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

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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.

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 » (10x, 20x, 50x depending on...
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 (R1, 2i±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 \( L_\infty \), K and \( t_0 \) were established according to Ford Walford method. The Von Bertalanffy curve is then fitted according to the relation:

\[ L_i = L_\infty (1 - e^{-k(t-t_0)}) \]

where \( L_i \) = length of fish at time \( t \); \( L_\infty \) = 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:

\[ TL(mm) = 32.339R(mm) + 79.741 \]

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

\[ TL_{r+1} = 103.51 + 0.9042 TL_r \]

with \( r = 0.9928 \).

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

\[ -\ln\left(1 - \frac{LT}{L_\infty}\right) = 0.1063 L_r + 0.0717 \]

The correlation coefficient of this adjustment is very high, \( r = 0.9977 \). After that, we pull out \( t_0 = -0.67 \) year\(^{-1}\). Having \( L_\infty \), \( K \) 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
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 $L_\infty = 107.91$ 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*.

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