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Some Aspect of the Biology of *Clarias Gariepinus* in Coca Cola Wastewater Reservoir Maiduguri Borno State, Nigeria

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Abstract
This study was carried out from July to December 2013 to ascertain the suitability of the Coca Cola wastewater reservoir for the production of Clarias gariepinus. The Length weight regression analysis revealed that the "b" values are 2.53, 2.83 and 2.59 for male, female and combined respectively all exhibiting allometric growth. The monthly mean range condition factor are 0.60 – 1.40 for male, 0.66 – 1.56 for female and 0.60 – 1.55 for combined sexes indicating that most of the species are not in relatively stable condition. While fecundity value of 2,698 – 25, 697 observed was considered to be high.
Key words: Biology, Wastewater resrvoir, Coca cola

Introduction

Clarias gariepinus belong to the family Claridae (air breathing catfish) order sulirifomes (catfis) and Class Actinoptergii (Ray-fined fish). It lives in benthopelagic, potamodromous fresh water (swamp and rivers) which are subject to seasonal fluctuation in volume, pH range of 6.5 – 8.5 and depth of 0 – 80m. the length of *C. gariepinus* is up to 170cm and weight up to 6,0kg (Yadav, 2006).

C. gariepinus is distributed throughout Africa from the Nile Delta to Orange River (Bruton, 1988). It is the fresh water species with the widest latitudinal range in the world (Hecht *et al.,* 1988). *C. gariepinus* is highly specialized to adopt to changing environment (Peter *et al., 2015*) and is generally considered to be one of the most important tropical fresh water fish with high consumer preference and species for aquaculture (Dada and Wonah, 2003).

It is highly priced and cultured fresh water fish all over Nigeria and therefore of considerable economic importance. The knowledge of fish status in the wastewater reservoir is necessary for sustainable management of fish resources in the area despite pollution of the aquatic environment being considered a major threat to the aquatic organism including fishes (ECDG, 2002), the reuse of wastewater is increasingly becoming important for supplementing drinking water needs in some countries around the world as a result of increase climatic change, thus leading to drought and water scarcity (Reitveld *et al., 2009*).

Materials and Methods

Study area: Maiduguri is the capital of Borno State and is located between latitude 10°09'and 13°44' N and longitude 11°36' and 14°38' E. Most part of the state lies within the sahelian climate zone classified under the tropical continental climate with rainfall of 250 – 1000mm. the temperature regime of the state is relatively more constant than that of rainfall pattern. The hottest months of the year are March, April, and May with mean temperature of 29.5, 32.8, and 34.5°C respectively (Aminu, and Omoyeni, 2001).The plant and reservoir constructed in 1978 are located at Pompomari industrial area and the reservoir covers an estimated area of about 43,200sq meter with an approximate depth of about 6 meters.

Fish were sampled by the fishermen using various size of gill net; 2", 2.5" stretched mesh size, Malian traps which was set at 5.00pm and was retrieved early morning the following day. Fish were sorted out from the catch as described by Olurin and Aderibigbe (2006). Samples of fish collected from the reservoir were transported to the laboratory (NAFDAC) where routine laboratory measured were carried out.

Measurement of total length, standard length and weight of sampled fish were carried out as described by Olatunde (1983). Total length was measured from tip most part of the mouth to the tip of hypural bone. All measurements were done in centimeters.

Fresh weight and ovary of the fish were also taken using an electronic balance (Model Scout spu 411), after removing water and other substances on the fish with the help of filter paper. All measurements were done in grams and in milligram.

Length-Weight Relationship

The length-weight relationship was determined using the conventional formula described by Le Cren (1951).

$$W = aL^b$$

The equation and the data were transformed to logarithm before the determination was made. The equation was therefore transformed into
$$\text{Log } W = \log a + b \log L$$

Where

W = weight of fish in grams

L = Standard length of fish in cm

a = a constant

b = an exponent.

Condition Factor

The condition factor "K" was determined for individual fish using conventional formula described by Worthington and Richardo (1931). The ratio of length to the weight of the fish was determined as:

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

Where
K = condition factor
W = weight in grams
L = standard length in centimeters.

Fecundity

Fecundity was determined as described in Gravimetric method by Khanna and Singh (2003). Matured ovaries were carefully removed (after making an incision from the vent to the lower jaw to expose the visceral organs of the fish) and preserved in 10% formalin in petridish. The weight of ovaries was determined and 3 samples of 100mg each was taken at random anterior, middle and posterior counted under a binocular microscope.
Fecundity was then determined as:

$$F = \frac{S \times OW}{100}$$

Where
F = Fecundity
S = Average number of eggs from 3 samples 100mg each
OW = Total weight of ovary

Results

The results of the monthly measurement of the standard lengths (SL) and body weight (BWT) of *Clarias gariepinus* examined are presented in Table1. The highest value of SL ranged from 15.5 to 27.00 cm with a mean of 30.85$\pm$3.32cm and a body weight range of 43.28-156.35g and a mean value of 94.13$\pm 49.7g$ recorded in the month of July and the lowest value of 15.65-22.25cm with a mean value of 17.72$\pm 1.90cm$ and a body weight range of 35.72-102.59g with a mean value of 60.56$\pm 21.1g$ recorded in November.

The value of the length weight regression analysis of the 120 *Clarias gariepinus* observed during the study period is presented in Tables 2. The 'b' value of males (2.53), female (2.83) and combined (2.59) all exhibited negative allometric growth. The length weight relationship of male, female and combined shows linear relationship with significant correlation coefficient of 0.94, 0.91 and 0.93 in male, female and combined respectively ($p<0.05$).

The monthly mean condition factor of male *Clarias gariepinus*, ranged from 0.92± 0.079 in August to 1.01± 0.166 in September and also 1.01± 0.237 in November (Table 3), female range from 0.92± 0.166 in

December to 1.30$\pm$0.189in November (Table 3), while the combined condition factor for both sexes ranged from 0.98$\pm$0.2118 in October to 1.14$\pm$0.217 in July as depicted in Table 3, respectively.

Table 6, showed the monthly mean fecundity of *Clarias gariepinus* as observed in the study. The monthly mean fecundity ranged from 11,016.50$\pm$6815.835 in July to 17,262.50$\pm$2915.137 in October.

Discussion

Length weight relationship gives information on the condition and growth pattern of fish (Bagenal and Tesch, 1978; Olurin and Adenibigbe, 2006). It is also of great importance in fishery assessment (Gracia *et al.,* 1998; Haimovici and Valesco, 2000). From the result obtained from this study, the highest mean values of standard length (SL) and body weight (BWT) were recorded in July, and this may be due to rainy season (Spawning period). Oni *et al.,* (1998) reported that feeding and reproductive phenomena were the main factors responsible for the size of fish. Most of the sample fish were probable adult with full laden stomachs and or with matured reproductive organs. The result also revealed that all the 120 *Clarias gariepinus* examined exhibited negative allometric growth pattern with regression analysis exponent 'b' values less than 3. The correlation coefficient (r) of the fishes ranged between 0.94, 0.91 and 0.93 for male, female and combined respectively, indicating high degree of positive correlation between the standard length and body weight of male and female. The implication is that the body weight of the fishes increased with increase in body length, but the rate of increase in weight is less than the rate of increase in length. Adeyemi *et al.,* (2009) reported that negative allometric growth pattern in fish implied that the weight increases at a lesser rate than the cube of the body length. This result also agrees with Abubakar (2006) and Haruna (1992). Olurin and Aderibigbe (2006) reported that the difference in length weight relationship is as a result of sex, maturity, season and environmental conditions (e.g. pollution). However, Abubakar (2006) also 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 cause an increase in weight, similarly food regurgitation and spawning can among other things cause lost of weight thus affecting "b" values.

Condition factor is used in order to compare the 'condition' 'fitness' or wellbeing of fish. It is based on the hypothesis that heavier fish of particular length are in better physiological condition (Bagenal, 1978). It is strongly influenced by both biotic and abiotic environmental condition and can be used as an index to access the status of the aquatic ecosystem in which fish live (Anene, 2005). The results obtained from this study revealed that most of the 120 *Clarias gariepinus* examined have low values of condition factor. This result implied that most of the fish are not in good physiological condition, this may be as a result of the water being polluted. Davenport (1993) reported that all living organisms have tolerable limits of water quality parameters in which they perform optimally. A sharp drop or an increase within these limits has adverse effect on their body functions. Moody and Folorunsho (2006) also reported that fish performance is directly affected by water quality or (physicochemical) properties of water body in which the fish lives. Also Abubakar (2006) reported that these might be as a result of changes in physical and chemical condition of the habitat caused by anthropogenic factors with negative effect on the fish. Another factor that may be responsible for the poor physiological condition of the fish might be due to the concentration of heavy metals observed in the water reservoir (Fabian and Abubakar in press). Manson (2002) reported that heavy metals have drastic environmental impact on all organisms. Furthermore, 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 *Bargus bagad* in Tiga Lake, Kano.

According to Khanna and Singh, (2003) fecundity is the number of eggs that are likely to be laid during the spawning season. From the result obtained in this study, monthly mean fecundity increases as the rainy season progresses and early sexual maturity was also observed. The number of eggs in mature ovaries of *Clarias gariepinus* ranged from 2,698 to 20, 566. This result is higher than 788.67 to 1243.65 reported by Abubakar (2006) in lake Geriyo, who also reported that the reproductive behaviour could be affected by environmental factors such as temperature, photoperiod, food and pollution. Olurin and Aderbigbge (2006) asserted that fish species exhibit wide fluctuations in fecundity among fish of the same species, size and age. The highest mean fecundity value of 17,262$\pm$2915 was recorded in October, which might be as a result of increase environmental harshness. James and Brutun, (1992) stated that the increase environmental harshness leads to sexual maturity at small size, extended spawning season, increased fecundity and high mortality. Lagler *et al.,* (1978) also reported that an increase in fecundity of an individual within the population represent an adaptive response to the population to environmental changes where an increase in fecundity ensures the preservation of the species.]

Conclusion and Recommendation

Clarias gariepinus in the wastewater reservoir exhibited allometric growth, where majority of the fish also indicate poor condition factor and the female with high fecundity. This might be as a result of stress due to poor water quality (pollution) by industrial activity and other anthropogenic factors taking place around the wastewater reservoir. However, further studies on wastewater treatment and water quality should be carryout to ascertain the international standard for wastewater discharge and reuse in aquaculture.

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Table 1: Range and Mean Values of Standard Lengths and Body Weights of 120 *Clarias gariepinus* from Coca-Cola Wastewater Reservoir

Month	Standard length (SL) (cm)		Body weight (BWT) (g)	
	Range	Mean	Range	Mean
July	15.65-27.00	30.85±3.32	43.28-156.35	94.13±49.7
August	18.45-28.4	23.00±3.15	58.29-219.13	111.67±47.7
September	15.5-29.5	20.16±4.58	39.23-230.36	97.09±59.6
October	14.75-26.5	24.74±3.70	39.73-142.47	81.48±29.6
November	15.65-22.25	17.72±1.90	35.72-102.59	60.56±21.1
December	16.5-23.5	19.31±2.50	55.71-103.36	79.64±19.8

Table 2: Length Weight Regression Analysis

Sex	No of fish examined	Log a	Log b	Standard error of b	Correlation coefficient
Male	68	-1.38	2.53	0.140312	0.94
Female	52	-1.74	2.83	0.234421	0.91
Combined	120	-1.44	2.59	0.120888	0.93

Table 3: Monthly Mean Condition Factor of *Clarias gariepinus* Observed in Wastewater Reservoir

Month	Sex								
	Male			Female			Combined		
	TE	R	CF Mean	TE	R	CF Mean	TE	R	CF Mean
July	10	0.82-1.07	0.95+0.103	10	0.82-1.46	1.14+0.169	20	0.82-1.46	1.14+0.217
August	7	0.81-1.03	0.92+0.079	13	0.90-1.34	1.12+0.133	20	0.81-1.34	1.08-0.155
September	10	0.24-1.28	0.01+0.166	10	0.77-1.42	1.10+0.200	20	0.74-1.28	1.01+0.182
October	12	0.61-1.35	0.98+0.220	8	0.79-1.56	1.18+0.210	20	0.61-1.34	0.98+0.218
November	16	0.62-1.39	1.01+0.273	4	1.04-1.55	1.30+0.189	20	0.62-1.55	1.09+0.227
December	13	0.60-1.40	1.00+0.259	7	0.66-1.17	0.92+0.166	20	0.60-1.40	1.00+0.236

TE = Total examined, R = Range, CFM = Condition factor mean

Table 4: Monthly Mean Fecundity of *Clarias gariepinus* Observed from Wastewater Reservoir

Month	Total Examined	Range	Mean Fecundity	Standard deviation
July	10	2,698-25,697	11,016.50	$\pm$6815.835
August	13	7,315-20,566	13,669.54	$\pm$4268.330
September	10	11,480-20,440	16,540.30	$\pm$2916.666
October	8	11,480-20,440	17,262.50	$\pm$2915.137
November	4	13,440-18,410	15,207.50	$\pm$1929.50
December	7	13,454-18,907	16,696.00	$\pm$2366.143