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Life history and other biological traits of *Capoeta buhsei* (Kessler,1877) in the Gharachay River, Saveh

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Abstract

Capoeta buhsei is native species in the Namak Lake basin and biological aspects of life history of this fish in Iranian waters is not very well known. Life history of this fish examined by collecting 92 samples in Gharachay River. Sampling done by using Electroshoker in July and January 2011 and October 2012. The maximum age was found +4 years in female. Sex Ratio (male: female) was 1:0.73, and length –weight relationship was $BW=35.55.TL^{3.2}$ in male and $BW=14.8.\ TL^{3.07}$ in female. Mean egg diameter (ED) was 0.8726 ± 0.12 mm ranging from 0.67 to 1.1 mm. Mean absolute (AF) and relative fecundity (RF) were 4917.2157 ($\pm$1690.04 SE) egg female^{-1} and 69.1 ($\pm$16.15 SE) eggs g^{-1} body weight, respectively.

AF and ED were found to increase significantly with increasing fish size, whereas RF increased significantly with both fish TL and weight.

Keywords: *Capoeta buhsei*, Life history, Egg diameter, Reproduction, Fecundity

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Introduction

Capoeta buhsei (Kessler, 1877) is a Cyprinid species and native fish in the Namak Lake basin, encompassing much of the Iranian part of Esfehan, Zaribar Lake in Kordestan, Kol River near Darab in Hormozgan basin and Jazmorian Compared with the other species of Cyprinidae family, many biological aspects of *C.buhsei* life cycle remains unknown. Growth and reproduction featured differences are unknown between the populations of this species are existing and living in various regions, and these differences are fundamental for understanding the specie's life history patterns. The aim of the this study is to introduce the first detailed data on the growth and life-history cycle of *C. buhsei* in the Gharachay River in Saveh.

Materials and methods

The Gharachay River is located in the Markazi Province (Latitude: 52°53'34" E; longitude: 50°22'48" N , altitude: 960m)

The reproduction cycle of the *C. buhsei* in Gharachay River is known to start from August and extend to January, so specimens were collected from middle parts of the river during these months in 2011 and 2012, by using an electroshoker device with 1.7 kw Power and 200-300 V voltage. All fish specimens were immediately preserved in 10% formaldehyde solution to subsequent examination in the laboratory. Total length (TL), body weight (BW) and gonad weight (0.01g) of all samples were measured in the laboratory. Age was determined by observing operculum taken from both sides, which were Validated with scale and cleithra [SE1] readings. Opercula were observed for banding patterns three times, each time by a different person using a binocular microscope under reflected light at 20-30X. The relationship between the TL and TW was determined by fitting the data with the equation $TW=aTL^b$, where a is the intercept and b is the slope (coefficient of allometry) .

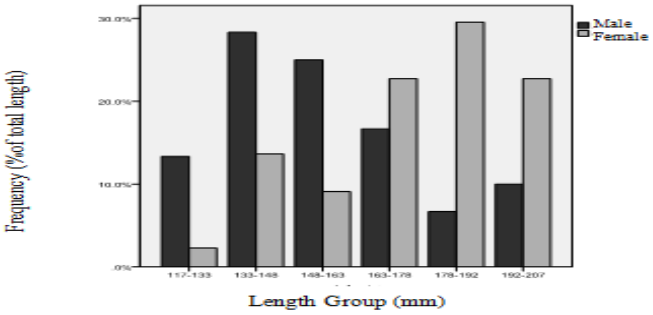

Figure 1: Total length (mm) frequency of males and females of *Capoeta buhsei* in Gharachay River, Saveh.

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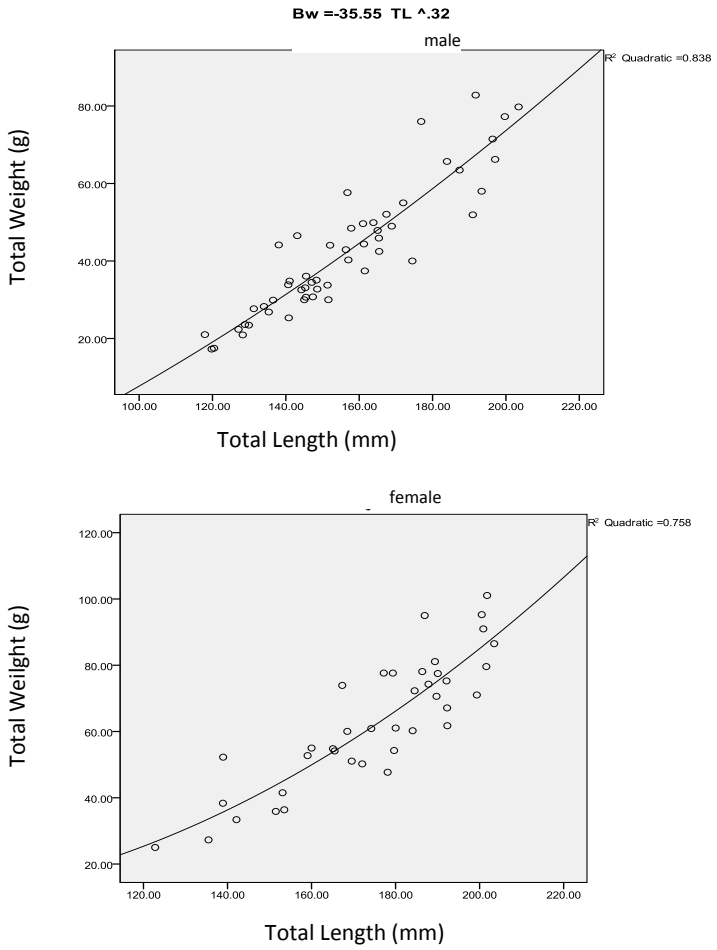

Figure 2: Relative growth curves (total length – total weight) of males, and females of *Capoeta buhsei* in Gharachay River, Saveh.

Sex was determined by visual examination of the gonad tissue by eye or by using stereomicroscope.

Gonadosomatic index (GSI%= [gonad weight ÷ Tw] ×100) was calculated for each fish and all the mean values was calculated for each sampling date. In order to estimate absolute (AF) and relative (RF) fecundities, the ovaries of 39 ripe females with maturity stage IV were used. Ovaries were removed, weighed and then placed in Gilson's fluid for 3-4 days to harden eggs and dissolve ovarian membranes.

AF was estimated using the gravimetric method, using three pieces removed around anterior, medial and posterior parts of the ovary. RF was calculated as RF=AF/TW.

Mean egg diameter was examined by measuring 25-30 eggs taken randomly from pieces of the ovary of 39 ripe females used for fecundity determination. Measurements were made to the nearest 0.05 mm with an ocular micrometer microscope. Analysis of covariance (ANCOVA) was performed to test significance differences in weight length

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relationships between sexes. The overall sex ratio was assessed using the chi-square test. Comparison of GSI values between sexes was carried out by analysis of variance (ANOVA). Statistical analyses were performed with the SPSS 19 software package and a significant level of 0.05 was accepted.

Results

In the 92 specimens of the captured *C. buhsei* maximum age in both sexes was age +4, with males ranging from 64/74 to 202/79 mm, TL and 17.26 to 82.81 gr. TW and females ranging from 76/5 to 222/44 mm TL and 25 to 101.05 gr TW. The most frequent size class in the samples was 133-148 mm for males and 178-182 mm for females (Fig. 1). The overall sex ratio was 0.73:1 female: males, with males significantly more prevalent than (x^2=0.14, p<0.05). Length – weight relationships were significant with a high regression coefficient (Figs. 1, 2).

The coefficients of the calculated regressions were significantly different between each of considered groups. The slope b values indicate a positive pattern of allometric growth. GSI was significantly lower in males than females, with the highest mean value observed in January for both sex, 4.6 ± 0.5 SE and 2.08 ± 0.3 SE in November, 2.7 ± 0.3 SE in Aug, in 2011 and 2012, respectively. Spawning was first observed in August, so the reproductive period for this species in Gharachay River, Saveh is August to January.

Mean egg size was 0.8726 ± 0.12 SE mm, with the majority of oocyte ranging from 0.67 to 1.1 mm. Egg diameter was positively correlated with both TL and TW.

Minimum absolute fecundity (AF) was 4917.2157 (± 1690.04 SE) eggs per female. AF was found to increase significantly with increasing fish size. Mean RF was 69.1 (± 16.15 SE), ranging from 38.91 to 98/42 eggs g^{-1}. RF was found to increase significantly with both fish TL and TW.

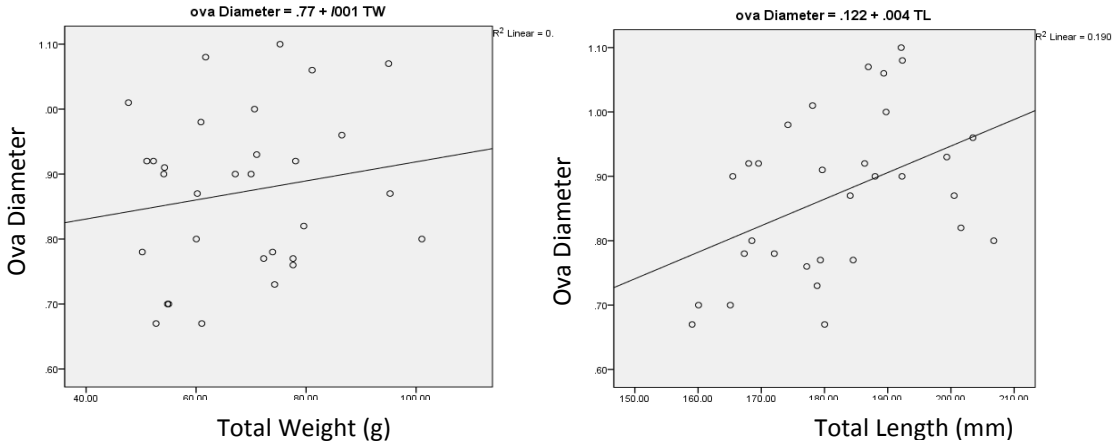

Figure 3: Relationship between ovarium diameter and total length (mm) and total weight (g) of female trout barb *Capoeta buhsei* in the Gharachay River, Saveh.

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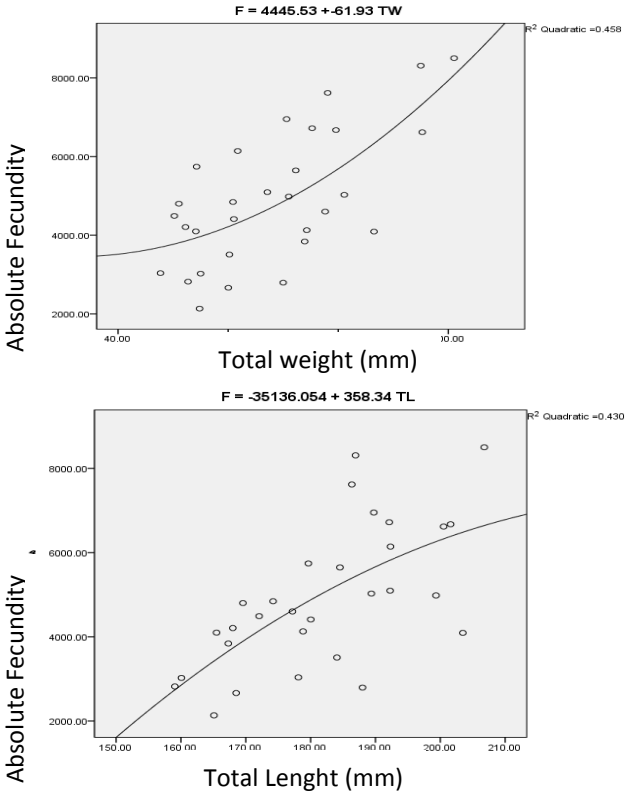

Figure 4: Relationship between absolute fecundity and fish total length (mm) and total weight (g) of female *Capoeta buhsei* in the Gharachay River, Saveh.

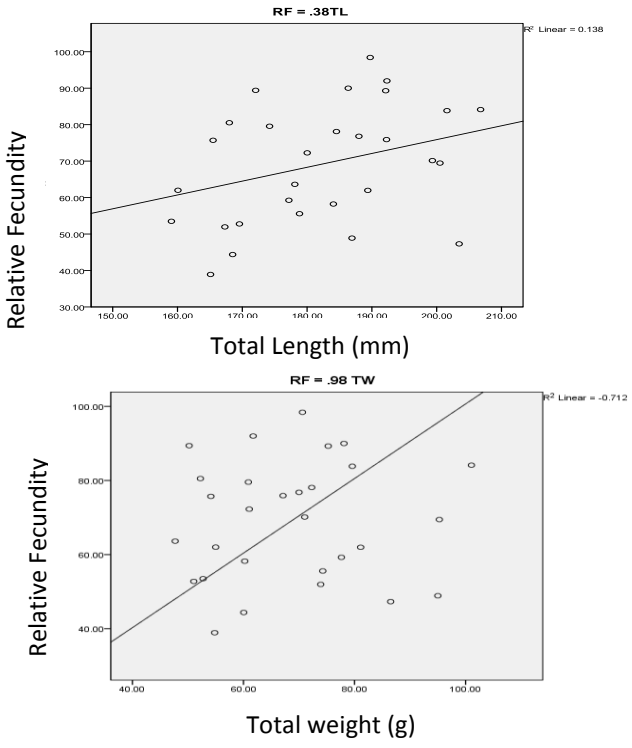

Figure 5: Relationship between relative fecundity and fish total weight (mm) and total length (g) of female *Capoeta buhsei* in the Gharachay River, Saveh.

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Discussion

Life – history variables of organisms are often known to vary among habitats and geographical locations and *C. buhsei* of the Gharachy system of Saveh is no exception. Prior to the present study, no published data were available on the life history of this species in Iran, though information is available of some other *Capoeta* species (e.g. *C. capoeta gracilis, C. damascina*) in northern and central of Iran. Therefore, comparisons are only possible with other *Capoeta* species and with *trout barb* populations in other countries.

As with other *Capoeta* species, *C. buhsei* was found to be reasonably fast growing and short lived, with females exhibiting a much wider range in length and a higher maximum length.

Observed maximum in Gharachay River is lower than those reported in Turkish waters: +10 in Ceyhan River (Alp *et al.*, 2005), +12 in Karasu River (Turkmen *et al.*, 2002),+7 in karakaya lake (Kalkan, 2006), +10 in Oltu from Coruh (Yildirim and Sitki Aras, 2000). Differences in maximum length are also observed between populations, with *C. buhsei* of Gharachay River being smaller than those recorded in Turkey, 34.60 cm TL in the Ceyhan River (Alp *et al.*, 2005) 36.6 cm TL in Karasu River (Turkmen *et al.*, 2002) and 37.70 cm TL in the Karakaya Lake (Kalkan, 2006).

Variations in maximum age and fish size can usually be explained by differences in food resource availability, individual growth rates, natural selection processes, and, or exploitation patterns. Because *C. buhsci* is not subject to commercial exploitation in the Gharachay River. Environmental conditions are the likely sources of the observed variations.

C. buhsei growth is positively isometric in the Gharachay River, with differences between males and females explainable by differences in the size distributions of the two sexes. In the Gharachay population, the observed slope (b) values, which reflect the influence of local environmental factors on growth, differ from those found for the species in Karakaya Reservoir (Kalkan, 2006), where positive isometric growth was reported for females (b=-3.07) and positive isometric growth for males (b=3.20).

The GSI values for *C. buhsei* of the Gharachy River indicate that the relative investment in reproduction by the two sexes is similar to that reported for the Tajan River in south of the Caspian Sea, where a maximum GSI in females (8.3) was achieved in January (Shajee, 2007).

Even though differences in the timing of spawning has been reported for Capoeta in Turkey (Yildirim and Sitki Aras, 2000; Turkmen *et al*., 2002; Alp *et al*., 2005, Kalkan, 2006) and Iran (Badrifaiman, 2004; Johari, 2007; Gholizade, 2008) it seems that reproductive investment by females (as expressed by GSI) is not significantly different among population, an important parameter in the reproductive strategy for this species.

Absolute fecundity in the Gharachay River population of *C. buhsei* (4917 ± 1690 SE) was lower than the mean value for the species in Tajan

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River, Karasu River, Meyme River, which reflects the smaller maximum egg diameter (0.87mm) observed in Gharachay River population than reported for population in Turkey: 1.7 in Karasu River (Kalkan, 2006) and 1.6 in the Meymeh River (Patimar and Farzi, 2011).

Lower absolute fecundity and smaller ova suggests a lower energetic investment per egg in the Gharachay River population, and this increase with increasing female size. This is also evident in the minimum and maximum values for absolute fecundity (AF) compared with those reported for the Turkish Euphrates (2133-8501/76 eggs), though *C. buhsei* in the Gharachay River demonstrated a wider range of AF values as well as an AF dependency on fish size. This indicates an increasing total energetic investment in reproduction with increasing fish size.

In Conclusion, the *C. buhsei* population in the Gharachay River differs in its life history traits relative to other populations, reflecting adaptations to the environmental conditions associated with the climate of Markazi Province. Future comparative studies are recommended in order to reveal the processer underlying adaptation in different habitats of distribution range.

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