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Research article

Estimation of Growth Parameters of Four Commercial Fish Species in Jebel Aulia Dam Reservoir, Sudan

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Abstract

This study was conducted during a period from March 2008 to February 2009 on the three main fisheries sites of Jebel Aulia dam (45 Km South of Khartoum State), El hashaba, Kosti and El nuzul. Estimation of L_∞ and K were obtained from Von Bertalanffy growth parameters, presented for Four important commercial fish group *Lates niloticus*, Linnaeus, 1758; Family Centropomidae, *Oreochromis niloticus* , Linnaeus, 1758; Family Cichalidae and *Labeo niloticus*, Forskål, 1775; Family Cyprinidae and *Clarias gariepinus*,Burchell,182; Family Clariidae in Jebel Aulia Dam Reservoir, Sudan caught by beach seine nets. Four commercial fish species were studied for growth parameter with the results as follow: *Lates niloticus*, the estimate of growth coefficient year^{-1} (K) was 0.0693y^{-1}, while asymptotic length (L_∞) was 150.5 cm and Von Bertalanffy growth parameter $L_t = 150.5\ (1\text{-}e^{-0.0694})$. *Oreochromis niloticus* had K = 0.396y^{-1}, L_∞ = 34.6 cm and the equation of Von Bertalanffy growth parameter $L_t = 34.6\ (1\text{-}e^{-0.396})$ and *Labeo niloticus* had K = 0.0291y^{-1}, L_∞ = 74.4 cm ad the equation as: $L_t = 74.4(1\text{-}e^{-0.0291})$. *Clarias gareipinus* had a K = 0.130y^{-1}, L_∞ = 47.5 cm and the equation were: $L_t = 47.5\ (1\text{-}e^{-0.1307})$.

Key Word: Estimation, Growth Parameters, Jebel Aulia Reservoir.

1. Introduction

In the Sudan freshwater fish fauna comprises about 115-130 species (Bailey, 1993; Fish Base, 2006), of which about 90

% are found in the Nile. Approximately 70 species are likely to occur in the River Nile between Khartoum and Lake Nubia.

Growth studies are an essential instrument in stock assessment and the management fisheries resources because these studies contribute estimates the production, stock size, recruitment and mortality of fish population (Magnifico,G, 2007).

The estimation growth parameters may be based on absolute or relative age of the individual fishes or derived from length-frequency data. The most important growth parameters are L_∞, K and t_0 which forms the Von Bertalanffy growth equation. Jebel Aulia dam was constructed in 1937 across White Nile River, situated 45 km South of Khartoum State. The dam is situated between Longitude 032º29´ E and Latitude 15º14´ N and altitude 377.4 m above sea level and surface area of the dam reservoir extending over 1246 Km^2, mean depth range between 2.3- 6 m and maximum depth 12 m and design capacity is 3.5 mm^3 (Belleman and Khalid, 1998). The growth parameter of Nile perch *Lates niloticus* (L. Centropomidae) in the Nyanza Gulf of Lake Victoria estimates L_∞= 169 cm and 223 cm and K= 0.0195 yr^{-1} and 0.180 yr^{-1} (Rabour, et.al, 1991).The von Bertalanffy growth curve of *Lates niloticus* in the Nyanza Gulf, Lake Victoria, East Africa L_t= 1.35 L (l-e $^{K(t.to)}$) with the parameters L_∞ = 93.1cm, K = 0.272 yr^{-1} and t_0 = 0.046, is suggested to describe growth up to 5 years of age and the relationship L_t = 1.35(31.96 + 7.681t) for fish aged 6 years and above (Hughes, 1984). The von Bertalanffy parameters of *Oreochromis niloticus* (Tilapia) in the Nyanza Gulf of Lake Victoria were obtained from the analysis L_∞ = 61.3 cm T.L and K = 0.35 yr^{-1} where L_∞ represents asymptotic length and K, the growth constant (Dache, S.A.O, 1990). The age data of *Oreochromis niloticus* from a tropical shallow lake in Mexico, derived from opercular bone readings, were used to estimate the growth parameters of the Von Bertalanffy equation: L_∞=17.88cm, K = 0.3409, t_o = - 1.543 and W_∞ = 149.21 g (Márquez, et.al, 2008). The Von Bertalanffy growth function (VBGF) *Labeo parvus;* Boulenger, 1902 (Pisces: Cyprinidae) in the Ouémé River in Bénin (West Africa) was fitted to the 12 consecutive month's length-frequency data to obtain a VBGF with the following parameters: L_∞ = 30.5 cm TL, K = 0.40 $year^{-1}$.

2. Materials and Methods

2.1. Data collection

Fish species were collected monthly from three different fishing grounds El hashaba 32° 12'E and 14° 18' N, Kosti 32° 40'E and 13°10'N and El nuzul 32° 47' E and 12° 37'N (Fig, 1). Three samples of commercial beach seine nets were used with mesh sizes 110-60 mm in both sides of seine net and 50 mm in the center of net, depth 224-275cm, length 450-560 meter, warp rope length vary according to operation range from (420 to 450 meter) and 6-12 men usually operate the net. Each fish when caught was identified to species level according to Sandon (1950), Abu Gideiri (1984) and Bailey (1993). Fresh specimens were measured by used measuring board to total length (TL, nearest 0.1 cm) and weighed by using digital balance (SF-400) and dial balance (10Kg), large size more than 10Kg were weighed by spring balance (100Kg) and body weight (BW, nearest 1g) respectively.

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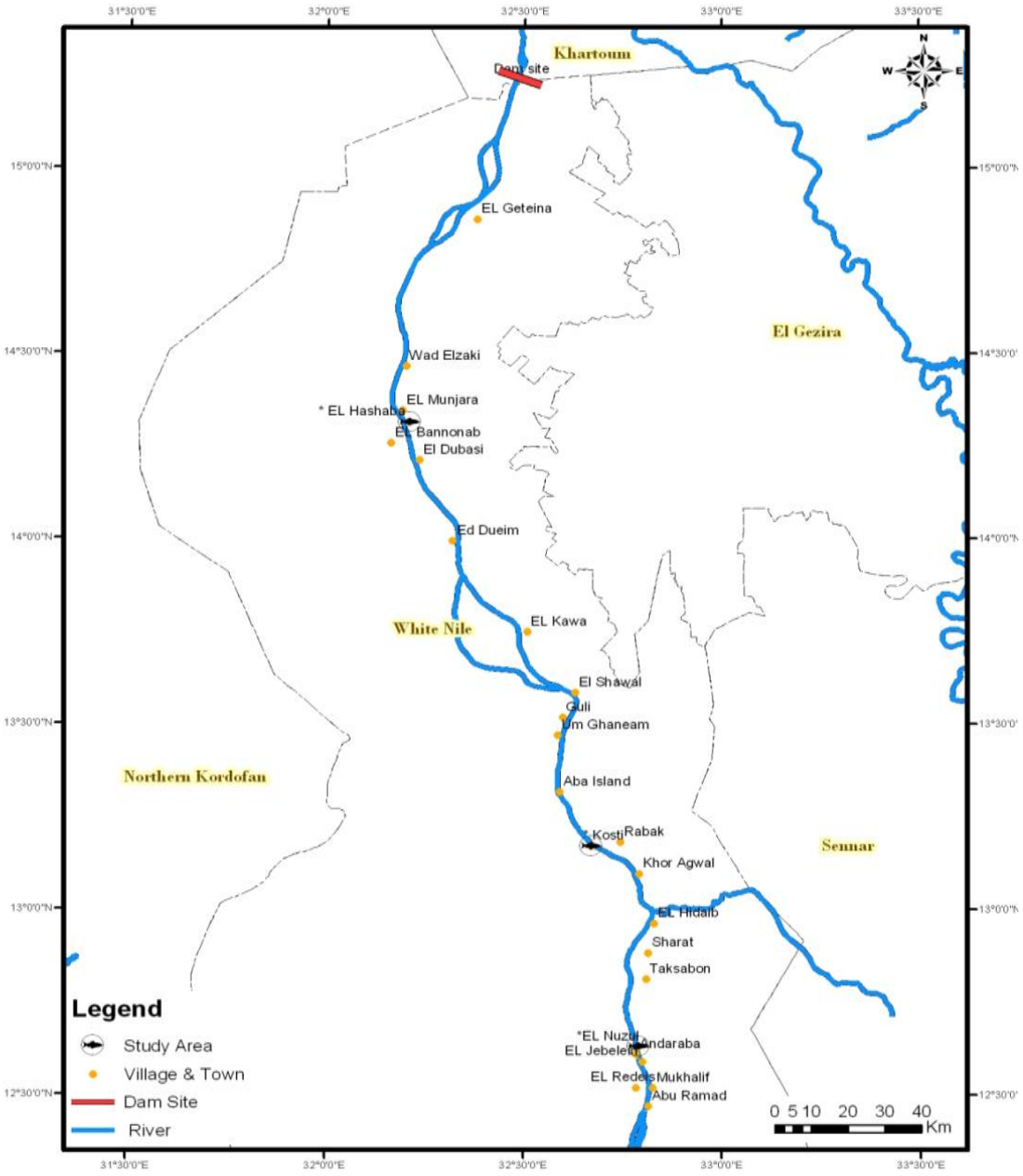

Figure 1: Location of sampling in Jebel Aulia Reservoir, Fishes showed sampling study area

2.1. Data Analysis

The Von Bertalanffy Growth Formula (VBGF):

$$L(t) = L_\infty * [1 - \exp(-K*(t-t_0))] \quad \ldots\ldots (1)$$

Where:

L_∞: asymptotic length (cm).

K: growth coefficient year^{-1}

t_0: theoretical time when length is zero years.

L_t: Standard length at age t.

The increment of annual growth was plotted against growth, linear regression were obtained from $L_t + T\text{-}L_t$ against L_t (length at age).

To estimate the values of K and L_∞ we can use Gulland and Holt equation:

$$L_t + T - L_t = L_\infty (1- e^{-K T}) - L_t (1- e^{-K T}) \quad \ldots\ldots (2)$$

The slope (b) in Gulland plot were represented by the equation

$$b = (1- e^{-K T}) \quad \ldots\ldots (3)$$

The intercept (a) were represented by the equation

$$a = L_\infty (1- e^{-K T}) \quad \ldots\ldots (4)$$

The curvature parameter in Gulland and Holt Plot was calculated as follow:

$$b = (1- e^{-K T}) = -1+ e^{-K T}$$

$$-K= \ln (b+1)$$

To calculate the value of L_∞:

$$\text{Ln} (L_\infty - L_t) = a - bt$$

3. Results and Discussion

3.1. Results

The equation of Gulland and Holt plots of *Lates niloticus*, *Oreochromis niloticus* and *Labeo niloticus* were used to calculate the values of (K), (L_∞), Slope (b) and Intercept (a) shown in (Table,1).

Table, 1: The Von Bertalanffy growth parameters for *Lates niloticus*, *Oreochromis niloticus*, *Labeo niloticus* and *Clarias gareipinus* in Jebel Aulia Dam Reservoir

Parameter/Species	K	L_∞	Slope	Intercept	Equation
Lates niloticus	0.0694y^{-1}	150.5 cm	-0.92012	138.504	$L_t = 150.5(1-e^{-0.0694})$
Oreochromis niloticus	0.396y^{-1}	34.6 cm	-0.385	133.6	$L_t = 34.6(1-e^{-0.396})$
Labeo niloticus	0.0291y^{-1}	74.4 cm	-0.2833	21.08	$L_t =74.4(1-e^{-0.0291})$
Clarias gareipinus	0.130y^{-1}	47.5 cm	-0.11532	54.83	$L_t = 47.5(1-e^{-0.1307})$

4. Discussion

Growth parameter of Nile perch (*Lates niloticus*) in Jebel Aulia Reservoir was estimated as L_∞= 150.5 cm and K= 0.0694y^{-1}. The Von Bertalanffy growth parameters for *Lates niloticus* in the study area was: L_t= 150.5(1-e$^{-0.0694}$). Rabour, et.al (1991) who calculated the values of growth parameter of Nile perch *Lates niloticus* (L. Centropomidae) in the Nyanza Gulf of Lake Victoria estimated that: L_∞= 169 cm and 223 cm and K=0.0195 yr^{-1} and 0.180 yr^{-1}. There was difference between present values which may be attributed to size of fish caught, type of fishing method and aquatic environment.

In the present study, the values of (K) and (L_∞) of *Oreochromis niloticus* were calculated as: K = 0.396y^{-1}, L_∞ = 34.6 cm

and the equation of Von Bertalanffy growth parameters as: $L_t=34.6(1-e^{-0.396})$. Khalid (1990) determined the Von Bertalanffy growth parameters for this species as well: L_∞= 450 mm; sK = 0.2949/yr; t_0 = 0.0109. In spite of, both studies have been done in same ecosystem they varied in the values of L_∞ and K may be due to difference in the sizes of fish studied and aging.

The Von Bertalanffy growth parameters of *Labeo niloticus* in the present work, were K = 0.0291y^{-1}, L_∞= 74.4 cm and the equation L_t =74.4 $(1-e^{-0.0291})$. The Von Bertalanffy growth *Labeo parvus* in the Ouémé River in Bénin (West Africa) was: L_∞ = 30.5 cm T.L, K = 0.40 $year^{-1}$. There was difference between two species in spite of belonging to one genus and family, but the difference may be to environment, sizes and type of fishing method and aging.

Calculated the Von Bertalanffy growth parameters of *Clarias gareipinus* gave the values of K = 0.130y^{-1}, L_∞ = 47.5 cm S.L and in this study L_t = 47.5 $(1-e^{-0.1307})$. Sükran, et.al (2002) who calculated the same parameters of the same species (males and females) in the River Asi, Turkey, found that the equation of Von Bertalanffy growth: L_t = 82.94 $[1-e^{-0.15(t+1.72)}]$ and L_t = 85.32 $[1- e^{-0.144(t+0.69)}]$. Above difference may be due to sizes, environment or type of fishing method and aging.

4. Conclusions

This study was presented the basic information on the four economic fish species in Jebel Aulia Dam Reservoir and supported to contribute to population dynamics study and ultimately add to stock assessments.

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