African Journal of Environmental Science and Technology Vol. 4(5), pp. 279-283, May 2010
Available online at http://www.academicjournals.org/AJEST
DOI: 10.5897/AJEST09.211
ISSN 1991-637X © 2010 Academic Journals

Full Length Research Paper

Age and growth of *Distichodus antonii* (Schilthuis, 1891) (Pisces, Teleostei, Distichontidae) in Pool Malebo, Congo River

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Accepted 7 February 2010

The estimation of demographic parameters of *Distichodus antonii,* in Pool Malebo (Congo River), was obtained from analysis of 36 good scales samples. L_∞ was estimated at 107.91 cm, K at 0.10 .year^{-1} and t_0 at -0.67 year^{-1}. The growth parameters calculated from this method revealed that this fish has a slow growth rate and it reaches a large size. The analysis of marginal increase shows that the formation of annulus takes place to the dry season. During the dry season, the environmental conditions are disturbed and the access to food becomes difficult. This is probably the base of the stress that induces the formation of annuli on the scales.

Key words: *Distichodus antonii*, age and growth, Congo River, Pool Malebo, democratic republic of Congo.

INTRODUCTION

The age and growth parameters of fishes constitute essential data to control the dynamic of ichthyologic populations; they give an important indication on the fisheries management and on the level of their exploitation (Summerfelt and Hall, 1975).

Distichodus antonii is an important economic fish for the inhabitants of Kinshasa. But this species becomes scarce in the captures of the fishermen in Pool Malebo (Kinshasa, Congo River). However, as Merona et al. (1988) said, there is no growth parameters estimation for the greater number of fishes of African equatorial forests rivers and it is also the case for our species in Pool Malebo. In African sub-tropical region with long periods of low water, the growth parameters and age have been calculated only for some characiformes: *Micralestes acutidens* (Lek and Lek, 1977), *Alestes baremoze* and *Distichodus rostratus* (de Merona et al., 1988). Therefore, to improve the knowledge of age and growth parameters of *Distichodus* species, we have, from scales analysis, estimated the growth parameters for *D. antonii* in Pool Malebo.

This is very important to provide baseline scientific data for input policy and better sustainable exploitation of the fish stock in Pool Malebo where an intensive overexploitation of ichthyological resources is observed.

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MATERIALS AND METHODS

Data were collected monthly in Congo River at the Pool Malebo (4°5'-4°18' S. and 15°19'-15°32' E.), situated between Kinshasa and Brazzaville (Figure 1). For this study, *D. antonii* were captured with two batteries of gill nets of 10, 15, 25, 35 and 50 mm stretched mesh sizes; each gill net was 2 m high and 30 m wide. Other specimens were obtained from independent fishermen. We collected 135 scales samples according to the method described by DeVries and Frie (1996), between May 2005 and February 2007. In the final analysis, we retained only 36 scales samples with clear annuli of *D. antonii* whose total length varies from 105 to 570 mm.

Three or five scales were mounted between glass slides according to DeVries and Frie (1996), and observed under « Profile projector Nikon model 6 c: 40444 » (10×, 20×, 50× depending on

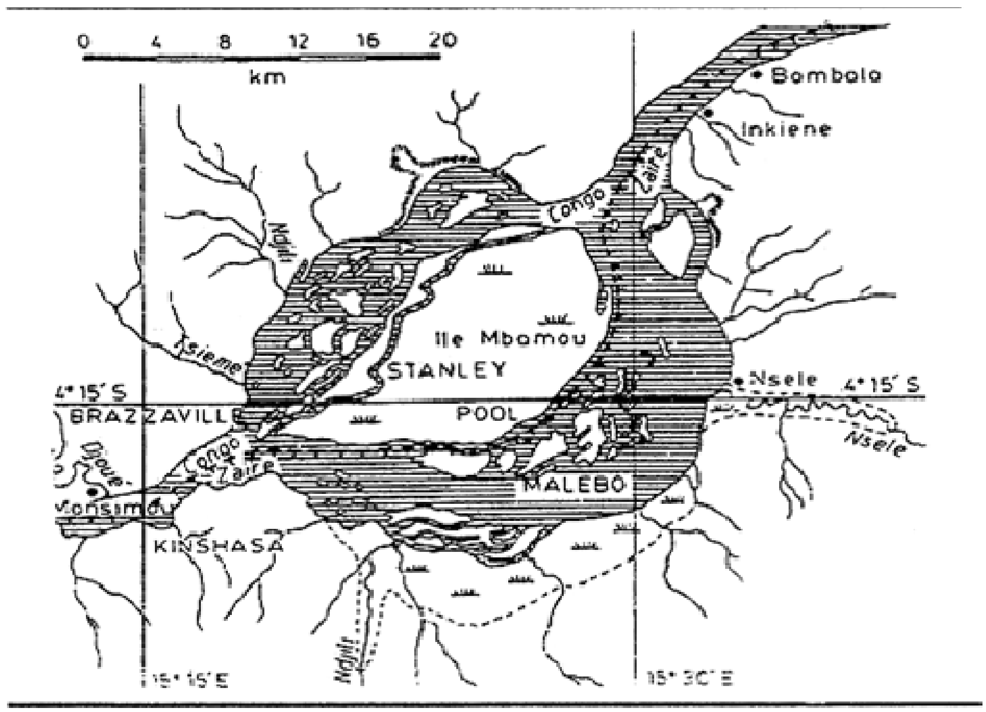

Figure 1. Map of Pool Malebo (modified according to Burgis and Symoens, 1987).

the scale size); we used also a Northwest microfilms reader (42x). The age of fish is estimated by counting the number of regular annuli (Bagenal and Tesch, 1978). For each fish, we measured total length (TL±1 cm), standard length (SL±1 cm) and weight (g); and on each scale, measures were taken from the focus to the anterior edge of scale, the total scale length (R±1 mm) and from the focus to each annulus observed ($R_{1,2..i}$±1 mm). Only were retained, the scales whose reading agreed; this verification was carried out at FUNDP- Namur (Belgium) and at ENSAT-Toulouse (France).

We set up the parameters of the linear relation existing between the fish total length TL (mm) and the scale total length R (mm) ((Francis, 1990)), expressed by the equation:

$$TL = a + bR\ ;$$

then, we estimated by back calculation method the size of fish at the time of the appearance of each annulus using the expression of Fraser-Lee (1920) in (Pierce et al.,1996):

$$L_i - a = \frac{R_i}{R}(TL - a)$$

where L_i (mm): the length of the fish when the annulus *i* appears; TL (mm): the total length of fish; R_i (mm): the scale radius from the focus to the annulus *i*; R (mm): the total length of scale radius. The relative linear growth rate was estimated by using the relation of Deniel (1984):

$$C.r.(\%) = \frac{L_{i+1} - L_i}{\frac{1}{2}(L_{i+1} + L_i)} * 100$$

where C. r. (%): relative growth; L_i (mm): length at annulus *i*; L_{i+1} (mm): length at annulus (i+1). The growth parameters L_∞, K and t_0 were established according to Ford Walford method. The Von Bertalanffy curve is then fitted according to the relation:

$$L_t = L_\infty(1 - e^{-k(t-t_0)})$$

where L_t = length of fish at time t ; L_∞ = asymptotic length; K = the Von Bertalanffy growth coefficient and t_0 : the age of fish at zero length.

RESULTS

The linearised relation between TL and weight in *D. antonii* is:

$$Log\,(P) = 3.1772\,Log\,(TL) - 12.069$$

with r = 0.9755.

The scale growth is also strongly correlated to the body total length according to the linear equation:

$$TL(mm) = 32.339\,R(mm) + 79.741$$

with r = 0.9694.

The back calculated lengths were made individually; their average values at the instant t, (TL_t) and t+1, (TL_{t+1}) are

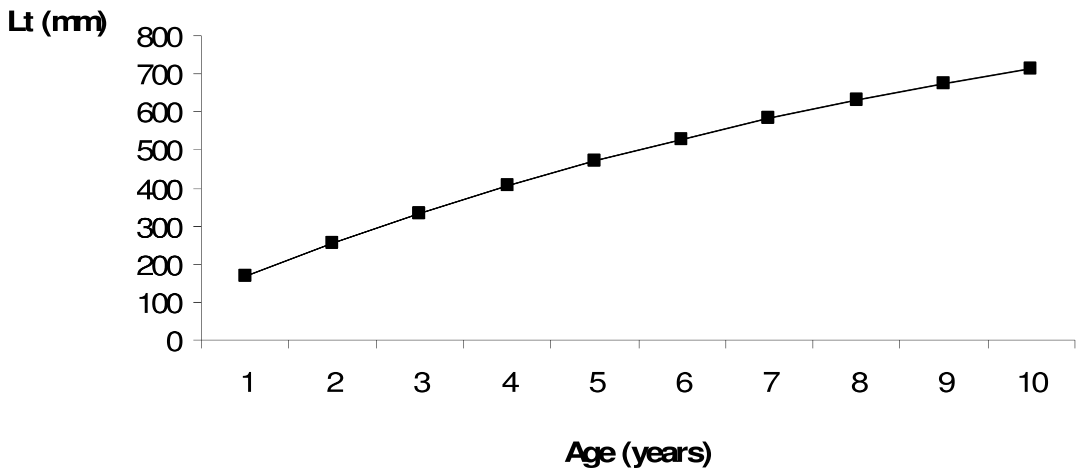

Figure 2. Von Bertalanffy growth curve for *D. antonii* in Pool Malebo.

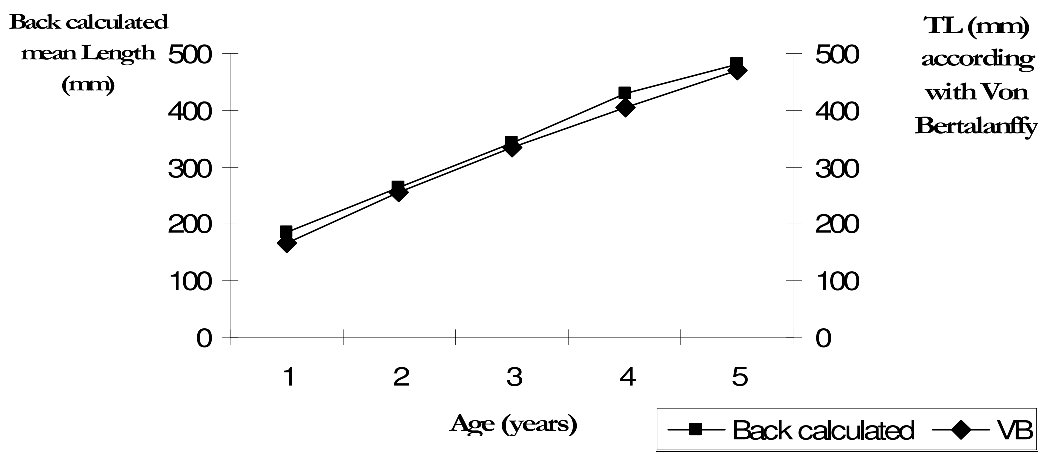

Figure 3. Comparison between the lengths from Von Bertalanffy growth curve and the lengths back-calculated for *D. antonii* in Pool Malebo.

used to fit the Ford Walford line expressed by the equation:

$$TL_{t+1} = 103.51 + 0.9042\,TL_t$$

with r = 0.9928.

From this relation, we calculated L_∞ = 107.91 cm and K = 0.10 $year^{-1}$. These values are used to establish the Von Bertalanffy equation as follow:

$$-Ln(1 - \frac{LT}{L\infty}) = 0.1063\,L_t + 0.0717$$

The correlation coefficient of this adjustment is very high, r = 0.9977. After that, we pull out t_0 = -0.67 $year^{-1}$. Having L∞, K and t_0, we fitted the Von Bertalanffy growth curve (Figure 2). The growth curve modelised from the Von Bertalanffy equation shows a regular length growth of *D. antonii* in Pool Malebo. Likewise, there is a very good correlation (r = 0.99) between the average back-calculated lengths and the lengths deducted from the Von Bertalanffy growth function (Figure 3). The statistical analysis did not show a significant difference between back calculated lengths and the lengths derived from von Bertalanffy growth function (t calculated = 0.003 < t tabulated = 2.776; p = 0.05).

The analysis of marginal increase shows that the formation of annulus takes place between May and October. The lowest increase is observed in July, corresponding to the dry season when precipitations are low and even non-existent at Pool Malebo (Kinshasa, DR Congo) (Figure 4). The growth rate decreases progressively with the age (Table 1). For the first years, the rate is important; it settles at 35.24% while at fourth year, the

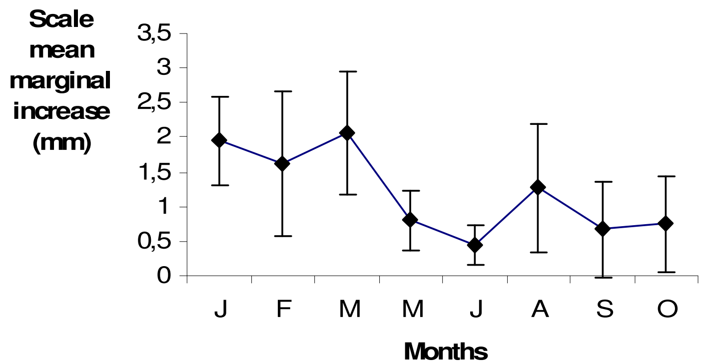

Figure 4. Scales mean marginal increase for *D. antonii* in Pool Malebo.

Table 1. Variation of annual average growth rate of *D. antonii* in Pool Malebo.

Age (years)	1	2	3	4
Growth rate (%)	35.24	26.26	22.19	11.36

rate growth is only at 11.36%.

DISCUSSION

The growth parameters of *D. antonii* were estimated from the scales analysis (36 samples). The correlation between the weight and the length is high (r = 0.98). The scale increase is also proportional to the body increase (r = 0.95). The comparison of the back-calculated lengths with the lengths coming from the Von Bertalanffy growth function shows two curves greatly correlated (r = 0.99), the model is therefore acceptable for *D. antonii* in Pool Malebo (Congo River). The growth parameters estimated from this method shows also that *D.antonii* in Pool Malebo (Congo River) presents a K estimated at 0.10. This observation is lower than the findings of de Merona *et al.* (1988) about *D. rostratus* in Niger-Bénoué: K = 0.22.

The estimated asymptotic length L_∞ = 107.91 is higher than the value obtained for *D. rostratus* (105.61 cm) in Niger-Bénoué; while t_0 (-0.42 year^{-1}) is the same with that of the *D. rostratus* (de Merona et al., 1988). According to Balon (1971), the growth parameters can present inter and intra specific variations. The percentage of relative growth decreases with the age (Table 1). The Von Bertalanffy curve confirms a fast relative growth in young individuals and slow relative growth in adults' specimens. The analysis of marginal increase shows that the formation of annulus takes place to the dry season when precipitations are lowest and even non-existent at Pool Malebo (Kinshasa, DR Congo). The water level falls about three meters during this period of year. The grassy banks are then bare and the feeding of this fish species essentially herbivorous (Mbadu et al., 2010) becomes difficult. In opposition to De Bont (1967), who privileged, in the African fishes, the endogenous factors action in the formation of annuli on the fish bony pieces, the spatial and temporal fluctuations of ecological conditions like the climatic, trophic and physico-chemical conditions, the diseases, the population density and the temperature can also so be much decisive factors as stress sources leading to the formation of the growth stopping lines in the bony pieces of fish.

For *D. antonii*, the water level falling leading to the scarcity of macrophytes, its main food and the reduction of vital space can be factors activating the formation of annuli. In the other hand, in situation of scarcity of its feeding resource, the species can also be in competition with others herbivorous fishes. Moreover, Miller *et al.* (1988) emphasizes that the growth is under influence of physical and biological factors like the quality and the quantity of food and the environment.

A better knowledge of physical and biological factors is needed to input policy for a sustainable exploitation of *D. antonii*.

ACKNOWLEDGEMENTS

We thank all who contributed for the realisation of this study, especially Nile Basin Initiative (ATP program) for its grant. We acknowledge the FUNDP-Namur/Belgium and the Faculty of Sciences of the University of Kinshasa for their training and supervision. We acknowledge also the professors J. C. Micha (FUNDP-Namur/Belgium), J. Moreau (ENSAT-Toulouse/France), Mbomba N. B. and Takoy L. (University of Kinshasa/D. R. Congo).

REFERENCES

Bagenal TB, Tesch FW (1978). Age and growth. In : Bagenal TB (ed.). Methods for assessment of fish production in fresh waters. Blackwell Sci. Publications, Oxford: pp. 101-136.

Balon EK (1971). Age and growth of Hydrocynus vittatus Casteneau (1861) in Lake Kariba, Sinazongwe area. Fish. Res. Bull. Zambia 5: 89-93

DE Bont AF (1967). Some aspects of age and growth of fish in temperate and tropical waters. In: Gerking SD (ed.). The biological basis of freshwater fish production, Blackwell, Oxford: 67-88.

Devries DR, Frie RV (1996). Determination of age and growth. In Murphy BR, Willis DW (eds). Fisheries Tech. Am. Fish. Soc. Bettesda, 483-512.

Francis RICC (1990). Back-calculation of fish length. A critical Rev. J. Fish. Biol. 36 : 883-902.

Mbadu ZV, Mbomba NB, Micha JC (2010). Diet comparison in three species of Distichodus Müller & Troschel, 1845 (Distichodontidae, Pisces) of Pool Malebo, Congo River (Democratic Republic of Congo). Int. J. Biol. Chem. Sci., Vol. 4 (1):145-157.

Miller TJ, Crowder LB, Rice JA, Marschall EA (1988). Larval size and recruitment mechanisms in fishes: Toward a conceptual framework. Can. J. Fish. Aquatic. Sci., 45: 1657-1670.

Pierce CI, Rasmussen JB, Legget WC (1996). Back-calculation of fish length from scales: empirical comparison of proportional methods. Trans. Am. Fish. Soc., 125 : 889-898.

Summerfelt RC, Hall GE (1975). Age and growth of fish. Iowa State University Press. Ames.