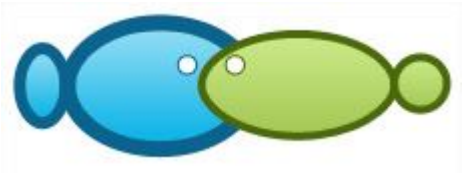

Study of some biological parameters of *Cyprinus carpio* from Foum El-khanga Dam, Souk-Ahras, Algeria

[1]Fatiha Sahtout, [1]Chahinez Boualleg, [1]Naima Khelifi, [1]Nouha Kaouachi, [3]Billel Boufekane, [2]Sarra Brahmia, [1]Wahiba Mouaissia, [2]Mourad Bensouilah

[1] Laboratory of Aquatic and Terrestrial Ecosystems, Faculty of Science, Mohamed Cherif Messadia University-Souk Ahras, 41000 Souk Ahras, Algeria; [2] Laboratory of Ecobiology for Marine Environments and Coastlines, Faculty of Science, Badji Mokhtar University-Annaba, 23000 Annaba, Algeria; [3] Laboratory of Biological Oceanography and Marine Environment, Faculty of Biological Sciences, University of Science and Technology Houari Boumediene-Bab Ezzouar, 16111 Bab Ezzouar, Algeria.
Corresponding author: F. Sahtout, fsahtoutdoct@gmail.com

Abstract. *Cyprinus carpio* (Linnaeus, 1758) is a wide-world freshwater fish, and is among the top important aquaculture species of the world. Since there are no available data on the growth pattern of this species in Foum El-Khanga Dam Souk-Ahras, Algeria, this study was carried out to determine the condition factor, length-weight relationship, age and growth. A total of 347 specimens of *C. carpio* were collected from Foum El-Khanga Dam (Souk-Ahras, Algeria) by monthly sampling from March 2015 to February 2016. Significant differences were noticed between the mean length of females (33.44±0.38) and males (30.88±0.31). The age of the examined fishes ranged from 2- to 7-year-old, meanwhile the dominant age group was 3-year-old. The size frequency distributions and the growth parameters were analyzed according to ELEFAN method, using FISAT II software. The Von Bertalanffy growth parameters were found as asymptotic length, $L\infty$ = 58.28 cm, asymptotic weight, $W\infty$ = 2019.76 g, growth coefficient, K = 0.30 year^{-1}, t_o = -0.47 year for both combined sexes, asymptotic length, $L\infty$ = 48.83 cm, asymptotic weight, $W\infty$ = 1148.56 g, growth coefficient, K = 0.49 year^{-1}, t_o = -0.29 year for males, and asymptotic length, $L\infty$ = 58.28 cm, asymptotic weight, $W\infty$ = 2049.84 g, growth coefficient, K = 0.41 year^{-1}, t_o = -0.34 year for females. Also, the results indicated that $L\infty$ and $W\infty$ values of females were higher than those of males. The growth performance index was estimated as Φ' = 3.008 for combined sexes, Φ' = 3.068 for males, and Φ' = 3.144 for females. The condition factor indicates good conditions of the *C. carpio* fish. Moreover, the length-weight relationship was estimated as $W = 0.0181 \times Lt^{2.859}$ (the coefficient of determination, R^2 = 0.963) for both sexes. Statistical analyses showed that the *b* coefficient is significantly lower than 3 (negative allometry) for separated and combined sexes (t-test, $p < 0.05$), as well as the relationship between the length and the weight exhibited a high correlation.
Key Words: common carp, length-weight relationship, ELEFAN method, growth.

Introduction. Cyprinids are ubiquitous freshwater fishes all over the world, widely used as a fish model in evolutionary biological research (Szlachciak & Strakowska 2010). Also, *Cyprinus carpio* (Linnaeus, 1758) is the common species of Cyprinidea family, and is the major cultivated fish species of Cyprinids. In fact, *C. carpio* originated in central Asia and spread east and west to China and the Danube. Hence, the species was successfully spread throughout Europe, Australia, North America (Vooren 1972; Shearer & Mulley 1978; Mills et al 1993). Due to the continuous political introduction of new species fish, Algeria becomes one of the most concerned countries in the world by the biodiversity of fish species (Brahmia et al 2016).

Additionally, *C. carpio* is considered as a new species that was introduced in Algeria between the period of 1858 to 1931 (Dieuzeide & Roland 1951; Kottelat 1997; Kara 2012). The wide spreading and effective introductions of *C. carpio* are essentially due to their tolerance under varying environmental conditions (Forester & Lawrence 1978), as well as to their capability for early sexual maturity and rapid growth (Koehn

2004). Interestingly, some European countries produce more than 80% of total of *C. carpio* fish (Woynarovich et al 2010; Anton-Pardo et al 2014).

Determination of growth and age of fishes is highly important to highlight the ecology and the assessment of fish species population (Froese 2006), as well as to understand species' life histories, population dynamics and fisheries sustainability (Beddington & Kirkwood 2005; Frisk et al 2005). Due to the commercial importance of *C. carpio,* several studies performed in different countries of the world have evidenced the biological features of this species, like France (Crivelli 1981), Iran (Fatemi et al 2009), Tunisia (Hajlaoui et al 2016), Pakistan (Mirza et al 2012), Spain (Fernadez-Delgado 1990; Andreu-Soler et al 2006), and in Turkey (Birecikligil et al 2016; Yuce et al 2016). Similarly, qualitative studies on biological parameters characterizing *C. carpio* species were carried out in Algeria (Mimeche & Biche 2015; Brahmia et al 2016). As previously reported, the total length and body weight of *C. carpio* ranged from 17.1 to 69.2 cm in length, and from 86 to 5473 g in weight. The majority of the individuals (48.12%) were between 46.0 and 55.0 cm of length groups (Mert & Bulut 2014), since the size of the carp varied from 11 to 51 cm in length, and however more than 70% did not exceed 31 cm in length (Brahmia et al 2016). On the other hand, Hajlaoui et al (2016) found that the proportion of males was lower than that of females. Also, the age composition of *C. carpio,* varied from 1 to 6-year accordingly to the percentage of occurrence, indicating that group I is dominant (Fernadez-Delgado 1990). Mirza et al (2012) found that the parameters of the Von Bertalanffy growth for length were asymptotic length, $L\infty$ = 80.33 cm, growth coefficient K = 0.60 $year^{-1}$. According to the Von Bertalanffy growth equations, the examined female population grew to a greater asymptotic length and weight than the males (Mert & Bulut 2014), whilst the length-weight relationship demonstrated a negative allometric growth (Fatemi et al 2009; Mimeche & Biche 2015).

Up to now, there are no available results regarding the biological characteristics of this species in Foum El-Khanga Dam. Therefore, this study was devoted to investigate, at the first time, some parameters of *C. carpio* species population of Foum El-Khanga Dam (Souk-Ahras, Algeria), such as the length frequency distribution, length-weight relationship, age and Von Bertalanffy growth parameters. Of note, knowledge of the biological characteristics of this economically species is very important for assessment and management.

Material and Method. Data of *C. carpio* were collected from Foum El-Khanga Dam, located 20 km in the south-east region of Sedrata (Souk-Ahras, Algeria), between Zouabi and Bir Bouhouche municipalities (36°04.344' N/007°26.351'E). A total of 347 fishes were collected monthly between March 2015 and February 2016. The samples were afterwards transported immediately in an ice box to the laboratory for being measured. For each specimen, total length (TL) was determined to the nearest cm, since the total weight (TW) and eviscerated weight (EW) were obtained to the nearest gram. The *C. carpio* sex determination was performed by macroscopic examination of the gonads (Bagenal & Tesch 1978).

Sex-ratio. Global sex ratio (SR) is estimated by the following SR relationship: SR = number of females/number of males. The value of the reduced gap (Schwartz 1983) was also estimated by a homogeneous test, in order to compare the average sizes of males and females of the large samples according to the following relation:

$$\varepsilon = \frac{|\bar{X}_1 - \bar{X}_2|}{\sqrt{\frac{{\sigma_1}^2}{n_1} + \frac{{\sigma_2}^2}{n_2}}}$$

$\bar{X}_1$: mean of females;

$\bar{X}_2$: mean of males;

σ_1^2 : the variance of females;

σ_1^2 : the variance of males;
n_1 : sample size of females;
n_2 : sample size of males.

Length-weight relationship. The relationship between total length and weight (LWR) was calculated annually for the total sample and separately for sex by using the allometric equation: $W = a \times tL^b$ (Ricker 1973), which can be transformed into a logarithmic form: $\text{Log } W = \text{Log } a + b \times \text{Log } tL$, in which W is the total weight (g), TL is the total length (cm), *a* and *b* are regression constants.

The b value was analyzed by a Student's t-test, accordingly to the statistical equation reported by Schwartz (1992). Following *b* values, the relation becomes isometric ($b = 3.0$), minorant ($b < 3.0$), and majorant ($b > 3.0$) (Ecoutin et al 2005).

Condition factor. Condition factor (K) was calculated for each fish by the following equation: $K = W / L^b \times 100$, where W, L and *b* represent respectively, eviscerated weight (g), total length (cm), and coefficient of allometry (Bagenal 1978). Of note, this parameter was evaluated according to seasons for combined population. The Levene's test was performed to assess homogeneity of variances of k-means, which were statistically tested by the ANOVA test using Statistica (data analysis software system) version 8.0, with 95% confidence.

Age and growth parameters. The fish's age was determined by removing 6 to 10 scales from the antero-medial part of the body above the lateral line of each specimen (Bagenal & Tesch 1978). Scales were viewed by the stereo binocular microscope, and the scale reading was then examined twice by two independent readers.

The growth parameters of *C. carpio* were realized by the analysis of size frequency data of 347 specimens organized in groups of 3 cm interval for each month. These parameters "L∞ (asymptotic length) and K (growth coefficient)" of the equation of Von Bertalanffy were determined by Electronic Length-Frequency Analysis ELEFAN I (FISAT II), as previously described by Gayanilo et al (2005). The growth in length and in weight was determined using the following equations: $Lt = L\infty [1-e^{-k (t-t_0)}]$ and $Wt = W\infty [(1-e^{-k (t-t_0)}]^b$; $W\infty = a \times L\infty^b$ (Ricker 1975), where Lt is the total length in cm at age t, Wt is the total weight at age t, since L∞ and W∞ represent, respectively the asymptotic length and asymptotic weight. Also, k is the growth coefficient, t_0 is the theoretical age for a length equal to zero and *b* is the coefficient of allometry. The parameter (t_0) was estimated using the empirical equation of Pauly (1979):

$$\text{Log}_{10} (-t_0) = -0.3922-0.2752 \times \text{Log}_{10} L\infty-1.038 \times \text{Log}_{10} K.$$

Also, the index of overall growth performance (Φ′, phi-prime) was calculated using the following formula: $\Phi' = \log K + 2 \times \log L\infty$ (Pauly & Munro 1984).

Results

Sex-ratio and Length frequency distribution. A total of 347 specimens of both sexes (198 females and 149 males) were examined, and the global sex-ratio (SR) in favour of females of 1.33:1 was studied during the year. The length and weight of the *C. carpio* were respectively ranged from 21.7 to 54.9 cm and from 200 to 1589 g. Also, the total length of the female samples ranged from 26.6 to 54.9 cm, since their weight ranged from 200 to 1589 g. In parallel, the total length and the weight of male samples were respectively ranged from 21.7 to 47.8 cm and from 200 to 1103 g. For both sexes, the dominant length group was 28.5 cm (Frequency, F = 36.89%), 31.5 cm (Frequency = 32.28%) and 34.5 cm (F = 10.09%). Hence, females were generally most abundant in all sizes, meanwhile males predominated in the sizes of 22.5 cm (F = 0.67%), 25.5 cm (F = 4.03%), 28.5 cm (F = 51.68%) and 37.5 cm (F = 6.71%) (Figure 1).

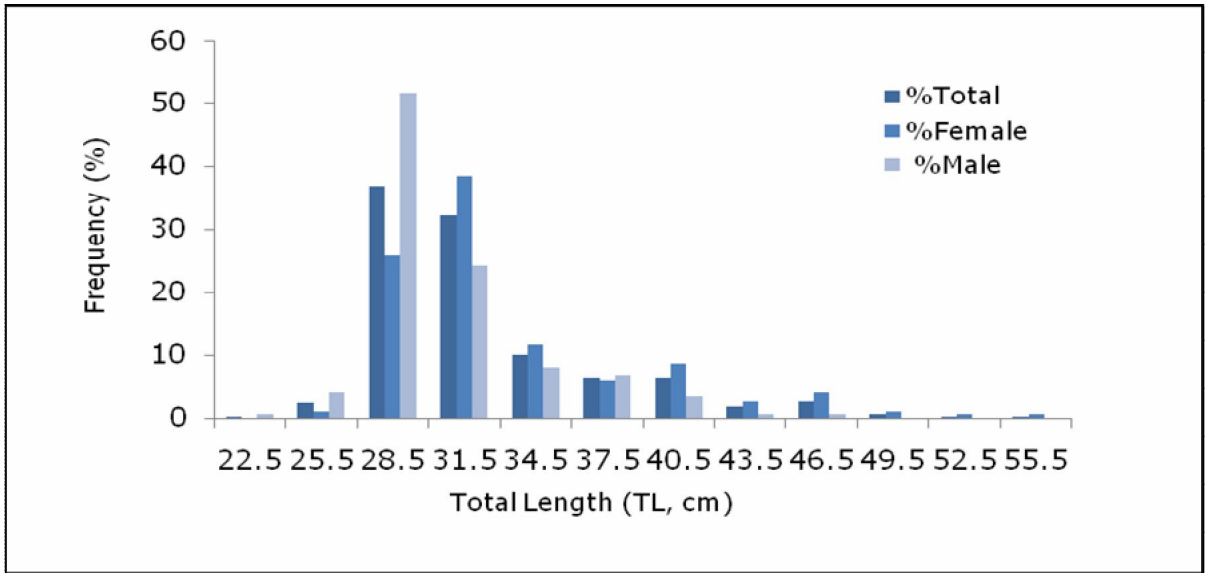

Figure 1. Length frequency distribution of *C. carpio* collected from March 2015 to February 2016.

The mean size of females and males was respectively, 33.44±0.38, and 30.88±0.31. The results were expressed as mean±standard error of the mean (SEM), and were statistically compared with theoretical value at ε (1.96) and a rate of 95% of confidence. The calculated value of the reduced gap ε (ε = 5.17) is higher than the value given in the table of Gaussian distribution (1.96), indicating that the mean total length of females is significantly larger than that seen for males.

Length-weight relationship. The length-weight relationship of *C. carpio* males, females and both sexes are presented in Figure 2. The obtained results of the annual length-weight relationship (LWR) showed that the intercept *a* value was found as 0.0181 along with the exponent *b* of 2.859 for the combined sexes, since *a* was obtained as 0.0246, when the exponent *b* takes the value of 2.765 for males. Also, *a* value was found as 0.0179 when the exponent *b* equals 2.865 for females.

The exponent *b* was significantly less than 3 (t-test, $p < 0.05$) for males, females and both sexes, showing a minor growth allometry of *C. carpio* (Table 1, $p < 0.05$).

Table 1

Length-weight relationship parameters of *C. carpio*

	n	*a*	*b*	R^2	t_{cal}	*Significance*	*Allometry*
Males	149	0.0246	2.765	0.933	3.83	+	Minorant
Females	198	0.0179	2.865	0.974	4.03	+	Minorant
Combined	347	0.0181	2.859	0.963	4.71	+	Minorant

n: number of sample; *a*: intercept; *b*: slope; R^2: coefficient of determination; t_{cal}: t-test calculated; (+ ; -) significance at 95% confidence level of t-test.

As seen in Table 2, the length-weight relationship of all individuals was determined following this equation: $W = 0.0181 \times L^{2.859}$ ($R^2 = 0.963$, n = 347) for both sexes, $W = 0.0246 \times L^{2.765}$ ($R^2 = 0.933$, n = 149) for males and $W = 0.0179 \times L^{2.865}$ ($R^2 = 0.974$, n = 198) for females.

Table 2

Length-weight relationship of *C. carpio*

	$W = a \times tL^b$	$Log\ W = Log\ a + b \times Log\ tL$
Males	$W = 0.0246 \times tL^{2.765}$	Log W = -1.608 + 2.765 × Log tL
Females	$W = 0.0179 \times tL^{2.865}$	Log W = -1.746 + 2.865 × Log tL
Combined	$W = 0.0181 \times tL^{2.859}$	Log W = -1.741 + 2.859 × Log tL

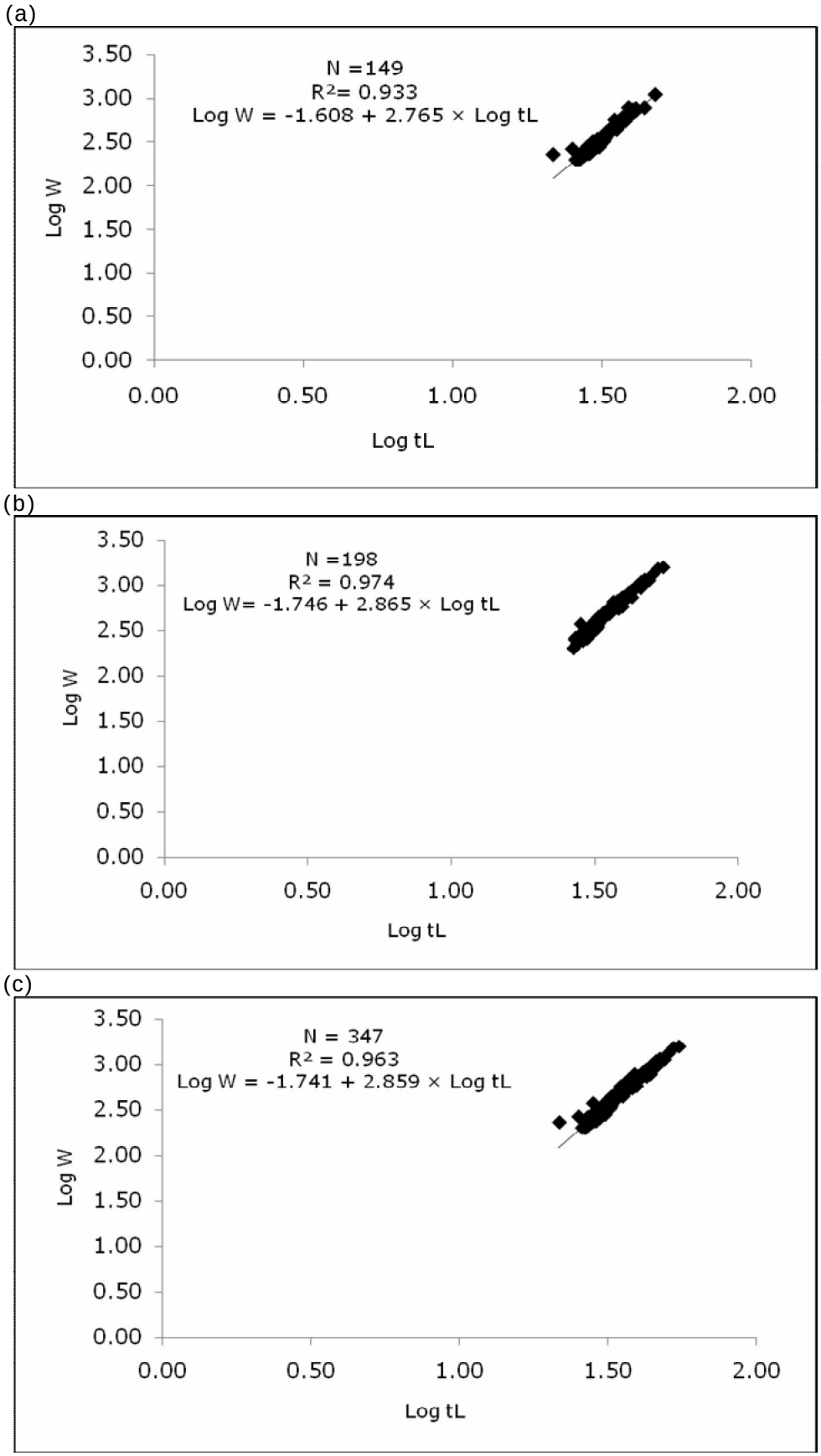

Figure 2. Length-weight relationship according to sexes of *C. carpio* obtained from Foum El-Khanga Dam during March 2015 - February 2016; (a) males, (b) females, and (c) all individuals.

Condition factor. The Levene's test analysis (F = 0.75, p > 0.05) of the homogeneity of variance between the mean values of K, showed no significant difference. Also, the values of mean condition factor (K) for *C. carpio* varies from 1.49 to 1.61. The mean seasonal K ranged from 1.55 (±0.0105) to reach a peak of 1.60 (±0.0104) in summer, and then decreased suddenly in autumn to 1.49 (±0.0108) and reached their highest mean K values of 1.61 (±0.0181) in winter, hence the best condition was noticed in winter and summer with K values, respectively, 1.61 and 1.60 (Table 3). Analysis of variance (ANOVA) showed a very highly significant difference between the mean values of K (ANOVA, F = 14.48, p < 0.001).

Table 3

Evolution of seasonal values of condition factor (K) of *C. carpio* obtained from Foum El- Khanga Dam during March 2015-February 2016

Season	*Means K±SEM*
Spring	1.55±0.0105
Summer	1.60±0.0104
Autumn	1.49±0.0108
Winter	1.61±0.0181

K: mean condition factor; SEM: standard error of the mean.

Age and growth parameters. Age compositions of 347 fish are presented in Figure 3. The whole caught specimens of *C. carpio* were formed of six age-groups of 2- to 7- year-old (Figure 3).

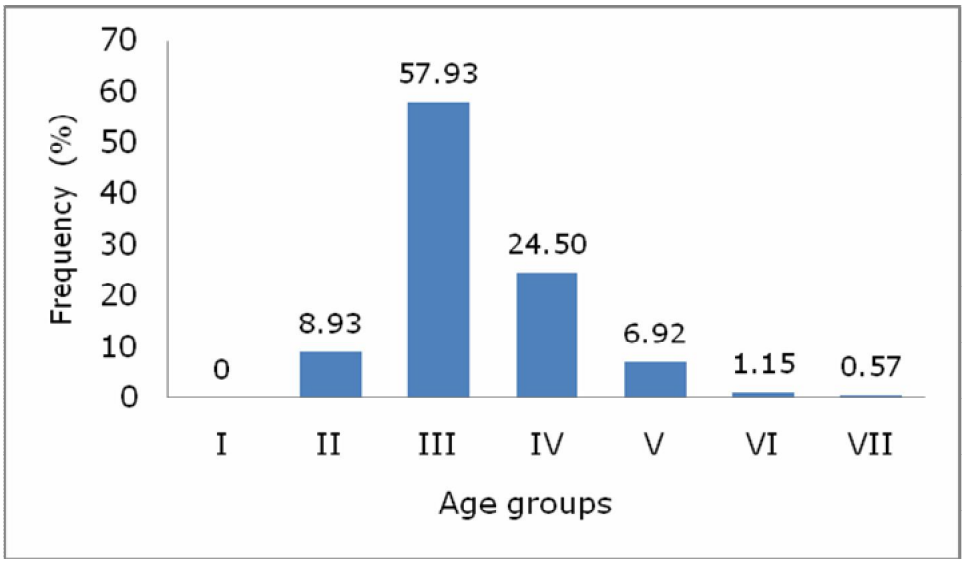

Figure 3. Age composition of *C. carpio* in Foum El-Khanga Dam.

Including the most dominant age-groups of 2-, 3- and 4-year-old, in which the mean total length and weight of each age-group were 27.28±0.23 cm; 238.52±3.85 g (F = 8.93%), 29.92±0.07 cm; 299.08±2.55 g (F = 57.93%), and 35.55±0.27 cm; 515.13±11.86 g (F = 24.50%) respectively (Table 4).

Using the ELEFAN program (software FISAT II), the Von Bertalanffy growth parameters were as follow: $L\infty$ = 58.28 cm, K = 0.30 $year^{-1}$ for the both sexes, $L\infty$ = 48.83 cm, K = 0.49 $year^{-1}$ for males, and $L\infty$ = 58.28 cm, K = 0.41 $year^{-1}$ for females (Table 5). Furthermore, the (t_0) values obtained from the Von Bertalanffy parameters are found as -0.47 year for both sexes, -0.29 year for males and -0.34 year for females. Whilst, the equation of the Von Bertalanffy growth model is $Lt = 58.28\ [1-e^{-0.30\ (t+0.47)}]$ for both sexes (Table 6). Von Bertalanffy growth equations of *C. carpio* were respectively shown in Table 5. The values of growth performance index are equal to $\Phi' = 3.008$ for both combined sexes, $\Phi' = 3.068$ for males and $\Phi' = 3.144$ for females (Table 5).

Table 4

Age-frequency distributions in total length and weight

Age groups			TL (cm)		TW (g)	
	n	%F	Min-Max	Mean±SEM	Min-Max	Mean±SEM
I	-	-	-	-	-	-
II	31	8.93	21.7-28.5	27.28 ±0.23	200-282	238.52±3.85
III	201	57.93	28-32.8	29.92±0.07	236-409	299.08±2.55
IV	85	24.50	30.6-40.2	35.55±0.27	340-786	515.13±11.86
V	24	6.92	39.9-47.6	42.93±0.48	701-1088	846.13±26.02
VI	4	1.15	47.3-50.5	48.65±0.71	1103-1326	1179.25±50.10
VII	2	0.57	52.6-54.9	53.75±1.15	1535-1589	1562±27

n: number of sample; F: frequency; Min: minimum; Max: maximum; TL: total length; TW: total weight; SEM: standard error of the mean.

Table 5

Von Bertalanffy growth parameters of *C. carpio* according to sexes (females, males and both)

Sex	L∞ (cm)	W∞ (g)	K (yr^{-1})	t_o (yr)	Φ'
Males	48.83	1148.56	0.49	-0.29	3.068
Females	58.28	2049.84	0.41	-0.34	3.144
Combined	58.28	2019.76	0.30	-0.47	3.008

Using the coefficients *a* and *b* of length-weight relationship conducted that the values of W∞ for males and/or females are respectively, 2019.76 g, 1148.56 g, and 2049.84 g since the equation of growth for the combined sexes is given by the following equation: $Wt = 2019.76\ [(1-e^{-0.30\ (t+0.47)}]^{2.859}$ (Table 6).

Table 6

Von Bertalanffy equation of *C. carpio* according to sexes *(*females, males and both)

	Von Bertallanffy Equation	
Males	$Lt = 48.83\ [1-e^{-0.49\ (t\ +\ 0.29)}]$	$Wt = 1148.56\ [1-e^{-0.49\ (t+0.29)}]^{2.765}$
Females	$Lt = 58.28\ [1-e^{-0.41\ (t\ +\ 0.34)}]$	$Wt = 2049.84\ [1-e^{-0.41\ (t+0.34)}]^{2.865}$
Combined	$Lt = 58.28\ [1-e^{-0.30\ (t\ +\ 0.47)}]$	$Wt = 2019.76\ [1-e^{-0.30\ (t+0.47)}]^{2.859}$

Discussion. This work considered as the first study on the biological characteristics of *C. carpio* in Foum El-Khanga Dam, Souk-Ahras (Algeria), in which the results were compared with other carp species of other area. Here, our data showed that the maximum size of all the samples was 54.9 cm, unlike of those reported by Mert & Bulut (2014) in Damsa Dam Lake, Turkey (69.2 cm). Brahmia et al (2016) report that *C. carpio* in Oubeira Lake, has a maximum size of 51 cm. Also, the maximum size of the samples is 54.9 cm for females and 47.8 cm for males, which are in a good agreement with some previous findings, such as those of Fatemi et al (2009) in Iran, and Yuce et al (2016) in Turkey, indicating that females of *C. carpio* reach larger sizes than males. Hence, differences can be attributed to fishing methods, population density, and ecological characteristics of studied areas (Yılmaz et al 2012).

Accordingly to the previous works, the present study confirmed that the value of the sex ratio is in favor of females (Crivelli 1981; Hajlaoui et al 2016). Mert & Bulut (2014) stated that *C. carpio* caught in the Damsa Dam Lake of Turkey presented a sex ratio tilted in favor of males, and hence the overall sex ratio of species may undergo a yearly change within the same population (Nikolsky 1963).

The parameters of the length-weight relationship of *C. carpio* of Foum El Khanga Dam are comparable to those of the previous studies (Table 7), since the *b* value ranged from 2.80 (Brahmia et al 2016) to 3.68 (Andreu-Soler et al 2006). Our results showed also that the exponent *b* of length-weight relationship presented of negative allometry growth ($b < 3$) for *C. carpio* females, males and both sexes, as well as the results

showed that the length of the species grows faster than the cube of the weight. According to previous studies, the similar growth pattern for *C. carpio* was recorded in Ain Zada reservoir (Mimeche & Biche 2015).

Table 7

Length-weight relationship for *C. carpio* of the previous studies

Location	*Sex*	*n*	*a*	*b*	R^2	*Author/s*
Segura river basin, Spain	♀+♂			3.68		Andreu-Soler et al (2006)
Southern Caspian Sea, Iran	♀+♂	328	0.00003	2.89	0.982	Fatemi et al (2009)
Oubeira Lake, Algeria	♀+♂	360	0.018	2.802	0.929	Brahmia et al (2016)
Kızılırmak River Basin, Turkey	♀+♂	301	0.001	3.138	0.93	Birecikligil et al (2016)
Atatürk Dam Lake, Turkey	♀+♂	231	0.029	2.847	0.95	Yuce et al (2016)
	♀♀	106	0.024	2.892	0.96	
	♂♂	125	0.034	2.807	0.95	
Foum El-Khanga Dam, Algeria	♀+♂	347	0.018	2.859	0.963	Present study
	♀♀	198	0.017	2.865	0.974	
	♂♂	149	0.024	2.765	0.933	

The relationship between the length and the weight of this species was highly correlated (the coefficient of determination, $R^2 > 0.92$). The obtained *b*-value for *C. carpio* population is in line with those reported by Yuce et al (2016) and Fatemi et al (2009). Additionally, higher *b* values were observed in Kızılırmak River Basin, Turkey (Birecikligil et al 2016). The variations in *b*-value could be attributed to differences in age, maturity, sex, geographic location and associated environmental conditions, such as seasonality, stomach fullness, disease and parasite loads (Bagenal & Tesh 1978).

In the present study, the maximum mean condition factor was calculated as 1.61 in winter for all samples, confirming the findings of Brahmia et al (2016) who found that the highest value of condition factor was recorded in winter. The mean condition factor of all population was calculated as 1.57±0.007 which is very close to that obtained in Damsa Dam Lake (K = 1.58) (Mert & Bulut 2014). However, the mean condition factor value was greater than the result found in the lake Oubeira (K = 1.01) (Brahmia et al 2016), and conversely, the K value is much lower than that estimated for *C. carpio* in the Guadalquivir river, south-west Spain (K = 1.94) (Fernadez-Delgado 1990). According to Bagenal & Tesch (1978) and Froese (2006), the mean condition factor has been used as an important tool in indicating health, growth, and feeding in intensity, and thus contributing to knowledge that the Foum El-Khanga Dam provides good conditions for development of *C. carpio* population.

The age groups of the studied population (n = 347) collected from the Foum El-Khanga Dam varied from 2-7-year. Previous studies reported that the age of the carp species was ranged from 1-6-year old in the Guadalquivir river, south-west Spain (Fernadez-Delgado 1990), and 1-7-year old in Almus Dam Lake (Karatas et al 2007). Hence, the most of the samples were in the age-group of 3-year old, as previously found in Turkey (Karatas et al 2007), since the most dominant age-group was found as 1-year old in the Guadalquivir river, south-west Spain (Fernadez-Delgado 1990). Age differences between previous studies is likely due the selectivity of the sampling nets used and high fishing pressure (Bilici et al 2017).

The $L\infty$ values obtained from Von Bertalanffy growth equations of *C. carpio* for females was calculated as $L\infty$ = 58.28 cm, and $L\infty$ = 48.83 cm for males. This information indicates that the females have an asymptotic length higher that the males. Similar data were also obtained from Ataturk Dam, Turkey (Yuce et al 2016) (Table 8). Moreover, our results showed that the growth coefficient (K) of the population obtained from the Foum El-Khanga Dam was found to be as K = 0.30 $year^{-1}$. The $L\infty$ and K values of *C. carpio* samples obtained in this study are lower than the values obtained in the

Mangla reservoir, Pakistan (Mirza et al 2012), and in Bafra Fish Lake, Turkey (Yılmaz et al 2012). On the other hand, the L∞ and K values of *Cyprinus carpio* obtained in this study are higher in comparison of those reported by Karatas et al (2007). Brahmia et al (2016) stated that *C. carpio* caught in the lake Oubeira, Algeria revealed an asymptotic length of 55.65 cm and growth coefficient rate (K) of 0.22 year^{-1}. In explaining these differences in growth parameters (L∞ and K), Kapoor & Khanna (2004) stated that some of environmental factors such as water temperature, food supply, poor water quality, physical disturbance, and biology of fish maturity and hormones have an obvious and major influence on growth rate. Though, fish populations of the same species from different geographical regions may exhibit highly variable individual growth rates (Wootton 1990).

The asymptotic weight (W∞) values of *C. carpio* for females and males were respectively, 2049.84 g and 1148.56 g, showing thus that the W∞ value of females are higher than that of males. These results are in line with those observed in Atatürk Dam (Yuce et al 2016) and Damsa Dam Lake, Turkey (Mert & Bulut 2014) (Table 8). According to Goncalves et al (2003), the variation in the estimated parameters may due to various factors, such as the region, sampling method, year, methodology etc. The parameter (t_o) of *C. carpio* in Foum El-Khanga Dam is comparable to those obtained by other authors (Table 8). Additionally, the highest value (t_o = -0.39 year) was obtained from Mangla reservoir, Pakistan (Mirza et al 2012), since the lowest value (t_o = -1.922 year) was found in Almus Dam Lake, Turkey (Karatas et al 2007). Furthermore, the index (phi-prime index) Φ′ was estimated as Φ′ = 3.0 for the entire population. This value is similar to that noticed in the carp population of Iran (Fatemi et al 2009). In contrary, our result is higher than that obtained from the Almus Dam Lake (Karatas et al 2007), and lower than that noticed in the Mangla reservoir of Pakistan (Mirza et al 2012) (Table 8). This difference in the phi-prime index within the same species may due to different factors (endogenous and exogenous) affecting fish growth performance and longevity (Wootton 1990).

Table 8

Von Bertalanffy growth parameters of *C. carpio* as previously reported by several authors

Location	*Sex*	*n*	*L∞ (cm)*	*W∞ (g)*	*K (yr^{-1})*	*t_o (yr)*	*Φ′*	*Author/s*
Almus Dam Lake, Turkey	♀+♂	307	46.39		0.153	-1.922	2.52	Karatas et al (2007)
	♀♀		47.24		0.183	-1.982	2.61	
	♂♂		41.61		0.198	-1.428	2.54	
Southern Caspian Sea, Iran	♀+♂	328	72		0.18	-0.65	2.97	Fatemi et al (2009)
	♀+♂	155	60.96	3814.8	0.274	-0.802	3.01	
Bafra Fish Lake, Turkey	♀♀	81	54.07	1689.6	0.359	-0.537	3.02	Yilmaz et al (2012)
	♂♂	74	45.67	2729.1	0.544	-0.238	3.05	
Mangla reservoir, Pakistan	♀+♂	10.182	80.33		0.60	-0.39	3.59	Mirza et al (2012)
	♀+♂	160	88.45	9854.9	0.168	-0.583		
Damsa Dam Lake, Turkey	♀♀	63	86.8	10302.7	0.189	-0.396		Mert & Bulut (2014)
	♂♂	97	85.34	8868.0	0.175	-0.468		
Oubeira Lake, Algeria	♀+♂	360	55.65		0.22			Brahmia et al (2016)
	♀+♂	231	111.01	19746.6	0.06	-1.48	2.87	
Atatürk Dam Lake, Turkey	♀♀	106	111.03	20265.5	0.07	-1.48	2.94	Yuce et al (2016)
	♂♂	125	104.72	16192	0.06	-1.39	2.82	
	♀+♂	347	58.28	2019.7	0.30	-0.47	3.008	
Foum El-Khanga Dam, Algeria	♀♀	198	58.28	2049.8	0.41	-0.34	3.144	Present study
	♀♀	149	48.83	1148.5	0.49	-0.29	3.068	

Conclusions. We report the first findings of the length-weight relationship, age and growth of *C. carpio* (Linnaeus, 1958) from Foum El-khanga Dam in Souk-Ahras (Algeria):

- the LWR analysis exhibited that *C. carpio* has a negative allometric growth (b < 3), indicating that the length of the species increases faster than the cube of the weight;
- the condition factor (K) indicates that the Foum El-Khanga Dam provides favorable conditions for *C. carpio* population development;
- the age of *C. carpio* caught from Foum El-Khanga dam varied from II to VII years;
- the asymptotic length (L∞) and the asymptotic weight (W∞) values obtained from Von Bertalanffy growth equations of *C. carpio* for females was higher than the males.

The gained knowledge will provide an improved understanding of the management and the evaluation of the stocks of this valuable species.

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Authors:
Fatiha Sahtout, Laboratory of Aquatic and Terrestrial Ecosystems, Faculty of Science, Mohamed Cherif Messadia University-Souk Ahras, 41000 Souk Ahras, Algeria, e-mail: fsahtoutdoct@gmail.com
Chahinez Boualleg, Laboratory of Aquatic and Terrestrial Ecosystems, Faculty of Science, Mohamed Cherif Messadia University-Souk Ahras, 41000 Souk Ahras, Algeria, e-mail: chahinezboualleg@yahoo.fr
Naima Khelifi, Laboratory of Aquatic and Terrestrial Ecosystems, Faculty of Science, Mohamed Cherif Messadia University-Souk Ahras, 41000 Souk Ahras, Algeria, e-mail: naimakhelifi@yahoo.fr
Nouha Kaouachi, Laboratory of Aquatic and Terrestrial Ecosystems, Faculty of Science, Mohamed Cherif Messadia University-Souk Ahras, 41000 Souk Ahras, Algeria, e-mail: nouha.kaouachi41@gmail.com
Billel Boufekane, Laboratory of Biological Oceanography and Marine Environment, Faculty of Biological Sciences, University of Science and Technology Houari Boumediene-Bab Ezzouar, 16111 Bab Ezzouar, Algeria, e-mail: boufekanebillel@gmail.com
Sarra Brahmia, Laboratory of Ecobiology for Marine Environments and Coastlines, Faculty of Science, Badji Mokhtar University-Annaba, 23000 Annaba, Algeria, e-mail: sarita-eco@hotmail.fr
Wahiba Mouaissia, Laboratory of Aquatic and Terrestrial Ecosystems, Faculty of Science, Mohamed Cherif Messadia University-Souk Ahras, 41000 Souk Ahras, Algeria, e-mail: wahiba.mouaissia@gmail.com
Mourad Bensouilah, Laboratory of Ecobiology for Marine Environments and Coastlines, Faculty of Science, Badji Mokhtar University-Annaba, 23000 Annaba, Algeria, e-mail: bensouilah_mourad@yahoo.fr
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