Nigerian Journal of Fisheries and Aquaculture (2): 1 – 5 September, 2014

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Available online: http://www.unimaid.edu.ng
ISSN-2350-1537

The Length-Weight Relationship, Condition Factor and Fecundity of *Clarias gariepinus* in Luhu Reservoir, Michika Local Government Area, Adamawa State-Nigeria

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Received June 17, 2013 Accepted June 26, 2014

ABSTRACT
The length-weight relationship, condition factor and fecundity of *Clarias gariepinus* in Luhu Reservoir were studied between May and October, 2011 to ascertain the suitability of the reservoir for fish production. Gill nets of different sizes were used to sample the fish. Length-weight regression analysis showed that the "b" values of male (1.22), and female (0.51) exhibited allometric growth. There was significant correlation between length and weight of both sexes. The monthly mean range condition factor of males (1.02±0.06 to 1.43± 0.19) and Females (1.07± 0.01 to 1.52± 0.05) indicated that the species were in relatively stable condition throughout the period of study, while the fecundity values (790.92±871.73 to 1258.84± 527.05) observed was considered too low. Condition factor and fecundity were not significantly different within months.
Keywords: Length-Weight relationship, condition factor, fecundity, *C. gariepinus*, Luhu reservoir

INTRODUCTION
Clarias gariepinus is distributed throughout Africa from the Nile Delta to Orange River (Bruton, 1998). It is the freshwater species with the widest latitudinal range in the world (Hecht *et al*., 1988). It is a highly prized fish in Nigeria, including Michika local government area of Adamawa State.

The habitat of *Clarias* species in tropical swamps and rivers are subject to seasonal fluctuations in water volume. The fish, as a result is highly specialized to adapt to changing environments. Holden and Reed (1972) observed that *Clarias* could reach a size of one meter in length and 7 kilograms in weight. The fish possesses specialized structures which enables it to survive outside water for several hours.

Clarias gariepinus has high consumer preference in ranking (Ritcher, 1976). It is generally considered to be one of the most important tropical freshwater fish species for aquaculture (Dada and Wonah, 2003).

Length-weight relationship is an important parameter in fish biology to serving as a reference in fish biology for the estimation of unknown weight from known length or vice versa. It has been used extensively in fishery analysis due to difficulties in getting data from the field (Ayoade, 2011; Froese, 2006; Sinovcic *et al*., 2004; Yousaf *et al*., 2009). Weight can be estimated based on length obtained from length-frequency distribution. Also, values of LWR are used for comparison of isometric growth among different regions. Rahim *et al*. (2009) suggested that fish grow at isometric rate when the b equal to 3. Khairenizam and Norma-Rashid (2002) further lamented that, when the b-value is less than 3, the fish has a negative allometric growth but when it is greater than 3, it has a positive allometric growth and when it is equal to 3, the fish has isometric growth. *Clarias macrocephalus* showed negative allometric growth (a = 0.011, b = 2.945) in North Kerian (Ali, 1993). Yalcin *et al.* (2002) observed negative allometric growth in *C. gariepinus* (a = 0.013, b = 2.82) in the River Asi (Orontes), in Turkey.

The condition factor often referred to as "K" provides information on the wellbeing of a fish and is usually influenced by the fish, sex, season, maturity stage etc. (Anyanwu *et al*., 2007). Fulton (1902)

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proposed the use of a mathematical formula for quantifying or estimating the condition of fish as K= 100w/L3. The role of the condition indices as stated by Stevenson and Woods (2006) is to quantify the health of individuals in a population or to tell whether a population is healthy relative to other populations. In addition, the coefficient of condition factor value can be determined from the data obtained. Yusof *et al*. (2011) reported the b values range from a minimum of 2.19 for *C. batrachus* to a maximum of 3.2 for *H. nemurus*. Davies *et al*. (2013) reported that the overall mean condition factor for *Clarias gariepinus* juveniles reared in concrete tanks to range between 1.06 (males) and 1.15 (females).

Studies on fecundity fish is of paramount importance in order to evaluate the reproductive potentials of the species, (Duarte and Araujo, 2002) and to give prerequisite information required for breeding plans to determine the number of female broodstock needed. The fecundity rate of the fish will also assist in the sizes and quantities of the rearing facilities required and the extent to which various culture equipment would be put to use (Eyo and Mgbenka, 1992).

Egwui (2007) reported the total fecundity of hatchery raised *C. gariepinus* is between 6,450 to 71,450 eggs per fish and linear and positive condition factor (r=0. 9046). Yusuf *et al*. (2013) reported the fecundity *C. gariepinus* caught from the Doma dam of Nassarawa State to be between 180 and 84,440 eggs. Nawar and Yoakim (1962) found the range of the fecundity of *C. gariepinus* to be from 13, 900 to 164, 800 eggs per fish in the river Nile, North Africa. Mulder (1971) recorded 293, 000 to 446, 000 eggs per fish from the Transvaal, South Africa. Micha (1973) in the Ubangui river, recorded 3,000 to 328,000; Richter (1976) in Central and West Africa recorded 10,000 to 120,000; Gaigher (1977) in Hardep Dam, South West Africa found 70,000 to 1,100,000 and Bruton (1979) in Lake Sibaya, South Africa reported a figure of 5000 to 163,000 and Eyo and Mgbenka (1992) for Anambra river, Nigeria, West Africa reported a fecundity range of 9,000 to 25,000 eggs per female *C. gariepinus*.

The knowledge of the conditions of the fish in Luhu Reservoir is required for proper management in developing the fisheries. This paper discusses the length-weight relationship, condition factors and fecundity of *Clarias gariepinus* in Luhu Reservoir. The Luhu Reservoir is located in Michika Local government area of Adamawa State within the north eastern region of Nigeria.Michika local government is located at longitude 13^0 20' E and latitude 10^0 35'N. The reservoir covers about 1.15km and is situated in the Sudan Savannah vegetation Zone of the Country (Adebayo, 2004)

MATERIALS AND METHODS

Fish species were sampled from river Luhu reservoir fortnightly for a period of six months; from May to October, 2011. Fish were sampled using gill nets of different mesh sizes. *Clarias gariepinus* were selected from the catch and were transported to the laboratory for measurements. A total of 156 fish made of 95 males and 61 females was examined.

Measurements were done as described by Olatunde (1983), and sex determined according to de-Graaf and Janseen (1996). Length-weight relationship was determined using the conventional formula described by Olurin and Aderibigbe (2006): W = alb, Where, W = weight (g), L = total length (cm), a = constant b = exponent of values. The log transformed data gave a regression equation Log W = Log a + b log L. The condition factor was also determined for individual fish using formula by Olurin and Aderibigbe (2006): K= W x 100/L^3. Fecundity was determined using the gravimetric method in line with Kharma and Singh (2003) Matured ovaries were carefully removed and preserved. The weight of ovaries was determined and 3 samples of 100mg each was taken at random from anterior, middle and posterior parts. The numbers of eggs in each sample were counted under a binocular microscope and the total fecundity estimated using the formula: F = S x OW/100, Where, F = Fecundity, S = Average number of eggs from 3 samples of 100mg each, OW = Total weight of ovary

RESULTS

The results of length-weight regression analysis of *Clarias gariepinus* is shown in Table 1. The "b" values for males (1.22) and females (0.51) show allometric growth. The length-weight relationship of males and females showed a linear relationship with significant (P<0.05) correlation of 0.07 and 0.84, respectively.

Table 1: Length-weight regression of *C. gariepinus* caught from Luhu reservoir

Sex	No. of fish examined	Log	b	Coefficient of correlation

Male	95	0.07	1.22	0.07
Female	51	0.438	0.50	0.84

The monthly mean condition factor of *C. gariepinus* from Luhu River is shown in Table 2. The monthly mean condition factor values of male *Clarias gariepinus* range from 1.02 in July to 1.43 in September, while that of female range from 1.07 in July to 1.52 in May. There was no significant difference (P>0.05) among the condition factor values of *C. gariepinus* within months.

Table 2: Mean monthly condition factor of *Clarias gariepinus* caught from Luhu reservoir

Month	**Male**			**Female**		
	Total Examined	**Range**	**SEM**	**Total Examined**	**Range**	**SEM**
May	11	1.25-1.03[a]	0.114	8	1.45-1.55[a]	0.053
June	17	1.07-1.09[c]	0.010	7	1.18-1.10[b]	0.042
July	17	0.98-1.10[c]	0.062	11	1.09-1.09[a]	0.011
August	16	1.10-1.41[b]	0.160	7	1.09-1.44[c]	0.185
September	16	1.62-1.25[a]	0.191	10	1.32-1.18[c]	0.074
October	18	1.18-1.30[b]	0.062	8	1.43-1.36[a]	0.037

Means with the same superscripts in the row same are not significantly different (p>0.05)

Table 3 shows the mean monthly fecundity of *Clarias gariepinus* caught from Luhu River. Higher fecundity (1258.840.75eggs) was observed the month of May followed by 1237.70±0.79 eggs observed in June. While the lowest fecundity (790.92±0.73 eggs) was observed in July. There was no significant variation (P>0.05) between mean fecundity values recorded in May compared to that in June. However, there significant variation (P<0.05) was observed between the fecundity rate of *C. gariepinus* in the month of August and September.

Table 3: Mean (±SEM) monthly fecundity of *Clarias gariepinus* caught from Luhu reservoir

Month	**Total examined**	**Mean**	**Range**
May	8	1258.84±0.75[a]	756-1756
June	7	1237.70±0.79[a]	576-2084
July	11	790.92±0.73[d]	488-2142
August	7	1110.20±0.89[b]	408-1946
September	10	974.00±0.78[c]	462-2037
October	8	806.00±0.67[d]	590-1376

Means with the same superscripts in the same row are not significantly different (p>0.05).

DISCUSSION

The result of length-weight regression analysis showed that from the "b" values, males and females exhibited allometric growth. The values of "b" obtained during the period of the study shows that the increase in length is not equal in proportion to the weight under constant specific gravity. This agrees with the findings of Abubakar (2006) and Haruna, (1992). Olurin and Aderibigbe, (2006) stated that there may be differences in length-weight relationship due to sex, maturity, season and environmental conditions (e.g. pollution). It was observed that certain factors such as increase in weight due to intake of water or food, season of the year, and the time of the day when the fish was captured, could have cause the influence the increase in weight of the fish. Similarly food regurgitation and spawning can among other things cause loss of weight thus affecting "b" values (Lagler, 1952).

The mean condition factor values indicated that males and females were in good condition throughout the period of the study. Slight fall was, however observed in June and July. This might be due to changes in the physical and chemical condition of the habitat caused by human activities which can affect the fish (Abubakar, 2006). This might also be attributed to changes in the available dietary items because of the seasonal variation of fish food as observed by Abdullahi and Abolude (2001) in their studies of *Bagrus bayad* in Tiga Lake.

The number of eggs in mature ovaries of *Clarias garipeinus* ranged from 790.92 to 1258.84, this is close to the findings of Abubakar (2006) who obtained 788.67 to 1243.65 eggs from Lake Geriyo in

Adamawa State. Issa (2006) reported that reproductive behaviour could be affected by environmental factors such as temperature, photoperiod, food and pollution etc. This might be the case in river Luhu reservoir, which experienced a lot of abuse through dumping of wastes. It was observed that fish specimens of the same length - weight had variable fecundities. Bagenal (1967) asserted that fish species exhibit wide fluctuations in fecundity among fish of the same species, size and age.

Conclusion

C. gariepinus in Luhu reservoir exhibited allometric growth and low fecundity. This might be as a result of stress imposed by the dumping of wastes and other human activities in the reservoir. However further studies covering the environment and more fish samples need to be carried out to ascertain the reasons for the observed phenomenon.

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