World Journal of Fish and Marine Sciences 4 (6): 550-553, 2012
ISSN 2078-4589

DOI: 10.5829/idosi.wjfms.2012.04.06.64171

Age and Growth of Chub, *Squalius cephalus* (Bonaparte, 1837), in Gamasiab Riverof the Hamadan Province, Iran

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Abstract: In the present study, age, growth, length-weight relationship and condition factor were investigated in 60 specimens of chub, *Squalius cephalus* (Bonaparte, 1837), collected from Gamasiab River of the Hamadan Province, Iran from Marchto June 2011. Age was determined using scale reading. The age, total length and weight of samples ranged from 1 to 4 years, 13.828 to 29.514 cm and 31.4 to 271.12grespectively. The 1 year age group has the most frequent (45.16%) and the 4 year' age groups were the least frequent classes (12.9%). The mean condition factor was 875g/cm. Length-weight relationship showed positive allometric for average total species as: $W = 0.006\ TL^{3.97}$ ($r2 = 0.97$).

Key words: *Squalius cephalus* % Age % Growth % Gamasiab River

INTRODUCTION

Squalius cephalus is a cyprinid species encountered in the Anatolian inland water bodies as well as the whole Europe, Black sea, Caspian Sea and Azow Sea Basins [1]. A vast amount of researches by domestic and foreign investigators was conducted on the *Squalius cephalus*, an economically important fish species living in the inland waters, in terms of populational studies, elucidation of the potential nutritional value and the studies of population dynamic changes over time.

Any management strategy that aims to safeguard biodiversity can be successful only if it is based on a thorough awareness of the diffusion, ecology and biology of the fish species [2]. Age and growth quantification, combined with knowledge of reproductive aspects, is vital to understanding the ecology and life history of any fish species. Growth rate information can also be used to compare dynamics among water bodies, years and fish sizes, describe trends over timeexamine total mortality rates and determine the general status of a population [3] these are crucial aspects in fishery research and management [4, 5].

The present study aims to determine the age, growth, relationship length- weight, growth pattern (t) and condition factor of chub, *Squalius cephalus* (Bonaparte, 1837), in Gamasiab River of the Hamadan Province, Iran.

MATERIALS AND METHODS

60 specimens were collected from July 2011 to September 2011 in Gamasiab River of the Hamadan Province. The length of Gamasiab River is about 200km, that about 78 km of it flows in Hamadan. This river is the main branch of KarkheRiver and it is called this name to connection point of to Qaraso (Kermanshah) branch. This river originate of southern hillsides of Alvand mountain (Qalqal and KHorramRivers) and northern hillsides of green Nahavand mountain and Zalian height at north of Borojerd (Figure 1).

Fresh samples of *Squalius cephalus* (Bonaparte, 1837)collected using a gill and seine nets. Total length of captured fish was measured to the nearest 0.01 cm and weighted to the nearest 0.01 g [6].

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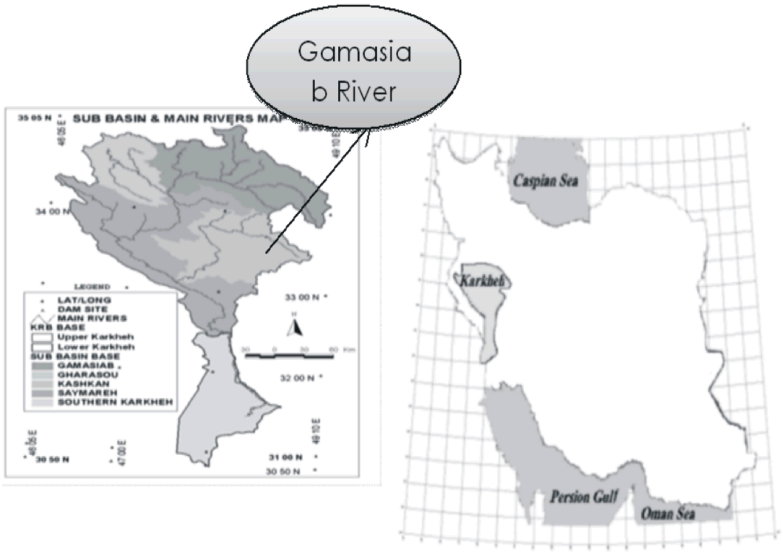

Fig. 1: Location map of the Gamasiab River in KarkhehRiver of the Hamadan Province, Iran

Age was determined using scale reading [7]. Scales were taken from the middle of the body, behind the pectoral fins and above the lateral line. They were then placed in labeled envelopes and returned to the laboratories for reading and analysis. The scales were washed and placed in small covered Petri dishes with tap water. Then, the organic layers of scales were removed by rubbing and washing in tap water [8].

The relationship between length and weight was calculated using the exponential regression: W= a×Lb [9], where W is the total weight (g), L is the total length (cm), a is the regression constant (intercept) and b is the regression coefficient (slope) that it is usually between 2 and 4. The Fulton condition factor (CF) was determined for each fish using the following equation: CF= (W/L^3) × 100 [6], where W is the total fish weight (g), L is the total length (cm).

The growth pattern (t) was using the following equation: [10]

$$t = \frac{sd\ln L}{sd\ln W} * \frac{|b-3|}{\sqrt{1-r^2}} * \sqrt{1-2}$$

Where *SdLnL* is standard deviation of the length natural logarithm (cm), *SdLnW* is standard deviation of the natural logarithm weight (g), b is curve slope of the relationship between length and weight, R^2 is regression coefficient between length and weight and n is number of samples**.**Tables and graphs were drawn by Excel software.

Table 1: Mean Total length (cm) and weight (g) in both sexes and total average of chub, *Squalius cephalus* (Bonaparte, 1837) in Gamasiab River

	Age groups			
	1	2	3	4
Total length(cm)	13.82	19.27	21.96	29.51
Weight(g)	31.4	98.68	133.24	372.12
Frequent (%)	45.16	16.14	25.8	12.9

RESULTS

The ages, lengths and weights of the samples ranged between 1-4 years, 13.828 to 29.514 cm and 31.4 to 271.12g. The mean condition factor was calculated as 875g/cm. The mean lengths, weights and Frequent (%) of different ages are given in Table 1.

Age Frequency: Age determination, based on scale readings, showed that the population was composed of 4 age-groups. The highest and lowest age groups were 1 (45.16%) and 4 age groups (12.9%) in population (Figure 2)

Length Frequency: Specimens with mean total length 10-15cm were the most frequent (37.14%) and mean total length 25-30cm were the least frequent (2.85%) (Figure. 3).

Length-weight Relationship: The length-weight relationships were calculated for population. Body weight exponentially increased with TL (cm) by the following relationship:

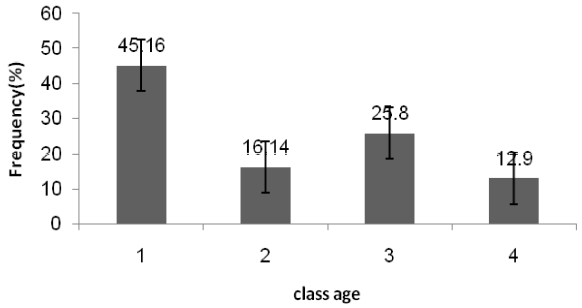

Fig. 2: Age class frequency of chub, *Squalius cephalus* (Bonaparte, 1837) in Gamasiab River

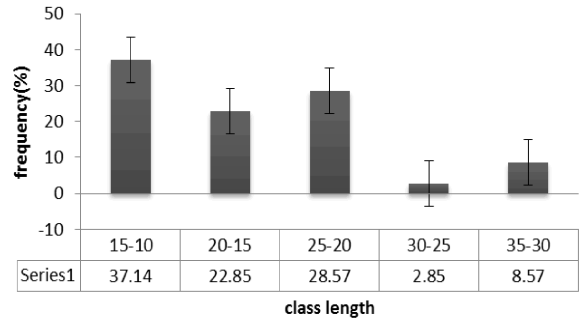

Fig. 3: Length class frequency of chub, *Squalius cephalus* (Bonaparte, 1837) in Gamasiab River

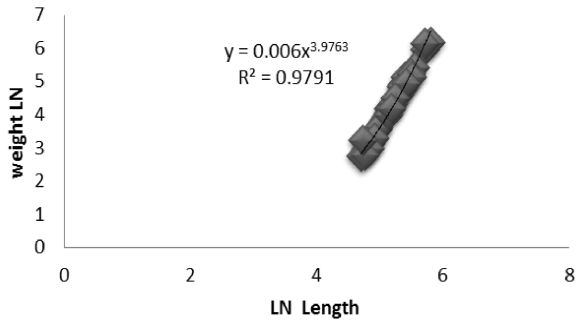

Fig. 4: Length-weight relationship of chub, *Squalius cephalus* (Bonaparte, 1837) in GamasiabRiver

Table 2: Mean condition factor (CF), regression coefficient (r2), growth pattern (t) and parameters estimated for the linear relationship weight-length of chub, *Squalius cephalus* (Bonaparte, 1837) in Gamasiab River

			Parameters estimated		
	CF	t	R^2	b	a
Total fish	875	17.36	0.97	3.97	0.006

$$W = 0.006\ TL^{3.97}\ (r2 = 0.97)\ (Figure.4)$$

We determined a positive allometry power length-weight relationship for average total species (Table 2).

DISCUSSION

In the present study, the TL for *Squalius cephalus* ranged from 13.82 to 29.51cm. The fork length of the European Chub population in Camkoru Pond ranged from 8 cm to 38.4cm [11] probably this different owing to the selectivity of the sampling tools and different environmental conditions.

The most abundant age groups were 1, 2, 3 and 4years, which are in agreement with the findings of Mert *et al*. [11].

Among the specimens, individuals under the age 1 have not been encountered, possibly due to the selectivity of the nets employed for collection.

The slope (b) value of the length-weight relationship calculated for the overall sample was 3.97; this indicates allometric growth in which length increases less than proportionally to other dimensions [9]. The available data analysis in the literature showed that the value of b for other *Squalius cephalus* populations can vary from 2.49 to 3.86 [12-14]. Geographic location, environmental conditions different amounts of food available, life span or growth increment and disease and parasite loads can affect the length-weight relationship [9].

The finding on age and growth of *Squalius cephalus* from this research will help to elucidate the distribution with age of fish and their sustainable management.

ACKNOWLEDGEMENTS

The authors are thankful to the Department of Fisheries, Babol Branch, Islamic Azad University in Iran.

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