

GROWTH PARAMETERS OF *CYPRINUS CARPIO* LINNAEUS, 1758 (CYPRINIDAE) IN THE K'SOB RESERVOIR IN M'SILA (ALGERIA)

CROISSANCE DE *CYPRINUS CARPIO* LINNAEUS, 1758 (CYPRINIDAE) DANS LE BARRAGE EL K'SOB DANS LA WILAYA DE M'SILA (ALGÉRIE)

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ABSTRACT

In the present study, sex, some biometric measurements, relationship length-weight and condition factor were examined in 150 specimens of *Cyprinus carpio* L. 1758 (common carp) captured in the K'sob reservoir (M'Sila, NE of Algeria) from January to June 2013. The overall male to female ratio was 1: 0.24 (Chi-square $X^2 = 16.96$, $P = 0.0019$). The maximum lengths were observed is 38.0 cm in females and 30.0 cm in males. Comparing the values of the slope of the regression lines to the unit by the "t" test of Student for both sexes has shown the existence of a significant difference for some characters; LS isometric in females, minorant allometry in males; LF isometric for both sexes; HB minorant allometry in males, isometric in females and PD allometry minorant for both sexes. The relation between (LT -WT) and (FL - EW) of the carp shows that the exponent b is between 2.52 and 2.69. The mean condition factor was 0.961 ± 0.229 ($\pm IC$).

KEYWORDS: *Cyprinus carpio*, sex, growth, condition factor, K'sob reservoir.

1 INTRODUCTION

In Algeria, about 27 fish species were introduced in the reservoir and at least 303 introduction events were established either intentionally or accidentally (Kara 2012). The most interest fish species used in such operations, in the North Africa were belonging to the Cyprinidae family. *Cyprinus carpio* species was introduced in Algeria between 1858 and 1931 (Dieuzeide & Roland 1951; Kottelat 1997; Kara 2012). These introductions reflect prevailing attitudes and values by the public authorities, in which the primary concern is a socioeconomic benefit (Kara 2012). This fish species presents an important food source, mainly in proteins, for rural community situated far from the coast in Algeria.

This study was carried out on some growth parameters, sex ratio and the condition factors of the fish *Cyprinus carpio* bred in the K'sob reservoir, located in a semi-arid region of the Hodna Basin in the Saharan Atlas National Park, northeastern Algeria (Wilaya of M'Sila).

This Inhabit population is an artificial lake characterized by an annual variation in water temperature and volume (Mimeche et al 2013; 2014).

2 MATERIALS AND METHODS

The K'sob Reservoir is one of the oldest reservoirs made in Algeria during the year 1935. It was constructed on the K'sob river, with the main objective is to irrigate the plain of M'Sila. It is located 15 km north of the M'Sila town (geographic coordinates: $5^{\circ}06'09''E-4^{\circ}34'37''E$ and $35^{\circ}33'52''N-36^{\circ}18'45''N$). The surface of the Reservoir is 230 ha. Its maximum depth is 47 m and a capacity to the origin of 30 Mm³; actually its water storage is less than 10 Mm³. The area of the study is characterized by semi-arid bioclimatic on the Saharan Atlas National Park (North Algeria, M'Sila). (Mimeche et al., 2013).

Samples of fish were done a monthly over a period of six months covering the period from January until June 2013. The fishing was carried out with gillnet (40 mm and 65 mm).

The samples were transported immediately to the laboratory for taking different parameters.

The measurements were carried out with an ichtyomètre (1mm) TL= total length, FL= fork length and SL= standard length and a caliper to 0.02mm for BH = body height and Inter-orbital distance = ID.

The weight was evaluated by an electronic balance accuracy of 1g by considering the total weight (TW). All specimens were dissected to obtain eviscerated weight (EW). Sex is determined by the external observation of the gonads. The sex ratio is expressed in different forms depending on the author (Kertas and Guionard, 1984), generally in fish, the sex ratio is expressed by 1: 1 (M: F) and uses the Chi-squared test. The distribution *C. carpio* was analyzed for the entire population by sex and size.

In order to monitor the relative linear growth of this population of *Cyrinus carpio*, several morphometric variables were identified and analyzed (Fig.1) according to Trabelsi and Kartas (1989):

- Total length (TL) extends from the end of the snout to the end of the tail, the two lobes close together in the body axis. The fork length (FL) is the estimated length from the tip of the snout to the junction of the two lobes of the caudal fin. The standard length (SL) presents from tip of nose to the point of attachment of the caudal fin.
- Body height (BH) is the distance corresponding to the maximum height of the body from the joint of the first ray of the dorsal fin. The Inter-orbital distance (ID): minimum distance between the orbits.

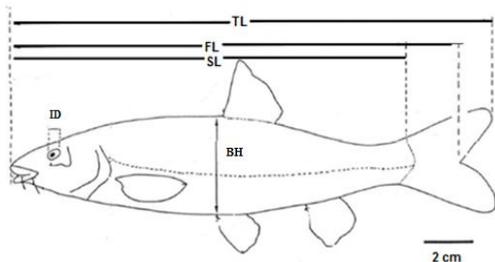


Figure 1: Presentation of the different morphological parameters of the fish *Cyrinus carpio*.

The data were statistically processed; involving means, linear regression equation for obtained the correlation coefficient, clarify the nature of the allometry observed and sexual dimorphism by applied the Student’s t-test (Mayrat, 1970).

The relationship between the length (LT, LF) and weight (TW, EW) (logarithmic transformation) were calculated for all samples and for males and females separately (Froese, 2006):

$$\text{Log TW} = a + b \log \text{LT} \qquad \text{Log EW} = a + b \log \text{LF}$$

Where: TW = total weight; EW= eviscerated weight;

TL = total length; FL = fork length;

a = the intercept; b = the regression slope.

Parameters a and b were calculated by least-squares regression, as was the coefficient of determination (r^2). Significant difference of b values from 3, which represent

isometric growth (Pauly, 1993).

The somatic condition (K r) was analysed by residuals from the FL–EW relationships (log transformed data), thus removing body length effects (Sutton et al., 2000). To avoid negative values, the variables were previously multiplied by 104, a procedure considered suitable when variables range from 0 to 1 (Garcia-Berthou and Moreno-Amich, 1993). The somatic condition cycle was indexed by residuals from these regressions.

Statistical analyses were performed with SPSS (SPSS,Chicago, IL, USA) software package.

3 RESULTS AND DISCUSSION

The population of *C. carpio* consists of 150 individuals, including 36 females and 114 males. The value of the sex ratio in favor of males is 76% and the percentage of females is 24%. The calculated overall sex ratio is 1: 0.24 (Chi-square $X^2 = 16.96$, $P = 0.0019$). In the Apa Dam Lake (Konya-Turkey) Mert et al (2008) shown 1.028:1.

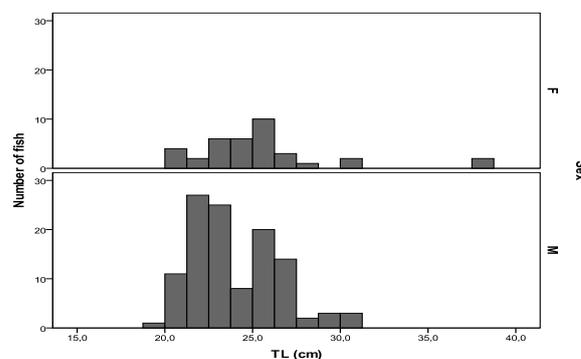


Figure 2: Length-frequency of males (M) and females (F) of the specimens caught in the K'sob reservoir during the study period. TL is Total length (cm)

Figures 2 illustrate the size frequency carp in the K'sob reservoir. They show that the size-class structure is relatively stable. We note that all the histogram show a good representation of individuals from 20 to 27 cm. The size range of the males during the study period was 19.9 cm and 30.0 cm (24.15 ± 0.34), for the females between 20.3 cm and 38.0 cm (25.20 ± 0.94). In the present study, the catchability of specimens less than 19 cm TL was null (Fig 2), maybe due to the selectivity of fishing nets.

All linear regression equation of relative growth were highly significant ($P < 0.05$), with r values being greater than 0.886.

Comparing the values of the slope of the regression (Tab.1, Tab.2, Fig 3 and Fig 4) to the unit by the "t" test of Student for both sexes has shown the existence of a significant difference for some paramestr:

- LS: isometric growth in females, minorant allometry growth in males;
- LF: isometric for both sexes;
- HB: minorant allometry in males, isometric in

females;

- ID: allometry minorant for both sexes.

The identification of morphometric *Cyprinus carpio* allows the following observations between the sex:

- Highly significant differences slope affect two characters: LS is greater in females compared to males (length of the largest body in females versus males); body height in females favors, is probably due to the gonad development (reproduction) (Tempero et al 2006; Bouhbouh 2002).

Table 1: Morphometric measurements between total length (TL) and standard lengths (SL), fork length (FL), the body height (BH) and preorbital distances (ID) in males of *Cyprinus carpio* in the K'sob reservoir.

Allometric equations Log Y = a Log X+b	N	Mean (X) (cm) ±SE	Min-max (cm)	Mean Y (cm)	Min-max (cm)	r	t (+,-)
Log LS = 1.012 Log LT - 9.626	114	24.15±0.34	19.9-30	19.89±0.29	16.4-25	0.986	3.068 (-)
Log LF = 1.020 Log LT - 6.622	114	24.15±0.34	19.9-30	21.85±0.32	17.8-27.5	0.978	1.662 (-)
Log BH = 0.95 Log LT - 0.469	114	24.15±0.34	19.9-30	6.91±0.10	5.8-8.8	0.886	5.104 (-)
Log ID = 0.991 Log LT - 0.608	114	24.15±0.34	19.9-30	5.73±0.08	4.7-7.6	0.947	9.781 (-)

N: effective; SE: standard error; r: correlation coefficient; t: value of the Student test; +/-: Significance of the test to the risk level of 5%.

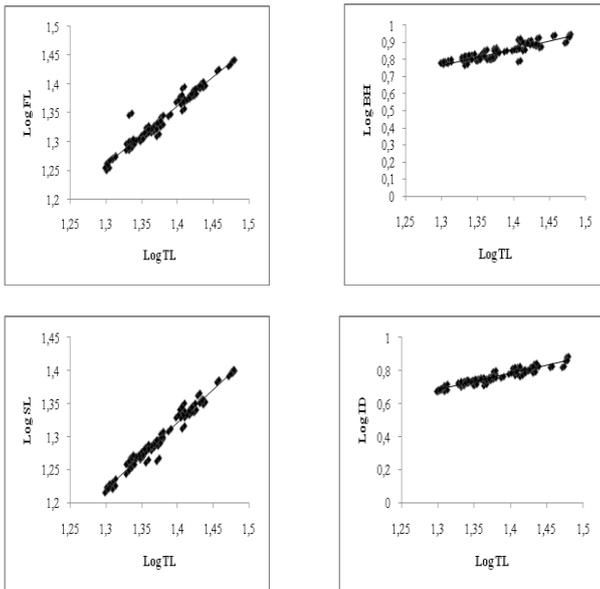


Figure 3: Linear regression illustrates to the parameters growth of males of *Cyprinus carpio* in K'sob the reservoir. Total length (TL; cm), fork length (FL; cm), standard length (SL; cm), body height (BH; cm) and Inter-orbital distance (ID; cm).

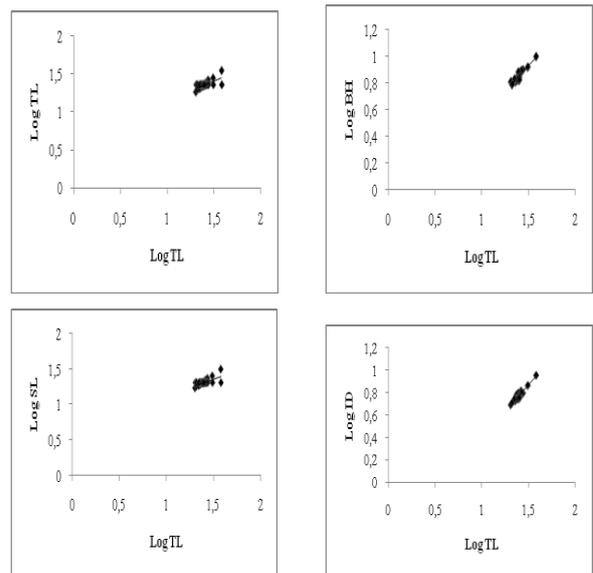


Figure 4: Linear regression illustrates to the parameters growth of females of *Cyprinus carpio* in K'sob the reservoir. Total length (TL; cm), fork length (FL; cm), standard length (SL; cm), body height (BH; cm) and Inter-orbital distance (ID; cm).

Table 2: Morphometric measurements between total length (TL) and standard lengths (SL), fork length (FL), the height of the body (HB) and preorbital distances (ID) in females of *Cyprinus carpio* in K'sob the reservoir.

Allometric equations	N	Mean (X) (cm) ±SE	Min-max (cm)	Mean Y (cm)	Min-max (cm)	r	t (+,-)
Log Y = a Log X+b							
Log LS= 0.970Log LT -3.768	36	25.20±0.94	20.3-38	21.03±0.78	17.1-31.8	0.990	0.768(-)
Log LF= 1.026Log LT -7.676	36	25.20±0.94	20.3-38	23.05±0.89	18.2-35.2	0.992	1.674(-)
Log BH=0.783Log LT -0.241	36	25.20±0.94	20.3-38	7.16±0.22	6.4-10	0.931	2.252(-)
Log ID= 0.928 Log LT -0.523	36	25.20±0.94	20.3-38	5.99±0.22	4.9-9	0.952	5.026(-)

N: effective; SE: standard error, r: correlation coefficient; t: value of the Student test; +/-: Significance of the test to the risk level of 5%.

The relation (LT -TW) and (FL - EW) of the Carp shows that the exponent b is between 2.52 and 2.69. The parameter b values remained mostly within the expected range of 2.5–3.5 (Froese 2006). In general and despite the many variations in fish forms between species, b is close to 3, indicating that fish grow isometrically; values significantly different from 3 indicate allometric growth

(Tesch, 1971). The growth of population of *C. carpio* in K'sob reservoir is allometric minorant (< 3). This result is similar to Attal et Arab (2013) in Ghrib reservoir (Ain Defla- Algeria) with b=2.762, Balık et al (2006) in the Lake Karamık (Afyonkarahisar-Turkey) was found a value of b= 2.952±0.031. Mert et al (2008) shown similar value of b (2.53 of males and 2.71of females).

Table 3: Allometric Relationship between total length - total weight of *Cyprinus carpio* in K'sob reservoir

Allometric equations		N	b±SD	ANCOVA	r ²
Log TW = a Log LT+b					
Population	Log TW = 2.66LogTL-1.35	150	2.66±0.06	F(1,148)= 1846.87	0.926
Male	LogTW= 2.69LogTL-1.39	114	2.69±0.08	F(1,112)= 1082.49	0.906
Female	Log TW =2.63Log TL-1.31	36	2.63±0.08	F(1,34)=885.94	0.963

N: effective; r: correlation coefficient; b: growth factor; SD: standard deviation.

Table 4: Allometric relationships between fork length and eviscerated weight; and the condition factor (Kr) of *Cyprinus carpio* in K'sob reservoir.

Allometric equations		N	b ±SD	ANCOVA	r ²	Kr ± IC
Log WV = a Log LF+b						
Population	Log EW = 2.60*Log FL -1.23	150	2.60±0.06	F(1,148)= 1432.73	0.906	0.961 ± 0.229
Male	Log EW = 2.64*Log FL -1.28	114	2.64±0.09	F(1,112)= 782.54	0.875	0.124± 0.482
Female	Log EW = 2.52*Log FL -1.12	36	2.52±0.07	F(1,34)= 1121.17	0.971	0.009 ± 0.263

N: effective; r²: determination coefficient; b: growth factor; SD: standard deviation, Kr: condition factor mean relative and IC: Confidence interval

FL-WV relationship was used for all individuals together to get the standardized residuals where the condition factor values (Kr), which shows low values of males and very low of females (Tab.4). The winter season characterized by poor

environmental conditions (low temperature) and the spring is the period of reproduction of carp. This of study coincided with the both season that cause the decreased metabolism of the fish, so dropping the somatic overweight

(kraïem and Pattee, 1980). Low values indicate Kr maximum body size in females just before the breeding season, thus highlighting the importance of gonad weight (Jamet 1995) and indicates the post-spawning period described by an energy expenditure and loss of weight (kraïem 1994, Mert et al 2008). The mean relative condition factor (Kr) in males results in intense feeding activity and habits (Balık et al 2006, Sedaghat et al 2013).

4 CONCLUSION

In conclusion, it is established that the population of *Cyprinus carpio* reflects the expected and previously observed features of growing and condition factor in natural fish populations in the Ksob reservoir.

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