

THREE NEW SPECIES OF *RHINOGOBIUS* GILL, 1859 (TELEOSTEI: GOBIIDAE) FROM THE HANJIANG BASIN, SOUTHERN CHINA

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ABSTRACT. – Three new freshwater gobies of the genus *Rhinogobius* (Gill, 1859) are described in this study, namely, *Rhinogobius changtinensis*, *R. lungwoensis* and *R. ponkouensis*. They were collected from the Hanjiang basin, Southern China during expeditions conducted in 2002 and 2004. The three species of *Rhinogobius* are found in different tributaries of the basin. The three species can be distinguished from all other congeneric species by unique combinations of meristic features, body shape and specific coloration patterns. All three species are non-diadromous species, with high vertebral counts. A key to all nominal species of *Rhinogobius* found in the Hanjiang basin is provided.

KEY WORDS. – Fish fauna, Gobiidae, Southern China, Hanjiang basin, *Rhinogobius*, fish taxonomy.

INTRODUCTION

The Asiatic freshwater goby genus *Rhinogobius* Gill, 1859, is widely distributed on islands of the West Pacific including Japan (Akihito et al., 1984; Masuda et al., 1989; Akihito et al., 1993, 2003), Taiwan (Aonuma & Chen, 1996; Chen & Shao, 1996; Lee & Chang, 1996; Chen et al., 1998; Chen & Fang, 1999), Hainan (Wu & Ni, 1986; Chen et al., 2002), the Philippines (Herre, 1927; Chen, unpublished data), as well as in continental Asia: Russia, Korea, China, Vietnam, Laos and Thailand (Chu & Wu, 1965; Chen & Miller, 1998; Chen, Kottelat & Miller, 1999; Chen, Wu & Shao, 1999; Chen, Yang & Chen, 1999; Chen & Kottelat, 2000, 2003, 2005). The genus includes both amphidromous and non-diadromous landlocked species (Mizuno, 1960; Mizuno & Goto, 1987; Iguchi & Mizuno, 1991; Akihito et al., 1993; Akihito et al., 2002). So far, it is estimated that there are at least 80 species known in East and Southeast Asia and many of them are undescribed (Akihito et al., 2002; Chen & Kottelat, 2003; Chen, unpublished data). The continental *Rhinogobius* species are mainly non-diadromous landlocked species as they tend to have limited distribution and are confined to small and upper tributaries of river systems (Chen & Miller, 1998; Chen, Wu & Shao, 1999b; Chen, Yang & Chen, 1999c; Chen, unpublished data). In mainland China, only one nominal species of amphidromous *Rhinogobius* (*R. leavelii* Herre, 1935b) is known (Chen et al., 2002).

In Southern China, the large Hanjiang River originating from Western and Southern Fujian Province to the Eastern Guangdong Province. It was rarely surveyed for this genus until recently when two expeditions were made in 2002 and 2004 to sample the river's freshwater fish fauna. Chen & Fang (2006) have described a distinct new species, *Rhinogobius wangi* from this basin. Most species of *Rhinogobius* from this area have a high vertebral count of 27 - 29. This is similar to the endemic, landlocked Japanese kawa-yoshinobori, *Rhinogobius flumineus* (Mizuno, 1960). The present study of the specimens from the 2002 and 2004 expeditions of freshwater habitats have yielded three other undescribed species. The three endemic species will herein be described with a comment on related species in from nearby Chinese basins. An artificial key to all nominal species in this basin will be provided.

MATERIALS AND METHODS

All type specimens of the new species were collected by hand-net. Counts and measurements were made from specimens 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 organ (sensory papillae) is from Wongrat & Miller (1991),

based on Sanzo (1911). Meristic abbreviations used herein are: A = anal fin; C = caudal fin; D1, D2 = 1st and 2nd dorsal fins, respectively; LR = longitudinal scale series; P = pectoral fin; PreD = predorsal scales; SDP = scale series from origin of first dorsal fin to upper pectoral origin; TR = transverse scale series from second dorsal to anal fins; V = pelvic fin; VC = vertebral count. Standard lengths (SL) are used throughout.

Type specimens are deposited at the Biodiversity Research Centre, Academia Sinica (ASIZP), Taipei, the Museum of Institute of Marine Biology, National Taiwan Ocean University (NTOU P), Keelung and the Zoological Reference Collection of the Raffles Museum of Biodiversity Research (ZRC), National University of Singapore, Singapore.

COMPARATIVE MATERIALS FROM SOUTHERN CHINA

Rhinogobius duospilus (Herre, 1935a)

Holotype - CAS 130955(SU 30955), 36.6 mm SL, brook on a hill of New Territory, Hong Kong, PR China, coll. A. W. Herre, 3 Mar.1934.

Others - NTOU P, 2006-4-473, 30 specimens, 15.7 - 33.2 mm SL, Jingling, Hong Kong, PR China, coll. D. H. Chong, Mar.1990; NTOU P, 2006-4-474, 19 specimens, 13.2 - 30.0 mm SL, small brook in Dongchung, Daryushan, Hong Kong, PR China, coll. I-S. Chen, Dec.1990.

Rhinogobius leavelli (Herre, 1935b)

NTOU P 2006-4-470, 2 specimens, 28.6 - 30.9 mm SL, Mei-Chou City, Hanjiang River basin, Guangdong Province, PR China, coll. J. H. Wu & J. W. Wang, Apr. 2004.

Others - NTOU P 2006-4-471, 2 specimens, 50.8 - 51.1 mm SL, Mu-Loon, Liojiang River, Xijiang River, Pearl River basin, Guangxi Province, PR China, coll. B. Chen et al., Oct.2002; NTOU P 2006-4-472, 1 specimen, 69.7 mm SL, Jo-Wan-Shan, Liojiang River, Xijiang River, Pearl River basin, Guangxi Province, PR China, coll. B. Chen et al., Oct.2002.

TAXONOMY

Rhinogobius changtinensis, new species

(Figs. 1, 2 & 7)

Material examined. – Holotype- 34.1 mm SL, ZRC-50527, small hill-stream near the freeway terminal, tributary near Chang-Ting County, Fujian Province, Hanjiang basin, coll. I-S. Chen, 10 Sep.2002.

Paratypes. – NTOU P, 2005-7-011, 7 specimens, 22.4 - 26.3 mm SL, all other data same as holotype above; ASIZP0066340, 1 specimen, 24.8 mm SL, all other data same as holotype above.

Diagnosis. – *Rhinogobius changtinensis* is well distinguished from all congeners by the unique combination of the following features: second dorsal fin rays I/7 - 8 (modally 8); anal fin rays I/7 - 8 (modally 8); pectoral fin rays 15 - 16 (modally 16); longitudinal scale rows 28 - 30 (modally 29); vertebral count modally 27 and coloration pattern: cheek with 3 very

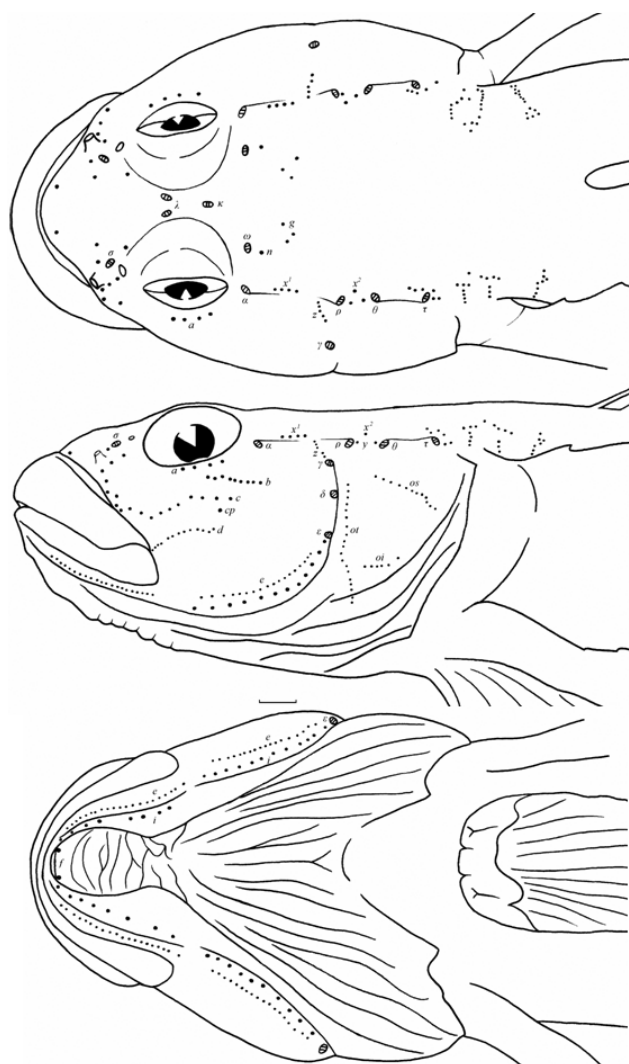


Fig. 1. *Rhinogobius changtinensis*, male, paratype, NTOU P 2005-07-011, head lateral-line system. Top = dorsal view; Middle = lateral view; Bottom = ventral view. Scale bar = 1 mm.

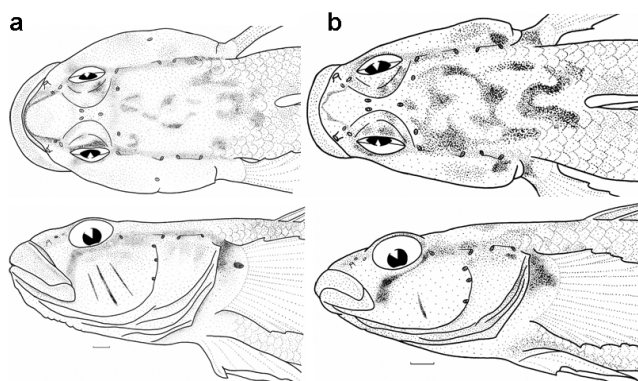


Fig. 2. *Rhinogobius changtinensis*, NTOU P 2005-07-011 showing head colour pattern. a) male, paratype, b) female, paratype. Scale bar = 1 mm.

Table 1. Morphometry of three new species of *Rhinogobius* from the Hanjiang River basin, China.

Characters	<i>R. changtintensis</i>			<i>R. lungwoensis</i>			<i>R. ponkoiensis</i>		
	Male 3	Female 6	Male 10	Female 17	Male 4	Female 2			
Percent of standard length (%)									
Head length	31.1 - 32.2 (31.8)	28.7 - 30.0 (29.3)	28.4 - 30.6 (29.3)	26.3 - 28.7 (27.5)	29.2 - 30.7 (30.1)	26.1 - 26.4 (26.3)			
Predorsal length	42.0 - 42.9 (41.7)	38.4 - 41.3 (40.1)	37.0 - 40.8 (38.5)	35.9 - 38.9 (37.4)	37.3 - 38.8 (38.3)	36.2 - 37.1 (36.6)			
Snout to 2nd dorsal origin	56.6 - 61.2 (58.7)	57.5 - 59.7 (59.0)	57.0 - 59.1 (58.1)	56.1 - 59.2 (58.0)	57.0 - 57.8 (57.3)	57.2 - 58.2 (57.7)			
Snout to anus	58.4 - 61.6 (59.7)	55.1 - 59.7 (57.6)	56.7 - 60.9 (58.1)	56.0 - 58.6 (57.2)	56.8 - 58.7 (57.7)	57.8 - 58.4 (58.1)			
Snout to anal fin origin	61.3 - 62.5 (61.9)	59.2 - 62.5 (60.9)	60.0 - 62.4 (61.5)	60.3 - 63.3 (61.8)	60.6 - 61.9 (61.1)	62.2 - 63.1 (62.7)			
Prepelvic length	31.6 - 33.7 (33.0)	29.6 - 32.8 (31.2)	28.8 - 31.4 (30.0)	27.0 - 29.5 (28.3)	30.5 - 32.1 (31.2)	28.4 - 28.9 (28.6)			
Caudal peduncle length	26.0 - 28.0 (26.8)	25.6 - 28.1 (26.9)	27.0 - 29.9 (28.0)	26.4 - 28.4 (27.2)	26.8 - 27.8 (27.3)	26.2 - 27.1 (26.6)			
Caudal peduncle depth	10.8 - 12.0 (11.5)	10.6 - 11.6 (11.1)	9.4 - 10.5 (10.0)	9.2 - 10.5 (9.8)	10.2 - 10.5 (10.3)	9.6 - 9.8 (9.7)			
1st dorsal fin base	12.7 - 14.1 (13.4)	13.5 - 15.1 (14.3)	12.1 - 14.0 (12.6)	12.3 - 14.6 (13.6)	12.8 - 13.8 (13.0)	13.2 - 13.5 (13.4)			
2nd dorsal fin base	17.7 - 18.8 (18.2)	17.1 - 18.9 (18.1)	17.0 - 19.7 (18.1)	17.5 - 21.4 (19.8)	18.4 - 19.3 (18.8)	18.9 - 19.5 (19.2)			
Anal fin base	13.3 - 15.4 (14.1)	14.4 - 16.3 (15.3)	12.3 - 16.2 (13.8)	12.6 - 14.6 (13.6)	12.5 - 13.4 (13.0)	12.6 - 12.8 (12.7)			
Caudal fin length	23.6 - 25.7 (24.7)	22.9 - 25.7 (24.4)	21.9 - 25.1 (23.2)	21.3 - 25.4 (23.1)	23.1 - 24.6 (23.9)	22.0 - 22.5 (22.2)			
Pectoral fin length	25.7 - 27.7 (26.6)	24.2 - 27.5 (25.8)	23.5 - 27.1 (25.3)	24.2 - 26.8 (25.2)	25.7 - 27.3 (26.2)	24.0 - 24.3 (24.1)			
Pelvic fin length	17.2 - 17.6 (17.3)	16.9 - 18.3 (17.6)	16.5 - 19.3 (17.6)	16.2 - 19.1 (17.5)	16.1 - 18.8 (17.5)	16.7 - 17.3 (17.0)			
Body depth at pelvic fin origin	20.9 - 21.0 (21.0)	19.8 - 21.8 (21.2)	16.8 - 18.8 (17.5)	16.4 - 19.3 (18.1)	18.2 - 18.9 (18.5)	18.1 - 18.7 (18.4)			
Body depth at anal fin origin	18.4 - 21.0 (19.9)	18.0 - 20.5 (19.5)	15.2 - 17.3 (16.3)	14.8 - 17.6 (16.4)	16.7 - 18.8 (17.7)	18.1 - 18.8 (18.4)			
Body width at anal fin origin	12.4 - 13.5 (13.0)	11.0 - 12.3 (11.6)	10.2 - 12.0 (11.0)	10.2 - 12.0 (11.2)	10.8 - 11.2 (11.0)	12.2 - 12.6 (12.4)			
Pelvic fin origin to anus	27.3 - 29.5 (28.6)	27.4 - 30.5 (28.3)	27.0 - 30.7 (29.5)	28.0 - 31.8 (29.3)	27.6 - 28.5 (27.9)	30.4 - 31.0 (30.7)			
Percent of head length (%)									
Snout length	31.4 - 33.7 (32.8)	29.2 - 32.2 (30.9)	31.0 - 33.4 (32.3)	26.7 - 30.7 (28.8)	31.4 - 33.9 (32.4)	31.2 - 31.3 (31.2)			
Eye diameter	20.3 - 22.7 (21.5)	22.8 - 24.7 (23.8)	22.6 - 25.5 (24.0)	23.9 - 27.4 (25.5)	21.8 - 23.6 (22.7)	25.1 - 25.3 (25.2)			
Cheek depth	30.2 - 33.7 (32.0)	27.3 - 32.3 (29.8)	27.1 - 31.1 (29.5)	25.2 - 28.2 (26.6)	29.3 - 33.6 (31.3)	30.2 - 30.3 (30.2)			
Postorbital length	43.4 - 45.9 (44.6)	45.9 - 49.2 (46.8)	49.2 - 52.1 (50.3)	48.3 - 52.2 (50.5)	43.3 - 44.4 (43.7)	43.2 - 43.4 (43.3)			
Head width at maximum	70.5 - 73.0 (71.9)	68.9 - 71.6 (70.2)	62.8 - 68.0 (65.6)	62.0 - 67.1 (65.7)	68.8 - 71.7 (70.1)	70.6 - 71.4 (71.0)			
Head width at upper gill-opening	44.8 - 46.4 (45.6)	47.8 - 49.6 (48.9)	42.2 - 48.8 (45.2)	45.7 - 51.4 (48.5)	46.1 - 48.1 (47.2)	47.3 - 47.5 (47.4)			
Bony interorbital width	7.2 - 7.5 (7.3)	7.3 - 8.0 (7.7)	6.5 - 8.3 (7.4)	6.5 - 8.6 (7.8)	7.2 - 7.7 (7.4)	7.8 - 8.5 (8.1)			
Fleshy interorbital width	20.2 - 22.7 (21.9)	20.8 - 24.1 (22.5)	17.3 - 22.5 (19.7)	18.4 - 21.6 (19.9)	19.6 - 21.4 (20.4)	20.0 - 20.8 (20.4)			
Lower jaw length	41.0 - 45.7 (43.1)	33.7 - 36.4 (35.2)	41.7 - 47.9 (46.1)	35.4 - 42.4 (38.3)	40.1 - 44.4 (42.4)	38.5 - 38.7 (38.6)			

Table 2. Frequency distribution of fin ray counts from valid *Rhinogobius* species from the Hanjiang River basin, China.

Species	D1							D2							A							P									
	V	VI	VII	Av	I/6	I/7	I/8	I/8	I/9	Av	I/6	I/7	I/8	I/9	Av	I/8	I/9	Av	I/8	I/9	Av	I/8	I/9	Av	I/8	I/9	Av	I/8	I/9	Av	
<i>R. duospilus</i> *	-	17	-	6.0	-	3	13	1	7.9	1	16	-	-	6.9	-	2	9	6	-	-	-	-	-	6	-	-	-	-	-	-	16.2
<i>R. leavelli</i>	-	5	-	6.0	-	-	4	1	8.2	-	-	4	1	8.2	-	-	-	-	1	4	2	19.1	-	-	-	-	-	-	-	19.1	
<i>R. wangi</i>	-	4	-	6.0	-	-	4	-	8.0	-	4	-	-	7.0	-	-	4	-	-	-	-	16.0	-	-	-	-	-	-	-	16.0	
<i>R. changinensis</i> new species	-	9	-	6.0	-	2	7	-	7.8	-	2	7	-	7.8	-	2	11	-	-	-	-	15.8	-	-	-	-	-	-	-	15.8	
<i>R. lungwoensis</i> new species	1	24	2	6.1	1	3	19	4	8.0	2	20	5	-	7.1	1	21	32	-	-	-	-	15.6	-	-	-	-	-	-	-	15.6	
<i>R. ponkouensis</i> new species	-	5	1	6.2	-	-	6	-	8.0	-	5	1	-	7.2	-	-	6	4	-	-	-	16.4	-	-	-	-	-	-	-	16.4	

D1 = 1st dorsal fin; D2 = 2nd dorsal fin; A = anal fin; P = pectoral fin; * = Specimens including types from Hong Kong.

 Table 3. Frequency distribution of scales series and vertebral count from valid *Rhinogobius* species from the Hanjiang River basin, China.

Species	LR																TR																PreD	Av			
	26	27	28	29	30	31	32	33	34	Av	7	8	9	10	10	Av	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			16	16	Av
<i>R. duospilus</i> *	-	-	-	3	8	6	-	-	-	30.2	-	3	14	-	8.8	-	-	-	-	-	-	-	-	-	-	-	3	8	5	1	-	-	-	-	-	-	10.2
<i>R. leavelli</i>	-	-	-	-	-	-	2	5	3	33.1	-	-	-	5	9.0	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	-	-	-	1	12.8	
<i>R. wangi</i>	4	4	-	-	-	-	-	-	26.5	-	-	4	-	9.0	-	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-	8.5	
<i>R. changinensis</i> new species	-	-	2	11	5	-	-	-	29.2	2	9	-	-	7.8	1	6	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.2
<i>R. lungwoensis</i> new species	-	-	-	-	-	9	15	24	6	32.5	3	24	-	7.9	-	-	1	5	12	8	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.1
<i>R. ponkouensis</i> new species	-	-	-	-	-	-	4	5	3	32.9	1	5	-	7.8	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.2

Species	SDP							VC										
	7	8	9	10	Av	26	27	28	Av	7	8	9	10	Av	26	27	28	Av
<i>R. duospilus</i> *	5	2	-	-	-	7.1	-	10	-	27.0	-	-	-	-	-	-	-	-
<i>R. leavelli</i>	-	2	3	-	8.6	5	-	26.0	-	26.0	-	-	-	-	-	-	-	-
<i>R. wangi</i>	-	2	2	-	8.5	-	4	27.0	-	27.0	-	-	-	-	-	-	-	-
<i>R. changinensis</i> new species	-	7	2	-	8.2	-	8	27.0	-	27.0	-	-	-	-	-	-	-	-
<i>R. lungwoensis</i> new species	-	5	16	6	9.0	-	10	28.0	-	28.0	-	-	-	-	-	-	-	-
<i>R. ponkouensis</i> new species	-	5	1	-	8.2	-	6	28.0	-	28.0	-	-	-	-	-	-	-	-

LR = longitudinal scale series; TR = transverse scale series; PreD = predorsal scales; SDP = scale series from origin of first dorsal fin to upper pectoral origin; VC = vertebral count; * = specimens including types from Hong Kong.

thin, oblique blackish brown stripes in males; a vertical deep brown infraorbital line anteriorly below orbit and extending to upper lip; pectoral fin base with horizontal bar; branchiostegal membranes with 9 - 12 orange-red spots (light grayish in preservation); caudal fin with 4 - 6 rows of vertical deep brown lines or spots.

Description. – Body elongate, sub-cylindrical anteriorly and compressed posteriorly. Head moderately large, eye high and large, lip thick. Upper lip slightly more prominent than lower lip. Snout length in males longer than in females. Mouth oblique, corner of mouth extending to vertical of anterior margin of pupil in male, but just reaching or slightly beyond anterior margin of orbit. Anterior nostril is a short tube and posterior nostril is a round hole. Gill-opening extending to vertical of rear margin of preopercle. Isthmus broad. Vertebral count $11 + 16 = 27$. Morphometric data of the three new *Rhinogobius* species are given in Table 1. D1 VI; D2 I/8; A I/7 - 8 (modally 7); P 16 - 17 (modally 16) (frequency distribution in Table 2). V I/5 + I/5, D1 4, 5 rays longest, rear tip extending to second branched ray of D2 in male but just reaching origin of D2 in female. An origin inserted below first branched rays of D2. P is large, its rear tip extending to vertical of anus in male, but not in female. V disc rounded, spinous ray with pointed membranous lobe. C rounded, rear edge rounded.

Body with rather large ctenoid scales, anterior part of predorsal area naked; scales on posterior predorsal region and belly cycloid; scales in longitudinal series 28 - 30 (modally 29); transverse series 7 - 8 (modally 8); predorsal scale series 0 - 2 (modally 1); series between first dorsal and upper pectoral fin origin 8 - 9 (modally 8). The frequency distribution of the scale series and vertebral count is given in Table 3. Head, including opercle, preopercle and prepelvic areas naked. Predorsal squamation with bifurcate anterior edge, anterior extension of median series not reaching vertical of upper end of gill-opening.

Head canals. – Nasal extension of anterior oculoscapular canal with terminal pore σ in vertical between anterior and posterior nostrils. Anterior interorbital section of oculoscapular canal separated, with paired pores λ . A single pore κ in posterior interorbital region. Pore ω present at posterior edge of eye. Gap between anterior and posterior oculoscapular canals slightly smaller than length of posterior oculoscapular canal. Preopercular canal with 3 pores: γ , δ and ϵ .

Sensory papillae. – Row *a* extends to midline of orbit. Length of row *b* longer than half of eye diameter. Rows *c* and *d* long, not extending to vertical of pore α . Row *cp* as a single papilla. Row *f* paired. Opercular rows *ot* and *oi* are well-separated.

Colouration in alcohol. – Head and body are yellow-brown or brown. Body with 6 - 7 somewhat blackish-brown blotches scattered with small black spots. Dorsum with 6 - 7 deep brown blotches. Each body scale has a deep brown margin. Belly is yellowish-brown in male and pale yellow in female. A horizontal black-brown bar is present on the upper half of

pectoral fin base. There are always 3 very thin black lines on the cheeks of males. Branchiostegal membrane with 9 - 12 brownish-red spots. A vertical deep brown infraorbital stripe turning vertically near the corner of upper lip. Dorsal fin with series of blackish-brown spots in both sexes. Second dorsal fin with 3 - 4 longitudinal rows of deep brown spots. Anal fin pale white but with distal black-brown stripes in male. Caudal fin with 4 - 6 vertical rows of deep brown spots. Pelvic fin pale white, with irregular tiny brown spots in male.

Distribution. – This new species was found in the moderately swift currents of a hill-stream near Northern region of Changting, the tributary in upper reaches of Hanjiang basin, Fujian Province.

Etymology. – The name, *changtinensis*, is with reference to the type locality, 'Chang-Tin County', in the Northern outskirts near the upper tributary of the Hanjiang basin.

Rhinogobius lungwoensis, new species

(Figs. 3, 4 & 8)

Material examined. – Holotype- 30.0 mm SL, ZRC-50528, hill-stream near Lung-Wo County, Guangdong Province, Western

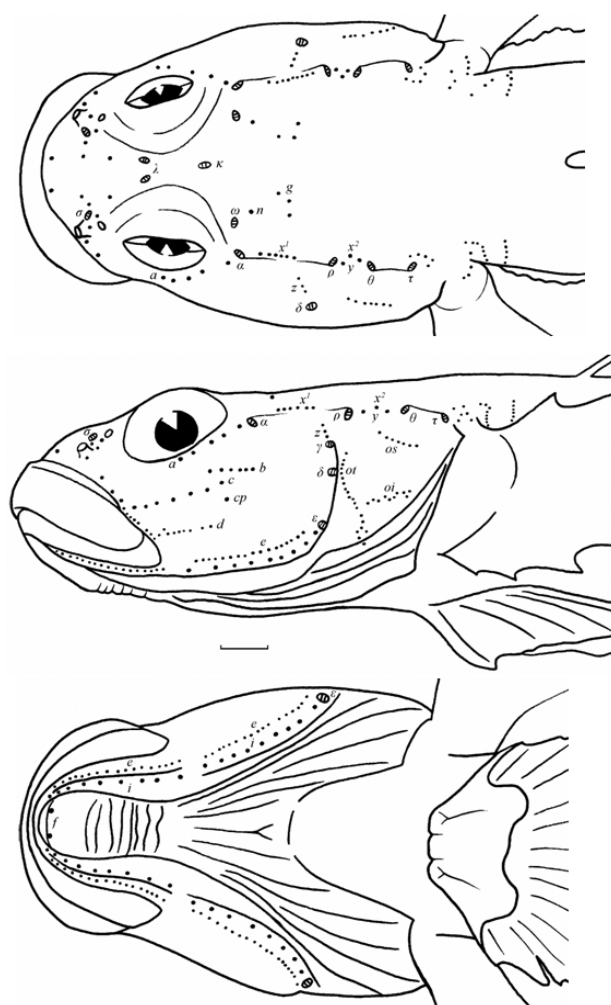


Fig. 3. *Rhinogobius lungwoensis*, paratype, male, NTOU P 2005-07-012, head lateral-line system. Top = dorsal view; Middle = lateral view; Bottom = ventral view. Scale bar = 1 mm.

drainage of the Hanjiang River basin, PR China, coll. J.H. Wu & J. W. Wang, Apr.2004.

Paratypes. – NTOU P, 2005-7-012, 22 specimens, 22.7 - 33.7 mm SL, all remaining data as holotype. ASIZP0066342, 2 specimens, 24.2 - 26.8 mm SL, all other data same as holotype above; ZRC-50529, 31.1 mm SL, all other data same as holotype above.

Diagnosis. – *Rhinogobius lungwoensis* is distinguished from all congeners by the unique combination of the following features: second dorsal fin rays I/6 - 9 (modally 8); anal fin rays I/6 - 8 (modally 7); pectoral fin rays 14 - 16 (modally 15 - 16); longitudinal scale rows 28 - 30 (modally 31 - 32); vertebral count modally 28 and coloration pattern: cheek usually with only one oblique grayish-brown stripe in male; branchiostegal membranes with 22 - 28 small orange-red spots in male (light grayish in preservation); pectoral fin base with 2 conspicuous blackish-brown spots; and caudal fin with 4 - 6 rows of vertical deep brown lines or spots.

Description. – Body elongate, sub-cylindrical anteriorly and compressed posteriorly. Head moderately large, eye high and large, lip thick. Upper lip slightly more prominent than lower lip. Snout length in male longer than in female. Mouth oblique, corner of mouth extending to vertical of anterior margin of pupil in male, but just reaching or slightly beyond anterior margin of orbit in female. Anterior nostril is a short tube and posterior nostril is a round hole. Gill-opening extending to vertical of rear margin of preopercle. Isthmus broad. Vertebral count 11 + 17 = 28. (See Table 1 for morphometric data). D1 V - VII (modally VI); D2 I/6 - 9 (modally 8); A I/6 - 8 (modally 7); P 14 - 16 (modally 16) (frequency distribution in Table 2). V I/5 + I/5, D1 4, 5 rays longest, rear tip extending to origin of D2 in male but not reaching this point in female. An origin inserted below second branched rays of D2. P is large, its rear tip extending to vertical of anus in male, but not in female. V disc rounded, spinous ray with pointed membranous lobe. C rounded, rear edge rounded.

Body with moderately-large ctenoid scales, anterior part of

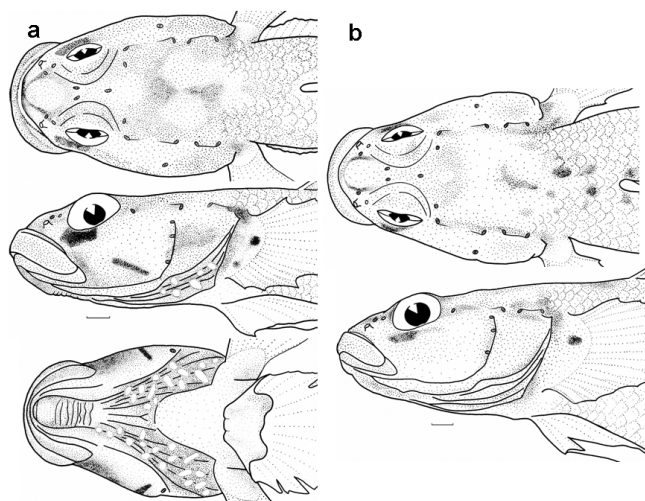


Fig. 4. *Rhinogobius lungwoensis*, NTOU P 2005-07-012 showing head colour pattern. a) male, paratype, b) female, paratype. Scale bar = 1 mm.

predorsal area naked; scales on posterior predorsal region and belly cycloid; scales in longitudinal series 31 - 34 (modally 33); transverse series 7 - 8 (modally 8); predorsal scale series 3 - 7 (modally 5); series between first dorsal and upper pectoral fin origin 8 - 10 (modally 8) (See the frequency distribution of the scale series and vertebral count in Table 3). Head, including opercle, preopercle and prepelvic areas naked. Predorsal squamation with bifurcate anterior edge, anterior extension of median series almost reaching the vertical of gill-opening.

Head canals. – Nasal extension of anterior oculoscapular canal with terminal pore σ in the vertical between anterior and posterior nostrils. Anterior interorbital section of oculoscapular canal separated, with paired pores λ . A single pore κ in posterior interorbital region. Pore ω present at posterior edge of eye. Gap between anterior and posterior oculoscapular canals about equal to the length of posterior oculoscapular canal. Preopercular canal with 3 pores: γ , δ and ϵ .

Sensory papillae. – Row a extends to midline of orbit. Length of row b is approximately equivalent to eye diameter. Rows c, d long, not extending to vertical of pore α . Row cp as a single papilla. Row f paired. Opercular rows ot and oi are well-separated.

Colouration in alcohol. – Both the body and head is yellowish-brown or light brown. Body with 6 - 7 blackish-brown blotches. Snout with a pair of brown stripes united at snout tip. A somewhat square grayish-brown mark below orbit. Cheek usually with only one oblique grayish-brown stripe in male; branchiostegal membrane with 22 - 28 small orange-red spots in male (light grayish in preservation). First dorsal fin with wide grayish-black band in male and with 3 - 4 rows of small brown spots in female. Second dorsal fin with 3 rows of blackish-brown spots. Pectoral fin base with 2 conspicuous blackish-brown spots. Caudal fin with 4 - 6 rows of vertical deep brown lines or spots. There is a deep black spot on middle of the caudal fin base. Pelvic fins are pale.

Distribution. – This species was only collected from a hill-stream near Lung-Wo County, Guangdong Province, the Western drainage of the Hanjiang River basin, China.

Etymology. – The name, lungwoensis, is with reference to the type locality, 'Lung-Wo County', the tributary of the Hanjiang basin in Guangdong Province.

***Rhinogobius ponkouensis*, new species**
(Figs. 5, 6 & 9)

Material examined. – Holotype - male (30.2 mm SL), ZRC-50526, Pon-Kou County, Hanjiang River basin, Fujian Province, PR China, coll. I-S. Chen, 10 Sep.2002.

Paratypes. – NTOU P, 2005-7-010, 4 specimens, 28.7 - 30.3 mm SL, all remaining data same as above. ASIZP0066340, 1 specimen, 26.2 mm SL, all other data same as holotype above.

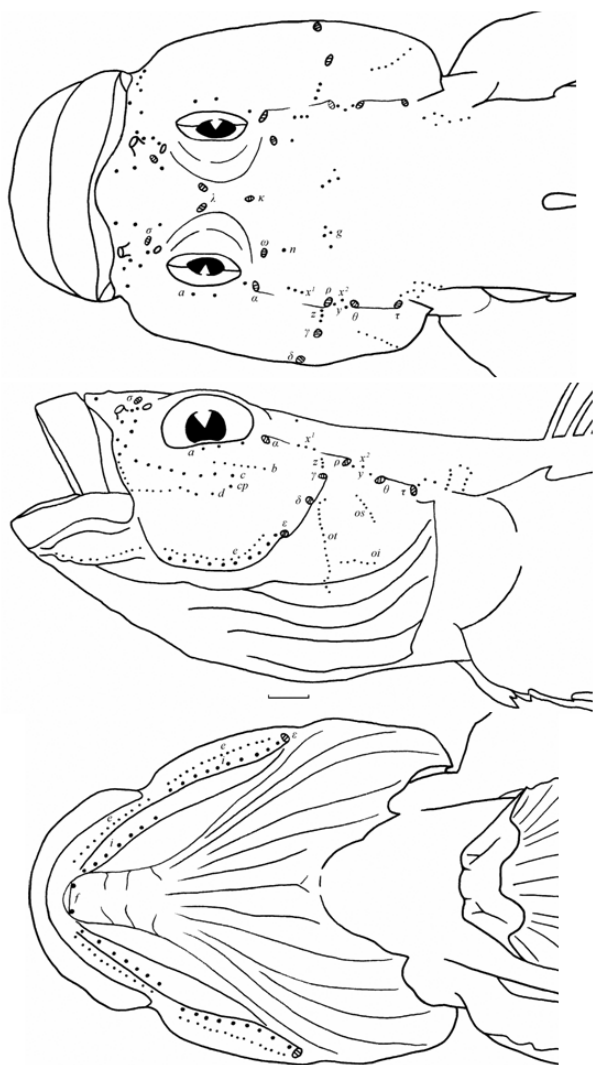


Fig. 5. *Rhinogobius poukouensis*, paratype, male, NTOU P 2005-07-010, head lateral-line system. Top = dorsal view; Middle = lateral view; Bottom = ventral view. Scale bar = 1 mm.

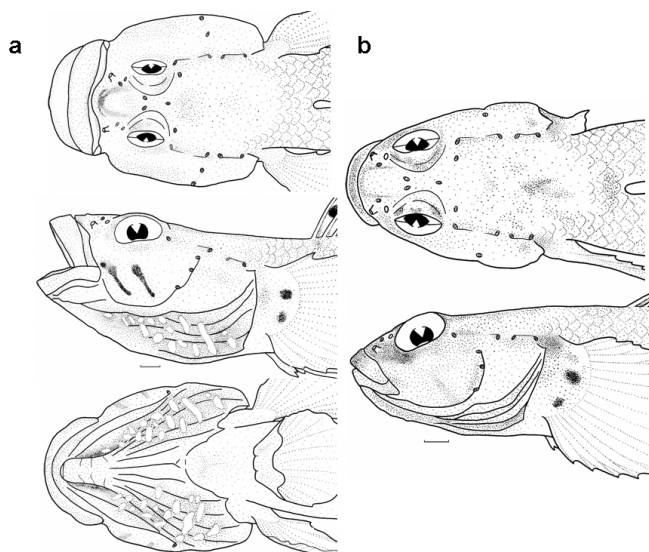


Fig. 6. *Rhinogobius poukouensis*, NTOU P 2005-07-010 showing head colour pattern. a) male, paratype, b) female, paratype. Scale bar = 1 mm.

Diagnosis. – *Rhinogobius poukouensis* is distinguished from all congeners by the unique combination of the following features: second dorsal fin rays I/8; anal fin rays I/7 - 8 (modally 7); pectoral fin rays 16 - 17 (modally 16); longitudinal scale rows 32 - 34; vertebral count modally 28; and coloration pattern: cheek with 2 conspicuous, oblique blackish-brown stripes in male; pectoral fin base with 2 deep brown spots; branchiostegal membrane with 15 - 18 orange-red spots (light grayish in preservation); and caudal fin with 4 - 6 rows of vertical deep brown lines or spots.

Description. – Body elongate, sub-cylindrical anteriorly and compressed posteriorly. Head moderately large, eye high-set and large, thick lips. Upper lip is slightly more prominent than lower lip. Snout length in male longer than in female. Mouth oblique, corner of mouth extending to vertical of anterior margin of pupil in male, but this line just reaching or slightly beyond the anterior margin of orbit. Anterior nostril is a short tube and posterior nostril is a round hole. Gill-opening extending to vertical of rear margin of preopercle. Isthmus broad. Vertebral count 11 + 17 = 28 (Table 1 for morphometric data). D1 VI - VII (modally VI); D2 I/8; A I/7 - 8 (modally 7); P 16 - 17 (modally 16) (frequency distribution in Table 2). V I/5 + I/5, D1 2, 3, 4 rays longest, rear tip extending to origin of D2 in male but not reaching this point in female. An origin inserted below second branched rays of D2. P is large, its rear tip extending to vertical of anus in male, but not extending to that point in female. V disc rounded, spinous ray with pointed membranous lobe. C rounded.

Body with moderately large ctenoid scales, anterior part of predorsal area naked; scales on posterior predorsal region and belly cycloid; scales in longitudinal series 32 - 34; transverse series 7 - 8 (modally 8); predorsal scale series 4 - 5 (modally 4); series between and pectoral fin origin 8 - 9 (modally 8) (see the frequency distribution of the scale series and vertebral count in Table 3). Head, including opercle and preopercle naked. Prepelvic area naked. Predorsal squamation with slightly trifurcate anterior edge, anterior extension of median series reaching midline of gap between anterior and posterior oculoscapular canals.

Head canals. – Nasal extension of anterior oculoscapular canal with terminal pore σ in the vertical between anterior and posterior nostrils. Anterior interorbital section of oculoscapular canal separated, with paired pores λ . A single pore κ in posterior interorbital region. Pore ω present at posterior edge of eye. Gap between anterior and posterior oculoscapular canals about equal to the length of posterior oculoscapular canal. Preopercular canal with 3 pores: γ , δ and ϵ .

Sensory papillae. – Row *a* extends to midline of orbit. Length of row *b* is longer than half of eye diameter. Row *c*, *d* long, not extending to vertical of pore α . Row *cp* as a single papilla. Row *f* paired. Opercular rows *ot* and *oi* are well-separated.

Colouration in alcohol. – Both the head and trunk are

creamy-yellow or light brown, body with indistinct cross-bars accompanied by a few small dark spots; the interspaces are narrower than cross-bars. Body scales with deep brown edges. Body is pale yellow. Caudal fin with rounded black-brown spots. Cheek always with 2 oblique black-brown stripes and branchiostegal membrane with 15 - 18 orange-red bars or spots in male but no stripe and branchiostegal spot in female. Snout with pair of brown stripes united at snout tip. A small grayish-black mark below eye. First dorsal fin with black spot before anterior 2 branched rays and a horizontal pale grey after the spot. Caudal fin base with large deep black spot on the middle. Caudal fin with 4 - 6 rows of vertical or somewhat oblique brown spots. Pectoral fin base with 2 oblong black to brown spots. Anal fin grayish-white, with grayish-black line distally in male.

Distribution. – This species is found in the shallow riffles of swiftly flowing tributaries near Pon-Kou County in the Hanjiang basin, Western Fujian Province, China.

Etymology. – The name, *ponkouensis*, is with reference to the type locality, Pon-Kou County, in the middle reaches of the Hanjiang basin.

DISCUSSION

The four non-diadromous species of *Rhinogobius* in the Hanjiang basin (*R. changtinensis*, *R. lungwoensis*, *R. ponkouensis* and *R. wangi*) can be distinguished from the



Fig. 7. *Rhinogobius changtinensis*, lateral view. a) male, holotype, ZRC-50527, b) female, paratype, NTOU P 2005-07-011, Chang-Ting, upper tributary of Hanjiang River basin, Fujian, China.

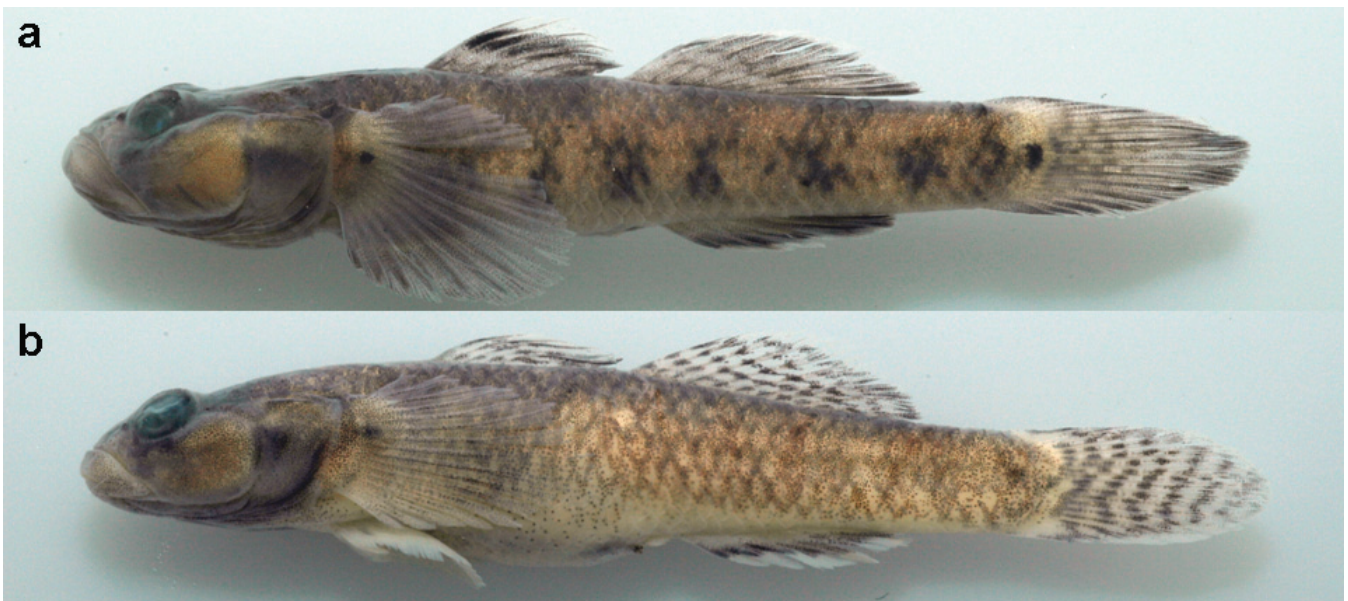


Fig. 8. *Rhinogobius lungwoensis*, lateral view. a) male, holotype, ZRC-50528, b) female, paratype, NTOU P 2005-07-012, upper tributary around Lung-Wo, Hanjiang River basin, Guangdong, China.

common amphidromous goby, *R. leavelli* by the following morphometric features: lower count of pectoral fin rays (14 - 17 vs. 18 - 20); lower count of predorsal scales (0 - 9 vs. 10 - 16) and; higher vertebral count (27 - 28 vs. 26).

The four non-diadromous species of Hanjiang River basin have the common features of striped cheek and spotted pectoral fin base and higher vertebral count. The three new gobies can be further distinguished from *R. wangi* by no more than 3 dark stripes on cheek vs. 6 to 7 dark stripes on cheek. They can be also distinguished from *R. duospilus* by the following features: lower count of predorsal scales (1 - 6 vs. 10 - 11); and more reduced predorsal squamation of midline series not extending beyond the gill-opening vs. more midline series extending beyond cross-line of terminal pore σ of anterior oculoscapular canal.

These four non-diadromous species can be divided into two groups according to the number of vertebrae.

The first group with 27 vertebrae includes two related species, *R. changtinensis* and *R. wangi*. They share the following features such as the same dorsal and anal fin rays counts, 16 pectoral fin rays modally and have a similar single dark spot on the upper pectoral fin base. However, they can be separated by their meristic features and specific colouration pattern.

The second group with a vertebral count of 28 includes two related species, *R. lungwoensis* and *R. ponkouensis*. They share the following features such as the same dorsal and anal fin rays counts, 16 pectoral fin rays modally and a pair of spots on upper pectoral fin base. However, they can be separated by the specific colouration pattern of males using the following key

Further systematic studies using a molecular phylogenetic approach should be carried out in the river basins nearby.

The data would present a more detailed evolutionary history among the great diversity of *Rhinogobius* species in Southeastern Asia and China.

An artificial key for five nominal species of *Rhinogobius* in Hanjiang basin

1. Pectoral fin ray count more than 18, fin base with a vertical deep brown bar, vertebral count 26 *Rhinogobius leavelli*
 – Pectoral fin ray count less than 17, fin base without such mark, vertebral count 27 - 28 2
2. Longitudinal scale series 26 - 27, cheek with 6 - 7 oblique, deep brown stripes in male *R. wangi*
 – Longitudinal scale series 29 - 34; cheek with 1 - 3 oblique deep brown stripes in male 3
3. Cheek with 3 oblique, thin blackish brown stripes in male, a vertical line anteriorly on cheek below orbit, predorsal scales modally 1 (range 0 - 2) *R. changtinensis*
 – Cheek with less than 3 oblique stripes, no vertical line below eye, scales in predorsal region modally 4 - 6, vertebral count 28 4
4. Cheek with 1 oblique stripe in male, branchiostegal membrane with 20 - 28 orange-red spots or bars *R. lungwoensis*
 – Cheek with modally 2 oblique stripes in male, branchiostegal membrane with 15 - 18 small orange-red spots *R. ponkouensis*

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Fig. 9. *Rhinogobius ponkouensis*, lateral view. a) male, holotype, ZRC-50526, b) female, paratype, NTOU P 2005-07-010, Pon-kou, middle reaches of Hanjiang River basin, Fujian, China.

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