

## Growth of *Barbus rajanorum mystaceus* Heckel, 1843 Living in Keban Dam Lake on the Euphrates River of Turkey

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**Abstract:** In study, a total of 559 *Barbus rajanorum mystaceus* was investigated. Growth of *B. r. mystaceus* was examined by means of scale reading. The growth rate of *B. r. mystaceus* from age I-IX was: 16.94, 22.40, 28.74, 32.99, 36.78, 41.31, 45.26, 48.72 and 60.60 cm respectively. The length-weight relationship was calculated as  $W = 5.2476L^{3.07}$  (both sexes together). The mean condition factor ( $K_{\pi}$ ) value of the population was counted as 0.830. The estimated value of von Bertalanffy parameters for *B. r. mystaceus* are  $L = 89.20$  cm,  $K = 0.085$  and  $t = 1.52$ .

**Key Words:** Growth; age; *Barbus rajanorum mystaceus*.

**Özet:** *Keban Baraj Gölü'nde yaşayan Barbus rajanorum mystaceus Heckel, 1843'da büyüme özellikleri.* Çalışmada toplam 559 *Barbus rajanorum mystaceus* örneği incelenmiştir. *B. r. mystaceus*'ün yaşları pullardan tespit edilmiştir. *B. r. mystaceus* da gelişme, I-IX yaşlarında sırasıyla, 16.94, 22.40, 28.74, 32.99, 36.78, 41.31, 45.26, 48.72 ve 60.60 cm olarak belirlenmiştir. Boy – ağırlık ilişkisi eşey ayırmadan,  $W = 5.2476 L^{3.07}$  olarak hesaplanmıştır. Popülasyonun kondüsyon değeri de total boya göre 0.830 olarak bulunmuştur. *B. r. mystaceus*'da von Bertalanffy parametreleri de;  $L = 89.20$  cm,  $K = 0.085$  ve  $t = 1.52$  olarak tahmin edilmiştir.

**Anahtar Kelimeler:** Gelişme; yaş; *Barbus rajanorum mystaceus*.

### Introduction

Fisheries biologists use the simple growth equations to summarize much information on length or weight at age, to compare the growth of different species, or different stock, in various environments and to express the change of weight and number with age in form of yield curves as function of fishing mortality or stock (Cushing, 1981).

For age and growth study several different methods have been used. Simple growth equations are used to graduate weight or length measurements in age (Cushing, 1981). Weight and length are related by a power relationship. The relationship takes the form:  $W = a \cdot L^b$ , where  $b \approx 3$  and  $a$  is a constant. Weight

and length are transformed to logarithms equation from  $\log W = \log a + b \log L$  (Pitcher and Hart, 1990; Wootton, 1991).

In ecology, the length-weight regression coefficient is often used as a measure of fish condition. The condition factor calculated by mean of equation that  $K = W/L^3$ . Fish with a high value of  $K$  are heavy for their length, while fish with a low value are light for their length (Wootton, 1991).

The von Bertalanffy equation assume that fish grow towards some theoretical maximum length or weight, and that the closer the length gets to the maximum the slower the rate of change of size (Pitcher and Hart, 1990).

*B. r. mystaceus* (Cyprinidae) is little known species. It is very common in

Euphrates and Tigris Rivers (Kuru, 1975). It is also found in Karun River and Karkheh River (In Iran) (Coad, 1979).

*B. r. mystaceus* is one of the most economic fish species in Keban Dam Lake.

Various works have been done on the biology and systematic of *B. r. mystaceus* from Euphrates and Tigris River (Kuru, 1975; Coad, 1979; Ekingen and Sarıyüpeoğlu, 1981; Özdemir, 1983; Ünlü and Bilgin, 1988).

This study reports observations on the age and growth of *B. r. mystaceus* living Keban Dame Lake (on Euphrates River) in Elazığ/Turkey.

#### Materials and Methods

A total of 559 specimens of *B. r. mystaceus* was collected montly. The fish were caught by gill nets of 20 to 55 mm mesh size. The total length of each fish was measured (mm) and fish weight (g) was determined after removing moisture.

The age determination was achieved on scale removed from the area between the origin of the dorsal fin and lateral line.

The length-weight relationship was computed with the formula  $W = a L^b$  given by Le Cren where  $W$ = weight (g),  $L$ = total length (mm) and  $a$  &  $b$  are the regression parameter (Woottan 1991).

The relationship between length and

weight provides an index frequently used. This index is the condition factor,  $K = W/L^3$  (Lagler, 1952).

Theoretical growth study was performed von Bertalanffy growth equations (Pitcher and Hart, 1990).

#### Results

The age distribution of *B. r. mystaceus* were found between I-IX years as males and females were given in Table 1.

Growth rates of *B. r. mystaceus* from ages I to IX were given in Table 2.

At the population of *B. r. mystaceus*, age groups III, IV, and V, were found to be dominated (Table 2).

The scatter diagram of total length on weight of 559 specimens (both sexes together) of *B. r. mystaceus* gave a smooth curvilinear relationship (Fig. 1). The equations were as follow;

$$females = 5.2762 L^{3.08} \quad (N=203, r=0.962)$$

$$males = 5.3962 L^{3.13} \quad (N=356, r=0.949)$$

$$males+females = 5.2476 L^{3.07} \quad (N=559, r=0.964)$$

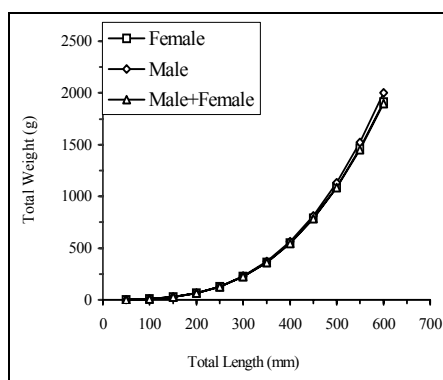
It was observed that the calculated weight and length in every age groups were differented. It was obvious that the maximum length annual increment recorded between II. and III. age groups and maximum weight between VII. and VIII. age groups.

**Table 1.** Age groups, number and percentage and sex of fish.

Age groups	Fish number and percentage (%)		Sex	
			Famale	Male
I	12	2.15	3	9
II	53	9.48	19	34
III	132	23.61	38	94
IV	209	37.38	83	126
V	107	19.14	42	65
VI	29	5.19	14	15
VII	12	2.15	3	9
VIII	4	0.72	1	3
IX	1	0.18	-	1
Total	559	100.00	203	356

**Table 2.** Mean total length (cm) and mean weight (g) that standart error (SE) in age groups (both sexes together).

Age groups	Fish number	Mean length(cm)	Min-Max	Mean weight(g)	Min-Max
I	12	16.94±0.76	13.3-19.9	39.79±5.21	11.0-59.0
II	53	22.40±0.32	18.7-27.9	91.49±3.39	55.0-152.0
III	132	28.74±0.19	24.0-34.1	194.53±3.99	110.0-303.0
IV	209	32.99±0.14	28.0-37.2	302.03±3.51	180.0-435.0
V	107	36.78±0.22	30.4-42.0	423.89±6.44	300.0-610.0
VI	29	41.31±0.37	37.3-44.8	603.17±12.47	445.0-700.0
VII	12	45.26±0.68	41.0-50.7	806.17±34.46	615.0-1065.0
VIII	4	48.72±1.65	46.2-48.3	1167.50±139.38	915.0-1150.0
IX	1	60.60	-	2010.00	-



**Fig 1.** Length-weight relationship of *B. r. mystaceus*

The condition factor ( $K_{TL}$ ) of *B. r. mystaceus* was calculated for males and females. The average K value was found as 0.830. K value in relation to age groups were not show any evident trend (Table 3).

**Table 3.** At *B. r. mystaceus* average K value according to age groups.

Age groups	Average $K_{TL}$ value	Min-Max
I	0.755±0.03	0.468-0.884
II	0.806±0.01	0.488-1.071
III	0.808±0.01	0.602-1.067
IV	0.837±0.00	0.679-0.980
V	0.849±0.01	0.696-1.246
VI	0.855±0.02	0.696-1.060
VII	0.866±0.01	0.801-0.945
VIII	0.995±0.02	0.928-1.021
IX	0.903	-

The von Bertalanffy growth applied for *B. r. mystaceus* expressed with the following equations.

$$\begin{aligned}
 \text{females} &= L_{\infty} = 90.82 [1 - e^{-0.086(t+1.451)}] \\
 \text{males} &= L_{\infty} = 71.17 [1 - e^{-0.115(t+1.313)}] \\
 \text{males+females} &= L_{\infty} = 89.20 [1 - e^{-0.085(t+1.520)}]
 \end{aligned}$$

## Discussion

This study shows the age distribution of *B. r. mystaceus* was found between I-IX groups. This finding agrees with Polat (1986).

The 320.99 mm length and 302.03 g weight group (IV. age) dominated in population. Only one specimen belonging to the IX. (male) age group represented the oldest fish in the samples.

The formation of pairs is consistent with a 1:1 sex ratio, but males suffer a higher mortality rate so that older fish are nearly always females. This results could be typical of many temperate freshwater and marine fish (Pitcher and Hart, 1990). The population of *B. r. mystaceus* were determined more males than females.

At the same population III. IV. and V. age groups were dominated (Table 1). The age groups found in this samples below and above samples were not determined.

If the fish retains same shape it is growing isometrically and the length exponent "b" take the value 3.0. A value significantly larger or smaller than 3.0 indicates allometric growth (Wootton, 1991). In the present study, the value of "b" is found to be 3.07 that nearly isometric relationship between length and weight was also observed. This implies that habitat is suitable for *B. r. mystaceus*.

The average  $K_{TL}$  value was determined 0.8304 of *B. r. mystaceus* living in Keban Dam Lake. The K value at forward age groups was increased that were for normal at fusiform fish. Changes in the K value of fish may indicate gonadal maturation or changes in feeding intensity (Wootton, 1991).

At this study von Bertalanffy growth model for *B. r. mystaceus* was estimated and in present measured length parameters was nearly. The highest annual length increments for males and

females of *B. r. mystaceus* were recorded during their first, second and third year of life.

The results of this study shows that the environmental conditions of Keban Dam Lake was seemly for the growth of *B. r. mystaceus*.

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