AGE AND GROWTH OF DOMINANT CICHLIDS IN GBEDIKERE LAKE, KOGI STATE, NIGERIA

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ABSTRACT

Age, growth and mortality of two dominant Cichlids collected from an Ox bow lake on the tributary of River Benue were studied between October 2006 and September 2008. Sixty samples of the fish species comprising thirty Tilapia zilli and thirty Oreochromis niloticus were obtained from the Artisanal fishers from the common landing site along the lake. Age was determined from Bhattacharya's length frequency assortment method using where applicable the scale of fish and opercula bones. Growth was found to be allometric among the species studied conforming to the growth factor $W = aL^b$. Four age groups were observed while averaged instantaneous total mortality for the species was 0.48/year and an exploitation rate of 0.41 while the longevity was 8 years.

Keywords: Age, Cichlids Species, Instantaneous Growth, Exploitation, Gbedikere Lake, Nigeria

INTRODUCTION

Age and growth studies are very necessary to fishery science (Adeyemi *et al.,* 2009). Age, length and weight data are very important tools to fishery biologists since details of species growth, mortality rates, age at maturity and life span can be determined from such information (Ricker, 1975; Gulland, 1983).

Although numerous methods have been used to age fishes (Nielson and Johnson, 1983), three general methods predominate. The first is the mark and recapture method. The second is Peterson method which involves the comparisons of length frequency distribution of fish population samples (Ricker, 1975). This method requires measuring the lengths of a large number of fish in a population. The third method is to count growth marks that develop periodically in various hard parts of fishes. This is the most commonly used method. Several kinds of hard parts in fishes can be useful in determining age (Nielson and Johnson, 1983). Otoliths and scales are the hard parts most often used but in elasmobranchs and some other bony fishes, rings or bands in the vertebrae have been studied as well. Also bony fish opercula, fin rays and other calcified structures may show annual marks (Six and Horton, 1977). This work seeks to identify growth and mortality rate of *Oreochromis niloticus* and *Tilapia zilli* the two most dominant cichlids in Gbedikere Lake, Kogi State, Nigeria.

MATERIALS AND METHODS

Study Area: The study area was Gbedikere Lake; a natural lake located between Latitudes $7^0 25^N$ and Longitudes $7^0 30^E$ and is about 10km to the East of Oguma the Headquarter of Bassa Local Government Area of Kogi State. Water enters the Lake from tributaries that run from River Benue during rainy or flood season. When the season is over, the Lake separates out. The Lake is about 450m north of Gbedikere village. The water body covers an area of about 400m – 450m with a mean depth of 10 – 14m (UBRDA, 1985) depending on the season and is used for domestic purposes and fishing; consequently most of the settlers around the Lake are fishermen (UBRDA, 1985).

Sampling: A total of 60 samples of fish were collected from the fishermen using gill nets, cast nets, hook and line and Malian traps between October 2006 and September 2008 and identified. The total length (TL) of the fish was measured from the tip of the anterior or part of the month to the caudal fin using meter rule calibrated in centimeters. Fish were measured to the nearest centimeter. Fish weight was measured after blot drying with a piece of clean hand towel. Weighing was done with a tabletop weighing balance, to the nearest gram. The length measurements were converted into length frequencies with constant class intervals of 2 cm. The mean lengths and weights of the classes were used for data analysis, the format accepted by FISAT (Gayanilo and Pauly, 1997). Age estimation were carried out, using where applicable, scale of fish and opercula bones as described in Hynes (1950), Bagenal (1978) in conjunction with von Bertallanffy growth model available in LFSA/FISAT computer programmes.

Age: Age estimation was also carried out, using where applicable, scales of fish and opercula bones (Hynes, 1950; Bagenal, 1978; Sparre and Venema, 1992) in conjunction with von Bertallanffy growth model (von Bertallanffy, 1938).

Growth: Estimation of growth parameters was done for length frequency, length-weight relationships and length at age using the Bhattacharya's, von Bertallanffy's, Powell-Wetherall and Ford-Walford methods.

Analysis: Length and weight data collected were analysis using the length frequency based fish stock assessment computer programme (Gayanilo and Pauly, 1997). Fish growth was described by the equation: $Lt = L\infty\ (1-e^{-k\ (t-to)})$ (von Bertallanffy, 1938), where: Lt = predicted length at time t, L∞ = asymptotic length or maximum attainable length, e = base of the natural log t, T = time, t_o = the size at which organism would theoretically have being age 0 and K = instantaneous growth rate or growth coefficient. Values of length at infinity (L∞ parameter of the von Bertallanffy growth formula (VBGF) expressing asymptotic length i.e. the mean length the fish in a population would reach if they were to grow indefinitely), K (growth curvature factor), t_o (size at which organism would theoretically have been at age 0) and Ø'= Phi – Prime (i.e. length based index of growth performance ($Ø' = Log_{10}\ K + 2\ Log_{10}\ L\infty$) were estimated from the von Bertallanffy growth equation thus:

$L\ (t) = L\infty \times \{1 - \exp\ (-\ k \times (t - t_o)\}$ ……….. (1)

A series of algebraic manipulations gave:

$L\ (t + \Delta t) = a + b \times L\ (t)$ ……………………….. (2)

(Sparre and Venema, 1992).

$a = L\infty \times (1 - b)$ and $b = \exp\ (-k \times \Delta t)$ …….. (3)

Since k and L∞ are constants, a and b also become constants if Δt is a constant. The growth parameters k and L∞ were then derived from $k = 1/\Delta t \times Lnb$ and $\Delta t = a/1\text{-}b$. a and b were obtained from carrying out the regression analysis of the Ford-Walford plot (Figure 1 and 2). The Ford-Walford plot was used to estimate L∞ graphically from the intersection sample point of the 45^0 diagonal where L (t) = L (t+Δt).

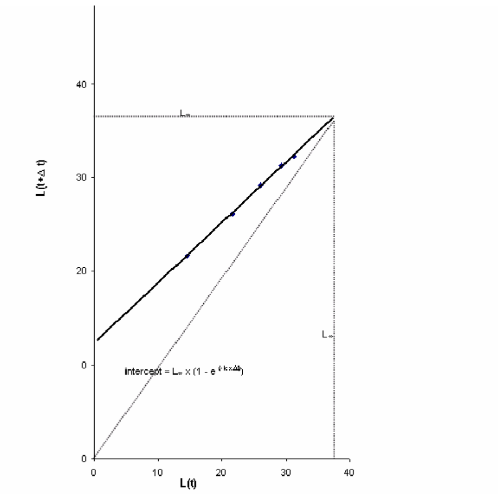

Fig 1: Ford- Walford plot for estimating L∞ for *Tilipia zilli* at Gbedikere Lake, Kogi State.

RESULTS

An examination of the relationship that exists between the lengths and weights of the cichlid species was undertaken using the ICLARM length-weight programme (Table 1). For growth parameters, the asymptotic length, L∞ was 34.52cm in *T. zilli* and 43.82 in *O. niloticus,* respectively.

The instantaneous growth rate and growth coefficient or growth curvature factor (K) were 0.44 Yr^{-1} and 0.32, respectively.

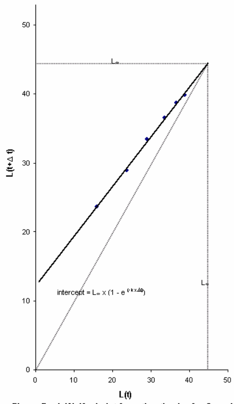

Fig 2: Ford- Walford plot for estimating L∞ for *Oreochromis niloticus* at Gbediere Lake, Kogi State.

Table 1: Length-weight relationships of *T. zilli* and *O. niloticus* in Gbedikere Lake, Kogi State, Nigeria

Species	a	b	r	n	p
Tilapia zilli	0.00452	3.496	0.9548	30	< 5%
Oreochromis niloticus	0.01768	3.047	0.9361	30	< 5%

The highest age at t_o were -0.222 and -0.350 for *T. zilli* and *O. niloticus,* respectively. Furthermore, the growth performance indices (Ø′) were 2.72 and 2.79 for *Tilapia zilli* and *Oreochromis niloticus,* respectively (Table 2).

Table 2: Growth parameters of *Tilapia zilli* and *Oreochromis niloticus* in Gbedikere Lake, Kogi State, Nigeria

Species	K (yr^{-1})	t_o	L∞	Ø′
Tilapia zilli	0.44	-0.222	34.52	2.72
Oreochromis niloticus	0.32	-0.350	43.82	2.79

The species (*T. zilli* and *O. niloticus*) caught fall within 1+ and 2+ age brackets (Table 3).

DISCUSSION

Growth in Gbedikere Lake cichlid fish species could be related to the availability of food as reported by Adeyemi *et al.* (2009).

Table 3: Length at age of *Tilapia zilli* and *Oreochromis niloticus* in Gbedikere Lake, Kogi State, Nigeria

Species	Total Length at Age (cm)				
	Age	L1	L2	L3	L4
Tilapia zilli	1+	12.4			
	2+		14.0		
	3+			17.1	
	4+				
Mean					**14.5**
Oreochromis niloticus	1+	11.1			
	2+		12.7		
	3+			15.8	
	4+				19.7
Mean					**14.8**

The rate at which they grow could be related to the rate at which they are harvested. Rikhter and Efanov (1976) demonstrated that fish with a high natural mortality mature early in life, compensating for the high mortality by starting to reproduce early. This also is supported by the small sizes at which the species reach maturity. The length-weight relationships obtained for the species compared favourably with those obtained elsewhere. Bongoyinge (1984) obtained Log W = -4.4656 + 3.21 Log L, recorded for *Tilapia mariae* in Port Harcourt. Log W = -1.5273 + 3.1014 Log L (r = 0.9923) was obtained by Bankole (1989) in Tiga Lake. Furthermore, Olatunde (1983) obtained Log W = -4.1352 + 2.880 Log L (r = 0.974) in Zaria, while Kings (1996) obtained Log W = 5.2591 + 3.25 Log L (r = 0.949) for *Clarias gariepinus* and Adeyemi *et al.* (2009) obtained b value of 3.496 for *Tilapia zilli* in Gbedikere lake respectively. The attempt at ageing the fish based on scale and length frequencies was a difficult one because identification of the year classes was difficult. Programmes in the FiSAT were very helpful especially, in the estimation of the length at infinity (L∞), K and t_0.

Although drastic changes that lead to ring formation in the hard parts of temperate fish do not occur that sharply in the tropics (Sparre and Venema, 1992), it was still possible to deduce some reasonable conclusions with the aid of the hard parts used, such as the opercula bones and scales. The bulk of the fish species (*O. niloticus and T. zilli*) caught from the Gbedikere Lake fall within 1+ and 2+ age brackets. The implication for the fishery is that many of the fish would enter the fishery at an early age and this could lead to the present experience of the fish reproducing early (Adeyemi, 2011). However, Landau (1979) found similar length at age in *Tilapia galilaea* of Lake Kinneret where the length at age distribution ranged from 1+ to 4+ in the fish caught over four seasons.

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