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## Length-weight relationship and relative condition factor of *Schizothorax eurystomus* Kessler, 1872 from Fergana valley

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**Abstract**

The focus was on the length-weight relationship and relative condition factor of *Schizothorax eurystomus* from Fergana Valley, which was studied for eight months (August-December, 2016, January 2017 and July-August, 2019). During the study, 125 fish samples were studied, including 16 females, 48 males and 61 immature, with a total body length from 6.16 to 29.2 cm and weight from 2.12 to 216.23 grams. The parameters “a” and “b” of the length-weight relationship were estimated using the equation  $W=aL^b$  while the relative condition factor was also calculated from the equation,  $W_r = 100w/a_m L^{bm}$ . The regression coefficient “b” values were 2.7486; 3.0724; 3.1179 and 3.0874 for males, females, immature and combined sexes, respectively. The general results showed positive allometric growth ( $b>3$ ) exhibited by the species. The mean “ $W_r$ ” value for the females was  $100.22\pm 6.83$ , males  $100.37\pm 8.57$ , immature  $100.27\pm 7.45$  while the combined sex was  $100.37\pm 8.53$  and there was a significant difference among the sexes.

**Keywords:** Morphology, *Schizothorax*, growth pattern, Uzbekistan

**Introduction**

The length-weight relations of fish are important in fisheries research, in part because they enable the conversion of growth-in-length to growth-in-weight equations [1]. In addition, it can be used to determine the structure of fish stocks, manage isometric or allometric growth of somatic growth, and assess the condition of fish [8, 9, 16].

The relative condition factor is broadly used in fisheries and ichthyology studies. The relative condition factor in fish indicates the general physiological state of the fish concerning its wellbeing [16]. This factor is calculated from the relationship between the weight of a fish and its length, with the intention of describing the “condition” of that individual fish [8]. Different values in relative condition factor of a fish indicate the state of sexual maturity, availability of prey resources, abundance of predators, age and sex of some species [2, 21] and the system of environment [10].

*Schizothorax eurystomus* Kessler, 1872 (fig. 1) is distributed at high altitudes in China [27] and Central Asia [4, 30], including invaded almost all the tributaries of the Syr Darya River, which is located in the mountainous areas of the Fergana Valley [14]. Despite the implication of the knowledge of the length-weight relationship in areas related to the management and conservation of fish species [8, 9], the information available to the species invaded in Uzbekistan is almost limited. This work aimed to calculate the length-weight relationship and the relative condition factor of this species collected from the Syr Darya River, Fergana Valley.



**Fig 1:** *Schizothorax eurystomus* from the Syr Darya River, Fergana Valley.

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## 2. Materials and Methods

The Syr Darya River (46°09'15"N 60°52'25"E) is formed at the confluence of Naryn River and Kara Darya River in the eastern part of the Fergana Valley and flows for some 2,212 kilometers west and north-west through Uzbekistan and southern Kazakhstan to the remains of the Aral Sea. A total of 125 samples of *S. eurystomus* were collected monthly from August 2016 to August 2019 from the upper stream of the Syr Darya River by nets with mesh sizes from 10 to 25 mm. Specimens were chosen randomly from the captured fishes and transported to the laboratory for further examination. Total length (TL), standard length (SL) to the nearest 0.01 mm and weight (W) to the nearest 0.01 g were recorded for each specimen. The identification of fishes was done following Sultanov (1974) [23] and Veselov (1977) [25]. The sex was recognized by observation of gonads.

The length-weight relation was calculated based on equation

$$W = aL^b$$

where *W* is the total weight of fish in grams, *L* is the total length in cm, *a* is the intercept, and *b* is the regression coefficient (slope) [8, 16, 22]. The coefficients *a* and *b* were estimated by linear regression logarithms:

$$\log(W) = \log(a) + b * \log(L)$$

The 95% confidence limits of *a* and *b*, and the coefficient of determination (*r*<sup>2</sup>) were calculated using the equations by Sparre and Venema (1998) [22].

In order to estimate the relative condition factor between sex, the relative weight (*W<sub>r</sub>*) was used according to Froese (2006) [8] as:

$$W_r = 100 \frac{W}{a_m L^{b_m}}$$

Where *W<sub>r</sub>* is the relative weight, *W* and *L* are the weight (g) and length (cm) of each fish. *a<sub>m</sub>* and *b<sub>m</sub>* are the mean values of *a* and *b* from the length-weight relationship. All the statistical analysis was done in MS Excel 2013.

## 3. Results

The total collection of 125 specimens consisted of 48 (38.4%) males, 16 (12.8%) females and 61 (48.8%) immature. Table 1 presents data related to descriptive statistics. Total length ranged from 8.3 to 23.1 cm for males, from 12.3 to 29.2 cm for females and from 6.16 to 13.14 cm for immature. Weight of body ranged from 5.27 to 100.12 g for males, from 18.11 to 216.23 g for females and from 2.12 to 21.13 g for immature. Table 2 presents data related to estimating parameters of LWR. The overall allometric coefficient *b* for the LWR indicated positive allometric growth (>3.0) in males (*y*=0.0075*x*<sup>3.0724</sup>, *r*<sup>2</sup>=0.988) and in immature (*y*=0.0065*x*<sup>3.1179</sup>, *r*<sup>2</sup>=0.977) and negative growth (<3.0) in females (*y*=0.02*x*<sup>-2.748</sup>, *r*<sup>2</sup>=0.989). The coefficient *b* value of the overall combined gender indicated positive allometric growth (*y*=0.0071*x*<sup>3.087</sup>, *r*<sup>2</sup>=0.994) (fig. 2).

**Table 1:** Descriptive statistics and condition factor for *Schizothorax eurystomus* from Syr Darya River, Fergana Valley

	Length (cm)		Weight (g)		Relative weight ( <i>W<sub>r</sub></i> )
	min-max	Mean ± SD	min-max	Mean ± SD	Mean ± SD
Female	12.3-29.2	22.02±4.75	18.11-216.23	107.85±52.93	100.22±6.83
Male	8.3-23.1	12.29±3.55	5.27-100.12	21.44±20.80	100.37±8.57
Immature	6.16-13.14	8.76±1.43	2.12-21.13	6.23±3.82	100.27±7.45
All	6.16-29.2	11.81±5.16	2.12-216.23	25.08±39.67	100.37±8.53

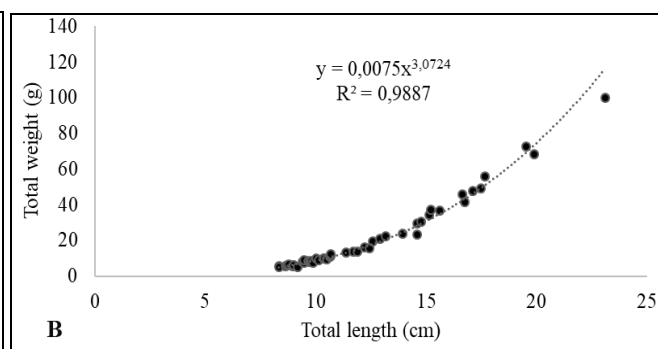
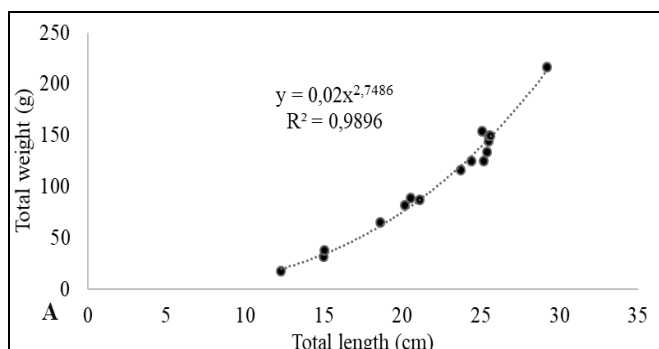
**Table 2:** Estimated parameters of LWR for *Schizothorax eurystomus* from Syr Darya River, Fergana Valley

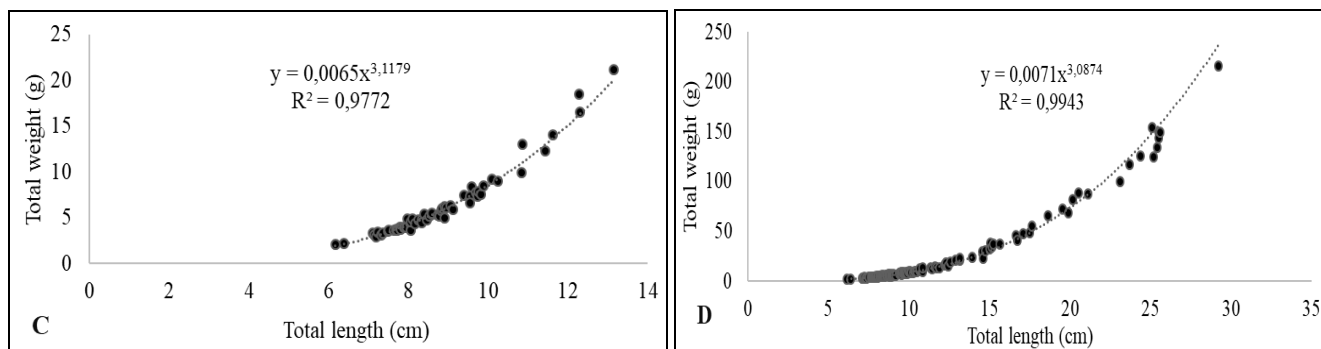
	<i>n</i>	<i>a</i>	95% CL of <i>a</i>	<i>B</i>	95% CL of <i>b</i>	<i>r</i> <sup>2</sup>
Female	16	0.019979	0.012128-0.032913	2.748567	2.586272-2.910862	0.990
Male	48	0.007509	0.005908-0.009543	3.072369	2.975922-3.168816	0.989
Immature	61	0.006519	0.004986-0.008525	3.117913	2.993941-3.241885	0.977
All	125	0.007080	0.006407-0.007824	3.087363	3.046130-3.128596	0.994

*n* = number of fish, *a* = intercept, *b* = slope, CL = confidence limit, *r*<sup>2</sup> = coefficient of determination.

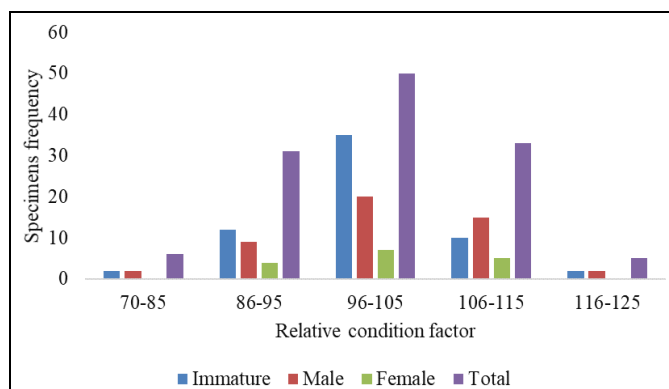
The relative condition factor ranged from 77.45 to 116.36 (100.37±8.57) for males, from 87.92 to 109.79 (100.22±6.83) for females, from 83.78 to 118.32 (100.27±7.45) for immature

and from 79.46 to 123.65 (100.37±8.53) for the total combined specimen (fig. 3).





**Fig 2:** Length-weight relationship of *S. eurystomus* from Fergana Valley. (A) female, (B) male, (C) immature, (D) total.



**Fig 3:** Relative condition factor frequency of *S. eurystomus* from Fergana Valley

#### 4. Discussion

No information on length-weight relationships of the *S. eurystomus* was available in FishBase [7] from water basins of Central Asia. However, Huo *et al.* (2012) [13] first reported values of *b* for this species as 3.38 from the Tarim River in China.

The length-weight relationship of fish has important significance in studying the growth, gonadal development and general welfare of the fish population [15, 16, 24] and for comparing mode of life of fish from different species [19]. Consequently, fish species of *b* value in the same area can change at different years or periods. The value of '*b*' for an ideal fish is 3.0 which represents as isometric growth, as suggested by Le Cren (1951) [16] and we used it in our study for comparison purposes. Other workers [5, 8] also suggested that the range of the value of *b* should be between 2.5 and 3.5. In the present study, the value of *b* ranged from 2.748567 to 3.117913.

The length-weight relationships of *S. eurystomus* from the Syr Darya River in Fergana Valley are described herewith for the first time. Our results differ from other previous research results. These differences may be due to environmental factors in a distributed geographic location, habitat type [6, 28], but also to biotic factors such as differences in the native community, sex, gonadal maturity, degree of stomach fullness, food competition and trophic potential of rivers and ponds [11, 12, 17], in addition to human factors such as number of specimens examined, differences in the observed length ranges of the specimens caught and overfishing [8, 29, 31].

The relative condition factor for *S. eurystomus* from the Syr Darya River differed between sex (Table 1). Values of relative condition factor lower than 100 indicate that fish is under low availability of food resources and high abundance of predators, while higher values indicate a high abundance of prey, low predation and indicate an isometric growth, which

is the desirable in a fish farm [3, 8, 16, 20]. There may be differences in the condition factor due to the gonadal development in adults, sex, environmental conditions such as pollution [18, 26]. In this case, *S. eurystomus* from the Syr Darya River, by average is very close to 100. This index indicates that fish show an average or low rate of prey consumption in combination with an abundance of competitor fish.

In conclusion, this study provides the first basic information on the length-weight relationships and relative condition factor of *S. eurystomus* in Central Asian water that could be useful for fishery biologists/managers to impose adequate regulations for sustainable management of fisheries in the current flow and nearby areas, to prevent their complete disappearance.

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