Length-weight relationship and condition factor of 11 commercial fish species of Daberam, Reservoir, Katsina State.

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ABSTRACT

Length-weight relationship and condition factors of some commercially important fish species; *Clarias, gariepinus, Schilbemicropogan, Mormyrusrume, Petrocephalusbovei, Alestes nurse, Protopterusannectins, Latesniloticus, Oerochromisniloticus, Sarotherondongalilaeus, Tilapia guntheri*and *Tilapia zilli* are described. The sample size, minimum and maximum lengths and weights, length-weight relationships, ±95% CI of b, r^2 r are summarized. The meanvalue of *b* co-efficient for the eleven species studied was 2.3954.The results indicated nearly negative allometricrelationship in*S.micropogan,T.zilli and A.nurse*. While *C.gariepinus,O.niloticus,P.bovei,M.rume and L.niloticus*indicated nearly isometric relationship and *P.annectins,T.guntheri* and *S.galilaeus* shows positive allometric growth. The condition factor(k) values indicated fish population ranged from immature to mature ones.

Keywords: Daberam reservoir, fish species, Length-weight relationship, condition factor.
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INTRODUCTION

The length-weight relationship is very important for proper exploitation and management of the population of fish species, because the changes in weight in relation to length are generally not on the basis of specific gravity but due to changes in the form of volume because the density in the organism and that of surrounding water. To obtain the relationship between total length and other body weight are also very much essential for stabilizing the taxonomic characters of the species. Among the freshwater fishes, length-weight relationship of different fishes has been done by many researchers viz*Tilapia mosambica*[1]-, *Puntius stigma*[2], *Alia coila*[3]*Chandanama*and *Chandaranga* ([4], *Botialohacuta*[5].

[6]reported that length-weight relationship of *Brienomyruslongianalis* indicated allometric growth and reflected the gain in weight associated with increase in length of fish. He also reported that the condition factor(K) for both males and female increases with length and suggested that the food foraging ability and conservation of stored food energy in species improved with increasing length.

Condition factors of different population of the same species give some information about food supply, the timing and duration of breeding [7]. The condition factor can also be used in assessing the wellbeing of fish [8]. In a study of some reproductive aspects of C*hrysichthysnigrodigitatus* from Cross River, Nigeria. [9]found that the condition of the population varied from 0.24 to 1.34, with 0.977 as a mean; 52.8% had condition factor higher than the mean and 47% had condition factor above unity and that smaller fishes are more efficient in finding food than the bigger ones.

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[10]observed monthly variation in the condition factor (k) of *Chrysichthysauratus*, which was higher in the wet season than in the dry seasons, and effective utilization of the rich resources of the rainy seasons. They surmised that increase in the means K – values of values of both male and female fishes was attributable to conservation of stored energy, increasing size and weight of maturing gonads. [11] reported a mean b value of 3.0072 for*Clariasgariepinus, Illishaafricana, Chysichthysnigrodigitatus, Chrysichthyswalkeri* and*Ethmalosafimbriata* in Epe lagoon, Lagos; this showed a nearly isometric relationship with 60% of the variation in body weight being accounted for by change in length of the fish.

[12]reported a *b* value of 3.92 for *Bagrusbayad* from the lower Benue which showed that the fish weight increased allometrically. They noted that the condition factor of 1.51 they obtained showed that the fish was in good condition throughout the study period and attributed it to favorable environmental conditions, especially availability of food.

[13]reported that the length-weight relationship of *Protopterusannectens* showed positive correlation (r = 0.85) in both sexes indicating an increase weight as length increased. The regression exponent (b>3) for both sexes showed allometric growth. [14]stated that the isometric value of b = 3 was for an ideal fish that maintained a three dimensional equality. When the b – value is < 3 it has negativeallometric growth [15]. If fish have to maintain their shape as they grow, their *b* – values must be equal to 3.

MATERIALS AND METHODS

The study Area
The research areas were Daberam Reservoir and Biology Department, Umaru Musa Yar'adua University; Katsina. Daberam Reservoir is located on rivers Kigo and Riniyalwhich are seasonal rivers, as its sources of water and River Dan-nakola as its tributary at Daura and Dutsi local government, Katsina state, at latitude 13^02^1N and longitude 8^02^1E.

The reservoir lies in northern sudan savannah zone the climate is characterized by distinct wet and dry seasons with an annual rainfall of 600 – 640mm. The reservoir has a total storage capacity of about 400 hectares of land, but because of siltation, only 200 hectares is fully been utilized. The depth of the reservoir is 42.6meter with a crest length of 2377.44 meters[16].

Water samples and fish were collected at the following sampling stations; station A (HayinDaura) station B (HayinDutsi), and station C (Madawa). (Fig I&2).

Sampling Sites
i.　Station A :HayinDaura is located at the entry of the reservoir on the channel of Kigo River.
ii.　Station B: HayinDutsi is located at the middle of the reservoir where　human activity is minimal except agricultural and irrigational activities.
iii. Station C: Madawa is located at the extreme end of the reservoir and a lot of fishing activities take place there and also there is a presence of fish market .

Fish sampling
A fleet of gill nets made up of nine (9) multifilament nets of the following stretched mesh size of 1", 1 ½" 2", 2 ½", 3", 3 ½", 4", 5", 7", were used with the assistance of the fishermen to sample shore, surface and bottom of the reservoir. Each net measured 30m long and 3m deep. The nets was set at approximately 2 hours before sunset and lifted 2 hours after sunrise. Samples were collected fortnightly from bothexperimental fish sampling nets and artisanal fishermen, for a period of seven months (March 2009 – September, 2009) .

The fish samples collected were transported to the laboratory in an ice-cooled buckets in order to prevent fish spoilage.

Fish identification
The fish samples were identified in the laboratory from genus to species level using dorsal and anal fin counts, gill rakers counts, body shape, size, and shape of caudal fin, anal papillae with the help of a standard texts such as fish and fisheries of Northern Nigeria [17], and 'A field guide to Nigerian freshwater fishes; [18].

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RESULTS AND DISCUSSION

Length – weight relationship and condition factor

After plotting a graph of LnW against Ln L for all the eleven species, the values of *b* was found to be 2.4737, 2.7403, 2.3183, 2.0410, 2.5105, 3.0433, 2.3460, 2.7830, for *Clariasgariepeins, Oreochromisniloticus, Schilbedeamicropogon, Tilapia zilli, Petrocephalusbovei, Protopeterusannectens, Alestes nurse, Mormyrusrume.* The mean value of *b* coefficient for the eleven species studies was 2.3954 (Table 2.).Figure 3-24 shows that some of the species curves were isometric in growth, some are negative allometric while some are positive allometric.

Table 1: Length – weight relationship and condition factor for eleven species of fishes of Daberam reservoir

SPECIES	N	Length (cm) Min – Max	Weight (g) Min – Max	$W = a L^b$ A	b	±95% C I of b	r^2	K	r
Clariasgariepinus	174	3.2 - 56.0	10.0 – 1450	0.2305	2.4737	0.0951	0.7385	0.6931	0.8466
Oreochromisniloticus	153	6.3 - 39.0	08.0 – 1200	0.1187	2.7403	0.2516	0.8614	1.7746	0.9208
Schilbemicropogon	85	6.1 - 23.0	07.0 – 110	0.2457	2.3183	0.2791	0.8259	1.9589	0.9145
Tilapia zilli	132	1.7 - 25.0	03.2 – 700	0.2103	2.0410	0.2950	0.8740	1.8147	0.9399
Petrocephalusbovei	43	3.1 - 21.4	06.2 – 70.0	0.2995	2.5105	0.2649	0.8479	0.9586	0.9208
Protepterusannectens	52	15.6 - 96.8	38.0 – 5500	0.0076	3.0433	0.0001	0.0584	0.3541	0.9250
Alestes nurse	45	4.3 - 13.5	01.8 – 22.0	0.0482	2.3460	0.0186	0.9193	1.2403	0.9792
Mormyrusrume	98	6.8 - 14.6	02.9 – 22.6	0.2549	2.7830	0.0390	0.7194	0.8883	0.8315
Tilapia guntheri	50	9.3 - 37.0	24.0 – 980	0.2703	3.0083	0.1657	0.9581	2.4685	0.9787
Sarotherodongalilaea	44	13.8 - 33.0	40.0 – 732	0.0148	3.0580	0.0007	0.8030	1.8782	0.8931
Latesniloticus	45	19.7 - 42.0	91.0 – 930	0.0318	2.7670	0.0070	0.4768	1.3391	0.9708

n = Sample size, a = regression intercept, b = regression coefficient, r^2 = coefficient of determination, r=correlation coefficient, k = Condition factor, CI = Confidence interval.

The condition factor is an index reflecting interaction between biotic and abiotic factors in the physiological conditions of fishes. The condition factors were found to be 0.6931, 1.7746, 1.9589, 1.8147,0.9586, 0.3541, 1.2403, 0.8883, 2.4685, 1.8782 and 1.3391 for *Clariasgariepinus, Oreochromisniloticus, Schlbedeamicropogon, Tilapia zilli, Petrocephalusbovei, Protepterusannectens, Alestes nurse, Mormyrusrume,Tilapiaguntheri, Sarotherondongalilaeus and Latesniloticus* respectively. The regression co-efficient 'r' was 0.8417, 0.9339, 0.9145, 0.9399, 0.9208, 0.9250, 0.9792, 0.8315, 0.9787, 0.9708 and 0.8931 for *C. gariepinus, O.niloticus, S.micropogon, T.zilli, P.bovei, P.annetens, A.nurse, M.rume, T.guntheri, L.niloticus and S.galilaeus*.

Length-weight relationship and condition factor

The length-weight relationship for all the eleven species was recorded. They generally conform to the formula $W=aL^b$. The mean value of *b* co-efficient for the eleven species studied was 2.3954. The '*b*' values of 2.3183, 2.0410, 2.3460, for *S.micropogon, T.zilli and A. nurse*, respectively compared to the mean value of '*b*' coefficient 2.3954 indicated a nearly negative allometric relationship which means increase in length is not accounted by increase in weight and vice versa resulting in not favorable condition compared to other freshwater fishes. The '*b*' value of 2.4737, 2.7403, 2.5105, 2.7839 and 2.7670 for *C.gariepinus, O.niloticus, P.boveiM.rume and L.niloticus* respectively compared to the mean value of *b* 2.3954 indicates nearly isometric relationship with 60% of the variation in body weight is being accounted for by the change in body length. While the values of *b* of 3.0433, 3.0833 and 3.0580 for*P.annectens, T.guntheri and S.galilaeus* respectively compared to the mean value of b of 2.3954 shows positive allometric growth which shows disproportionate relationship between weight and length but generally resulting in positive wellbeing of fishes.

The confidence limit indicates that only the first decimal in the estimate of *b* is significant, hence the true value of *b* could as well as be 3.0, Similar result were obtained for *Chrysichthyswalkeri*[19] and *Ethamolosafimbriata*[20]. [21]obtained 2.85 and 3.0 values of *b*, while [22] recorded *b* values of between 2.5 to 3.44 for the fish studies in marine water bodies. According [23], *b* values may range from 2.5 to 3.5, [24] also obtained *b* values of 2.0 to 5.0 suggesting that the result of this study is valid.

The condition factor is an index reflecting interaction between biotic and abiotic factors in the physiological conditions of fishes. It shows population's welfare during the various stages of the lifecycle [25]. The condition factor were found to be between 0.3541 – 2.4685. the variation in K-value indicated that the fish population ranged from immature to mature ones. This suggest differences in their growth.[26].The condition factor of other *Bagrids* such as *Chrysichthysfilamentosus* from Oguta Lake has a range from 0.77-1.80[27] and *Chrysichthysnigrodigitatus*

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in Epe Lagoon ranged from 0.15-0.79[11].[28] documented a K-value of 2.9 to 4.8 for mature freshwater fish and suggested that the condition factor may vary among fish of different species in different location.

CONCLUSION

The length-weight relationship shows negative allometric growth in all the fish studied except *P. annectens, T. guntheri* and *S. galilaea*. Also condition factor are lower than the values documented in tropical water bodies, generally suggesting the fish are not living well compared to other freshwater fishes.

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