

LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF *Clarias gariepinus* AND *Tilapia zillii* IN LAKE ALAU AND MONGUNO HATCHERY, BORNO STATE, NIGERIA

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ABSTRACT

Length-Weight relationship and condition factor of Clarias gariepinus and Tilapia Zillii were studied in lake Alau and Monguno hatchery, both in Borno State of Nigeria, for a period of two weeks. A total of 98 C. gariepinus and 140. T. zillii were measured. The length-weight regression coefficient (b) for both fishes in lake Alau were not significantly different from the hypothesized value 3, but for both fishes in Monguno hatchery (b) differed significantly from the hypothesized value. Isometric growth of both fishes was recorded in lake Alau while a comparative decline in weight in relation to specific length of fishes was recorded in Monguno hatchery. Furthermore, condition of C. gareipinus in lake Alau revealed that all size groups of the fish grew better than those in Monguno hatchery, while the condition of T. zillii in Monguno hatchery was better than that in lake Alau. Although our results suggest that C. gariepinus in lake Alau grew faster than that cultured in Monguno hatchery, the study is not conclusive as abiotic, biotic, and sampling error might have interplayed. The reverse is also true for the growth potentials of T. zillii in Monguno hatchery when compared to that in lake Alau.

Keywords: *Clarias gariepinus*, *Tilapia zillii*, lake, Hatchery pond

INTRODUCTION

The global demand for animal protein has increased because of geometrical growth in human population along with decline agricultural productivity. Fisheries is an important contributor to animal protein needs. The rational and scientific management of fisheries depend on a fundamental understanding of fish biology and ecology. Among the various biological aspects of fish, the length-weight relationship and the condition factor of fish are of importance in the management of both culture and captive fisheries. The yield of fish is usually studied using weight as a measure of size. Fish grows both in length as well as in bulk, and length is easier to measure and so often used along with weight in growth studies.

Length and weight are related by a power relationship and the equation relating length to weight gives some indication of the growth pattern of fish in a population. The length-weight relationship has both applied and pure applications in the fisheries industry. Market sampling of fish of commercial importance often measures the length, as fish are usually gutted and life weight cannot be measured with certainty. An estimate of it can be obtained using predetermined length-weight regression.

Results of the studies on length-weight relationship of individual fresh-water fish are important and are applied in culturing, managing and developing individual fishery.

Against this background, an attempt was made in this study to determine and compare the

length-weight relationship and condition factor of *Clarias gariepinus* and *Tilapia Zillii* from lake Alau in Konduga Local Government Area and a hatchery in Monguno Local Government both in Borno State of Nigeria. *Clarias* and *Tilapia* are probably the most abundant groups of fish in Nigeria freshwater. A major proportion of the total fish in Maiduguri fish market is constituted by these groups of fish. These groups, therefore, have been selected for this study.

Clarias is a fish genus belonging to the family clariidae and it comprises ten species in Nigeria waters, namely, *C. gariepinus*, *C. anguillaris*, *C. jaensis*, *C. Macromystax*, *C. albopunctatus*, *C. agboyiensis*, *C. buthupogon*, *C. ebriensis*, *C. pachynema*, and *C. camerunensis* (Olaosebikan and Raji, 1998). *C. gariepinus* and *C. anguillaris* are capable of growing up to one meter or more in total length and more than 7 kilograms in weight (Holden and Reed, 1972). *C. gariepinus* is the main species of the genus found in Borno fisheries.

Tilapia is a fish genus belonging to family cichlidae and at least four species are found in Nigeria, namely, *T. zillii*, *T. mariae*, *T. dageti*, and *T. guineensis* (Olaosebikan and Raji 1998). *Tilapia* is the best known fish group in Nigeria. *I. zillii* is the most attractive and widely distributed species of the group. The species grows to an adult size of about 20 centimeters in total length (Holden and Reed, 1972). This species is common and abundant in lake Alau. Monguno hatchery pond and lake Alau are the main sources of fish supply to Borno State capital fish market.

Table 1: Values of log_a, regression coefficient (b), correlation coefficient (r) with t-test, and mean condition factor of *Clarias gariepinus* and *Tilapia zillii* of groups from Lake Alau and Monguno hatchery

| Study organism | Study Area | log _a | b | t-test Ho: β = 3 | r | t-test Ho: (P = 0) | Mean condition factor |
|---------------------------|-------------------|------------------|--------|------------------|--------|--------------------|-----------------------|
| <i>Clarias gariepinus</i> | Lake Alau | -2.18805 | 2.9999 | P > 0.05 | 0.996 | P < 0.001 | 0.7637 |
| | Monnguno hatchery | -0.1718 | 1.4173 | P < 0.001 | 0.9423 | P < 0.001 | 0.7036 |
| <i>Tilapia zillii</i> | Lake Alau | -17193 | 2.9696 | P > 0.05 | 0.9823 | P < 0.001 | 1.8666 |
| | Monnguno hatchery | -0.4459 | 2.0243 | P < 0.001 | 0.8621 | P < 0.001 | 3.1216 |

Table 2: Values of log_a, regression coefficient (b), correlation coefficient (r) with t-tests, and mean condition factor of *Clarias gariepinus* and *Tilapia zillii* of comparable size range from Lake Alau and Monnguno hatchery

| Study organism | Length range (in cm) | Study area | Loga | b | t-test Ho: β = 3 | r | t-test Ho: (P = 0) |
|---------------------------|----------------------|-------------------|--------|--------|------------------|-------|--------------------|
| <i>Clarias gariepinus</i> | 17.0-30.2 | Lake Alau | -2.222 | 3.0318 | P > 0.05 | 0.99 | P < 0.001 |
| | | Monnguno hatchery | -1.175 | 2.1528 | P < 0.005 | 0.903 | P < 0.001 |
| <i>Tilapia zillii</i> | 10.7-14.3 | Lake Alau | -1.757 | 3.0042 | P < 0.005 | 0.934 | P < 0.001 |
| | | Monnguno hatchery | -0.17 | 2.2603 | P < 0.05 | 0.828 | P < 0.001 |

The present work compares the length-weight relationship and condition of *Clarias gariepinus* and *Tilapia Zillii* in these two breeding habitats, natural and artificial habitats.

MATERIALS AND METHODS

Study Areas: Lake Alau is a natural water body while Monguno hatchery is an earthen cultured fish pond. Lake Alau is situated in the southeastern part of Maiduguri, 10 kilometers off Maiduguri-Konduga road the junction of which is at kilometer 15 from Maiduguri. The lake lies on approximately latitude 12°5' N and longitude 13°6' E. It receives annual delivery of water from the Ngadda and Yedzeram river systems and covers an area of about 22330 square meters (20 acres). It provides fish protein to people of Maiduguri and its suburbs.

Monguno hatchery is managed by the Directorate for Food, Roads, and Rural Infrastructure (DFRRI), Borno State. The pond is located in Monguno town, northern part of Maiduguri, about 85 kilometers from Maiduguri, Monguno town lies on latitude 12°40' N and longitude 13°30' E. The pond covers an area of 22.30 square meters (0.20 acre) fish in this pond live on natural food items.

Length-Weight Parameters: Life fish were collected and the total length and weight of individual fish were measured using a one-meter long rule and a triple-beam balance respectively. Lengths were measured in centimeter and to 0.1 cm while weights were taken in gram and to 0.1g. Weights were taken after wiping off water with a dry towel.

The relationship between total weight (W) and total length (L) of the fish were estimated using the equation: $W = aL^b$, where 'a' is a constant and 'b' is a regression coefficient relating weight (W in

grams) and length (L in cm), and was estimated by ordinary least square regression. After transforming the weight and length to logarithms the above equation was applied as follows: $\log W = \log a + b \log L$, calculated by the method of least square. Condition factor of the fish was calculated using the formula: $K = W \times 100 / L^3$ Where K= condition factor, W= fish weight in grams, L= total length of fish in centimeter.

The total length and total weight data of the fishes were subjected to statistical analysis according to Zar (1984). In order to verify if calculated 'b' was significantly, different from 3, the student's t-test was employed (Ezenwaji, 2004)

RESULTS AND DISCUSSION

Length-weight relationship was calculated for a total of 238 fishes made up of 70 *Clarias gariepinus* and 110 *Tilapia zillii* from lake Alau, and 28 *C. gariepinus* and 30 *T. zillii* from Monguno hatchery. The results of length-weight relationship and condition factor are shown in Tables 1 and 2.

Correlation coefficients for both *Clarias* and *Tilapia* in the study areas revealed a strong correlation between length and weight of the fishes (P<0.001) in lake Alau than in Monguno hatchery fishes (Table 1). This was also true when fish of the same size range from the two study areas were compared (Table 2). A similar strong correlation between length and weight of *Channa obscurus* in Nigeria freshwater was reported by Umeham (2001). Figures 1 and 2 represent the length-weight relationship (LWR) of *C. gariepinus* and *T. zillii* of comparable size range respectively in the study areas.

LWR of *Clarias* in lake Alau conforms with already recorded LWR of all species of the genus in Nigerian freshwater systems (Ezenwaji, 2004).

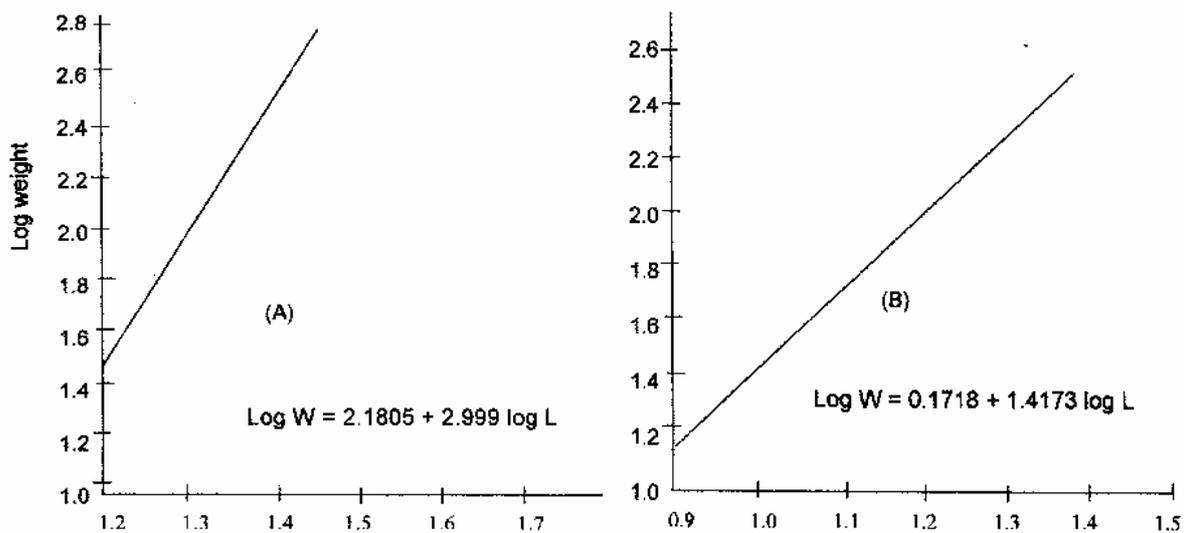


Figure 1: length-weight relationships using log length and log weight of *Clarias gariepinus* from (A) Lake Alau and (B) Monguno hatchery

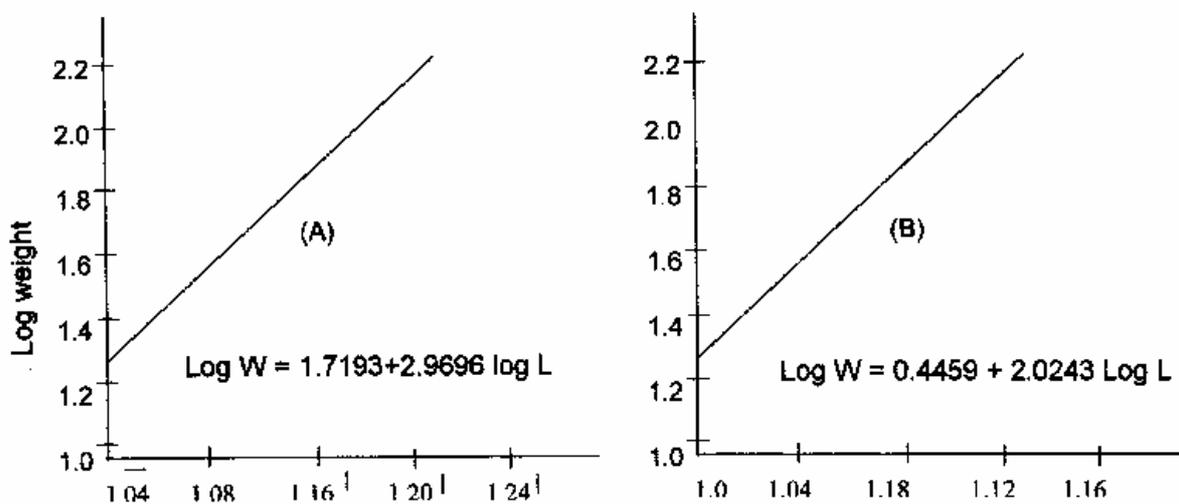


Figure 2: length-weight relationships using log length and log weight of *Tilapia zillii* from (A) Lake Alau and (B) Monguno hatchery

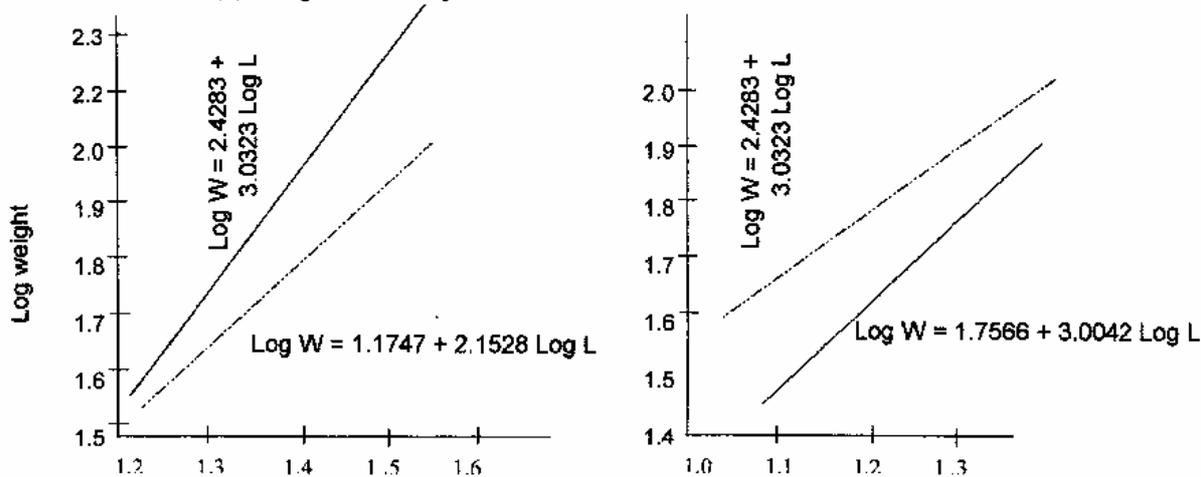


Figure 3: Regression line drawn between log length and calculated log weight of (A) *Clarias gariepinus* and (B) *Tilapia zillii* in lake Alau and Monguno hatchery

The same is true for LWR of *T. zillii* of this study in lake Alau with reference to LWR records in Nigeria (King, 1996 a, b).

The values of regression coefficient of *Clarias* and *Tilapia* in lake Alau did not differ significantly from 3 at 5 percent level of significance. Furthermore, fish of the same size range in Monguno hatchery differed significantly from 3 at 1 percent level of significance (Tables 1 and 2). Figure 3a showed the regression lines drawn between log length and calculated log weight for comparable size range of *Clarias* in both study areas; while the regression lines of *Tilapia* in the study areas are shown in Figure 3b.

Clarias of lake Alau showed higher values of mean condition factor than those of Monguno hatchery for all size groups (Table 1); whereas *Tilapia* of Monguno hatchery showed higher values of condition factor than lake Alau *Tilapia*.

Both *Clarias gariepinus* and *Tilapia zillii* from lake Alau were larger than those from Monguno hatchery. The difference in size of the fishes may be due to limited food supply to the hatchery resulting in poor pond productivity. The correlation coefficients for both species in the two study areas were found to be significant ($P < 0.001$). This proves that there is a strong relation between length and weight of all fish populations. But all fishes from lake Alau showed stronger relation than those of hatchery.

Regression coefficient for *C. gariepinus* and *T. zillii* from lake Alau did not differ significantly from the hypothesized value 3. This result indicated that both fishes from the lake satisfy the cube law, as they grew isometrically. Fishes from Monguno hatchery showed b- values significantly less than

the hypothesized value 3 and less than those of their counterparts in lake Alau. Low b-values of hatchery fishes revealed poor growth of the fishes, as they got relatively thinner as they grew. The regression lines computed between log length and log weight (Figure 3) for comparable size ranges from both *Clarias* and *Tilapia* populations also revealed the same result.

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