THE AGE AND GROWTH OF *TILAPIA ZILLII* (GERVAIS) IN OPA RESERVOIR, ILE-IFE, NIGERIA

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Abstract

Specimens of *Tilapia zillii* (Gervais) were collected from Opa reservoir in Ile-Ife, Nigeria, between October 1991 and February 1994. The fishing methods employed were castnetting and gillnetting. Annular rings were formed on the scales of 1310 specimens of the species between December and February of each year of study. Male fish specimens grew faster and bigger than the female fish irrespective of age. Fish length at maturity was 11.0cm (male) and 9.7cm (female). Allometric growth was observed in the species and the relationship between fish length and scale length gave a statistically significant correlation $r = 0.681$; $P < 0.001$. The species have a good condition factor which ranged between 1.40 to 3.06 with a mean of 2.86 in the reservoir.

Keywords: *Tilapia zillii*, annular ring, growth, age, condition-factor

1. Introduction

Cichlid fishes have been reported to dominate African freshwater bodies over many other species of fish (Harbott, 1975). Over 200 species of the cichlid family have been reported in inland waters of West Africa (Holden and Reed, 1978). Estimation of age and growth are fundamental to an understanding of the biology of fishes (Beamish and Mc-Farlane, 1983; Casselman, 1987). It is also of considerable importance if the fish is of commercial importance (Komolafe and Arawomo, 1998). Age data in conjunction with length and weight measurements can give information on stock composition, age at maturity, lifespan, mortality and production (Bagenal, 1978). In tropical waters, age determination is often difficult as reported by De Bont (1967) and Fagade (1974). This is because the rings on scales and hard parts of a fish may be associated with external factors such as dry season changes in food supply and stock density (Fryer and Iles, 1972). Fish scales exhibit great diversities in shape and size, yet they are veritable tools in age determination studies because their sizes and arrangement are constant (Lippitsch, 1992). Arawomo (1993) observed that the commercial importance of cichlid fishes in major rivers of West Africa has renewed interest in their age and growth determination. The objective of this study is to examine the annual growth in length, age at maturity and the length-weight relationship of a fish which is a commercially important species in Opa Reservoir.

2. Materials and Methods

Opa reservoir is located on the campus of Obafemi Awolowo University and has a catchment area covering 116 square kilometers. The reservoir (Longitudes 4° 31' E to 4° 32' E and Latitudes 7° 29' N to 7° 30' N; Fig. 1) has a surface area of 0.95 square kilometre and a maximum capacity of about 675 cubic metres. The minimum and maximum depths are 0.95m and 6.4m respectively.

The catchment area is characterized by wet and dry seasons. The dry season extends from November to March while the rainy season extends from April to October every year (Ekanade, 1980). During the rainy season, the reservoir receives high discharge of water from the catchment area making its water turbid. The substratum of the reservoir is mainly mud and sand. Shoreline vegetation is dense and identified macrophytes include *Commelina diffusa* Burm, *C. erecta* Linn, *Amarantus hibridus* Linn and *Acroceras zizaniodes* (Kunth) Dandy.

The specimens of *T. zillii* used for this study were caught between October 1991 and February 1994 in Opa reservoir. The fishing gears employed were castnetting and gillnetting. The gillnet was 250m long with five different mesh sizes of 50m each. The mesh sizes were 2.5cm, 5.1cm, 7.6cm, 10.2cm and 12.7cm with a depth of 1.32m stretched mesh. A castnet of 7.6cm and 2.5cm mesh sizes were used to catch fish. The total length, standard length and weight of fish were taken in the laboratory. Each fish specimen was slit open ventrally from the anus to the pectoral fin and its sex determined visually in line with the method of Roberts (1989). Scales were removed from just above the lateral line and below the dorsal fin of each fish specimen and kept in separate envelope. They were later washed in 10% Ammonia solution following the procedure of Rincon and Lobon-Cervia (1989).

Five clean and dried scales with good centra from each fish specimen were then mounted between two glass slides, labelled and examined under a dissecting microscope for annular rings. The radius of each scale was measured to assist in the determination of fish growth and the time when annular rings were laid down on the scales. The age of

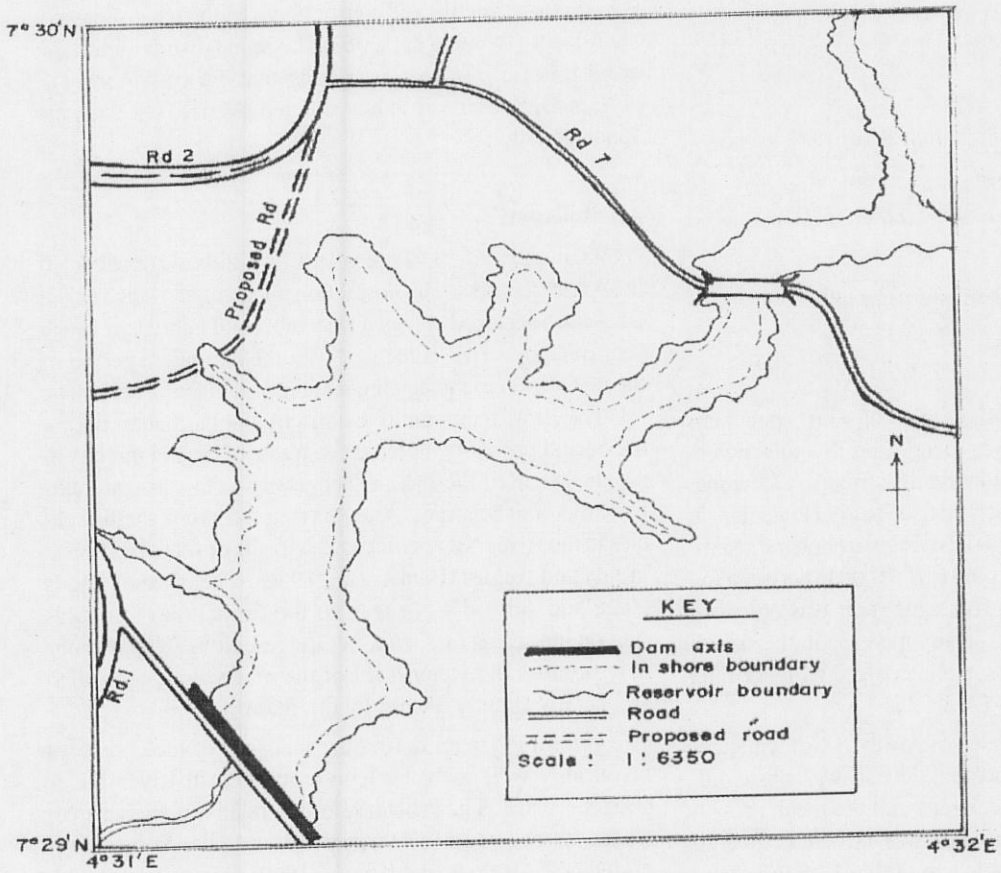

Fig. 1: Ona reservoir showing fish sampling site.

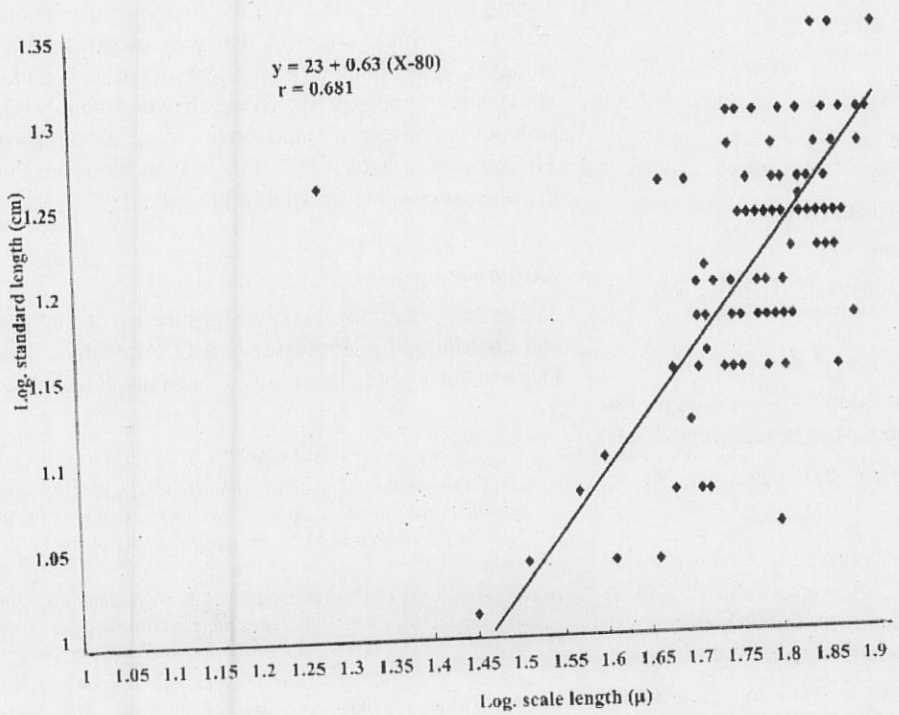

Figure 2: Graph of Log. standard length against Log. scale length.

each fish was determined by direct proportionality formula used by Bagenal (1978) viz:

$$L_n - C = \frac{S_n}{S}(L - C) \qquad (1)$$

where,

L_n = standard length when annulus 'n' was formed

C = intercept on abscissa

S_n = scale radius at annulus 'n' (at length L_n)

S = total scale radius

L = standard length when was sampled

3. Results

Annular rings formation on the scales of 1310 specimens of *T. zillii* in Opa reservoir was recognised by the characteristic crossing over of circuli which started in December and ended in February of each year of study (Plate 1). In other months, circuli were laid down regularly on the scales. A significant correlation ($r = 0.681$; $P < 0.001$) between log fish standard length and log fish scale radii was observed (Fig. 2). The result showed a steady increase in the size of fish with age. The male fish specimens grew bigger than the females in all age groups (Table 1).

However, a reduction in the rate of growth of fish with ageing process in both male and female fish was observed. There were 764 male fish specimens and the mean growth in length for the first year male fish was 11.0cm compared to 9.7cm observed in 546 female fish (Table 1). Subsequent increment in length of the male fish for the second, third and fourth year of life were 3.5cm, 2.8cm, 1.4cm compared to 3.1cm, 2.3cm, 1.2cm of the female fish of comparable age. The graph of length-weight relationship is described by the equation, (Bagenal, 1978):

$$W = al^b \qquad (2)$$

where, W = weight of fish (gm)

l = standard length of fish (cm)

a = Regression constant

b = Regression coefficient (an exponent with values between 2 and 4).

Tesch (1968) reported that the value $b = 3$ showed an isometric growth. The equation above can be represented thus;

$$\log W = \log(a) + b \,.\, \log(l) \qquad (3)$$

The graph of length-weight relationship for *T. zillii* showed allometric growth and the value of b calculated was 2.43. A significant correlation coefficient, $r = 0.960$ between fish log standard length and log weight was observed (Fig. 3).

The condition factor expresses the condition of a fish in terms of its general well being in a habitat. The values of condition factor of the male fish specimens ranged between 1.777 ± 0.150 to 1.983 ± 0.091 with a mean of 1.855 ± 0.154. In the female fish, the condition factor was between 1.799 ± 0.105 to 3.046 ± 0.160 and the mean was 1.910 ± 0.134. However, the difference between the means was not significant ($P>0.05$; df 1308). The values were quite high at all times of the year indicating that the condition of *T. zillii* in Opa reservoir is not affected by size, sex and seasonal variation.

4. Discussion

A total number of 1310 specimens of *T.* zillii were collected in Opa reservoir. The formation of annular rings on the fish scales occurred between December and February of each year of study. This coincided with the harmattan period of the dry season in the catchment area (Ekanade, 1980). The relatively low temperature caused by the harmattan during the period probably affected the water body and the physiological state of the fish in such a way as to cause annulus formation on the scales. Annulus ring formation on the species in the River Niger coincided with the onset of the floods in July and August (Banks *et al.*, 1966). The onset of floods (June and July) did not lead to the formation of annulus ring on the scales of *T. zillii* in Opa reservoir. This is probably because the water level of the reservoir is controlled and is only slightly altered by the floods.

The growth in length during the first year of life compares favourably well with the length attained in River Niger (Daget, 1956). The growth rate was relatively higher than what was observed in Egypt pond and lake Syria as reported by El-Bolock and Koura, (1960). Allometric growth was recorded for *T. zillii* in Opa reservoir. The fast growth rate recorded for the species could be attributed to the abundance of high quality natural food materials in Opa reservoir (Abayomi 1986; Komolafe and Arawomo, 1998). Decrease in growth length of *T. zillii* after the first year of life could be associated with changes in fish physiological state with maturity. The shunting of nutrients towards gonadal development during reproductive cycle was probably responsible for the observed reduction in growth as the fish aged. The condition factor of *T. zillii* in Opa reservoir showed that the species thrived well in the habitat.

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Table 1: Size range of male and female *T. zillii* at different age groups in Opa Reservoir

Age group	No. of Annuli	Designation	No of Fish	Male fish total length (cm) (Size range)	Mean total length (cm)	No of Fish	Female fish total length (cm) (Size range)	Mean total length (cm)
Less than one year old	None	0+	-	Less than 11.0	-	-	Less than 9.7	-
One year old	One	1	148	11.0 - 12.4	11.7 ± 0.44	36	9.7 - 10.5	10.1 ± 0.40
Less than two year old	One	1+	79	12.4 - 14.0	13.7 ± 0.20	28	10.5 - 12.8	11.7 ± 0.82
Two year old	Two	2	57	14.0 - 15.9	14.8 ± 0.21	151	12.8 - 13.6	13.1 ± 0.51
Less than three year old	Two	2+	25	15.9 - 16.8	16.1 ± 0.12	85	13.6 - 14.7	14.2 ± 0.49
Three year old	Three	3	111	16.8 - 18.7	17.3 ± 0.34	96	14.7 - 15.9	15.3 ± 0.55
Less than four year old	Three	3+	89	18.7 - 19.5	18.9 ± 0.16	77	15.9 - 16.6	16.1 ± 0.28
Four year old	Four	4	184	19.5 - 20.3	19.9 ± 0.28	73	16.6 - 17.1	17.0 ± 0.22
Less than five year old	Four	4+	71	Above 20.3	-	-	Above 17.1	-

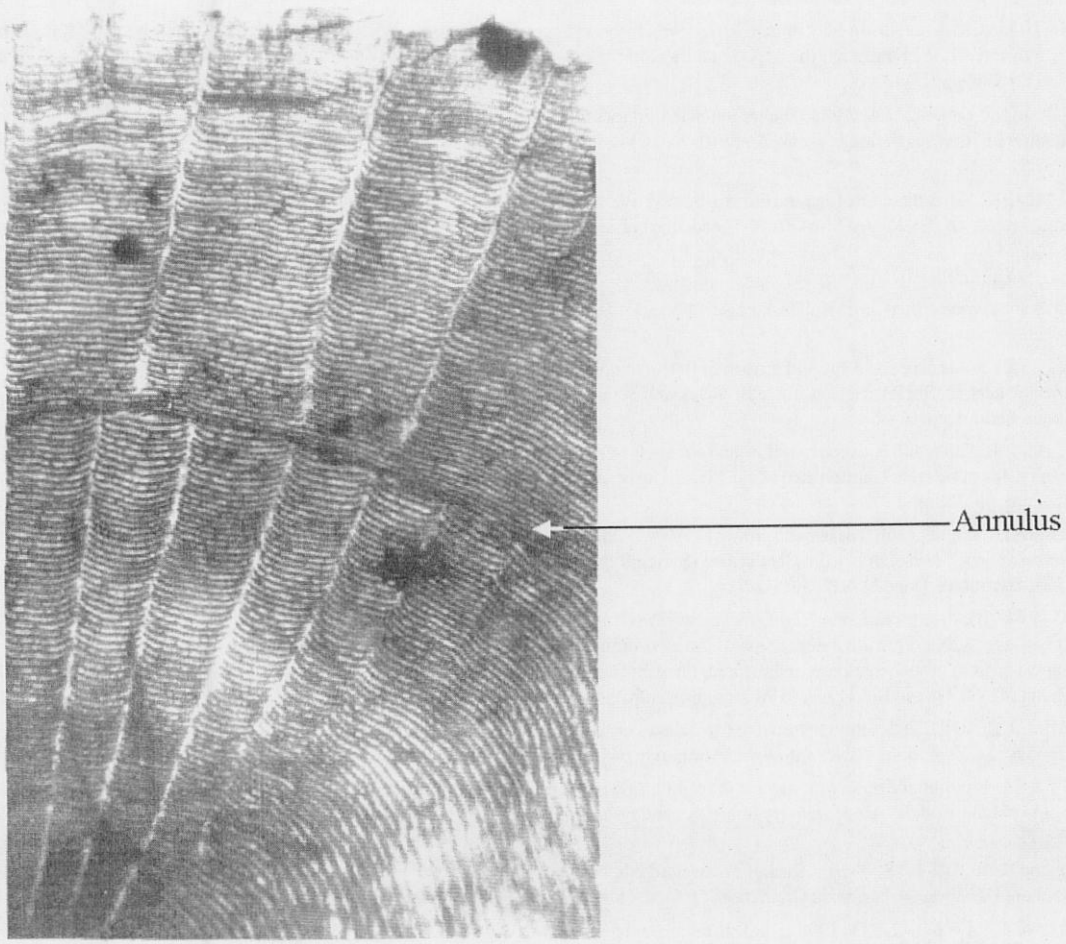

Plate 1: Fish scale showing annulus formation.

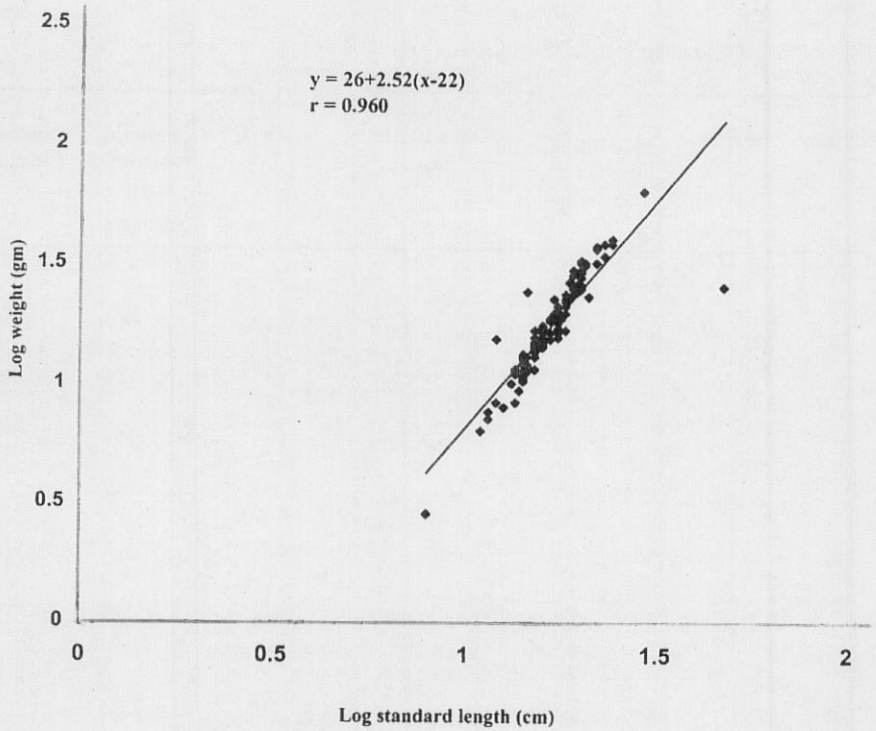

Figure 3: **Graph of Log. Weight (gm) against Log. Standard length (cm) of *Tilapia zillii* in Opa Reservoir**

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