LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF *Auchenoglanis occidentalis* IN ZARIA RESERVOIR, NIGERIA

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Abstract

The morphometric parameters of 266 *Auchenoglanis occidentalis* obtained from Zaria Reservoir were examined. The weight of *A occidentalis* sampled ranged from 12.0-800.0 g, the largest male weighed 660.0 g while the female was 800.0 g.The length-weight relationship of *A occidentalis* in Zaria showed positive correlation (r=0.96) in both sexes. The regression exponent (b>3) for both sexes showed positive allometric growth pattern. The mean condition factor (0.71-1.7) varied during the different months and appeared to be associated with the breeding activities of the fish. In both sexes, mean condition factor increased with increase in length, which was attributed to the ability of the fish to obtain food and increase in size.

Keywords: length-weight relstionship, condition factor, *Auchenoglanis occidentalis*, Zaria Reservoir.

Introduction

The length-weight relationship of a fish is basically a measure of its growth pattern or age. Growth is an important component of biological production, which affects overall production directly. Negative changes in growth rates may result in decreased individual health, reproductive success and increased risk of predation and mortality (Wootton, 1990). When the b-value is <3, a fish has negative allometric growth, and when it is >3 it has positive allometric growth (Khaironizam and Norma-Rashid, 2002). If fish have to maintain their shape as they grow their b-values must be equal to 3. Thomas *et al* (2003) stated that the isometric value of b=3 is for an ideal fish that maintained a three dimensional equality.

Fafioye and Oluajo (2005) reported a variation in b-values between 2.790 and 3.210 with a mean b-value of 3.0072 for *Clarias gariepinus, Illisha africana, Chrysichthys nigrodigitatus, Chrysichthys walkeri* and *Ethmalosa fimbriata* in Epe Lagoon, Lagos; indicating a nearly isometric relationship with 60% of the variation in body weight being accounted for by changes in length of the fish. Ogbe *et al* (2006) reported *a b*-value of 3.92 for *Bagrus bayad* from the lower Benue River which showed that the fish weight increased allometrically, the condition factor of 1.51 obtained showed that the fish was in good condition throughout the study period and attributed it to favourable environmental conditions, especially availability of food. Oniye *et al* (2006) reported that the length-weight relationship of *Protopterus annectens* showed positive correlation (r=0.85) in both sexes, indicating an increase in weight as length increased, and the regression exponent (b>3) for both sexes showed allometric growth pattern.

Condition factors of different populations of the same species give some information about food supply, and the timing and duration of breeding (Weatherly *et al* 1987). The condition factor can also be used in assessing the well-being of fish. Ikomi and Odum (1998) observed a monthly variation in the condition factor (K) of *Chysichthys auratus*, which was higher in the wet than in the dry season, and appeared to be influenced by the rainfall regime and effective utilisation of the rich resources of the rainy season, and that increase in the mean K-values of both male and female fish was attributable to conservation of stored energy, increasing size and weight of maturing gonads. In a study of some reproductive aspects of *C. nigrodigitatus* from Cross River, Nigeria, Ekanem (2000) found that the condition factor of the population varied from 0.24 to 1.34, with

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0.977 as the mean; 52.8% had condition factor higher than the mean and 47% had condition factor above unity and that the smaller fishes are more efficient in finding food than the bigger ones.

A. occidentalis is fairly common, especially in swamps, lakes and rivers throughout Africa (Reed *et al* 1967; Lewis, 1974; Risch, 1986), and in catches of fishermen throughout the year in Zaria Reservoir where it forms an important commercial catch. Its flesh is rich in carbohydrate, lipid, protein and minerals (Abdullahi, 2002). Irrespective of these, information on its length-weight relationship and condition factor is scarce compared to works on the biology of several other fish species.

Information on the length-weight relationship and condition factor of *A. occidentalis* is restricted to the study of Risch (1986) in Senegal but unavailable in Nigeria on the same species to the authors, hence the subject of this study in Zaria reservoir of Kaduna State, Nigeria.

Materials and methods

A. occidentalis were purchased monthly, from December 2005 to November 2006 from the landings of fishermen of Zaria Reservoir. The fish were transported in an insulated box containing ice to the Postgraduate Laboratory of the Department of Biological Sciences, Ahmadu Bello University, Zaria, where the total length, standard length and weight of the fish were determined as described by Nwadiaro (1985). Fultons condition factor, defined as weight percent divided by the cube of the length of fish, (Ikomi and Odum, 1998) was calculated for each fish, using the relationship:

$$K = \frac{100W}{L^3}$$

Where K is the condition factor, L the total length in centimeters and W the weight in grams.

The length-weight relationship of the fish was described by the equation $W=aL^b$; Where W is the weight in grams, L the total length in centimeters a and b the regression constant. The logarithm-transformed data will give the linear regression equation:

$$\log W = \log a + b \log L$$

Sex of fish was determined by visual and microscopic examination of the gonads (Ikomi and Odum, 1998). The unsexed small fish were regarded as immature.

Results

The weight of *A. occidentalis* sampled ranged from 12.0-800.0 g. The largest male weighed 660.0 g, while the largest female was 800.0 g. The regression coefficients *b* for male and female fish were 3.39 and 3.42 respectively. Correlation coefficients *r* for male and female fish were 0.95 and 0.96 respectively (Table 1). Figure 1 show a scatter diagram of the length-weight relationship regardless of sex of *A occidentalis* the relationship obtained reflect the common increase of weight with increase in length. The monthly values of the regression coefficient *b* were relatively higher in April, May, June and November with values of 4.15, 4.10, 3.95 and 3.85 respectively while the lowest value (2.62) was obtained in December. In all cases, the values of *b* were greater than 3 (Table 2).

Table 1: Length-weight relationship of male and female *A. occidentalis*.

Sex	Total length range (cm)	Weight range (g)	*n*	*a*	*b*	*r*
Combined	11.90-37.50	12.00-800	266	-5.63	3.50	0.96
Male	16.80-36.40	44.00-660	120	-5.17	3.39	0.95
Female	17.90-37.50	40.00-800	127	-5.23	3.42	0.96
Immature	11.90-19.2	12.00-40	19	-5.04	3.37	0.96

n = sample size, *a* = regression intercept, *b* = regression coefficient; *r* = correlation coefficient.

Table 2: Monthly variation in length-weight relationship of *A. occidentalis*.

Month	n	a	b	R
December	18	-2.74	2.62	0.98
January	19	-5.01	3.37	0.96
February	20	-3.99	3.01	0.98
March	14	-4.11	3.02	0.98
April	20	-7.74	4.15	0.98
May	30	-7.01	3.95	0.97
June	24	-7.32	4.10	0.95
July	21	-5.24	3.36	0.98
August	25	-4.75	3.25	0.90
September	24	-5.66	3.54	0.98
October	25	-6.15	3.75	0.99
November	26	-6.42	3.85	0.99

n = sample size, *a* = regression intercept, *b* = regression coefficient; *r* = correlation coefficient.

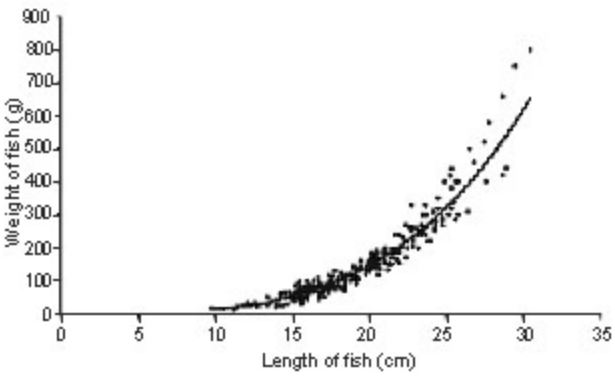

Figure 1: Length-Weight relationship of *Auchenoglanis occidentalis*.

The overall mean monthly condition factors (*K*) ranged from 0.71-1.17 (Table 3). The highest values were obtained in September, October and December. There was a decrease in April and a steady rise thereafter. Mean condition factor values increased with size of fish irrespective of sex (Table 4). However, the overall (mean) *K*-values appeared to be marginally higher in the male (1.04) than in the female fish (0.97), but no significant difference ($p<0.05$). Table 5 shows that the juvenile fish had the lowest condition factor (0.93+ 0.05 SE) while the adults had the highest (1.28+0.05 SE) irrespective of sex.

Table 3: Mean monthly variation in condition factor of *A. occidentalis*.

Month	Range	Mean (+SE)
December	0.82-1.30	1.11 (0.03)
January	0.64-1.15	0.99 (0.03)
February	0.86-1.13	0.98(0.02)
March	0.84-1.10	0.94 (0.02)
April	0.39-1.07	0.71 (0.05)
May	0.52-1.17	0.84 (0.03)
June	0.48-1.01	0.80 (0.03)
July	0.70-1.08	0.87 (0.02)
August	0.63-1.18	0.95 (0.02)
September	0.71-1.26	1.05 (0.03)
October	0.70-1.48	1.17 (0.05)
November	0.44-1.52	0.99 (0.05)

Table 4: Mean monthly condition factor (*K*) of male and female of *A. occidentalis.*

	Sample size (*n*)		(*k*) Range		Men condition factor	
	Male	Female	Male	Female	Male (+SE))	Female (+SE)
December	6	12	1.08-1.30	0.82-1.23	1.15(0.03)	1.08(0.03)
January	7	7	0.96-1.10	1.02-1.09	1.05(0.03)	1.07(0.03)
February	11	8	0.81-1.06	0.93-1.13	0.98(0.05)	1.00(0.05)
March	6	9	0.88-1.10	0.84-1.03	0.96(0.02)	0.93(0.02)
April	5	10	0.55-1.00	0.55-1.07	0.79(0.05)	0.80(0.03)
May	14	16	0.52-1.17	0.58-1.06	0.86(0.02)	0.81(0.03)
June	13	9	0.64-1.00	0.62-1.01	0.82(0.03)	0.81(0.03)
July	8	13	0.71-0.88	0.70-1.08	0.83(0.03)	0.88(0.02)
August	13	12	0.79-1.18	0.79-1.15	0.89(0.02)	0.96(0.02)
September	15	8	1.00-1.23	0.81-1.26	1.08(0.03)	1.03(0.03)
October	9	14	0.79-1.48	0.78-1.48	1.19(0.05)	1.22(0.06)
November	13	9	0.90-1.37	0.88-1.52	1.04(0.03)	1.10(0.03)
Total	**120**	**127**			**1.04(0.03)**	**0.97(0.05)**

Table 5: Condition factors of juveniles, sub-adult and adults of *A. occidentalis.*

	Standard Length(cm)	Male		Female		Combined	
		No	K (+SE)	No.	K (+SE)	No	K (+SE)
Juveniles	13.0-18.9	55	0.98 (0.04)	65	0.93 (0.04)	120	0.93 (0.04)
Sub-adults	19.0-24.9	55	1.01 (0.02)	44	1.01 (0.02)	99	1.01 (0.02)
Adults	25.0-33.9	10	1.29 (0.06)	18	1.31 (0.06)	28	1.28 (0.05)
Total		120		127		247	

Discussion

The maximum length of *A. occidentalis* obtained in this study (37.5 cm) and weight (800 g) are lower than the lengths of 50 cm and 70 cm, and weight of 2 kg reported from Lake Kainji (Nigeria) and in Senegal (Reed *et al* 1967, Lewis, 1974, Risch 1986). This variation in length and weight may be related to the level of exploitation of the fish species in different aquatic environments and also the prevailing ecological advantage confer on Lake Kainji over Zaria Reservoir. Sparre and Ursin (1989) stated that high exploitation of a fish stock over time would decrease the size and weight ranges. Alternatively, the *A. occidentalis* in Zaria may be part of a growing population or overfished resulting in the lower sizes of the fish in Zaria Reservoir.

The length-weight relationship of *A. occidentalis* in

Zaria showed positive correlation ($r = 0.96$) in both sexes, indicating an increase in weight as the length increases. The regression exponent ($b>3$) for both sexes shows a positive allometric growth pattern, i.e. the fish becomes heavier for its length as it grows longer (Tesch, 1968). According to Pauly and Gayanilo (1997), *b*-values may range from 2.5 to 3.5. This result compares favourably to 3.11 reported for *A. occidentalis* in Tiga Lake, Kano State (Maxwell, 1985). Similar results were also obtained for *Chrysichthys walkeri* in Lekki Lagoon (Ikusemiju, 1976), *Chrysichthys nigrodigitatus* in Asejire Dam (Fagade and Adebisi, 1979), *Chrysichthys walkeri* and *Chrysichthys nigrodigitatus* in Epe Lagoon (Fafioye and Oluajo, 2005).

The mean condition factor (*K*) in this study varied during the different months of study and, appear to be related to the feeding and breeding activities of the fish (Tesch, 1968; Ikomi and Odum, 1998). Lower *K*-values were recorded from April to July, which probably coincide with the spawning period. The appreciation of the mean *K*-values in August, September and October, may be associated with weight increase after spawning, which is a direct reflection of the availability and utilization of food items for growth then. In both sexes, mean *K*-values were found to increase with length, suggesting that the food foraging ability and utilization of food for growth was reflected in the increasing length. In other words, that increase in weight during these months is a reflection of increased food consumption, which may be responsible for the increase in *K*-value. The smaller fish (juveniles) in this population had the lowest condition factor of 0.93 while the sub-adults had a moderate condition factor of 1.01 and the bigger fish (adult) are in the better condition of 1.28. This is possible because the bigger fish and sub-adults are probably more efficient in finding food than the juveniles. The condition factor of other bagrids such as *Chrysichthys filamentosus* from Oguta Lake has a range of 0.77-1.80 (Nwadiaro and Okorie, 1985) and *C nigrodigitatus* in Epe Lagoon ranged from 0.15- 0.79 (Fafioye and Oluajo, 2005). The condition factor of *A. occidentalis* documented for mature fresh water fish (2.9 to 4.8) by Bagenal and Tesch (1978) suggests that it may vary among fish of same species in different locations.

Conclusion

The length-weight relationship of *A. occidentalis* in Zaria showed positive correlation (r=0.96) in both sexes. The regression exponent ($b>3$) for both sexes shows positive allometric growth pattern. The mean condition factor (0.71-1.7) varied during the different months and appears to be associated with the breeding activities of the fish, and in both sexes mean condition factor increased with increase in length and weight.

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