Journal of FisheriesSciences.com

© 2020 www.fisheriessciences.com

Research Article

Contribution to the Study of Growth of *Luciobarbus Mascarensis* (*Teleostei: Cyprinidae*) in two Freshwater Systems in Western Algeria

Sid Ahmed Benali*, Ghoumari Sidi Mohamed, Larbi Doukara Kamel, Gaouar Semir Bechir Suheil

University of Mostaghanem Central, Avenue Hamadou Hossine, Mostaganem, Algeria

Abstract: *Luciobarbus mascarensis* is a *Cyprinidae* endemic fish of the Macta basin, widely distributed in the region of Mascara, Sidi Bellabes and Saida. This study describes the population structure and biometric relationships such as the weight-length relationship and the condition index (K), of this native species in two different freshwater systems: oued El hammam located on the flank north of the high Oran plains and the Bouhanifia dam located in the north-west of Algeria about 100 km south of Oran and 25 km from Mascara. 116 specimens were fished in the two freshwater systems during the period from November 2017 to September 2019. For each individual, the total (Lt) and standard (Ls) lengths were measured. The total individual body weight (Wt) was taken using an electronic scale. The results showed a positive allometric growth for the *Luciobarbus mascarensis* which lives in a natural environment (Oued) and a negative allometry for that which lives in an artificial environment (Dam). In addition, it appears in our sampling that the largest fish is a female which weighs 728.2 g and a length of 423 mm this one, was captured in the wadi however in the dam, the maximum length recorded for this species is 342 mm against a maximum weight of 460.3 g

Our results would seem useful for the management and conservation of this native species in the different hydrosystems of western Algeria.

Keywords: *Luciobarbus mascarensis*; Condition factor; Allometry; Oued el hammam; Bouhanifia dam; Western Algeria

---

*Correspondence to: **Ahmed BS,** Faculty, University of Mostaghanem Central, Avenue Hamadou Hossine, Mostaganem, Algeria, Tel: 213541455433; E-mail: sidahmed.benali@univ-mosta.dz

Introduction

Metabolically, growth covers the part of energy used to increase body weight and body length (Jorgensen and Fiksen, 2006; Lévêque and Paugy, 2006). The ichthyofauna of the Bouahnifia dam is unknown. A fish fishery was undertaken respectively in the natural ecosystem (Oued el hammam river) which is an important sub-basin of the Macta characterized by strong water erosion and in the aquatic ecosystem of the Bouhanifia dam.

Studies of the length-weight relationship of fish are important in fisheries biology because they allow the average weight of fish in a given length group to be estimated by establishing a mathematical relationship between the two (Berg, 1981). The length-weight relationship has been studied by several researchers in different species of fish, namely Clarias gariepinus (Ayo-Olalus i, 2014), Oreochromis niloticus (Silva et al., 2015), Astyanax aff. fasciatus (Furuya et al., 2014), Pseudorasbora parva, Atherina boyeri, Aphanius danfordii, Tinca tinca and Cyprinus carpio (Kirankaya et al., 2014), Capoeta umbla (Serdar and Ozcan, 2016), Luciobarbus pectoralis (Özcan et al. Comm. 2019) Carasobarbus luteus, Chondrostoma regium, Clarias garie pinus, Angu illa anguilla and Cyprinus car pio (Ozcan, 2008).

These data are needed to estimate growth, size and age structures (Kolher et al., 1995) and other components such as the conversion of growth to height to weight growth (Pauly, 1993). Also, this relationship provides an essential tool for the study of population dynamics and allows the morphological comparison between fish populations in a given geographic region, in relation to different environmental scenarios (Gonclaves et al., 1997; Ritcher et al., 2000).

Materials and Methods

Study sites

Oued El-Hammam

The watershed of the Oued El Hammam is located in the North-West of Algeria. Covering an area of 8348 km², it belongs to all the Oran coastal basins and more particularly to the large Macta basin **(Figure 1)**. The basin of the Oued El-Hammam, located on the northern flank of the high Oran plains, has an elongated shape and its average altitude is 790 m. If about 65% of the area of the Oued El Hammam basin is below 1000 m, 3.6% is more than 1200 m, the highest point exceeding 1400 m near the confluence of the Macta **(Figure 2)**. The Beni Chougrane mountains (932 m) occupy a good part of the middle zone of the watershed. This goes up, to the east, to the Saïda Mountains (1201 m to Jebel Tiffrit) and, to the south, as far as the Monts de Dhaya and up to the heights of the northern edge of the high plateaus which separate the study area from the Chott Ech Chergui depression (Meddi et al. 2009). The Oued El Hammam takes its source 16 km southwest of Ras Elma and covers a distance of 175.5 km in a south-east-north-west direction **(Figure 1)**. The flow of the Oued El Hammam is regulated by the three dams of Fergoug, Bouhanifia and Ouizert.

Bouhanifia dam

The Bouhanifia dam is located in the north-west of Algeria, about 100 km south of Oran and 25 km from Mascara **(Figure 1)**. The Bouhanifia dam reservoir is
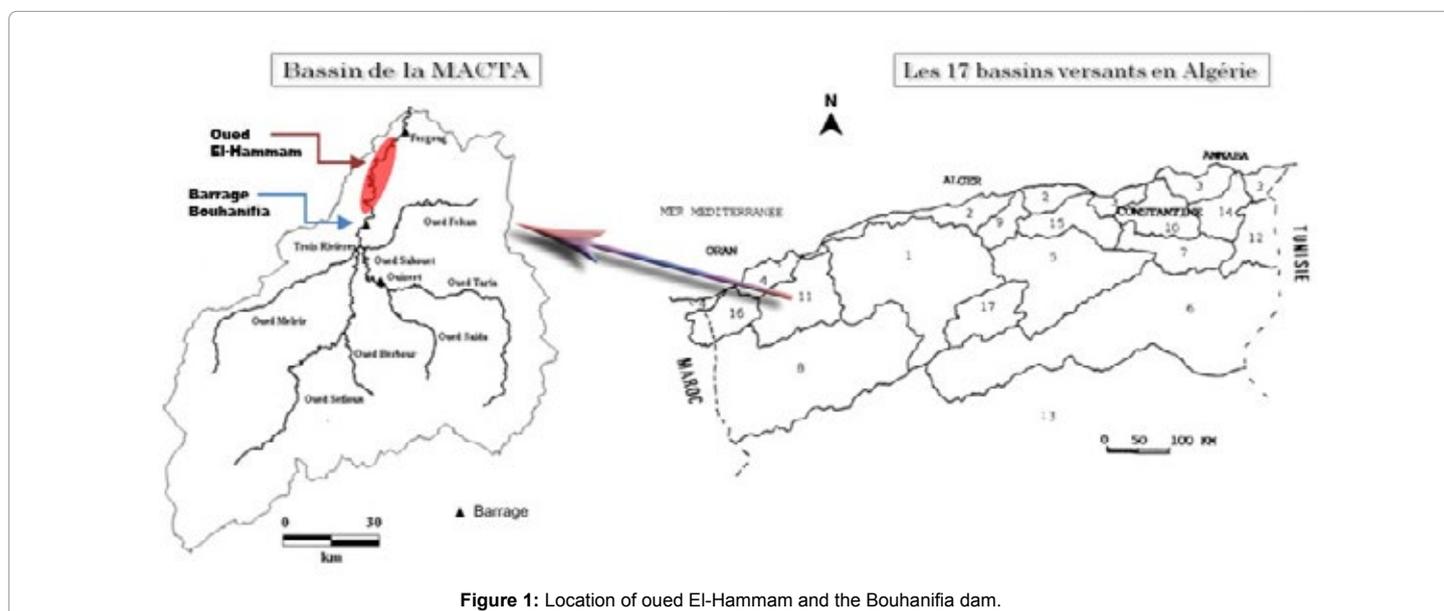
Figure 1: Location of oued El-Hammam and the Bouhanifia dam.
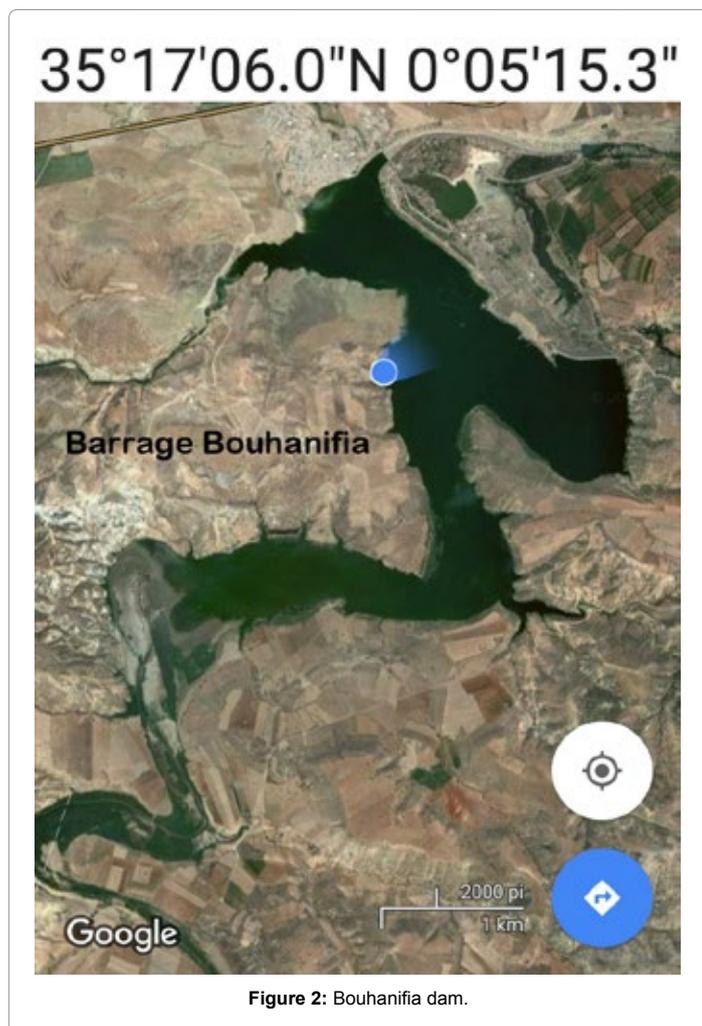
Figure 2: Bouhanifia dam.

supplied mainly by the El Hammam wadi which has its source at the Trois Rivières level, the point of confluence of the wadis Melrir, Hounet (formed by the confluence of the wadis Sefioum and Berbour) and wadi Sahouet (formed by the confluence of the Taria and Saïda wadis) and enlarged by the Fekane wadi. The watershed of the El Hammam wadi upstream of the Bouhanifia dam covers an area of approximately 7,700 km^2 **(Figure 2)**. It is under the influence of the Mediterranean climate, the temperature of which varies between 8°C and 10°C in winter to +30°C in summer, with an average rainfall of 350 mm per year.

Sampling

On each study site, three sampling stations were chosen taking into account the importance of fishing activities. A total of 116 specimens captured between November 2017 to September 2019, using a fishing net (Trémail: It is composed of three sheets of net with unequal meshes) with a width of 20 m, a drop of 1, 8 m and a gap of 20 mm mesh. For each fishing the net was set during the day, the fishing effort is on average 10 hours.

The length of the specimens was measured to the nearest mm (total length, Lt) and weighed to the nearest 0.1 g (total weight, wt).

Data analysis

Determination of the weight-length relationship

The height-to-weight relationship is generally expressed by the following equation:

W=aLb (Ricker 1973; Beverton & Holt, 1996)

where:

W: the total weight (g)

L: total length (cm),

(a) the intercept with the y-axis and (b) the slope of the regression line.

The parameters a and b were estimated by the method of least squares obtained by logarithmic transformation to correct the nonlinearity of the starting curve and the heterogeneity of the variances: Log Wt=b Log Lt+Log a. The values of b give an overview on the growth of the fish, when b=3, the growth is isometric and when b ≠ 3, the growth is said to be allometric, (positive allometry if b>3, negative allometry if b<3).

Determination of condition factor

The condition factor was determined according to the following formula: K=Pt /Ltb*100 (Tesch, 1971; Lalèyè et al., 1995b), with Pt and Lt respectively the total weight in grams and total length in centimeters and b being deduced from the weight-length relationship.

Results

Weight and length of fish at each site

A total of 116 specimens of *Luciobarbus mascarensis* were observed. The results show that in the dam the total length is between 17.4 cm and 34.2 cm while in the Oued, it varies from 19.4 cm to 42.3 cm **(Table 1)**. The longest specimens were observed in Oued el-Hammam. The minimum and maximum weight observed for *L.mascarensis* is also in **Table 1**.

The height-weight relationship

The parameters (a) and (b) of the height-weight

Table 1: Parameters of the weight-length relationship of Luciobarbus mascarensis.

Site	Species	N	Length (cm)		Weight (g)		a	b	Growth
			Min	Max	Min	Max			
Oued El-Hammam	*L. mascarensis*	60	19,4	42,3	68,7	728,2	0,003	3,041	A+
Barrage Bouhanifia	*L. mascarensis*	56	17,4	34,2	64,9	460,3	0,017	2,381	A-
A +: positive allometry; A-: negative allometry; N: sample size									

Table 2: Weight-length regression equation and condition factor K.

Site	Species	NOT	Regression equation	R²	Condition factor K	
					Average	Standard deviation
Oued el-Hammam	*L. mascarensis*	60	P = 0.003L3.236	0.948	0.396	0.345
Bouhanifia dam	*L. mascarensis*	56	P = 0.017L2.381	0.852	0.367	0.419
P: Total weight; L: Total length; N: sample size; R2: Correlation coefficient						

relationship are presented in **Table 1**. Student's t-test shows two types of growth. Growth is positive allometric for the site (Oued El-Hammam), on the other hand in the site (Bouhanifia dam) represents a negative allometric for the same species.

The condition factors

The condition factor values, the regression equations and the coefficient of determination R^2 are shown in **Table 2**. The highest condition factor values were recorded at Oued El-hammam.

Discussion

Our fisheries in the dam demonstrate the permanent presence of a population of *Luciobarbus mascarensis*, a species which is nevertheless naturally rheophilic and fluviatile like its close species *B. barbus* and *B. meridionalis* (Brusle and Guignard, 2001), although it also occurs naturally in gueltas in Algeria (Froese and Pauly, 2010) and in natural lakes such as that of Ichkeul in Tunisia (Chaouachi and Ben Hassine, 1998).

The fish caught in the Oued have a positive allometric growth compared to those caught in the dam, the individuals thus captured in the dam show a slight tendency to gain weight in relation to their growth in size. This same result has been reported by (Chaouachi and Ben Hassine, 1998) for barbel living in the lagoon of Ichkeul in Tunisia.

The length-weight relationship of *Luciobarbus mascarensis* is allometrically positive in wadi El-hammam. Indeed, the exponent of the length in the equation of weight as a function of length is very close to 3 (b=3.041) with a correlation coefficient R^2 of 0.948 **(Figure 3)**. on the other hand, in the Bouhanifia dam the allometry is negative (b=2.381) with a correlation coefficient R^2 of 0.852 **(Figure 4)**.
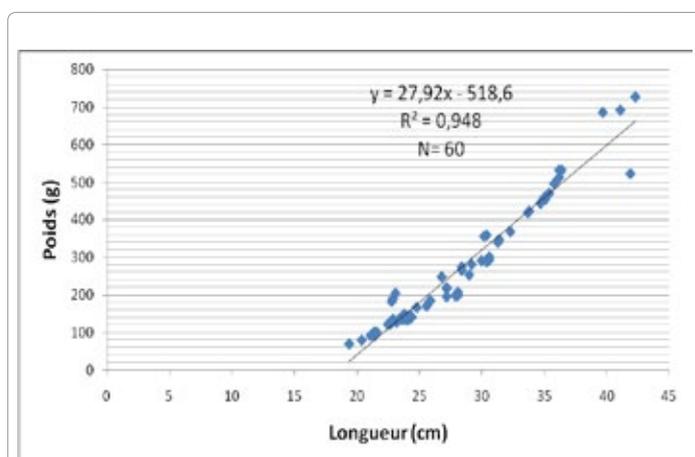
Figure 3: Weight-length relationship of Luciobarbus mascarensis in wadi El-Hammam.
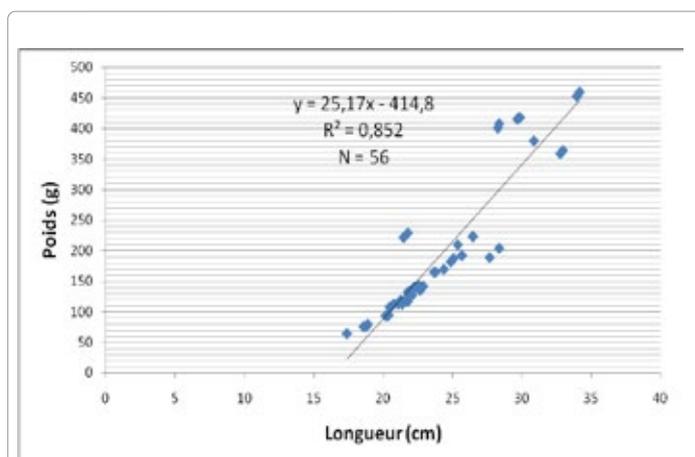
Figure 4: Weight-length relationship of Luciobarbus mascarensis in the Bouhanifia dam.

On the other hand, in the framework of a study on B. callensis from the AIIaI-eI-Fassi reservoir in Fès (Morocco), (Bouhbouh, 2002) found a higher coefficient, equal to 3.35.

Furthermore, (Bravo et al. 2001), in the GuadaIquivir river in Spain, obtain for Barbus sclateri a coefficient of the exponent b equal to 3.087 and a correlation coefficient r² of 0.98 very close to that measured for our species. On the other hand, (OIiva et al. 2003) obtain a coefficient of the exponent b varying between 2.76 and 2.99 in six stations in the semi-arid reservoirs of the Iberian Peninsula.

Conclusion

This study provides the first basic information on the length weight parameters and the condition factors of the species *Luciobarbus mascarensis* from Oued el-hammam and the bouhanifia dam. The study of the weight-length relationship of *L. mascarensis* shows that the growth model of the population of the wadi el-hammam is much better than that of the bouhanifia dam.

Our results specify the biological parameters inherent in our studied species. This species could be a good biological indicator of the state of ichthyological populations and should make it possible to establish a diagnosis both of the state of these populations and of the ecosystems in which it evolves.

References

Ayo-O lalus i, C.I. (2014) Length-weight relationship, condition factor and sex ratio of African mud catfish (Clarias garie pinus) reared in flow-through system tanks. Journal of Fisheries and Aquatic Science 9: 430-434.

Berg, R.K. (1981) Fish populations of the wild and scenic Missouri River. MSc Thesis, Department of Fish, Wildlife and Park, Montana State Library, Montana, USA.

Beverton, R.J.H., Holt, S.J. (1996) On the Dynamics of Exploited Fish Populations. Chapman and Hall. London, 533p.

Bouhbouh, S. (2002) Bio-ecology of Barbus callensis (Valenciennes 1842) and Barbus fritschi (Günther 1874) in Allal-el-Fassi Reservoir (Morocco) .Thèse doctorat.Fac.Sci. Dhar el Mehraz FES, Morocco. p164.

Brahimi, A., Freyhof, J., Henrard, A., Libois, R. (2017) Luciobarbus mascarensis and Luciobarbus chelifensis (Cyprinidae): two new species in Algeria. Zootaxa 4277:32-50.

Bravo, R., Soriguer, M.C., Villar, N., Hernando, J.A. (2001) The dynamics of fish populations in the Palancar stream, a small tributary of the river Guadalquivir, Spain. Acta Oecologica 22: 9-20.

Brusle, J., Guignard, J.P. (2001) Biology of European freshwater fish. 625p. Paris: Tec & Doc Editions.

Chaouachi, B., Ben Hassine, O.K. (1998) The barbel Barbus callensis Valenciennes, 1842 (Fish, Téléostéen) from the lagoon of Ichkeul. Arch. Inst. Pastor Tunis 75: 211-218

Froese, R., Pauly, D. (2010) Fish Base. World wide web electronic publication.

Furuya, V.R., Michelato, M., Cruz, T.P.D., Furuya, W.M. (2014) Length-weight relationships and prediction equations of body composition of farm raised Astyanax aff. Fasciatus (Actinopteryg ii: Characiformes: Characidae). Zoolog ia Curitiba 31: 521-524.

Gonçalves, J.M.S., Bentes, L., Lino, P.G., Ribeiro Canário, A.V.M., Erzini, K. (1997) Weight-length relationships for selected fish species of the small-scale demersal fisheries of the south and south-west coast of Portugal. Fisheries Research 30: 253-256.

Jørgensen, C., Fiksen, O. (2006) State-dependent energy allocation in cod (Gadus morhua). Can. Journal of Fisheries and Aquatic Science 199: 186-199.

Kirankaya, S.G., Ekmekci, F.G., Yalcin-Ozdilek, S., Yogurtcuoglu, B., Gencog lu, L. (2014) Condition, length-weight and length-length relationships for five fish species from Hirfanli Reservoir, Turkey. Journal of Fisheriessciences.com 8: 208-213.

Kolher, N.E., Casey, J.G., Turner, P.A. (1995) Length-weight relationships for 13 species of sharks from the Western North Atlantic. Fishery Bulletin 93: 412-418.

Lévêque, C., Paugy, D. (2006) Fish from African inland waters. Research Institute for Development. IRD Edition, Paris.

Ozcan, M., Ispir, U. (2019) Length-Weight Relationships of Luciobarbus pectorafis from the Menzelet Dam Lake of Kahramanmaras. Agricultural Journal 14: 35-39.

Meddi M., Talia A., Martin C. (2009) Recent evolution of climatic conditions and flows in the Macta watershed (North-West of Algeria). Journal of physical geography and environment 3: 61-84.

Oliva, P.F.J., Andreu, A., Torralva, M. (2003) Water quality affects the Condition of Barbus sclateri Günther, 1868 (Pisces, Cyprinidae) in semi-arid reservoirs from the Iberian Peninsula. Anales de Biología 25: 3-11.

Ozcan, G. (2008) Length-weight relationships of five freshwater fish species from the Hatay Province, Turkey. Journal of Fisheriessciences.com 2: 51-53.

Pauly, D. (1993) Fishbyte Section. Editorial. Naga. ICLARM Quarterly. 16:26.

Ricker, W.E. (1973) Linear regressions in fishery research. Journal of Fisheries Research. Board Can. 30: 409-434.

Ritcher, H., Luckstadt, C., Focken, U., Becker, K. (2000) An improved procedure to assess fish condition on the basis of length-weight relationships. Archive of Fishery and Marine Research 48: 255-264.

Serdar, O., Ozcan, E.I. (2016) Length-weight and length-length relationships of Ca poeta umbla in the Karasu River (East Anatolia, Turkey). Aegean Journal of Fisheries and Aquatic Science 33: 413-416.

Silva, T.S.D.C., Santos, L.D.D., Silva, L.C.R.D., Michelato, M., Furuya, V.R.B. (2015) Length-weight relationship and prediction equations of body composition for growing-finishing cage-farmed Nile tilapia. Rev. Arms. de Zootecnia, 44: 133-137.

Tesch, F.W. (1971) Age and growth. In: Methods for assessment of fish production in fresh waters. WE Ricker (Ed.). Blackwell Scientific Publications, Oxford pp.99-130.