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Morphological characteristics of *Rhinogobius brunneus* (Perciformes: Gobiidae) in some water basins of Uzbekistan

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ABSTRACT

This article highlights the research results on the morphological and morphometric characteristics of *Rhinogobius brunneus* collected in the Chirchik and Ahangaron Rivers and in the Tuzkon part of the Aydar-Arnasay lake system. The exact coordinate locations of the above-mentioned areas were obtained. Morphological analyses were carried out on specimens in the size range of 32.5-41.5 mm (n = 11), 29.6-40.6 mm (n = 14), and 28.4-40.5 mm (n = 13) collected from Lake Tuzkon, Ahangaron, and Chirchik Rivers, respectively.

INTRODUCTION

Natural habitat:

Studies on the genus *Rhinogobius* and its species has been conducted by foreign scientists **(Daisuke & Kohda, 2004** and **Vasileva, 2007)**. Water basins in Japan, Okhotsk, the Pacific coast of Japan, the Hakkoydo, Ryukyu, Taiwan Islands, Rivers in Korea, continental China, and Philippines **(Berg, 1949** and **Reshetnikov *et al.*, 1997)**; water bodies in Vietnam **(Nguyen *et al.*, 2011)**.

Distribution in the native water basins:

According to some literature, it was accidentally brought from China during the acclimatization of herbivorous fish in 1960-1970 **(Mirabdullaev *et al.*, 2002)**. In some sources, it was mentioned that specimens were also taken from Turkmenistan 'Karakum Canal' **(Sal'nikov, 1998)**. They were widespread on the banks of the Ahangaron and Chirchik Rivers (coordinates) and Tuzkan lake (coordinates).

In spring, summer, and autumn, *Rhinogobius brunneus* species live near the shore, in shallow, low-flowing parts of the Rivers Ahangaron and Chirchik, especially, in parts consisting of fine gravel soils. Whereas, in winter, it moves to the deeper part of the Rivers and lives in the lower reaches of a large rock and concrete fragments (the middle reaches of the Chirchik River). They are more widespread in the Tuzkon part of the Aydar-Arnasay lake

system than in other parts, occupying mainly the coastal shore. The present work aimed to highlight the research results on the morphological and morphometric characteristics of *Rhinogobius brunneus* collected in the Chirchik and Ahangaron Rivers and in the Tuzkon part of the Aydar-Arnasay lake system.

MATERIALS AND METHODS

Methodology:

Collection, sorting, fixation, and processing of fish specimens and morphometric calculations were based on a measurement method proposed by **Pravdin (1966)**. The *mm* was used as the unit of length and the following measurements were investigated:

TL - total length of the fish body;
SL - standard length of fish, excluding the caudal fin,
c - head length;
o - orbit length (eye diameter);
po - posterior part of eye;
hc - height of the head;
io - interorbital region width (the forehead);
H - height of the body;
h - height of caudal fin axis;
lP - length of pectoral fin;
lV - length of pelvic fin.

Statistical data processing was carried out by the methods of **Rokitsky (1967)**; statistical processing of a material, the mean value (*M*), its error (*m*), standard deviation (σ), and coefficient of variation (*Cv%*) were calculated according to **Lakin (1990)**. The taxonomic status of the species is given by **Mirzaev** and **Kuvatov (2020)**.

Materials:

Fish samples were collected from the middle and lower reaches of Ahangaron (*n-14*) (40°56'13.40"N, 69°23'57.12"E) and Chirchik Rivers (*n-13*) (41°15'34.43"N, 69°22'8.93"E) of the Syrdarya River basin, as well as, in the autumn (2021) from the Tuzkon part of the Aydar-Arnasay lake system (*n-11*) (40°39'49.85"N, 67°35'29.72"E) **(Fig. 1)**. Fish specimens were fixed in 10% formalin solution in the field and 4% formalin solution in the laboratory.

Morphological examinations were performed on individuals in terms of body size of *Rhinogobius brunneus*, the smallest specimen was 32.5 mm and the largest was 41.5 mm in Lake Tuzkon, the smallest was 29.6 mm and the largest was 40.6 mm in the Ahangaron River, the estimates were 28.4 mm and 40.5 mm in the Chirchik River, respectively. Data were obtained without segregation between males and females.

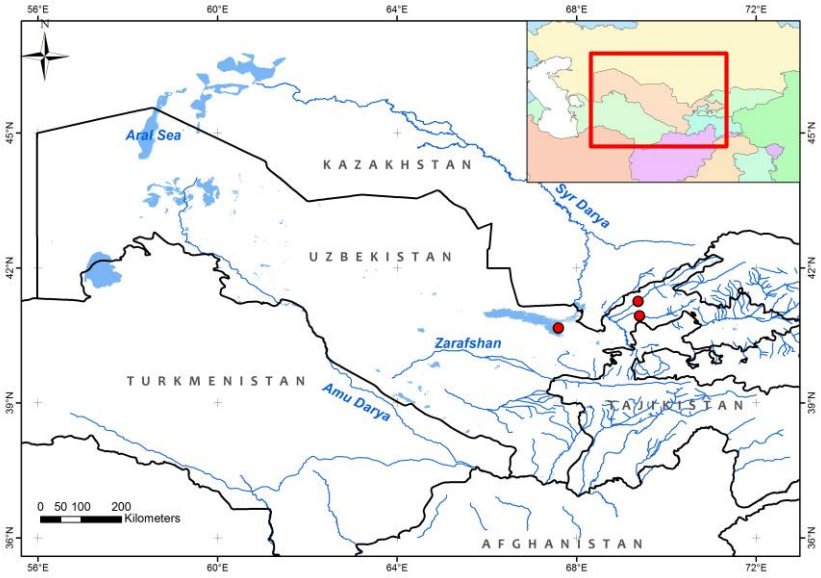

Fig. (1). Map view of the study areas where the samples were collected

Classification

According to the morphological characteristic of *Rhinogobius brunneus*, it was observed that the body color was grayish-yellow in the specimens collected from the Rivers Ahangaron and Chirchik, and darker in the specimens of Lake Tuzkon. There are 7 clearly visible black spots on both lateral sides and dorsal part of the body. In some literatures, 6 **(Berg, 1949)** and 6-7 **(Mirabdullaev *et al*., 2002)** spots were mentioned. In the specimens, the operculum reaches to the base of the pectoral fin. The head is stretched to the front of the dorsal fin and the lower part to the base of the pectoral fin, with holes around the eyes **(Berg, 1949; Mirabdullaev *et al*., 2002** and **Mirabdullaev *et al*., 2011)**. The pelvic fin shapes to form a circular adhesion organ. The rays of the pelvic fin form triple and quadruple branching, unlike the rays of the other fins. Through the organ of adhesion, it clings to underwater rocks and reeds and serves to maintain a suspended state.

RESULTS

Morphological and morphometric analyses were carried out on the materials and calculation parameters were determined. According to the analysis, the measurement marks were as follows. In terms of the number of rays on the fins: *D* (1) 6, *D* (2) I 9 on the dorsal fin, *A* I 9 on the anal fin (the last two rays of the dorsal fin and anal fins were considered separately), *P* 16-18 on the pectoral fin, *C* 14-17 on the caudal fin (only branched rays), *V* 5 + 5 in the pelvic fin, the number of scales in the lateral line was 29-30.

The appearance of male specimens (length TL = 34 mm, SL = 29 mm) and female specimens (TL = 42 mm, SL = 36 mm) is shown in **Fig. (2)**. The rays on the first dorsal fin of *Rhinogobius brunneus* is not branched (rigid) and consists of 6 rays. The second dorsal fin consists of 1 unbranched, 9 branched (soft) rays, as shown in **Fig. (3)**.

A female *Rhinogobius brunneus* specimen with length TL = 42 mm and SL = 36 mm had a pectoral fin length of 8 mm and 17 rays. The length of the pectoral fin reaches the last

part of the base of the first dorsal fin and passes slightly beyond it. The appearance and radiance of the pectoral fins are shown in **Fig. (4)**.

Fig. (2). General view of male **(a)** and female **(b)** *Rhinogobius brunneus* collected from the middle reaches of the Chirchik River in February 2021. Specimens were stored in a 4% formalin solution. TL: a = 34 mm, b = 42 mm. Photo by A. Quvatov

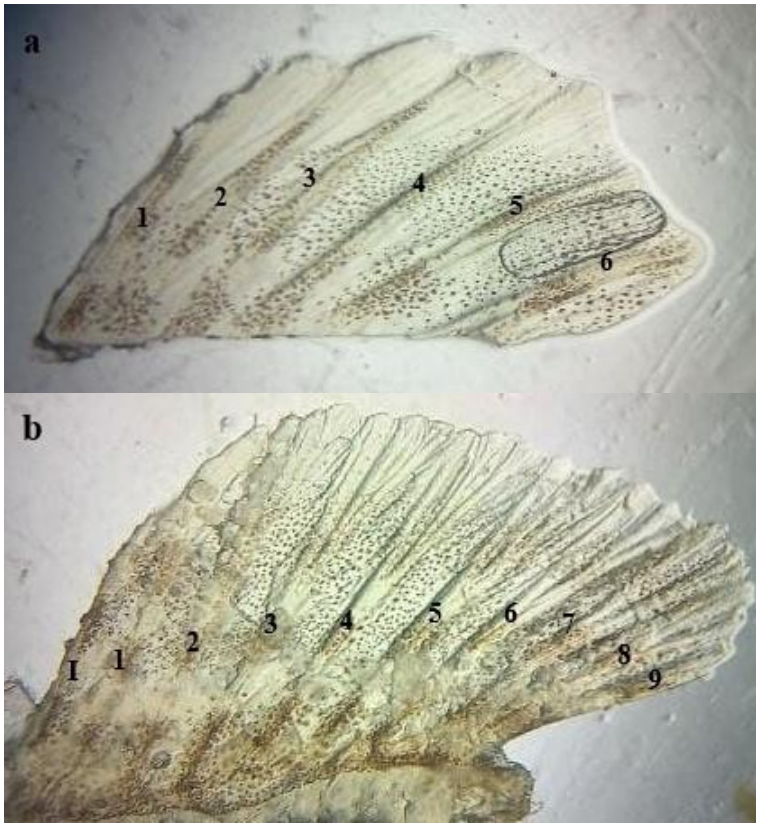

Fig. (3). The first **(a)** and second **(b)** dorsal fins of the female *Rhinogobius brunneus* collected from the middle reaches of the Chirchik River in February 2021. Specimens were stored in a 4% formalin solution. Photos by A. Quvatov and S. Namozov

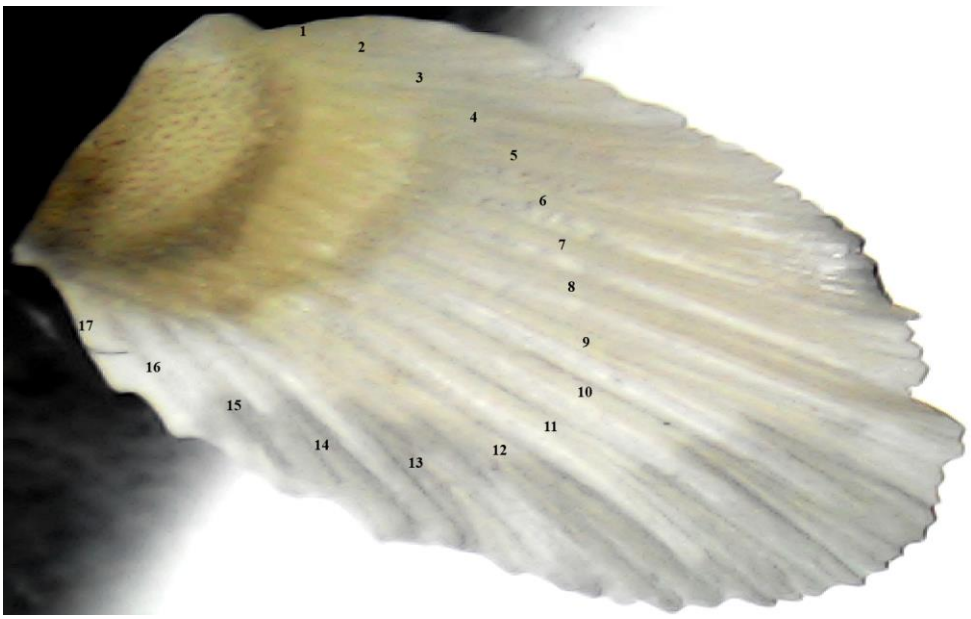

Fig. (4). The pectoral fin of the female *Rhinogobius brunneus* collected from the middle reaches of the Chirchik River in February 2021. Specimens were stored in 4% formalin solution. TL = 42 mm. Photos by A. Quvatov and S. Namozov

The caudal fin of *Rhinogobius brunneus* is circular, with well-defined orderly spots. There were branched and unbranched rays, and calculations were made on the branched rays. According to this, a female specimen with a length of TL = 42 mm and a length of SL = 36 mm had 16 rays. The view of the caudal fin is shown in **Fig. (5)**.

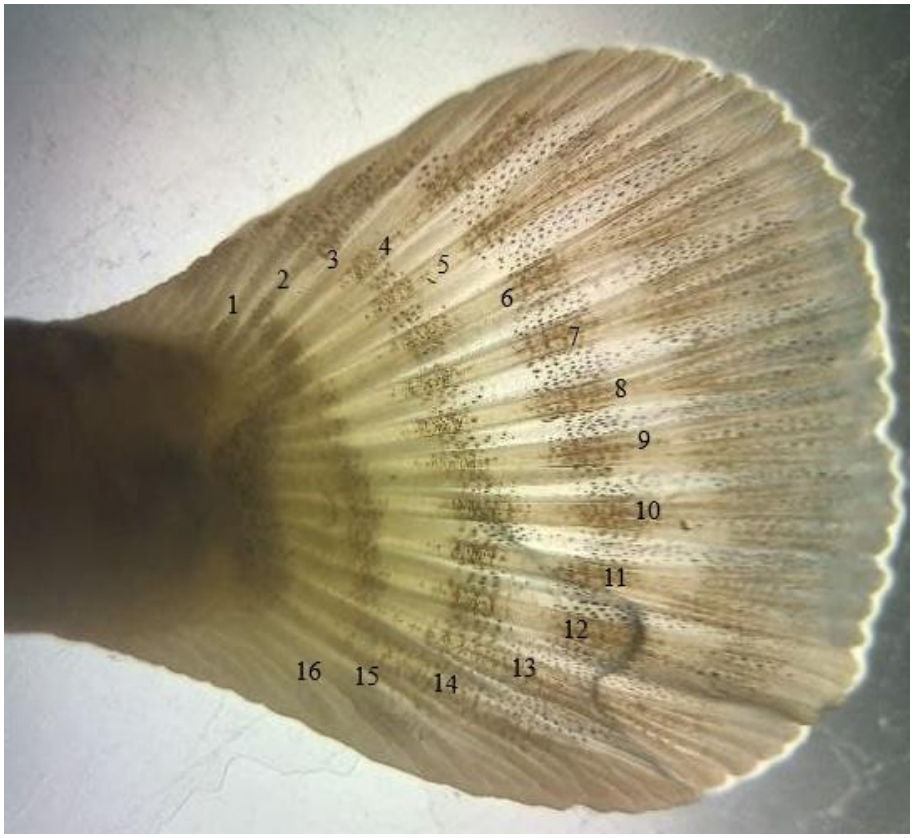

Fig. (5). The caudal fin of the female *Rhinogobius brunneus* collected from the middle reaches of the Chirchik River in February 2021. Specimens were stored in a 4% formalin solution. TL = 42 mm. Photos by A. Quvatov and S. Namozov

The pelvic fin of the *Rhinogobius brunneus* has become a circular adhesion organ. During the research, individuals of *Rhinogobius brunneus* (June 2021) were observed clinging to the body of a reed plant growing not far from the shore of Lake Tuzkon (0.5 km). There are 10 (5 + 5) branched rays in the pelvic fin, and unlike other branched rays, rays with a single base have been found to form 4-5 times branching up to its third part. The view of the circular pelvic fin is shown in **Fig. (6)**.

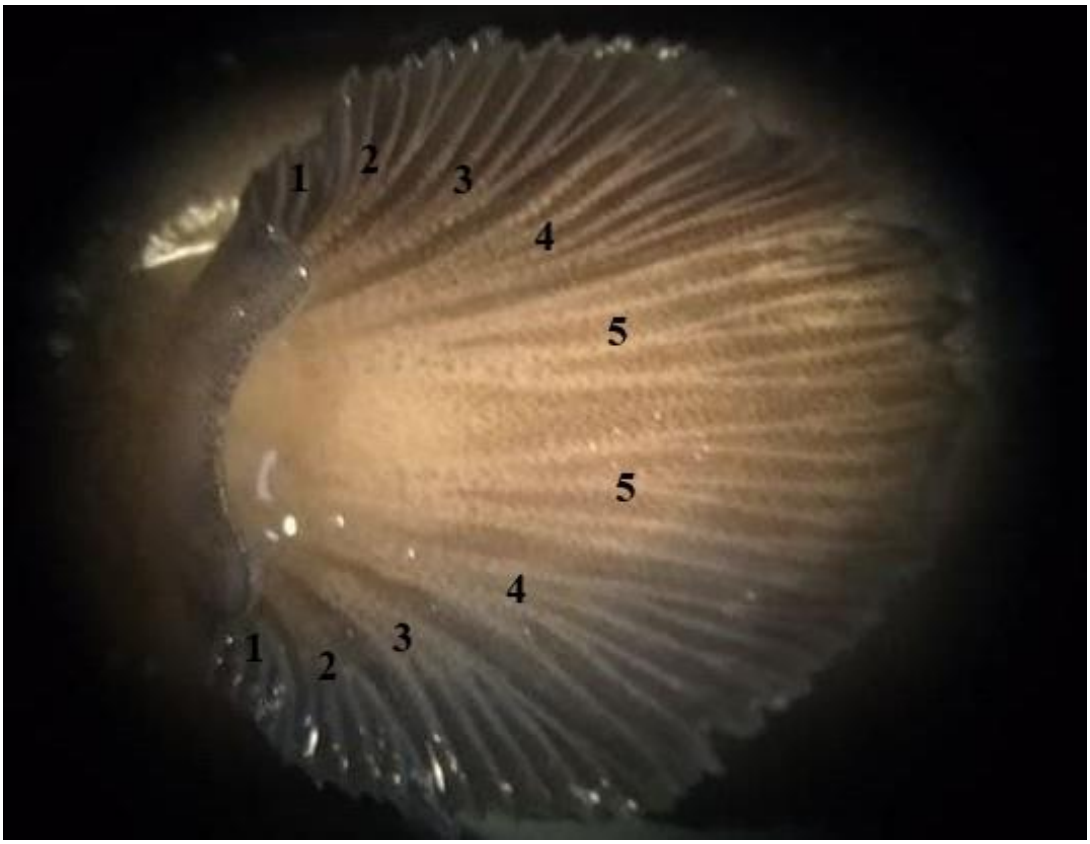

Fig. (6). The circular pelvic fin of Rhinogobius brunneus collected in June 2021 from the shoreline of Lake Tuzkon. Specimens were stored in a 4% formalin solution. SL = 32 mm. Photo by A. Quvatov

When taken as a percentage of body length, plastic features of *Rhinogobius brunneus* were high variability in the interorbital region (*io*) 25.63% and diameter of eye (*o*) 21.31%; average variability in the height of the axis of the caudal fin (*h*) 11.84%; low variability in head length (*c*) 7.24%, posterior part of the head (*po*) 7.35%, head height (*hc*) 6.06%, maximum body height (*H*) 8.42%, length of pectoral fin (*lP*) 9.91%, the length of pelvic fin (*lV*) is 7.43%.

When taken as a percentage of head length, the indicators of plastic features were high variability in the interorbital region (*io/c*) 27.79 %; average variability in diameter of eye (*o*) 18.80%; low variability in the posterior part of the head (*po*) 7.52%, head height (*hc*) 6.74%. The high variability is mainly reflected in the structure of the width of the interorbital region. Indicators of plastic features are given in **Table (1)**.

Table (1): Indicators of plastic features of *Rhinogobius brunneus* species in Chirchik River (n = 11)

	Features	Min-Max	M±m	σ	*Cv, %*
	SL (mm)	26-40	31.55±1.29	4.27	13.55
Ratio of standard length (%)	**c**	29-35.7	32.14±0.70	2.33	7.24
	o	6.5-11.5	8.44±0.54	1.80	21.31
	Po	14.7-18.2	16.17±0.36	1.19	7.35
	Hc	16.1-19.2	17.63±0.32	1.07	6.06
	Io	3.2-6.9	5.14±0.40	1.32	25.63
	H	15.2-20	17.88±0.45	1.51	8.42
	h	8.8-12.9	10.70±0.38	1.27	11.84
	lP	19.4-27.6	24.25±0.72	2.40	9.91
	lV	16.7-21.4	18.86±0.42	1.40	7.43
Ratio of c (%)	**o**	20-33.3	26.21±1.49	4.93	18.80
	po	44.4-55.6	50.41±1.14	3.79	7.52
	hc	50.1-60.2	55.02±1.12	3.71	6.74
	Io	10.2-22.2	16.10±1.35	4.47	27.79

M: average; **m**: mean error; **σ**: average quadratic constraint; **Cv**: coefficient of variation.
SL: standard length; **c**: head length; **o**: orbit length (eye diameter); **po**: posterior part of eye; **hc:** height of head; **Io:** width of interorbital region (the forehead); **H**: maximal height of body; **h**: height of axis of caudal fin; **lP**: length of pectoral fin; **lV**: length of pelvic fin.

DISCUSSION

Numerous scientific studies have been conducted on the biology, ecology, and gender differences of *Rhinogobius brunneus*. Data on the dynamics of movement of *Rhinogobius brunneus* at different speeds of water flow and their reaction to the mechanical effects of water have been reported **(Daisuke & Kohda, 2004)**. Sexual dimorphism is particularly pronounced in male and female individuals of *Rhinogobius* species **(Song *et al.*, 2005)**. A number of studies have been conducted on their distribution in different water bodies of the country. In particular, the occurrence of the species in the species composition of the ichthyofauna of the Aydar-Arnasay lakes system has been noted **(Mirzaev & Kuvatov, 2018)**. Scientific research has been conducted on their distribution and occurrence in the Ahangaron River **(Atamuratova, 2021)**.

CONCLUSION

Indicators of morphological features of *Rhinogobius brunneus* in Chirchik and Ahangaron Rivers and in Tuzkon lake (Syrdarya River basin) were obtained. Color descriptions of the fins were given. It was observed that the body color of species in Tuzkon Lake was darker (light-dark) than the specimens in the Rivers. It was assumed that such a change in body color was due to the mechanical and chemical effects of the lake water.

The coefficient of variation in plastic features can fluctuate from 6.06% to 27.79% (average 13.55%). In terms of overall proportions, the width of the interorbital region (*io*) was 25.63% and orbit diameter (*o*) was 21.31%, resulting in high variability. Indicators of plastic features were given without age and gender distinction.

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CONTRIBUTION OF AUTHORS IN THE ARTICLE

Materials collection and fixation works were done by A. Quvatov, M. Atamuratova and N. Azizov, cameral processing, calculation, article formation by A. Quvatov, funding was provided by all authors.

CONFLICT OF INTEREST

There were no conflicts between the authors on the collection, sorting, cameral processing, and distribution of the materials.

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