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# Study of reproductive characteristics of *Capoeta trutta* in Gamasyab River, Kermanshah Province, Iran

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**Abstract**

The reproductive characteristics of *Capoeta trutta* were monthly reviewed in the Gamasyab River Kermanshah province for one year from August of 2008 till July of 2009. Totally, 252 fishes were caught, of which 167 pieces were male and 85 were female. The sex ratio in this study was obtained as 1.96 ♂: 1 ♀. The maximum total length of the male and female fishes in Gamasyab River was measured as 205.25 and 303.5 mm respectively. Four reproductive characteristics including absolute fecundity, relative fecundity, Gonad somatic index (GSI) and ova diameter were measured and recorded from the fishes of Gamasyab River. The mean absolute fecundity of fishes in this river was 7756±736, whose minimum and maximum was obtained as 1920 and 17505 respectively. The mean relative fecundity of fishes in this river was calculated as 50.65±3.61. The average of Gonad somatic Index (GSI) of male and female fishes was achieved as 5.18±2.42 and 3.44±1.11 respectively, which showed a significant difference in the level of 5 percent ($P<0.05$). The mean ova diameter of fishes in Gamasyab River was measured as 0.9±0.09 mm, for which the range of 0.12-1.90 was obtained. Considering the fact that the Gonad somatic index of this fishes is maximized in May, the time for spawning was determined to be in May and for reproduction to be from March till June. Epithelial nodules appeared in March, maximize in May and disappear in June. The average water temperature and the amount of dissolved oxygen in the water were recorded to be 15.77c° and 8.91 mg respectively.

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## Introduction

Studies of teleost reproduction often favor commercial or valuable native species (Matsuyama *et al.*, 1998; Appleford *et al.,* 1998; Fowler *et al.,* 1999; Smith and Walker 2004).

*Capoeta trutta*

*Capoeta trutta* is belonging to *Cyprinidae* family fishes, which is living in the west and south-west waters of Iran (Abdoli, 2000). This fish has a fusiform body, very small scales, sub-terminal mouth, 3-rows pharyngeal teeth with the formula of 2.3.4 - 4.3.2, and the most recognizable characteristic of this kind of fish is black spots scattered on its body (Abdoli 2000). *Capoeta trutta* is of dominant fishes in the rivers of Kermanshah Province, especially in Gamasyab River. On one hand because of its abundance and on the other hand because of its economical and sport importance, and also the lack of studies about this species due to its specific regional distribution, this subject was chosen for the present research. This kind of fish has a vast distribution in the south of China, north of India, Turkmenistan, Aral Sea, the Middle East and Anatolia (Alp 2005) and has 7 species and 3 subspecies in Iran, (Abdoli 2000).

*Litter review*

Few researches have been carried out on the biology of this fish in Iran. According to the searches that have been done, the summary of researches which were carried out about this fish will be presented in the following. Patimar and Farzi (2011) studied the factors of population dynamics of *Capoeta trutta* fishes in Meimeh River in Ilam province. Duman (2004), investigated about the reproductive biology of *Capoeta trutta* in Karakaya Dam Lake in Turkey. In 1991, Unlu studied the biological characteristic of *Capoeta trutta* in the Tigris River in Turkey. In 1996, Gul *et al*. investigated about characteristics associated with *Capoeta trutta* fish growth in the Euphrates River of Turkey. Also, Polat (1987) studied the age of the *Capoeta trutta* fish in Keban Dam Lake in Turkey. Additionally, Javaheri *et al.* (2012) examined the relationship of length-weight and the condition factor of *Capoeta trutta* fish in the Shour River. The present research was carried out with aim to study and identify the reproductive characteristics of *Capoeta trutta* fish including absolute fecundity, ova diameter, Gonad somatic Index and relative fecundity of this kind of fishes at different ages in Gamasyab River of Kermanshah province.

It is hoped that the results of this study provide useful information for researchers, professionals and students in fisheries sciences.

The aim of this research is study of reproductive characteristics of *Capoeta trutta* (Heckel; 1843) fish in Gamasyab River, Kermanshah Province (west of Iran).

## Materials and methods

*Study area*

Kermanshah Province is located in the west of the Iran and Gamasyab River flows in this. Sampling locality which is located on north 34° 25´ 39˝ and east 47° 31´ 02˝and have an altitude as 1300 m from the sea level was chosen as sampling station for fishing the fishes of Gamasyab River.

*Methods*

The sampling was carrying out monthly from July of 2008 to July of 2009. Besides fishing, water physico-chemical factors including water temperature, Dissolved oxygen, pH, Hardness and Electro-conductivity of water was measured and recorded by using a HACH Model SENTION 15 instrument. Samples were caught by gill net with the length of 20, 30 and 40 m and width of 2 m with various mesh sizes of 1, 2, 3, 4 and 5 cm, and with Cast net with mesh sizes of 2 and 3 cm. After being caught, the fishes were fixed in 10% formalin and transferred to the laboratory for examination. Body weight measured with an accuracy of 0.1 g, total length, fish fork length and standard length of fishes measured with precision of 1 mm were recorded. For age determination scale were taken from above the lateral

line below the anterior part of the dorsal fin. Each scale was cleaned with 5% KOH. After preparing the scale, age reading was then carried out through microscopic examination using circular pattern and annulus numbers on the scale (Biswas 1993). The sex of fishes was determined by using macroscopic methods after ripping their belly. Fishes gonad weights were measured by using a 0.01 g scale. 20-30 ovules were sampled from each ovary (from the elementary, middle and end part) and their diameters were measured by using a micrometer-equipped loop. After picking up 0.1 g of ovules, their weight and number was measured. To calculate the absolute fecundity, existing ovules in 0.1 g of ovary, which were previously counted, was generalized to the total weight of ovary (Bagenal 1978). To determine Gonad somatic Index (GSI), the equation of GSI = GW ÷ BW × 100 was used, where BW is body weight per gram and GW is Gonad weight per gram (Bagenal 1978). To calculate the relative fecundity, absolute fecundity was divided by body weight of fishes (Bagenal 1978). In this study, parametric statistical methods were employed using SPSS 16 and Excel 2010 software.

## Results

*Fish in different months*

In sampling from *Capoeta trutta* fishes in Gamasyab River, 252 fishes were caught, among which 167 fishes were male and 85 fishes were female. The sex ratio of male to female was obtained as 1.96 ♂:1 ♀. Table.2 shows the frequency of fish caught during different months in terms of genus.

**Table 1.** frequency of fish caught during different months of year in terms genus from 2008 to 2009.

| SEX | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUNE | JULY | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAL | 17 | 7 | 13 | 9 | 11 | 11 | 11 | 12 | 14 | 28 | 14 | 20 | 167 |
| FEMAL | 10 | 15 | 11 | 3 | 6 | 4 | 4 | 5 | 3 | 18 | 60 | 0 | 85 |

Surveying the caught fish population in terms of age showed that fishes have 5 age classes (1-5). Table.3 is presenting the age, number, percentage and genus of fishes which have been caught.

Surveying the caught fish population in terms of age showed that fishes have 5 age classes (1-5). Table.3 is presenting the age, number, percentage and genus of fishes which have been caught.

Inspection of data reflected that there is a difference at the significance level of 1% ($p<0.01$) between frequency of male and female gender in this river. Besides fishing, Gamasyab River's water chemical-physical factors such as temperature, PH, Electrical conductivity, hardness and the amount of dissolved Oxygen was measured during one year, whose changes are given in Table. 4.

**Table 2.** Number, percentage and genus of fishes based on the age of fishes in the Gamasyab River from 2008 to 2009.

| Age | Number of Samples | Total Percentage | male | female |
|---|---|---|---|---|
| 1 | 54 | 21.43 | 37 | 17 |
| 2 | 157 | 62.30 | 113 | 44 |
| 3 | 33 | 13.09 | 16 | 17 |
| 4 | 6 | 2.33 | 1 | 5 |
| 5 | 2 | 0.8 | 0 | 2 |

The overall range of length for females and males was obtained as 184.18-303.5 and 186.54-205.25 mm, and the range of body weight changes as 75.59-329 and 76.189-107.5 g, respectively. Average ova diameter was 0.9 mm and the amplitude of these parameter changes was 0.12-1.90 mm. The maximum ova diameter for fishes of Gamasyab River was observed in May. In this study, the total length showed a difference at significance level of 1% ($p<0.01$) with ova diameter. Also, it was observed a difference at the significance level of 1% ($p<0.01$) between age and ova diameter.

Mean absolute fecundity for *Capoeta trutta* fishes in Gamasyab River was calculated as 7756±736, for which the minimum and maximum was obtained as 1920 and 17505 respectively. In this research, the age showed a significant difference at the level of 1% ($p<0.01$) with the absolute fecundity. The relationship between total length-absolute fecundity, body weight-absolute fecundity, Age-absolute fecundity, Ova diameter-absolute fecundity is plotted in Fig.1, 2, 3 and 4 respectively.

**Table 3.** Changes in physical-chemical characteristics of Gamasyab River's water from 2008 to 2009.

| Variables | Mean | Range | Maximum | Minimum | Standard Deviation | Standard Error |
|---|---|---|---|---|---|---|
| Water temperature (°C) | 15.77 | 21.1 | 25.1 | 4 | 5.91 | 0.37 |
| pH | 8.24 | 8.24 | 8.6 | 8 | 0.20 | 0.01 |
| EC(µs/cm) | 1260 | 1040 | 1864 | 824 | 363 | 26.13 |
| Hardness (mg/l) | 263 | 242 | 420 | 178 | 88 | 6.33 |
| $O_2$ (mg/l) | 8.91 | 8.8 | 13.3 | 4.5 | 2.85 | 0.17 |

*Relationship between fish parameter*

*Gonad somatic Index (GSI)*

In this research, the scope of Gonad somatic Index (GSI) for female fishes aged 1-5 years was varied between 0.33-9.23. The variations of Gonad somatic Index in different months of year have been presented in Table.5.

**Table 4.** Changes in mean ova diameter for fishes of Gamasyab River based upon spawning period in 2008 – 2009.

| Month | Mean Ova Diameter ±SD |
|---|---|
| Mar | 0.81±0.89 |
| Apr | 1.22±0.03 |
| May | 1.46±0.45 |
| Jun | 0.99±0.15 |

The maximized Gonad somatic index of fishes in this river took place in May, which indicates the spawning and reproduction period of this species. Similarly, Ova diameter has also been at its maximum level in this month (May), which is completely converged. The changes of Gonad somatic index (GSI) for female fishes in different months of the year is plotted in Figure.5.

**Table 5.** Variations of Gonad somatic Index for female fishes in different Months of the Year.

| Months of the Year | Variations of Gonad somatic Index (±SD) |
|---|---|
| Aug | 0.98±0.09 |
| Sep | 0.85±0.54 |
| Oct | 0.77±0.05 |
| Nov | 0.66±0.07 |
| Dec | 0.57±0.062 |
| Jun | 0.33±0.04 |
| Feb | 1.68±0.17 |
| Mar | 7.82±1.31 |
| Apr | 8.34±1.05 |
| May | 9.23±0.41 |
| Jun | 6.58± 0.83 |
| Jul | - |

The mean relative fecundity of Gamasyab River fishes was calculated as 50.65±3.61 ova per kilogram of body weight.

**Discussion**

Knowledge of the reproductive cycle and the factors affecting it are important issues in fish and fisheries biology (Tomkiewicz *et al.* 2003).

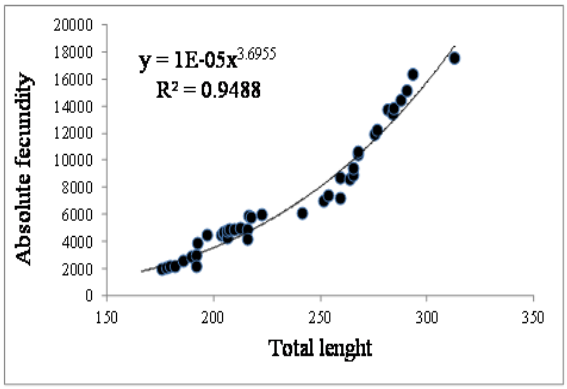


**Fig. 1.** The relationship between total length and absolute fecundity for fishes in Gamasyab River from 2008 to 2009.

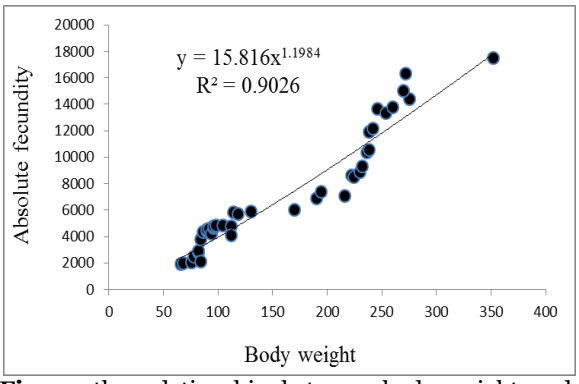


**Fig. 2**. the relationship between body weight and absolute fecundity for fishes in Gamasyab River from 2008 to 2009.

*Fish in different months*

During the one year survey of reproductive characteristics of *Capoeta trutta* fishes in Gamasyab River, 252 fishes were caught. The observed age range was 1-5 year. The maximum age observed in Studies of Unlu (1991), Polat (1987), Patimar and Farzi (2011), Duman (2004) and Kalkan (2008) was reported to be as 10, 8, 6, 8 and 7 years respectively. Comparing all of these data with present study data showed that the age range specified in this river is inconsistent with those mentioned literature papers. In this research, the mean total length of 5-year fishes was measured to be as 303.5 mm. in Studies of Patimar and Farzi (2011), Kalkan (2008) and Duman (2004), the mean total length of subjected 5-year fishes was recorded to be as 286, 296.1 and 370.2 respectively. According to the results, the total length of 5-year fishes in this research is lower only from Duman (2004) data and is higher than all of the other data. Variation in maximum age and size of fishes usually is resulted due to the differences in availability of food resources, individual growth rates and Natural selection processes, and/or exploitation patterns (Patimar and Farzi, 2011). In this study, the maximum ova diameter was measured as 1.90 mm. In studies of Patimar and Farzi (2011), Duman (2004), Unlu (1991), Gul *et al.* (1996) Kalkan (2008), and Polat (1987), the maximum ova diameter were obtained respectively as 1.90, 1.85, 1.38, 1.20, 1.04 and 1.03 mm, in such a manner that the magnitude of this index obtained from Gamasyab River was found to be consistent with Patimar and Farzi (2011) data and to be higher than the data achieved by other researchers .The diameter of the Ova, depends on the size and species of fishes, and individuals which belong to one species may have various ova sizes in different regions (Zulfu *et al* ; 2002). The mean absolute fecundity of 1-year and 5-year fishes was 1920 and 17505 Ova respectively. In the research of Duman (2004), the absolute fecundity of 3-year and 5-year old fishes was reported respectively to be as 11995 and 18612, and in Patimar and Farzi (2011) for the same fish species, the absolute fecundity of 1-year and 6-year fishes was recorded as 1627 and 18329 respectively. According to the results, this is obvious that the absolute fecundity of this research's data is lower than of Doman (2004) research's data, but is more consistent with of Patimar and Farzi (2011) research's data. However, 1-year fishes of Gamasyab River have the higher absolute fecundity magnitude than their peers in Patimar and Farzi (2011) study. Differences in fecundity estimates among studies might partly be artifacts due to differences in methods, or natural due to differences in fecundity with the geographic location or time, or intraspecific and interspecific differences among species

(Nikolosky 1963; Barbin & McCleave 1997; Jonsson 1999).

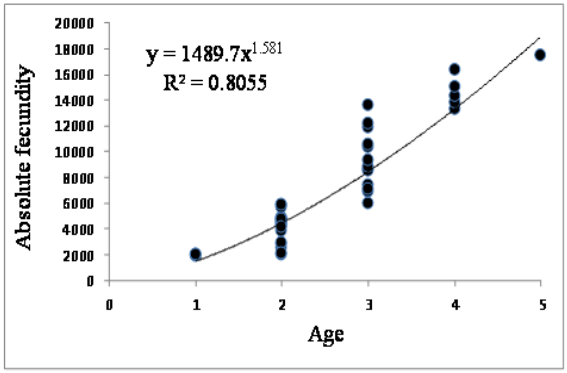


**Fig. 3.** The relationship between age and absolute fecundity for fishes in Gamasyab River from 2008 to 2009.

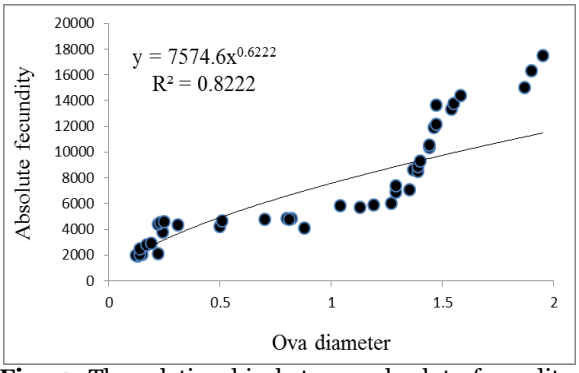


**Fig. 4.** The relationship between absolute fecundity and ova diameter for fishes in Gamasyab River from 2008 to 2009.

*Gonad somatic Index (GSI)*

The variation range of Gonad somatic Index (GSI) of fishes in Gamasyab River was 0.33- 9.23, while this range in study of Kalkan (2008) was reported (0.29-7.91, thus, the value of this index for fishes of Gamasyab River is larger than in the other data. In the viewpoint of Duman (2004), fish characteristics associated with spawning vary in respect of their species and ecological characteristics of their habitat water (Duman 2004). Also, Nikolsky (1963) expressed that the spawning characteristics of fishes are determined by environmental factors (Nikolosky 1963). The maximum Gonad somatic index of fishes in Gamasyab River was observed in May, which coincided with the appearance of maximum Ova diameter that was measured in the same month. Thus, the spawning time of this fish is in spring and in May. In studies of Kalkan (2008) and Duman (2004), the maximum value of Gonad somatic index took place in May and June respectively, thus the data of Gamasyab River is convergent with the data of Kalkan (2008). Considering the appearance of Epithelial nodules in March and their disappearance in July and also due to the significant increase in Gonad somatic index since March (7.82) and a sudden drop in June (6.58), the reproduction period of this fish is from March till June. In the studies of Patimar and Farzi (2011), Unlu (1991), Gul *et al.* (1996), Kalkan (2008) and Polat (1987), the reproduction period of this fish was respectively reported to be (March- May), (May-June), (May-July), (March-July), (April-June) and, hence, regarding the available data, the reproduction time for *Capoeta trutta* fish in Gamasyab River is consistent with the data of Kalkan (2008). The mean relative fecundity of fishes in Gamasyab River has been obtained as 50.61, and the relative fecundity for this species in the study of Patimar and Farzi (2011) was found to be as 70. The reason for this difference is the greater weight of fishes in Gamasyab than of fishes in Patimar and Farzi (2011) study. In several years ago, in reason of rainfall decrease, Gamasyab River was accosting to shortage of water and in some month accost to drought. Regarding to several factors including, floods, changes of ions concentrations, changes of taste water, water- level, pH, O2, CO2 and change of biotic factors are greatly related to rains, and these factors are important to effects on gonad maturation (Agarwal 1996), Thus drought and water pollution (due to presence of different industries) could change the quantity and quality of Gamasyab River water, which may act as stressors on fish population of this river. These stressors are known as factors which could effect on fish successful spawning (Agarwal 1996). Thus these stressors in addition to overfishing seem to be the most reason for change in age structure of *capoeta trutta* population in this river. Our results on elimination of large individual from studied population, deviation of sex ratio from 1 to 1 expected ratio and differences between GSI pattern of males and females were not in agreement with those data reported for this species, which all those could be witness for our claim.

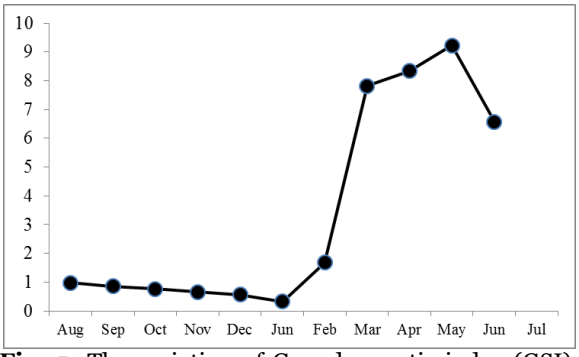


**Fig. 5.** The variation of Gonad somatic index (GSI) for female fishes in different months of the year from 2008 to 2009.

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