

Length-weight relationship and condition factor of *Bagrus docmac* from Lake Akata, Benue state, Nigeria

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Keyword: growth pattern, seasonal condition, *B. docmac*, Lake Akata

1 SUMMARY

This study aims to provide information on the length-weight relationship and condition factor of this valuable fish species which will aid in its management in the lake. Length-weight relationship and changes in the condition factor of *B. docmac* were analyzed from samples collected between May 2008-April 2009, in Lake Akata an ox-bow Lake of River Katsina-Ala, a tributary of River Benue. The mean weight and standard lengths of (n = 510) unsexed individuals of *B. docmac*, were 388.2(g) \pm 12.9 and 26.14(cm) \pm 0.54. The growth pattern of both male and female *B. docmac* was determined to be approximately allometric. The Length-Weight relationship equation for male and female *B. docmac* were $\text{Log}W = -1.5935 + 2.8367 \text{Log}l$ and $\text{Log}W = -1.2606 + 2.6093 \text{Log}l$, respectively. The combined length weight relationship for both sexes was $\text{Log} W = -1.5314 + 2.7942 \text{Log} L$. The overall condition factor was 1.62 ± 0.02 for males and females combined but individually, female *B. docmac* were in better condition (1.62 ± 0.04) compared to the males (1.61 ± 0.03). The variation in physiological, condition could be associated with sex ratio and reproductive activity. There was a higher correlation coefficient value in the length-weight for both sexes of *B. docmac*. Both sexes exhibited negative allometric growth pattern. The results indicated that there was no significant difference between the mean condition factor of male and female *B. docmac* ($p > 0.05$). The condition factor for *B. docmac* observed in dry season (1.62 ± 0.03) was statistically same with the mean value of wet season (1.61 ± 0.04) ($p > 0.05$).

2 INTRODUCTION

The Bagrid fishes are commonly known as naked catfishes. The family Bagridae is represented by thirty (30) genera and two hundred and ten (210) species. Bagrids have four pair's well-developed barbels; these four pairs of barbels are covered by a layer of taste bud-enriched epithelium, (Zhang *et al.*, 2006). Bagrid catfish are important economically and ecologically. They play silent roles in determining the dynamics and structure of the aquatic ecosystem and the value as food by man has been reported (Hem, 1986). Some species are kept as aquarium fishes (Nelson, 2006).

This family is of considerable commercial importance. *Bagrus docmac* are found in Benin, Congo Democratic Republic, Egypt, Mali, Ghana, Guinea, Kenya, Sudan, Nigeria, Tanzania, and Uganda. It is wide spread in African Rivers and lakes the Nile, Niger, Senegal, Congo, Volta Lake, Chad Basins, and East African Rift Lake (Froese and Pauly, 2009). The general ecology of bagrids in some aquatic ecosystems has been reported. (Fagade, 1980) in Asejire Lake, (Ogbe and Fagade, 2002), (Ogbe et al., 2003), and (Ogbe, et al., 2006) in the lower River Benue, (Entsua-Mensa

et al., 1995) also conducted a similar study on *B. docmac* in Volta River.

B. docmac is common throughout the year and it inhabits lakes, swamps and rivers, (Olaosebikan and Raji, 1998). It is wide spread in both shallow and deep water (Witte *et al.*, 1995); and is probably associated with rocky bottoms/coarse substrates (Lock, 1982). Length-Weight relationship parameters (a, b) are important in stock assessment studies (Moutopoulos and Stergiou, 2002), for conversion of length observations into weight estimates to provide some measurements of biomass (Froese, 1998), for between region comparisons of growth of fish species (Petrakis and Stergiou, 1995), and as a practical index of fish condition (Barros *et al.*, 2001). Fish found in tropical and sub-tropical water system

experience frequency growth fluctuations due to changes in food composition, environmental variables and spawning conditions among others. The condition factor (k) is a quantitative parameter of the well-being, state of the fish and reflects recent feeding conditions (Le cren, 1951). This factor varies according to influences of physiological factors, fluctuating according to different stages of the development. (Anderson and Neumann, 1996) refer to length-weight data of population, as basic parameters for any monitoring study of fishes, since it provides important information concerning the structure and function of populations. Therefore, this study present information on the length-weight, relationship and condition factor of this valuable fish specie and will aid its management in the lake.

3 MATERIALS AND METHODS

3.1 Study area: The study area, Lake Akata is an ox-bow lake of the River Katsina-Ala and lies between longitude 9°16' and 9°17' East and latitude 7°11' and 7°13' North (Figure 1). The host town, Katsina-Ala is a riverside resort with a unique feature and the scenic beauty of savannah landscape, supplemented by the famous River Katsina-ala with extensive fadama flood plain covered by numerous lakes scattered over the flood plain one of such lake is the Lake Agbo (MANR Makurdi, unpublished). Katsina-ala has a tropical savannah climate with two clearly marked season of wet between (April and October), and dry between (November and March).

3.2 Sample Collection: A total of 510 individuals of *B. docmac* were randomly sampled monthly for one year and usually in the mornings between 7.00am – 9.00am and in the evenings between 4:30pm – 6:30pm. The period of the study was from May 2008 to April 2009. The fish specimens used for the study were obtained from fishermen operating along Lake Akata. These fishermen use various fishing gears including hand nets, cast nets and gill nets of various standard mesh sizes (20.2, 25.4, and 30.5mm) as well as canoe were used as fishing craft. Length and weight

measurements were taken directly from the landing sites. The total and standard lengths were measured with a meter rule on measuring board according to (Olatunde, 1977). The sex of each fish sample was determined by visual observation of genitals. Length-weight relationship of fish was estimated from the equation:

$$W = a.L^b \text{ (Pauly 1984).}$$

The relationship was transformed into a linear form using the logarithm equation:

$$\text{Log}W = a + b\text{Log}L.$$

Where,

W = weight of fish (g),

L = standard length of fish (cm),

a = regression constant and

b = the allometric coefficient.

For males, females, and both combined sexes by least square regression method.

The condition factor, (k) was determined using the equation: $K = 100.W/L^3$ after Ricker (1975).

Where,

K = the condition factor,

W = Weight of fish in (g) and

L = Standard Length of fish (cm).

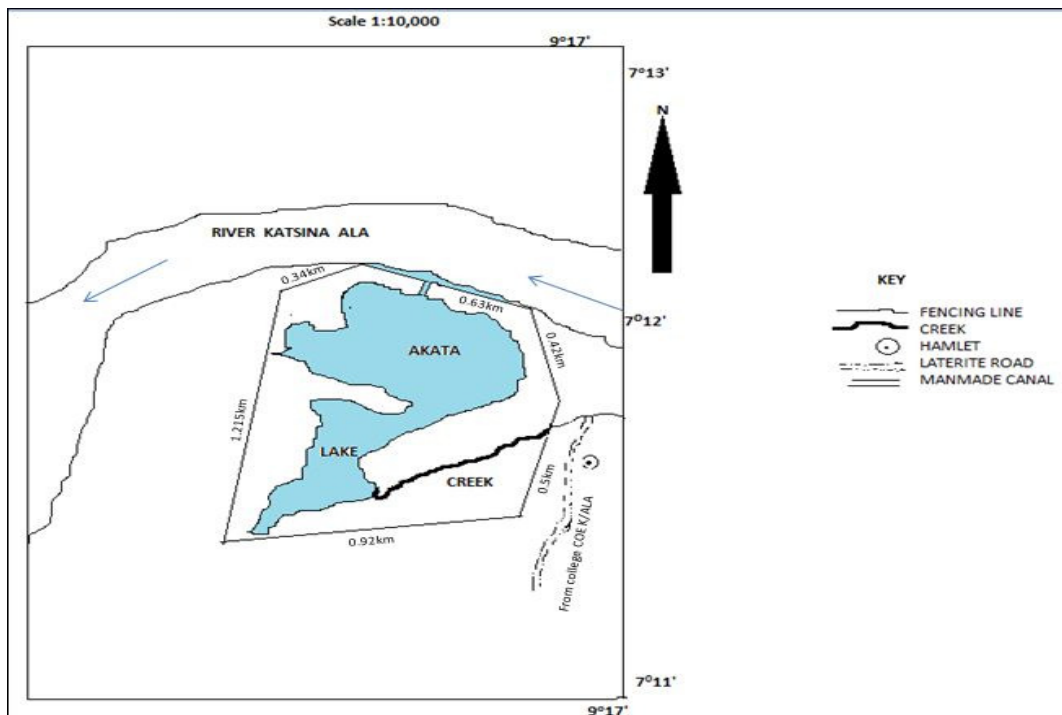


Figure 1: Map of Lake Akata

4 RESULTS

4.1 Length-weight relationship: The graphical representations of the regression equations of males, females and Combined Sexes

for *B. docmac* are given in Figures 2, 3 and 4 respectively.

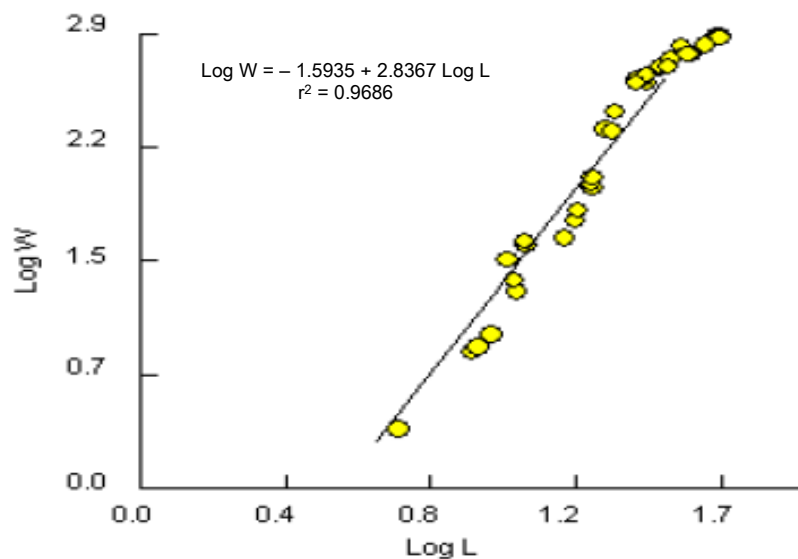


Figure 2: Length-Weight Relationship of *Bagrus docmac* Males from Lake Akata, Katsina-Ala.

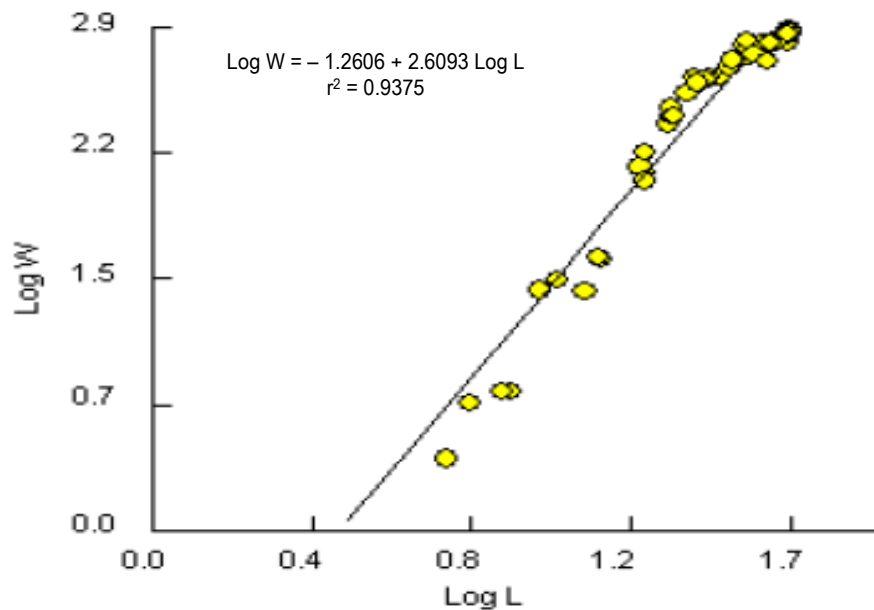


Figure 3: Length-Weight Relationship of *Bagrus docmac* Females from Lake Akata, Katsina-Ala.

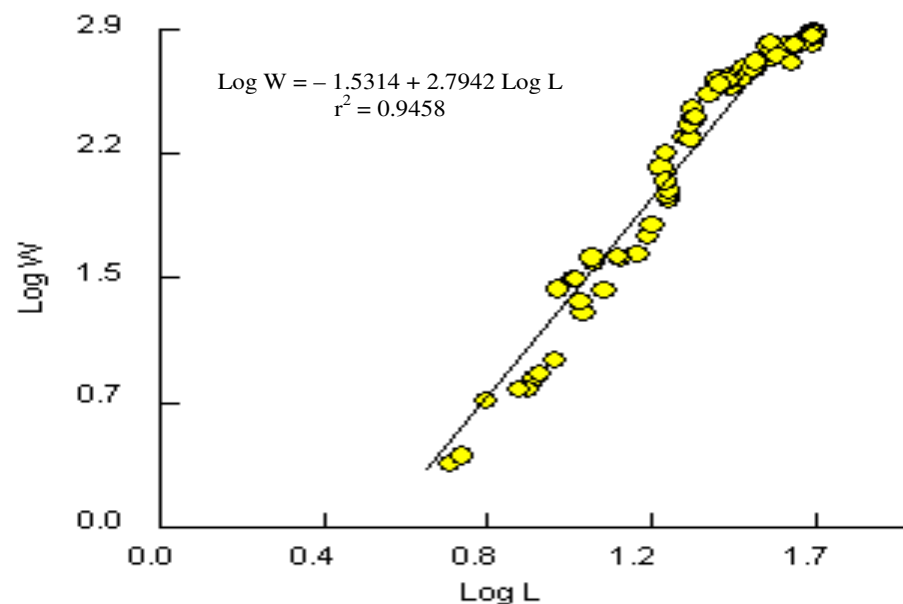


Figure 4: Length-Weight Relationship of *Bagrus docmac* (Combined Sexes) from Lake Akata, Katsina-Ala.

4.2 Length-Weight Relationship: Regression was calculated using the formulae described by (Le Cren, 1951). The log “a” value for both male and female *B. docmac* was - 1.5935 and - 1.2606 respectively, while “b” value for male and female of *B. docmac* is 2.8367 and 2.6093 respectively. The regression equation for estimating lengths of male and female *B. docmac* of known weight are $\text{Log } W = -$

$1.5935 + 2.8367 \text{ Log } l$ ($r^2 = 0.9686$) (figure 2), $\text{Log } W = - 1.2606 + 2.6093 \text{ Log } l$ ($r^2 = 0.9375$) (figure 3) and the combined sex's length-weight relationship is expressed by the regression equation: $\text{Log } W = - 1.5314 + 2.7942 \text{ Log } l$ ($r^2 = 0.9458$) (Figure 4) respectively. There was a higher correlation coefficient value in the length-weight for both sexes of *B. docmac*. The graph of log

transformation show that the weight increases faster at lower lengths than at higher lengths. Both sexes exhibited negative allometric growth pattern.

4.3 Condition Factor: The mean condition factor (k) of *B. docmac* is presented in Table 1. The mean condition factor was 1.62 ± 0.024 for *B. docmac* (combined Sexes). The results indicated that there was no significant difference between the mean condition factor of male and female *B. docmac* ($p > 0.05$). (Figure 5) Show the seasonal variation in mean monthly condition factor of *B. docmac*. Males had high k-values of 1.87 in December and 1.72 in March while females had theirs, 1.75 in January and 1.66 in March. However, peak values of 2.08 were observed in July, and May for males and females respectively. The condition factor for *B. docmac* observed in dry season (1.62 ± 0.03) was statistically same with the mean value of wet season (1.61 ± 0.04) ($p > 0.05$) Table 2.

Table 1: Mean Condition Factor of *B. docmac* in Lake Akata, Katsina-Ala.

Sex	N	Condition Factor (K)	T-test	P value
Male	245	1.61 ± 0.03	0.73	0.47
Female	265	1.62 ± 0.04		
Combined	510	1.62 ± 0.024		

Table 2: Seasonal Variation in Condition Factors of *B. docmac* in Lake Akata, Katsina-Ala.

Season	N	Condition Factor (K)	T-test	P value
Wet	194	1.61 ± 0.04	0.23	0.817
Dry	316	1.62 ± 0.03		

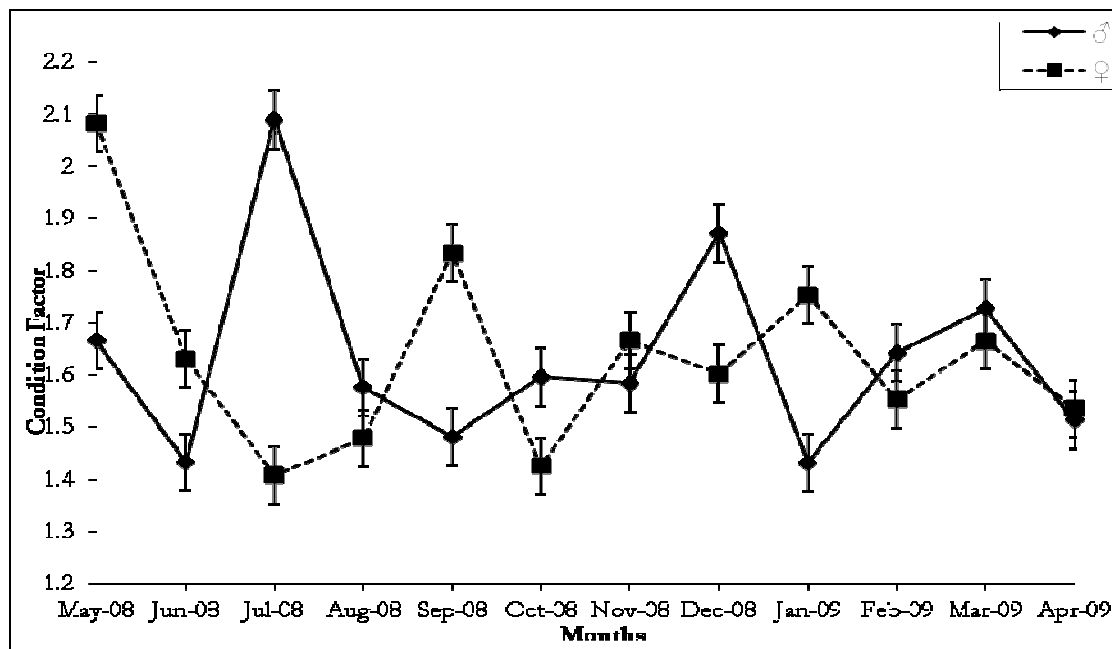


Figure 5: Monthly Variation in Condition Factor of *Bagrus docmac* from Lake Akata in Katsina-Ala.

5 DISCUSSION

There was observed variation in the “b” value of the fish under study. It showed that the rate of increase in body length is not proportional to the rate of increase in body weight. The values obtained for the length-weight relationship showed that both sexes of *B. docmac* exhibited allometric growth pattern. Several authors have reported isometric and allometric growth pattern for different fish species

from various water bodies. This agrees with “b” value 2.911 and 2.794 recorded for *Clarias gariepinus* (African sharptooth catfish) by (King, 1996a). Ogbe *et al.* (2006) reported positive allometric growth pattern for *Bagrus bayad* from Lower Benue River. In a similar study (Ogbe and Ataguba, 2008) also reported an isometric growth pattern for *Malapterurus electricus* from Lower Benue River. The

“b” value obtained for the species in this study were within the range (2.34-3.37) reported for Volta River Bagrids (Entsua-Mensah *et al*, 1995). King (1991) reported allometric growth pattern for *Tilapia species* from Umuoseriche Lake. Ikongbeh *et al* (in press) reported the growth pattern of *chrysichthyes nigrodigitatus* (silver catfish) from Lake Akata, Benue State, Nigeria. The graph of log transformation show that the weight increases faster at lower lengths than at higher lengths. Sufficient space area and abundant food supply throughout the year were probably some of the main factors contributing to the steady increase in their weight and length (growth).

It was observed in the present study that mean condition factor for *B. docmac* were of values of “1” and above which indicated that fish species are doing well in the Lake. The condition factor of the fish species in this study is favourably comparable with condition factors of different tropical fish species investigated and reported by (Saliu, 2001), and (Lizama *et al*, 2002). The condition factors of male, female and combined sexes of *B. docmac* (K=1.61, 1.62 and 1.62 respectively) in Lake Akata is lower than the values (1.68, 1.96 and 1.76 respectively) reported for *C. nigrodigitatus* in Epe Lagoon in Lagos by (Lawal *et al*, 2010). This may be due to reduced availability of food and prey items. The results indicated that there was no significant

difference between the condition factors of male and female *B. docmac* ($p>0.05$). The condition factor for *B. docmac* observed in dry season (1.62 ± 0.03) was statistically same with the mean value of wet season (1.61 ± 0.04) ($p>0.05$), on the contrary to *B. nurse* (Saliu, 2001). This study was in agreement with the values reported for different cichlid fish in Nigeria (King, 1994), and (Junquera *et al*, 1999). The seasonal condition factor for *B. docmac* showed that there was no significant differences in the condition factor between dry and wet seasons ($p>0.05$). Indicating that seasonal variations did not affect the general condition of the fish. Seasonal variation in condition factor of fish has been reported for *Leuciscus lepidus* and *Brycinus nurse* (Karabatak, 1997); (Saliu, 2001). These differences notwithstanding (Oni *et al*, 1983) noted that condition factor is not constant for a species or population over a time interval and might be influenced by both biotic and abiotic factors such as feeding regime and state of gonadal development (Saliu, 2001). Gomiero and. Braga, (2005) reported that better condition during the wet season was due to the availability of food and enhancement during their gonad development. There are also suggestions (Samat, *et al*, 2008) that fish condition can be influenced by certain extrinsic factors such as changes in temperature and photoperiod.

6 ACKNOWLEDGEMENT

The authors appreciate the Department of Fisheries and Aquaculture, University of Agriculture, Makurdi, for approving the use of the laboratory and providing necessary facilities for this study.

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