LENGTH-WEIGHT RELATIONSHIP AND THE DIETS OF *Clarias lazera* (CUVIER AND VALLENCIENNES), FAMILY CLARIIDAE (OSTEICHTHYES: SILURIFORMES) IN ZARIA, NIGERIA

by

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ABSTRACT

The length-weight relationship and the diets of *Clarias lazera* were investigated in Zaria, Nigeria between July 1981 and June 1982.

About 450 specimens were examined. The standard lengths of the fish ranged from 8.5 cm to 42.2 cm. Significant differences were found between the standard lengths of the males and females with the latter slightly shorter. Somatic weights varied between 10 g to 502 g. Lenght-weight regression analysis gave a "b" value of 3.02 for both males and females combined; thus indicating an isometric growth.

Analysis of the food in the stomachs showed that the fish is an omnivore although, it fed more on insects and fish than other food items.

INTRODUCTION

The Family Clariidae is a group of catfish found in most African and Asian minor freshwaters (Mills, 1966). There are two genera in this family, *Clarias* and *Heterobranchus*.

The genus *Clarias* has a wider distribution than *Heterobranchus*. Over ten species of *Clarias* have been described in West Africa (Lowe-McConnel, 1972, Sydenham, 1977). Recently Sydenham (1980 & 1981) described three new species of *Clarias* from River Ogun in southern part of Nigeria.

In Zaria, two species of *Clarias* are found. These are *Clarias anguillaris* and *Clarias lazera*. The latter is the more common of these two species. *C. lazera* is a highly priced fish. It is of considerable economic importance in Zaria area. They are found commonly in the market throughout the year. According to Holden and Reed (1972), *C. lazera* often attain large size of up to one metre in length and a weight of about seven kilogram. This fish possessed specialized structures which enable it survive outside water for several hours. Welman (1948) observed a shoal of *C. lazera* migrating from a cut-off pond to a river covering a distance of about 62 metres.

The biology of this species had been studied by various workers which include Moussa (1957), Bolock and Koura (1960), Nawar and Yoakin (1963 Mill (1956), Abdel-Magid (1971) and Ishak *et. al* (1977), and Ejike et. al (1982). Many of the work cited above were conducted elsewhere outside West-Africa. There is no published account of the biology of of this species in Zaria despite their commercial importance. The great commercial value of this fish has brought an increasing pressure on its population. This might result in a decline of annual catch. Such downward trend in annual catch can be stopped through sound management practice which requires a thorough understanding of the biology of the species.

In this paper, the length-weight relationship and the dietary composition of *Clarias lazera* are discussed.

MATERIALS AND METHODS

Fish samples were purchased once a week from fish landings at Sabongari Central Market in Zaria, between July 1981 and June 1982. A total of 450 specimens were examined. In the laboratory, the total length, standard length and weight of each fish were measured as described elsewhere (Olatunde, 1977). The sex and the gonad condition were also determined after dissection and visual examination. The gonad maturity levels were determined according to a scale modified after Nikolsky (1963). Stomachs with food were later removed from the fish and their fullness classified according to a table prepared by Olatunde (1978). The stomachs were either examined immediately or kept in 5% formalin until when needed. Two methods were used for analysis of the stomachs. These are the Points and Frequency of occurrence methods. A full description of these methods can be obtained from Hynes (1950). The condition factor and length-weight relationship were calculated using conventional formulae (see results).

RESULTS

Length Distribution

Table 1 shows the length and weight ranges of the specimens examined. The value obtained for the mean total lengths, standard lengths and weights show that the males were generally larger than the females. Statistical tests (Table 2) show that there are significant differences between the lengths and weights of the males and females ($P = 0.1 - .001$) The length frequency distribution of males and females were also plotted as seen in Figure 1. The figure shows two peaks at around 14 cm and 15cm for the females; while the males show one distinct peak also at around 14 and the second which is less distinct between 24 - 27 cm. This figure probably indicates either the presence of two population groups or two age groups in the samples.

Length-Weight Relationship

The length-weight relationship was calculated using the formla described by Le Cren (1951):

$$W = a\,L^{b} \quad \ldots\ldots (1)$$

The data were transformed into logarithms before the calculations were made. Thus equation (1) was transformed into:-

$$\text{Log}\ W = \text{Log}\ a + b\ \text{Log}\ L \quad \ldots\ldots (2)$$

where W = weight of the fish (g)

L = standard length of the fish (cm)

a = contant

and b = an exponent.

The results of the regression analysis are shown in Table 3. The 'b' values for males and females and both of them combined were very close to 3, thus indicating an isometric growth. This however, assumed that the specific gravity of the fish remained constant (Tesch, 1968). The correlation of co-efficients were found to be very high and highly significant (Table 3). Graphs of the length-weight relationship using log conversions were drawn (Figures 1 and 2).

Condition Factor

The condition factors ('K' values) were calculated, using the formula

$$K = \frac{W \times 100}{L^{3}} \quad \ldots\ldots\ldots (3)$$

where K = condition factor

W = weight of the fish (g)

and L = standard length of the fish (cm)

The results obtained for each month are as shown in Table 4. The results show a fall in condition factor from October to February during the dry season period, whereas during the rainy season the fish were generally in good condition.

Dietary Composition

Table 5 shows the dietary compositon of the fish. The bulk of the food were made up of adult and immature insects. The coleopterans and orthopterans featured prominently among the adult insects, while chironomid larvae and pupae were the most utilized immature insects. On the whole, the insects formed about 41% of the total food consumed.

Fish and bottom deposits contributed significantly to the diets. Over 25% of the population consumed fish and about 40% fed on bottom deposits. Molluscs, Crustaceans, and Plant debris including some diatoms were also found in the stomach samples. These formed important parts of the diets. The dietary composition shows that Clarias lazera is an omnivore feeding principally at the bottom of the river.

DISCUSSION

The analysis of size ranges of Clarias lazera showed that generally, the mean lengths and weights of males are generally higher than those of the females. In some catfishes, the females exhibit faster growth rates than the males (Olatunde, 1979). Thus, the mean weights and lengths of the females are usually higher than those of the males. The size ranges found in the samples depend on the types of fishing gears used for the capture, the season of the year and other structural and physiological adaptations which might make one fish more vulnerable to catch than others. The specimens used for this work were purchased from the market. The sizes met and purchased from the market were usually influenced by a lot of factors which were beyond the control of the researcher. Thus, analysis of sizes based on market samples may not give a true picture of the size ranges present in the wild population. Such results should, therefore, be accepted with caution.

The length-weight relationship showed as expected that as the fish grow in length, the weight also increase. Figures 2 and 3 showed that the weights increase faster at the lower lengths than at the higher lengths. This indicates that growth proceeds faster at the earlier part of life than the later part. The regression analysis showed that males and females exhibited isometric growth. This is based on the assumption that the specific gravity of the fish remained constant (Tesch, 1968) The mean condition factors showed that the fish were in good condition during the rainy season and there was a fall in the dry season. The fall in condition during the dry season might be due to several factors which might include physiological stress due to changes in physical and chemical conditions of the habitat. Inadequate feeding may also contribute to loss of condition. It was observed that most of the fish samples had empty stomachs during the dry season. According to Lagler (1952), the "K" values of fish can also be influenced by sexual differences, age, changes in seasons and the gonad maturity levels of the fish.

Analysis of the stomach contents revealed that Clarias lazera in Zaria are omnivores utilizing a lot of food items ranging from insects to bottom deposits and vegetable matter. Studies from other water bodies within and outside Nigeria, also depicted the fish as an opportunistic feeder, feeding on what-ever comes its way. Ejike et al (1982) reported that C. lazera from Jos area fed on a variety of food items which

Table 1 - Size ranges of Clarias lazera from Zaria

	Sex	Number of Fish Examined	Maximum	Minimum	Mean	Standard Deviation	Standard Error
Total length (cm)	M	115	41.3	13.7	23.7	7.2	0.93
	F	335	44.2	11.2	22.4	6.7	0.55
Standard length (cm)	M	115	40.2	12.2	20.7	6.3	0.81
	F	335	42.2	8.5	19.8	8.1	0.66
Body Weight (g)	M	115	430	18	112.8	96.5	12.45
	F	335	502	10	015.4	91.5	7.48

Table 2 - Statistical analysis for significant differences between lengths and weights of males and females Clarias lazera from Zaria

	Sex	Degree of	Mean	"t"	Mean significantly different?	Level
Total length (cm)	M	448	23.7	3.421	Yes	0.001
	F		22.4			
Standard length (cm)	M	448	20.7	6.000	Yes	0.001
			19.8			
Body weight (g)	M	448	112.8	1.489	Yes	0.1
	F		105.4			

Table 3 - Length-weight regression analysis of females and males of C. lazera from Zaria

	Number of Fish examined	Log a	b	Standard Error of b	Correlation Co-efficients
Males	115	-1.94	2.94	0.05	0.90 (P = 0.001)
Females	335	-2.00	3.01	0.08	0.99 (P = 0.001)
Both	450	-1.98	3.02	0.07	0.98 (P = 0.001)

Table 4 - Monthly mean condition factor for Clarias lazera from Zaria

Month	Total Fish Examined	Condition Factor	
		Mean	Standard Deviation
July 1981	36	1.06	0.14
August 1981	45	1.64	0.23
September 1981	38	1.24	0.42
October 1981	40	0.83	0.31
November 1981	60	0.91	0.24
January 1982	20	0.93	0.20
February 1982	72	0.98	0.28
March 1982	56	1.11	0.13
April 1982	30	1.02	0.21
May 1982	10	1.04	0.14
June	28	1.05	0.22

Table 5 - The dietary composition of *Clarias lazera* from Zaria

Dietary items	% Frequency of Occurence	% Total Points
Adult Insects		
Orthoptera	6.5	4.2
Hemiptera	12.4	3.5
Isoptera	3.0	0.5
Dictyoptera	10.8	3.5
Hemiptera	5.4	1.5
Coleptera	15.2	7.4
Immature Insects		
Chironomid larvae	10.8	5.2
Chironomid pupae	5.5	3.4
Chaoborus larvae	3.5	2.2
Trichoptera larvae	5.4	1.4
Dragonfly nymph	4.0	2.2
Unidentified insect remains	10.0	5.5
Total Insects		40.5
Fish remains	40.0	21.5
Molluscs	8.5	4.0
Crustaceans	10.8	6.0
Plant debris	15.0	5.5
Bottom deposits	25.0	19.5
Total		100.0

included crustacea, immature insects, bottom deposits and diatoms. Holden and Reed (1972) reported the fish as one of the best example of an omnivore which eat almost anything found in its habitat. They found stomach samples to contain fish remains, mud, vegetation, insects and occasionally zooplankton. Welman (1948) mentioned that their food consisted of fish, mulluscs, insects, frogs and weeds. Worthington (1932) describeed the Ugandan specimens as piscivores but found also small animals and plants in their stomachs. Those found in Lake Edward and Kivu were found to feed regularly on zooplankton, chironomid and ephemeropteran larvae. Algae and other vegetable matters were also found in their stomachs (Verbeke, 1959). Sandon and El-Tayib (1953) found only fish remains in the stomach of samples examined from the Nile. Imevbore and Bakare (1970) also reported the River Niger species in Nigeria to be mainly piscivorous, while Lewis (1974) reported C. lazera from Lake Kainji to feed on small fish and carrion. The ability to feed on anything coupled with their ability of air-breathing are adaptive features which probably contributed to the wide distribution and great success of the fish and hence their commercial importance.

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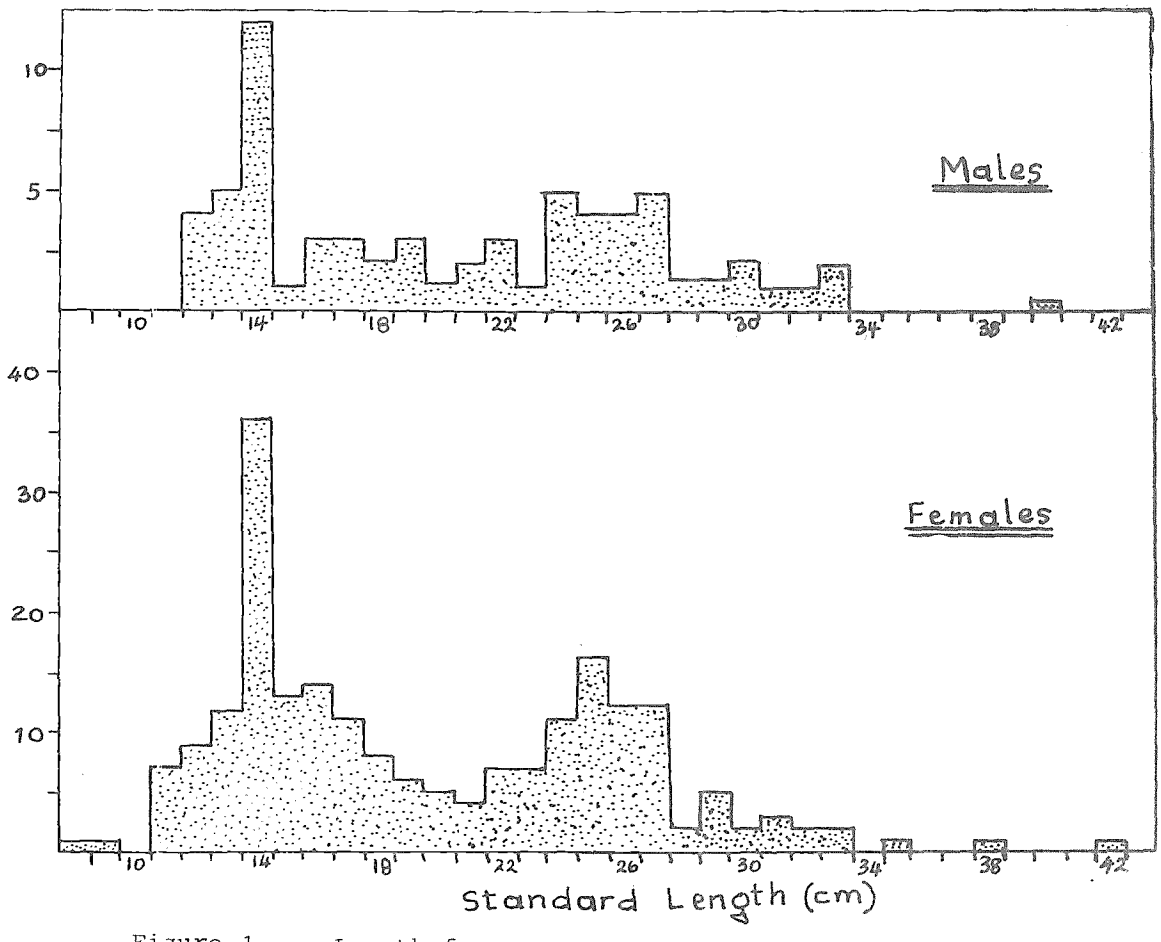

Figure 1 - Length frequency distribution of Males and Females of Clarias lazera in Zaria

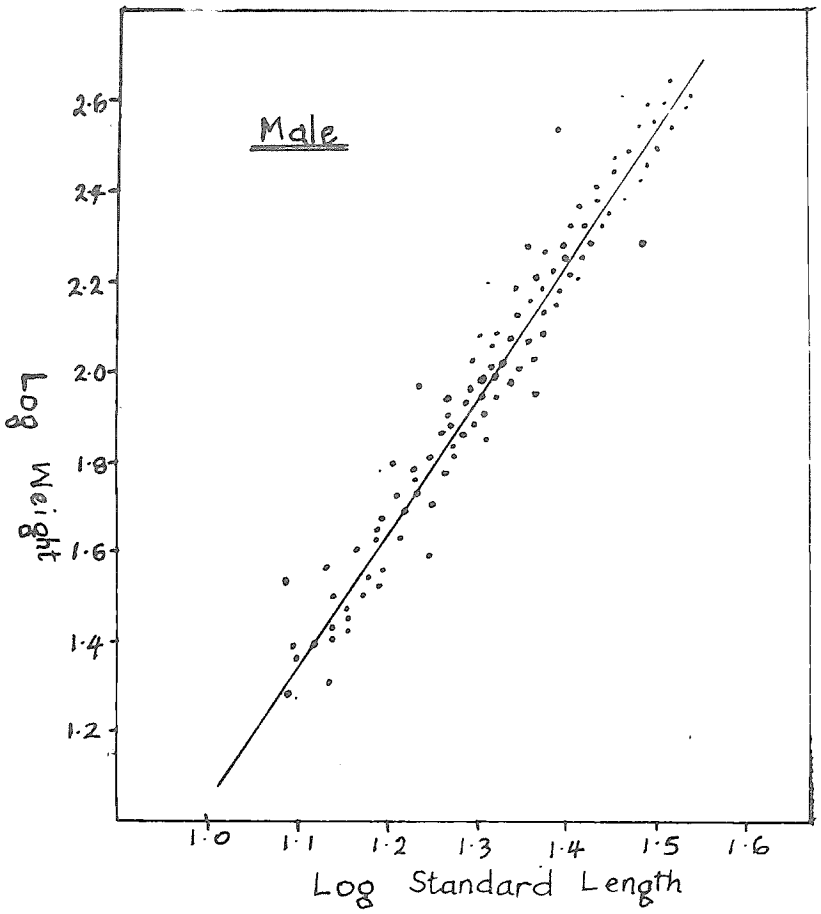

Figure 2 - Length-Weight relationship (Log - Log) of Male Clarias lazera in Zaria

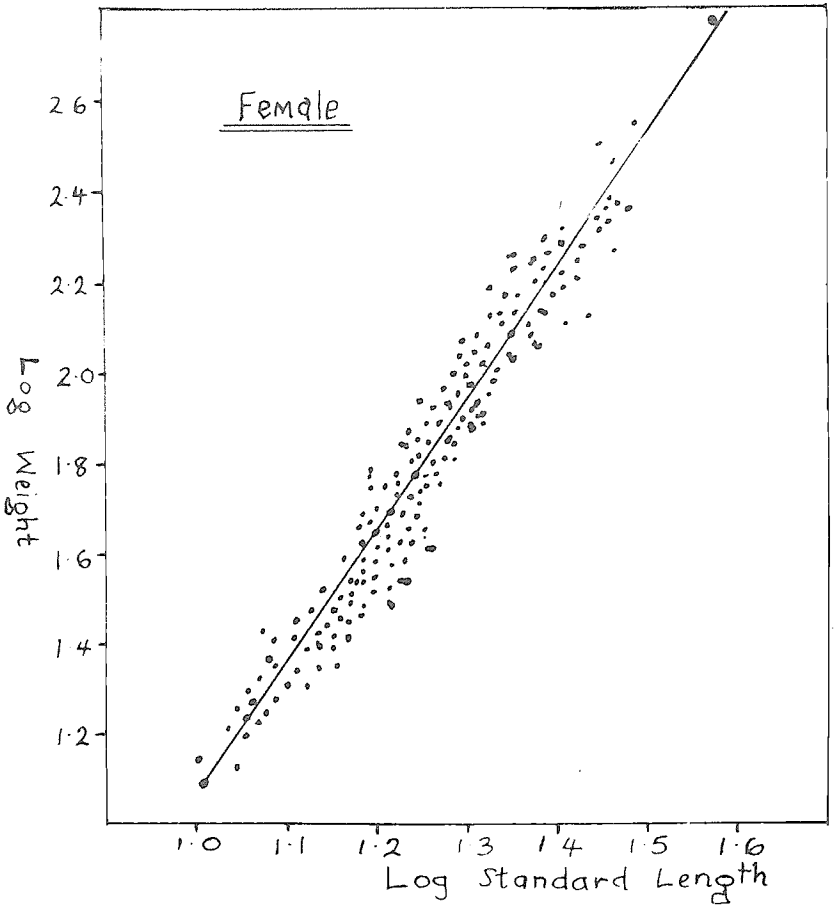

Figure 3 Length-Weight relationship (Log - Log) of Female Clarias lazera in Zaria