

A new freshwater gobiid species of *Rhinogobius* Gill, 1859 (Teleostei: Gobiidae) from the hillstream of Julongjiang basin, Fujian Province, southeastern China

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Abstract

A new species of freshwater gobiid fish of genus *Rhinogobius* Gill, 1859, was collected from the Julongjiang basin, southern region of Fujian Province, China. *Rhinogobius sexistriatus* sp. nov. can be well distinguished from other congeners by their specific patterns of coloration and meristic features: (1) fins rays: second dorsal fin rays I/8; anal fin rays I/7; pectoral fin rays 17; (2) squamation: longitudinal scale series 26–28 (modally 27); peridorsal scales 4–5 (modally 5); (3) vertebral count 27; and (4) specific colouration: cheek with six parallel black stripes on lower side in male. Branchiostegal membrane light blue and spotless in male. First dorsal fin bright orange on more than 1/2 dorsal region in male. Second dorsal fin brownish yellow with 3 longitudinal rows of brown spots and a distal yellow margin in male. Pectoral fin base greyish with a large, wide oblique black mark and an orange spot behind in male. Caudal fin greyish with 5 vertical rows of brown spots in male. A diagnostic key to all valid species from Fujian Province, China is also provided in this paper.

Key words: *Rhinogobius sexistriatus*, new species, Julongjiang basin, Fujian province, fish taxonomy

Introduction

The freshwater gobies of the genus *Rhinogobius* Gill, 1859 provided huge fish species diversity inhabiting the islands of the Western Pacific, including Japan (Akihito *et al.* 1984, 1993, 2002; Masuda *et al.*, 1989), Taiwan (Aonuma & Chen 1996; Chen & Shao 1996; Lee & Chang 1996; Chen *et al.* 1998; Chen & Fang 1999), Hainan (Wu & Ni 1985; Chen *et al.* 2002; Chen & Miller 2013), and the Philippines (Herre 1927), and also continental Asia, in Russia, Korea, China, Vietnam, Laos, Cambodia, and Thailand (Chu & Wu 1965; Zheng & Wu 1985; Chen *et al.* 1999a–c, Chen & Kottelat 2000, 2003, 2005; Chen & Fang 2006; Huang & Chen 2007; Li & Zhong 2007; Li *et al.* 2007; Chen *et al.* 2008; Chen & Miller 2008, 2013). In total, over 90 species can be estimated (Chen & Kottelat 2003, 2005; Chen & Fang 2006; Chen *et al.* 2008; Yang *et al.* 2008; Chen & Miller 2013).

In the Fujian province, our research team reported one fluvial species, *R. xianshuiensis*, was first described from the upper tributary of the Mulan River basin by Chen *et al.*, 2009b. Two more species were described from the upper tributaries of the Hanjiang basin, including both *R. changtinensis* and *R. ponkouensis* by Huang & Chen, 2007. The fourth species was described from the hillstream of the Minjiang basin, as *R. reticulatus* Li & Zhong, 2007. Later on, another endemic species, *R. longyanensis* Chen *et al.*, 2008 was described from the Julongjiang basin, the middle region of the province. Two species, including both *R. rubrolineatus* Chen & Miller, 2008 and *R. sagittus* Chen & Miller, 2008 were described from two different tributaries of the Minjiang basin. More recently, a newly discovered fluvial species, *R. lingtongyenensis* Chen *et al.*, 2022 from the Dongshi basin, and a new fluvial species, *R. lianchengensis* Wang & Chen, 2022 from the Minjiang basin. Again, one more species, *R. dongfangensis* Chen & Wei, 2024 from the Minjiang basin. Newly published species *R. jangshiensis* Chen *et al.*, 2024 from the Jangshi basin.

A more recent expedition of field surveys was conducted in 2023 from several remote hill streams of large river basins from the southern region of Fujian Province, and the survey of freshwater fish fauna has yielded some undescribed fishes, including gobiid fishes.

Herein we document the species new to science from the hillstream of the upper reach in the Julongjiang basin, southeastern China. A detailed formal description will be provided. A diagnostic key to all nominal species of *Rhinogobius* with longitudinal infraorbital papilla patterns from the different river basins of Fujian Province, China, is also provided in this paper.

Materials & Methods

Type specimens of the new goby were collected by hand-net and cast-net.

All counts and measurements were made from specimens finally preserved in 70% ethanol. Morphometric methods follow Miller (1988) and meristic methods follow Akihito *et al.*, (1984), Chen & Shao (1996) and Chen *et al.* (1999b).

Terminology of cephalic sensory canals and free neuromast organs (sensory papillae) is from Wongrat & Miller (1979), based on Sanzo (1911).

Meristic abbreviations are as follows: A = anal fin; C = caudal fin; D1 = first dorsal fin; D2 = second dorsal fin; LR = longitudinal scale rows; P = pectoral fin; PreD = predorsal scales; SDP = scale series from origin of first dorsal fin to upper pectoral fin origin; TR = transverse scale series from second dorsal to anal fins; V = pelvic fin; VC = vertebral count. All fish lengths are expressed by standard length (SL).

The type specimens are deposited in the Pisces collection of National Taiwan Ocean University, Keelung (NTOUP). The comparative materials of congeneric species are entirely listed in Chen *et al.* 2024.

Systematics

Rhinogobius sexistriatus sp. nov.

(中名: 六線吻鰕虎)

(Figs. 1–4)

Materials examined

Holotype. NTOUP-2023-05-450, 34.5 mm SL, Sharn-Shan Village, Tong-an stream, Julongjiang River basin, Fujian Province, P.R. China; coll. K.Y. Chen & H.E. Li, September 23, 2023.

Paratypes. NTOUP-2023-05-451, 2 specimens, 23.0–32.3 mm SL, other data same as holotype.

Diagnosis

Rhinogobius sexistriatus can be well distinguished from all other congeners by the unique combination of the following features: (1) fins rays: second dorsal fin rays I/8; anal fin rays I/7; pectoral fin rays 17; (2) squamation: longitudinal scale series 26–28 (modally 27); predorsal scales 4–5 (modally 5); (3) vertebral count 27; and (4) specific colouration: Cheek with six parallel black stripes on lower side in male. Branchiostegal membrane light blue and spotless in male. First dorsal fin bright orange on more than 1/2 dorsal region in male. Second dorsal fin brownish yellow with 3 longitudinal rows of brown spots and a distal yellow margin in male. Pectoral fin base greyish with a large, wide oblique black mark and an orange spot behind in male. Caudal fin greyish with 5 vertical rows of brown spots in male.

Description

Body proportions in Table 1. Body cylindrical anteriorly, compressed posteriorly. Head rather large, somewhat depressed in male. Eye large, dorsolateral. Snout pointed. Cheek fleshy in male. Lips thick. Mouth oblique, rear edge reaching to midline between anterior edge of orbit and anterior margin of pupil in male, but not reaching the vertical in female. Both jaws with 3–4 rows of conical teeth, outer jaws enlarged. Tongue margin rounded. Anterior nostril in short tube and posterior nostril round. Gill opening restricted, extending ventrally near but not reaching vertical midline of opercle. Vertebral count $11 + 16 = 27$ (in all 3 specimens).

TABLE 1. Morphometry of *Rhinogobius sexistriatus* from Fujian Province, China.

Type	Holotype	Paratype	Paratype
Sex	Male	Male	Female
standard length (mm)	34.5	32.3	23.0
% in SL			
Head length	30.5	30.3	31.7
Predorsal length	40.1	39.0	36.7
Snout to 2nd dorsal fin origin	60.0	61.2	57.3
Snout to anal fin origin	62.6	63.5	55.6
Snout to anus	55.8	58.9	57.2
Prepelvic length	4.0	34.3	30.4
Caudel peduncle length	32.5	24.2	26.4
Caudal peduncle depth	10.7	10.6	11.6
First dorsal fin base	20.6	20.8	18.1
Second dorsal fin base	20.4	20.4	19.4
Anal fin base	16.1	17.1	14.4
Caudal fin length	28.2	26.5	21.8
Pectoral fin length	27.3	27.3	25.3
Pelvic fin length	17.3	15.4	18.1
Body depth of pelvic fin origin	17.6	17.1	16.1
Body depth of anal fin origin	15.7	15.8	14.8
Body width of anal fin origin	11.6	12.8	11.2
Pelvic fin origin to anus	11.4	26.9	23.1
% in HL			
Snout length	31.6	34.0	25.7
Eye diameter	22.4	24.1	21.5
Postorbital length	55.3	59.5	52.0
Cheek depth	29.3	31.6	20.7
Head width in upper gill-opening	50.6	54.5	39.7
Head width in maximum	69.8	75.2	60.1
Fleshy interorbital width	26.7	28.7	20.9
Bony interorbital width	7.3	7.9	8.6
Lower jaw length	37.9	40.8	24.4
% in Caudel peduncle length			
Caudal peduncle depth	40.5	35.9	42.1

Values in parenthese are the average.

Fins. D1 VI, D2 I/8; A I/7; P 17; V I/5+I/5 (distribution frequency in Table 2). D1 rounded, 3rd rays slightly longest, with rear tip while depressed extending just to D2 origin in male, but not reaching the point in female. Origin of A inserted below second branched rays of D2. The rear tips of D2 and A rays when depressed fall well short of procurent rays of C. P moderate large and oblong, its rear tip near reaching vertical line through anus. V rounded, spinous rays with somewhat pointed membrane lobe. C elliptical, rear edge rounded.

Scales. Body with rather large ctenoid scales, anterior region of predorsal area naked; posterior dorsal area and belly cycloid. LR 26–28 (modally 27); TR 8; PreD 4–5 (modally 5); and SDP 6–7. Head and prepelvic region naked. Anterior edge of midpredorsal squamation near the midline of upper end of gellopening.

TABLE 2. Comparison of frequency distribution of fin-ray counts of *Rhinogobius* species with longitudinal infraorbital papillae pattern from Fujian Province, China.

	D1				D2 rays				A rays				P rays								
	V	VI	VII	M	6	7	8	9	M	6	7	8	9	M	15	16	17	18	19	20	M
<i>Rhinogobius sexistriatus</i> sp. nov.	-	3	-	6.0	-	-	3	-	8.0	-	3	-	-	7.0	-	-	6	-	-	-	17.0
<i>Rhinogobius changtinensis</i>	-	9	-	6.0	-	2	7	-	7.8	-	2	7	-	7.7	2	11	-	-	-	-	15.8
<i>Rhinogobius jangshienis</i>	-	7	-	6.0	-	-	7	-	8.0	-	7	-	-	7.0	-	4	10	-	-	-	16.7
<i>Rhinogobius leavelli</i>	-	5	-	6.0	-	-	4	1	8.2	-	-	4	1	8.2	-	-	-	1	4	2	19.1
<i>Rhinogobius lianchengensis</i>	-	4	-	6.0	-	-	4	-	8.0	2	2	-	-	6.5	-	5	3	-	-	-	16.4
<i>Rhinogobius lingtongyanensis</i>	-	5	-	6.0	-	-	5	-	8.0	-	5	-	-	7.0	3	7	-	-	-	-	15.7
<i>Rhinogobius longyanensis</i>	-	10	-	6.0	-	-	10	-	8.0	1	4	5	-	7.4	-	-	14	4	-	-	17.2
<i>Rhinogobius ponkouensis</i>	-	5	1	6.2	-	-	6	-	8.0	-	5	1	-	7.2	-	6	4	-	-	-	16.4
<i>Rhinogobius reticulatus</i>	-	13	-	6.0	-	-	7	6	8.5	-	9	4	-	7.3	-	5	7	-	-	-	16.5
<i>Rhinogobius rubrolineatus</i>	-	6	-	6.0	-	-	6	-	8.0	-	6	-	-	7.0	-	1	6	1	-	-	17.0
<i>Rhinogobius sagittus</i>	-	4	-	6.0	-	-	4	-	8.0	-	4	-	-	7.0	-	3	2	-	-	-	16.4
<i>Rhinogobius xianshuiensis</i>	4	16	-	5.8	-	-	18	2	8.1	5	14	1	-	6.8	10	10	-	-	-	-	15.5

TABLE 3. Comparison of frequency distribution of scale and vertebral counts of *Rhinogobius* species with longitudinal infraorbital papillae pattern from Fujian Province, China.

	LR										TR										PreD													
	25	26	27	28	29	30	31	32	33	34	M	7	8	9	10	M	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	M
<i>Rhinogobius sexistriatus</i> sp. nov.	-	1	3	2	-	-	-	-	-	-	27.1	-	3	-	-	8.0	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	4.7
<i>Rhinogobius changtinentis</i>	-	-	-	2	11	5	-	-	-	-	29.2	2	9	-	-	7.8	1	6	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.2
<i>Rhinogobius jangshienis</i>	-	-	-	1	12	1	-	-	-	-	29.0	-	-	5	2	9.3	-	-	-	-	-	-	-	-	-	7	2	-	-	-	-	-	-	9.2
<i>Rhinogobius leavelli</i>	-	-	-	-	-	-	-	2	5	3	33.1	-	-	-	-	5	10.0	-	-	-	-	-	-	-	-	-	1	1	1	1	1	-	1	12.8
<i>Rhinogobius lianchengensis</i>	-	-	-	-	-	-	-	-	6	2	33.3	-	1	3	-	8.8	1	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	1.8
<i>Rhinogobius lingtongyanensis</i>	2	5	3	-	-	-	-	-	-	-	26.1	-	4	1	-	8.2	-	-	-	1	-	2	2	-	-	-	-	-	-	-	-	-	-	5.0
<i>Rhinogobius longyanensis</i>	-	-	-	-	-	-	10	8	2	-	30.6	1	8	1	-	8.0	-	-	-	-	-	-	1	8	1	-	-	-	-	-	-	-	-	7.0
<i>Rhinogobius ponkouensis</i>	-	-	-	-	-	-	-	4	5	1	32.9	1	5	-	-	7.8	-	-	-	-	5	1	-	-	-	-	-	-	-	-	-	-	-	4.2
<i>Rhinogobius reticulatus</i>	-	-	6	5	2	-	-	-	-	-	27.7	-	-	13	-	9.0	-	-	-	2	4	3	4	-	-	-	-	-	-	-	-	-	-	4.7
<i>Rhinogobius rubrolineatus</i>	-	-	-	2	7	3	-	-	-	-	29.1	-	-	4	2	9.3	-	-	-	1	4	1	-	-	-	-	-	-	-	-	-	-	-	4.0
<i>Rhinogobius sagittus</i>	-	-	-	-	1	5	2	-	-	-	30.1	-	-	2	2	9.5	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	3.5
<i>Rhinogobius xianshuiensis</i>	-	-	-	-	3	9	7	1	-	-	30.3	-	-	18	2	9.1	-	-	-	1	-	8	9	2	-	-	-	-	-	-	-	-	-	5.6

.....continued below

TABLE 3. (Continued)

	SDP								VC							
	6	7	8	9	M	26	27	28	M	26	27	28	M			
<i>Rhinogobius sexistriatus</i> sp. nov.	1	2	-	-	6.7	-	3	-	27.0							
<i>Rhinogobius changtinensis</i>	-	-	7	2	8.2	-	8	-	27.0							
<i>Rhinogobius jangshienis</i>	-	-	7	-	8.0	-	7	-	27.0							
<i>Rhinogobius leavelli</i>	-	-	2	3	8.6	5	-	-	26.0							
<i>Rhinogobius lianchengensis</i>	-	-	2	2	8.5	-	4	-	27.0							
<i>Rhinogobius lingtongyanensis</i>	-	4	1	-	7.2	5	-	-	26.0							
<i>Rhinogobius longyanensis</i>	-	9	1	-	7.1	-	10	-	27.0							
<i>Rhinogobius ponkouensis</i>	-	-	5	1	8.2	-	-	6	28.0							
<i>Rhinogobius reticulatus</i>	-	8	5	-	7.4	7	6	-	26.5							
<i>Rhinogobius rubrolineatus</i>	6	-	-	-	6.0	6	-	-	26.0							
<i>Rhinogobius sagittus</i>	1	3	-	-	6.8	4	-	-	26.0							
<i>Rhinogobius xianshuiensis</i>	-	1	17	1	8.0	-	20	-	27.0							

Head lateral-line system. (Fig. 3)

Canals: Nasal extension of anterior oculoscapular canal with terminal pore σ located in between anterior and posterior nostrils. The gap between two oculoscapular canals is larger than the length of posterior oculoscapular canal. Anterior interorbital sections of oculoscapular canal with paired pore λ . A single pore κ near rear of interorbital region. Pore ω present near posterior, dorsal margin of eye. Lateral section of anterior oculoscapular canal with pore α and terminal pore ρ . Posterior oculoscapular canal with two terminal pores θ and τ . Distance between both oculoscapular canals about equal to the length of posterior oculoscapular canal. Preopercular canal with three pores γ , δ and ϵ .

Sensory papillae

Row *a* extending to vertical midline of orbit. Row *b* length slightly larger than eye diameter. Rows *c*, *d* longer, extending to the vertical of rear margin of eye. A single *cp* papilla. Row *f* paired. Anterior edge of row *oi* connected to lower region of row *ot*.

Coloration in fresh. (Figs. 1, 2, 4)

Body with five or six blackish brown and greyish brown blotches. Caudal fin base with a central black spot and the blackish or greyish brown curves. Head greyish brown or light greyish brown. Two pairs of blackish brown stripes and lateral stripe downward to rear tip of mouth. The latter one turn vertically to behind rear tip of both jaws in male. Cheek with six parallel black stripes on lower side in male. Cheek unmarked in female. Opercle with black curve in female. Branchiostegal membrane light blue and spotless in male.

First dorsal fin entirely bright orange on more than 1/2 dorsal region, and the lower, basal region pale brown a series of brown spots in male. First dorsal fin translucent with two longitudinal rows of brown spots in female. Second dorsal fin brownish yellow with 3 longitudinal rows of brown spots and a distal yellow margin in male. Second dorsal fin translucent with 3 longitudinal rows of brown spots in female. Pectoral fin base greyish with a large, wide oblique black mark and an orange spot behind in male. Pectoral fin base greyish in female. Anal fin entirely bright orange and a narrowly distal black margin in male. Anal fin entirely translucent in female. Caudal fin greyish with 5 vertical rows of brown spots in male. Caudal fin translucent with 3–4 rows of brown spots in female.



FIGURE 1. *Rhinogobius sexistriatus*, male, mm SL, Chongkang River basin, Maioli, Taiwan.



FIGURE 2. *Rhinogobius sexistriatus*, female, mm SL, Chongkang River basin, Maioli, Taiwan.

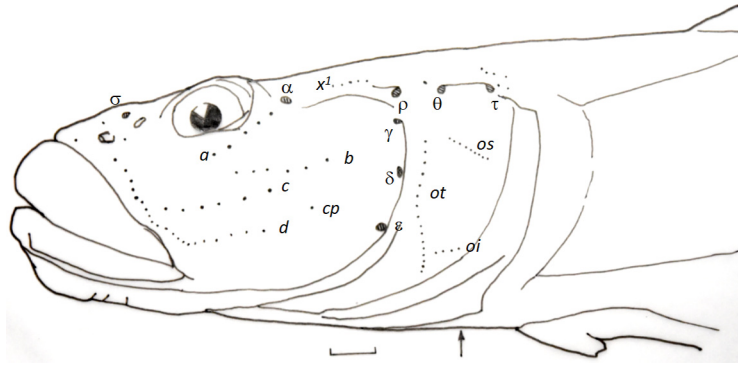


FIGURE 3. Head lateral-line system of *Rhinogobius sexistriatus*, holotype.



FIGURE 4. Dorsal fin pigmentation of *Rhinogobius sexistriatus*, holotype.

Etymology

The specific name, *sexistriatus*, is derived from the Latin “sex”-six and “striatus”-stripe which meaning the diagnostic features of current species with very unique 6 parallel black stripes on cheek in male.

Distribution

This new species, *Rhinogobius sexistriatus*, is so far only found in the small tributary of the Julongjiang river basin, City, Fujian, China. It occurs in shallow-water riffles and front region of pools (depth 20–60 cm depth) with substratum of large pebbles with slow to moderate flowing water.

Remarks

This new species, *Rhinogobius sexistriatus*, is rather similar to similar to the *R. longyangensis* Chen *et al.*, 2008 by overall meristic features of fin ray counts than any other nonimal, fluvial species within Fujian Province, China. However, *Rhinogobius sexistriatus*, can be well distinguished from *R. longyanensis* by the following features: (1) longitudinal scale rows: 27–28 (modally 27) vs. usually 30–31; (2) predorsal scales: modally 4–5 vs. 7; (3) cheek pattern: six main oblique black lines vs. three oblique black line in male; (4) banchiostegal memebrane entirely unmarked and with several red spots in male; and (5) pectoral fin base with wide oblique black mark vs. an upper, small black spot in male. This new species also somewhat similar to *Rhinogobius lingtongyanensis* Chen *et al.*, 2022 with similar unmarked brachiostegal memebrane in male. Threfor, the new species can be well distinguished from *Rhinogobius lingtongyanensis* by the following features: (1) vertebral count 27 vs. 26; (2) pectoral fin rays 17 vs. 15–16; (3) cheek pattern: six main oblique black lines vs. five oblique black line in male; and (4) pectoral fin base with large, wide oblique black mark vs. with small longitudinal deep brown bar in upper region in male.

Diagnostic key to all nominal species of *Rhinogobius* with longitudinal infraorbital papillae pattern from Fujian Province, PR China

1a	Pectoral fin rays modally 19–20, predorsal scales 10–16	<i>R. leavelli</i> (All main basins)
1b	Pectoral fin rays no more than 18; predorsal scales no more than 10	2
2a	Vertebrae 28	<i>R. ponkouensis</i> (Hanjiang basin)
2b	Vertebrae 26–27	3
3a	Longitudinal scale rows usually 33–34	4
3b	Longitudinal usually no more than 32	5
4a	Vertebrae 27; scales between first dorsal origin to upper pectoral fin base 8–9; cheek entirely blackish brown striped in male	<i>R. lianchengensis</i> (Minjiang basin)
4b	Vertebrae 26; scales between first dorsal origin to upper pectoral fin base 11–12; cheek with many brownish black spots in male	<i>R. dongfongensis</i> (Julongjiang basin)
5a	Cheek with many rounded spots, branchiostegal membrane with several parallel red stripes in male	<i>R. reticulatus</i> (Minjiang basin)
5b	Cheek and branchiostegal membrane without such both patterns	6
6a	Pore ω 1 present, pectoral fin base with reticulated orange pattern in male	<i>R. xianshueiensis</i> (Mulan River basin)
6b	Pore ω 1 absent, pectoral fin base without such pattern in male	7
7a	Infraorbital stripe long and well extending downward to rear edge of both jaws or ventral edge of cheek in male	8
7b	Infraorbital stripe/mark absent or short and not extending ventrally to rear edge of both jaws in male	9
8a	Cheek with a conspicuous arrow-shape, red to reddish brown infraorbital mark always following by 4 oblique dark stripes in male	<i>R. sagittus</i> (Minjian basin)
8b	Cheek without such arrow-shape mark in male	10
9a	Pectoral fin rays modally 17; 27 vertebrae; cheek with 3 thin black lines and blackish brown infraorbital stripe in male	<i>R. changtinensis</i> (Hanjiang basin)
9b	Pectoral fin rays modally 16; 26 vertebrae; cheek with 2 thin brown lines and bright red infraorbital stripe in male	<i>R. rubrolineatus</i> (Minjiang basin)
10a	Cheek with 6 brownish black stripes in male	<i>R. sexstriatus</i> (Julongjiang basin)
10b	Cheek with 2–4 brown to brownish black stripes in male	11
11a	Longitudinal scale rows 25–27; 26 vertebrae; branchiostegal membrane spotless in male	<i>R. longtongyanensis</i> (Dongshi basin)
11b	Longitudinal scale rows 28–32; 27 vertebrae; branchiostegal membrane with orange to red rounded spots in male	12
12a	Predorsal scales modally 9; cheek with 4 oblique thin black stripes; caudal fin with central yellowish mark	<i>R. jangshiensis</i> new species (Jangshi basin)
12b	Predorsal scales modally 7; cheek with 3 oblique thin black stripes; caudal fin without such mark	<i>R. lognyanensis</i> (Julongjiang basin)

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