained from the natural stock (i.e. wild) or pond which could be earthen or concrete [2]. Fish play an important role in the development of a nation. Apart from being one of the cheapest sources of highly nutrient protein, they also contain other essential nutrients required by the body [3]. Fish contribute proteins in human diets mainly the role of building and replacement of cells or tissues. Fishes are also excellent source of Sulphur-amino acids the mineral content of fish is richer in iodine than in other food. Fish oil is use for lowering blood cholesterol [4].

Biology of fish information contains necessary data for assessing fish species population structure to estimate the biomass from the length-weight frequency distribution and to convert-at-age by weight-at-age [5]. The relationship can be used as measuring the average weight of a given age group and in estimating the health status of the fish population especially in fisheries management [6]. Knowledge on fish biology is very important for evaluating the commercial potentialities of the fish stock, life history, culture practice and management of its fisheries. Length - weight relationship (LWR) is a very important fishery management tool for estimating overfishing, exploitation, and biodiversity of water body. It is also used in assessing the relative wellbeing of a fish population [7].

In fishes, LWR provide valuable information on the habitat where the fish lives, it can also provide important clues on climatic and environmental changes and the change in human subsistence practice. Condition factor can reflect their variations and provides information on the physiological state of the fish in its welfare [6].

However, the robustness of the individual fish may vary because of variation in food supply. Length and weight data are useful as standard result of fish sampling programs. These data are needed to estimate growth rates, length and age structures [8]. It is discovered that both animal and plant species are subdivided into morphologically and genetically distinct groups, which can be grouped as races or subspecies such that the groups are believed to have adapted to different ecological conditions through different selection regimes acting on geographically separated population [9]. The aim of the study was carried out to determine the length-weight relationship and growth pattern of some selected fish species in Kubani Reservoir Kaduna State Nigeria.

Materials and Methods

Study area

The study was carried out at Kubanni resevoir located between latitudes 11º 41 25 11N and 11º 101 4611 N and longitudes 7º 361 55 11E and 7º 44 11 12 11E, has an area of about 105 km2 [2]. The Reservoir has the following characteristics. It covers 18.8 hectares of land. Dam catchment area = 3200 Km2. Gross storage capacity = 16.0 x 106 m3. Maximum Dam height = 14.9m. Length of the Dam Crest = 640m. Length of the Lake = 32Km –35 Km at maximum flood water level. Water Supply Capacity = 872 million liters [10].

Collection and identification of fish specimens

Fish were collected twice a week for a period of four months (July-October 2018) from the fishermen at Kubanni Reservoir in the cool of the day around 9am -11am. A total of 434 specimens were collected during the period of study. Variation in number of samples is according to the fish species availability during the period of study. The fish were conveyed in a plastic container to the Hydrobiology and Fisheries Laboratory, Department of Biology Ahmadu Bello University. Fish samples collected were identified using text by Olaosebikan and Raji [11].

Morphometric measurement

Three (3) morphological measurements were made on each of the selected fish species: *Oreochromis niloticus, Clarias gariepinus, Pollimyrus petricolus, Schibe mystus* and *Lates niloticus*. Total Length (TL) of the fish was measure from the tip of the snout to the end of the caudal fin. Standard Length (SL) was taken from the tip of the snout to the end of the caudal peduncle. Both length measurements were done with measuring board and recorded in (cm). The fish were also weighed to the nearest gram. Body weight was taken using electronic weighting balance Sartorius AG Gottingen CP8201 model.

Length-weight relationships

Data generated from body weight and weight measurement was used to determine growth pattern of fish species. The total length (TL) was related with body weight of the fish using the equation:

$W = aL^b$ in logarithmic form: $\text{Log } W = \text{Log } a + b \text{ Log } L$

Where: $W = a L^b$
W = Weight in gram (g)
L = length in (cm)
a= a constant being the initial growth index
b = growth coefficient. Constant 'a' represents the point at which the regression line intercepts the y-axis and 'b' the slope of the regression line [12].

Condition factor (K)

Condition Factor was computed according to Bagenal and Tesch [13].

$$K = \frac{100w}{L3} \times 100$$

Where
W = weight of fry in g,
L = length of fry in cm

Data analysis

Data collected on the body weight (g) and total length (cm) for relationships between body weight and total length were subjected to Analysis of Variance (ANOVA) determined the correlation and regression was used to estimate the values of the intercept (a) and slope (b) for weight and length relationship. Variation observed in the monthly mean values on weight (g), and total length (cm), slope (b) and condition factor (CF) for each species was tested to determine significant difference ($P<0.05$) level.

Results

The Result Length Weight Relationship parameters for the fish species from Kubanni reservoir is presented in Table 1. Result shows the total number sampled is n= 41 specimen, *Oreochromis niloticus* had the highest number of fish species sampled with the weight ranging from 60.00 to1150 (g) with the mean value 426.43±74.50 and total length ranging from 16.00 to 43.00 cm with its the mean value of 31.21±2.12. The estimated (a) intercept of regression was 0.3473 of *Oreochromis niloticus* with the allometry coefficient of (b) value of 0.5965 which indicate that the fish species had negative allometric growth. The growth coefficient of (b) did not differ significantly ($P>0.05$). The correlation coefficient (r) for *Oreochromis niloticus* was 0.7464 indicating strong positive correlation while *Clarias gariepinus* weight ranging from 25.00 to750 (g) with the mean value 260.29±95.82 and total length ranging from 19.00 to 52.52 cm with its the mean value of 28.80±4.06 The estimated (a) intercept of regression is 0.9428 of *Clarias gariepinus* with the allometry coefficient of (b) value of 0.2310 which indicate that the fish species had negative allometric growth. The growth coefficient of (b) did not differ significantly ($P>0.05$). The correlation coffiecient (r) for *Clarias gariepinus* was 0.7903 indicating strong positive correlation. *Pollimyrus petricolus* weight ranging from 6.10 to 30.10 (g) with the mean value 12.56±3.05 and total length ranging from 7.0 to 11.40 cm with its the mean value of 9.20±0.49. The estimated (a) intercept of regression is 0.7030 of *Pollimyrus petricolus*. With the allometry coefficient of (b) value of 0.2467 which indicate that the fish species had negative allometric growth. The growth coefficient of (b) did not differ significantly ($p< 0.05$). The correlation coefficient (r) of *Pollimyrus petricolus* is 0.8365 indicating strong positive correlation. *Schilbe mystus* weight ranging from 21.70 to 55.60 (g) with the mean value 43.47±10.91 and total length ranging from 14.40 to16.80 (cm) with its the mean value of 15.67±0.70 The estimated (a) intercept of regression is 0.9750 of. *Schilbe mystus* with the allometry coefficient of (b) value of 0.1368 which indicate

that the fish species had negative allometric growth. The growth coefficient of (b) did not differ significantly (P>0.05). The correlation coefficient (r) of *Schilbe mystus* was 0.8738 indicating strong positive correlation. *Lates niloticus*, weight ranging from 50.00 to 4300 (g) with the mean value 840±382.32 and total length ranging from 17 to71 (cm) with its the mean value of 35.42±4.75 The estimated (a) intercept of regression was 0.6831 of *Lates niloticus*. with the allometry coefficient of (b) value of 0.3203 which indicate that the fish species had negative allometric growth. The growth coefficient of b did not differ significantly (P>0.05) with the Standard error of 0.16. The correlation coefficient (r) of *Lates niloticus* is 0.9491 indicating strong positive correlation.

Table 1: Length –Weight Relationships for species of fish from Kubbani Reservoir

Species	N	Min	Max	Mean±SD	Min	Max	Mean±SD	a	b	SE(b)	r
Oreochro mis niloticus	13	60.00	1150	426.43±74.5	16.00	43.00	31.21±2.12	0.3473	0.5965	0.08	0.7464
Clarias gariepinus	7	25.00	750.0	260.29±95.82	19.00	52.52	28.80±4.06	0.9428	0.2310	0.25	0.7903
Pollimyrus petricolus	7	6.10	30.10	12.56±3.05	07.80	11.40	9.20±0.49	0.7030	0.2467	0.13	0.8365
Schilbe mystus	3	21.70	55.60	43.47±10.91	14.40	16.80	15.67±0.70	0.9750	0.1368	0.05	0.8738
Lates niloticus	11	50.00	4300	840±382.32	17.00	71.00	35.42±4.75	0.6831	0.3203	0.16	0.9491
Total	41										

N=sample size, a, b=regression coefficients, r = correlation

Discussion

The five major fish species in Kubani reservoir and provide information on the species that will aid in management and maintenance of biological equilibrium of the ecosystem. The simple linear regression slope (b) of the fish species Length-Weight from recorded during the period of the study fall within 0.1368 and 0.5965 which contradicts the reports of Egbal *et al.* [14] whose study showed that the b value of fish species from both Atbara River and Khashm el-Girba reservoir in Sudan were within the range of 2.2 and 3.680, however, it was in line with findings of Getso *et al.* [15] who reported 0.1173 and 0.8058. The results of the present study carried out in Kubani reservoir revealed that *Orechromis niloticus* was 0.5965 which agreed with Nyaku *et al*. [16] and Omotayo *et al*. [1], but disagreed with Imam *et al*. [17]; while that of *Clarias gariepinus* 0.2310 and 0.3367 do not conform to the result of Kalu *et al*. [18] who reported 2.3 and 1.3 but was in line with Okomoda *et al*. [19] who reported 0.28; *Pollimyrus petricolus* from this study has b value of 0.2467 and 0.3205, this stands out to be a negative allomertric growth which disagreed Omotayo *et al*. [1]; *M. anguilloides* showed positive allometric growth pattern; *Schilbe mystus* has b value of 0.1368 and 0.3191 conforms to the report of Thomas *et al*. [12] and Uneke [20]; and *Lates niloticus* b- value is 0.3203 and 0.3028 agrees with Abeer *et al.* [21] who reported that the fishes had a negative allometric growth which implies that the fish is becoming tinnier as it increases in weight; hence, the fishes become slender. An isometric length-weight relationship on the other hand implies that the weight of these fishes increases at approximately the same rate as the length [22]. According to Matuoke, [23]; Franco-Lopez *et al*. [24] and Lawson [25], 'b' value in fish can be affected by many factors such as gonad maturity, sex, food availability, health, seasonal variability of the environment, sample size, habitat suitability, growth increment, temperature and salinity of the environment, fishing activities, individual metabolism, age and maturity. The r-value of the five fish species in Kubanni reservoir for *Orechromis niloticus*, *Clarias gariepinus Pollimyrus petricolus Schilbe mystus* and *Lates niloticus* were 0.7464, 0.7903, 0.8365, 0.8738 and 0.9491 respectively, this means that there was a high correlation between the total lengths and weight the fish in the location. This was in conformity with Ikongbeh *et al*. [26]; Azua and Akaahan, [27], this indicated that increases in length with corresponding increase in weight of the fish [28].

Conclusions

In conclusion, the study in Kubanni Reservoir showed strong positive correlation Length-Weight Relationship across the five major species in the location and growth pattern of the selected fish species showed negative allometric value in the location indicating the growth coefficient (b<3).

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