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A NEW SPECIES OF FRESHWATER GOBY (TELEOSTEI: GOBIIDAE: *STIPHODON*) FROM PULAU TIOMAN, PAHANG, PENINSULAR MALAYSIA

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***ABSTRACT.* –** An amphidromous goby, *Stiphodon aureorostrum*, new species, is described from the freshwater streams of Pulau Tioman off the east coast of Peninsular Malaysia. It is characterised by a combination of the following features: I/9 second dorsal fin rays; I/10 anal fin rays, 15-16 pectoral fin rays, 35-37 longitudinal scale rows, 4-11 predorsal scales, first dorsal fin with prolonged filamentous rays; pectoral fin with 8-10 vertical rows of greyish black spots, body with distinct 9-10 narrow, dark grey bars in male; golden longitudinal band on anterior and lateral aspects of snout on both sexes in life.

***KEY WORDS*. –** Gobiidae, *Stiphodon*, Peninsular Malaysia, new species.

INTRODUCTION

There is a high diversity of freshwater gobioid fishes inhabiting the basins of the west and tropical Pacific which comprise of amphidromous and landlocked species (Chen & Fang, 1999). Members of the genus *Stiphodon* Weber (1895) are small amphidromous freshwater gobiid fish with short, transverse infraorbital papillae pattern and showing distinct sexual dimorphism in colour pattern and dorsal fin shape; the male always with iridescent or bright colour pattern and usually with prolonged fin rays in the first dorsal fin; the female always with two longitudinal dark stripes on the body and no elongated rays in the first dorsal fin. Some studies on *Stiphodon* have been conducted in the Philippine islands (Herre, 1927; Watson & Kottelat, 1995); in Taiwan and the Ryukyu islands (Watson & Chen, 1998); and Hainan Island (Wu & Ni, 1985). Less is known of this taxon in Sundaic Southeast Asia, with only one recent record from the island of Tioman, off the east coast of Peninsular Malaysia (Ng et al., 1999).

Pulau Tioman is located about 45 km off the southern part of the east coast of the Malay Peninsula in the South China Sea. The inland water fishes of Tioman comprises mainly of diadromous, secondary division freshwater forms and these appear to be concentrated mainly in the lower reaches and estuaries (Alfred, 1966; Ng et al., 1999). There are only six primary freshwater fishes among the 48 recorded species of inland fishes (fide Ng et al., 1999; Lim & Ng, 1999) with two endemic species, viz. *Sundoreonectes tiomanensis* (Balitoridae) and *Clarias batu* (Clariidae). Among them, gobioids are the largest group, with 13 genera and 17 species recorded. Ng et al. (1999) reported the presence of *Stiphodon atropurpureus* (Herre, 1927) from Tioman, the first record of the genus for the area. After further surveys in 1999 and 2001, we found and confirmed another species of *Stiphodon*. It is herein described as a new species - *Stiphodon aureorostrum*.

MATERIAL AND METHODS

Specimens were collected with a cast net and also by utilising two hand-nets while snorkelling. All counts and measurements follow Chen & Shao (1996), except for the maximal extension of the predorsal scale series which is defined herein as the scale counts from the origin of the first dorsal fin base extending to the right side of the anterior tips of biforked squamation (PreD-max). Terminology of head lateral-line and neuromast organs follow Miller (1988). The type specimens examined are deposited in the National Museum of Marine Biology & Aquarium, Pingtung, Taiwan (NMMBP) and the Raffles Museum of Biodiversity Research, National University of Singapore (ZRC). Other comparative

materials of congeners are deposited in the Biological Laboratory, Imperial Household, Tokyo (BLIH), NSMT (followed Leviton et al., 1985), and the Pisces collection of ISC (ISP). The collection localities are shown in Fig. 1. All abbreviations for meristic and morphometric characters follow Miller (1988) and Chen et al. (1999).

Stiphodon aureorostrum, new species
(Figs. 2-5)

All material examined from Pulau Tioman, Pahang, Peninsular Malaysia.

Holotype. – Male (52.0 mm SL)(ZRC 46412), Juara: Sungai Keliling, coll. I-S. Chen, H. H. Tan & K. K. P. Lim, 17-18 Jul.2001.

Paratypes. – 2 females (55.1-60.3 mm SL)(ZRC 46413), same locality data as holotype; 2 males and 2 females (38.9-52.5 mm SL)(NMMBP 1984), same locality data as holotype; 2 females (52.0-58.9 mm SL)(ZRC 45409), Juara: Sungai Keliling, coll. H. H. Tan, 25 Jun.1999; 1 male (41.2 mm SL)(ZRC 45410), Juara: Sungai Keliling, coll. P. K. L. Ng et al., 24 Jun.1999.

Non-type material. –1 female (43.1 mm SL)(ZRC 45408), Juara: Sungai Keliling.

***Diagnosis*. –** *Stiphodon aureorostrum* differs from all its congeners by the unique combination of features: I/9 second dorsal fin rays, I/10 anal fin rays, 15-16 pectoral fin rays, 35-37 longitudinal scale rows, 4-11 predorsal scales, first dorsal fin with prolonged filamentous rays; pectoral fin with 8-10 vertical rows of greyish black spots, body with narrow 9-10 dark grey bars in male; golden longitudinal band on anterior and lateral aspects of snout on both sexes in life. *Stiphodon aureorostrum* also represents the largest species ever collected in the Indo-Pacific region. One female specimen (ZRC 46413) measures 60.3 mm SL.

***Description*. –** Body subcylindrical and somewhat square-like in cross section, compressed posteriorly. Head somewhat angular and snout semi-circular in dorsal view. Snout tip overhanging the upper lip. Mouth slightly oblique and subterminal. Eye medium to large (17.3-43.4 % HL), dorsolateral in position. Upper jaw teeth tricupsid; lower jaw teeth conical. Labial teeth present in lower jaw. Tongue margin rounded. Anterior nostril a short tube, posterior nostril a round hole. Gill-opening restricted, extending vertically and not beyond the rear edge of opercle. Isthmus broad. Vertebral count 10 + 16 = 26. Morphometric data listed in Table 1, and meristic counts in Table 2.

***Fins*. –** First dorsal fin ray count VI, second dorsal fin ray count I/9; anal fin ray count I/10; pectoral fin ray count 15-16 (modally 15); pelvic fin ray count I/5+I/5 (frequency distribution of fin-ray counts listed in Table 2). First dorsal fin with filamentous fin rays with fourth fin ray longest in male; first dorsal fin rays about equal in female. Distal tip of longest first dorsal fin ray extending to the bases of third to fifth fin rays of second dorsal fin when depressed; but the rear margin of first dorsal fin nearly reaching second dorsal fin origin in female. Posterior fin rays of second dorsal fin and anal fin long, reaching the procurrent rays in adult male when depressed, but respective fin rays in female not elongated. Origin of anal fin inserted below origin of second dorsal fin in male; the origin of anal fin inserted below first branched fin ray of second dorsal fin in female. Pectoral fin large, the rear tip reaching nearer the vertical of anus than the rear margin of pelvic fin in male; but not extending to the vertical midline between rear tip of pelvic fin and anus. Caudal fin elliptical, rear margin rounded.

***Scales*. –** Body covered with moderately large ctenoid scales, but the anterior portion before midline of first dorsal fin with relatively small cycloid scales extending to predorsal origin of nape. Predorsal squamation with the extension of bifid pattern (shown in Fig. 5A), the extension representing the sexual dimorphism in which the coverage of scales toward and beyond the vertical line of anterior terminal pore of posterior oculoscapular canal in female but never reaching the point in male. Longitudinal scale row 33-37; transverse row 9-10; scale rows between first dorsal fin origin and anterior dorsal pectoral fin origin 11-16; predorsal scale row 4-6 in male, 7-11 in female; maximal extension of predorsal

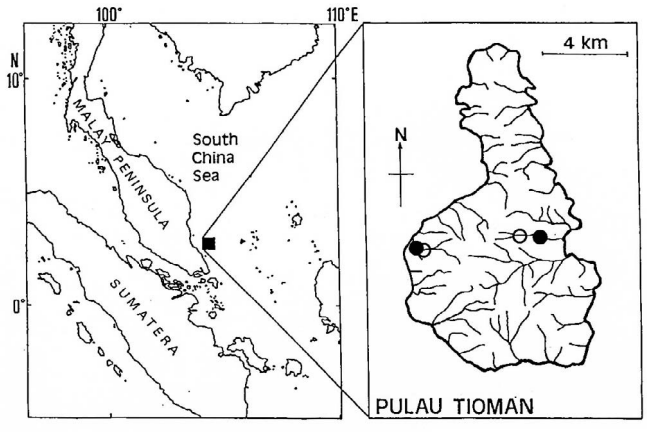

Fig. 1. Location of Pulau Tioman. Map of Pulau Tioman showing distribution of *Stiphodon aureorostrum* (solid symbol) and *S. atropurpureus* (hollow symbol).

Fig. 2. In-situ photograph of a small group of *Stiphodon aureorostrum* (centre area of image) grazing on gravel in Sungei Keliling (taken on 18 July 2001).

scale series 11-14 in male, 19-22 in female. Abdominal median squamation before anus extending to the rear edge of pelvic fin base. Head including snout, cheek, opercle; pectoral fin base and pre-ventral region naked.

Head lateral-line system (Fig. 5B)
Cacals: Pair of pores σ, σ', and λ of anterior oculoscapular canal on dorsal side of snout; pore s' on terminal of anterior branch of head canal near the anterior nostril; pore σ near the posterior nostril. Single pore k in interorbital region; no pore w. Anterior oculoscapular canal with lateral pores α and ρ. Posterior oculoscapular canal with terminal pores θ and τ. Preopercular canals with both terminal pores γ and ε, but lacking pore δ.

Head sensory papillae: The infraorbital papillae present as 6 short transverse rows shown in detail as Fig. 5B. Row 6 separated into row *6s* and *6i*. The row *b* and *d* present. Rows *os*, *ot*, and *oi* well separated on opercle. Row *os* separated into four divisions.

Life coloration. – See Figs. 3A-C for life coloration of male and female specimens.

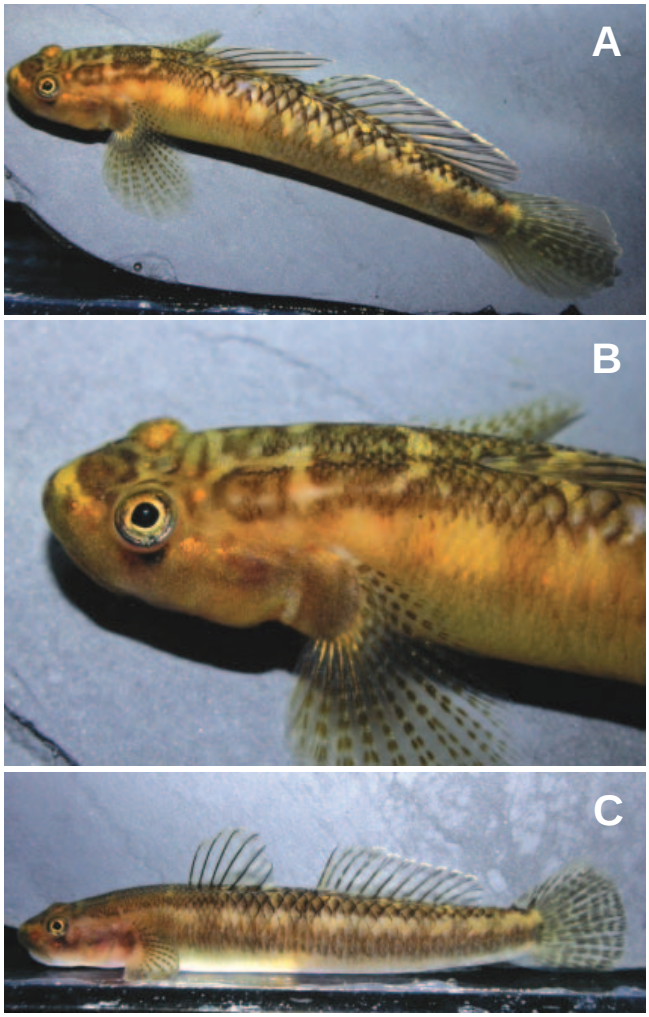

Fig. 3. *Stiphodon aureorostrum*, new species: A, Life male holotype, (ZRC 46412, 52.0 mm SL); B, Close-up of male's head; C, life female paratype (ZRC 46413, 60.3 mm SL).

Male: Head dorsum yellowish-brown with dark brown patches, golden-yellow patch on area above eye. Anterior tip of snout with golden-yellow longitudinal stripe to front of eye, bordered dorsally and ventrally with brown. Eye with golden iris. Region behind eye tinged with golden-yellow, bordered ventrally with brown to opercle edge. Body dorsum dark brown with posterior edge of scales black, forming a reticulate pattern. Body dorsum with one gold bar anterior to first dorsal fin, two gold bars at first dorsal fin base, four gold bars at second dorsal fin base. Body yellowish-brown with up to 10 dark brown bars, distance between bars progressively more narrow towards posterior. Body with one brown bar anterior to first dorsal fin, two bars below first dorsal fin, six bars below second dorsal fin and one bar at caudal peduncle. Ventrum light brown. Pectoral fin light yellowish with 10 to 12 curved thin brown bars, base with gold spot. Pelvic fin hyaline. First dorsal fin base yellow with dark brown patches, distal part reddish with white iridescent edge. Second dorsal fin yellowish with dark brown patches, distal part reddish with white iridescent edge. Anal fin dull reddish-brown with thin white edge. Caudal fin base with golden bar, whitish spot at base of upper caudal rays; upper and lower bands of caudal fin light reddish with white edge, middle section blackish with six to eight thin white bars, thin white margin.

Female: Head coloration similar to male, except golden stripe is faint. Body dorsum similar to male. Body with nine brown bars, one bar anterior to first dorsal fin, two bars below first dorsal fin, one bar in between dorsal fins, four bars below second dorsal fin and two bars at caudal peduncle. Ventrum light brown. Coloration of pectoral, pelvic, anal and caudal fins similar to male. First and second dorsal fins with black rays, hyaline interradial membrane, subdistal reddish band with white margin.

Preserved coloration. – See Figs. 4A-B for preserved coloration of male and female specimens. Body light creamy

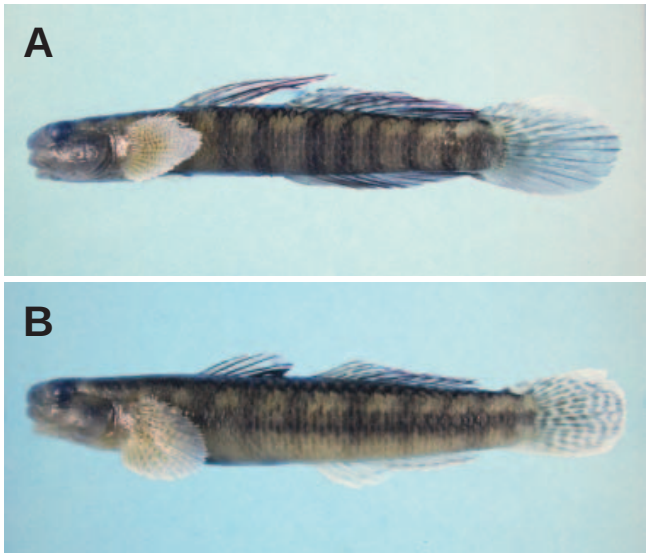

Fig. 4. *Stiphodon aureorostrum*, new species: A, Preserved male holotype (ZRC 46412, 52.0 mm SL); B, Preserved female paratype (ZRC 46413, 60.3 mm SL).

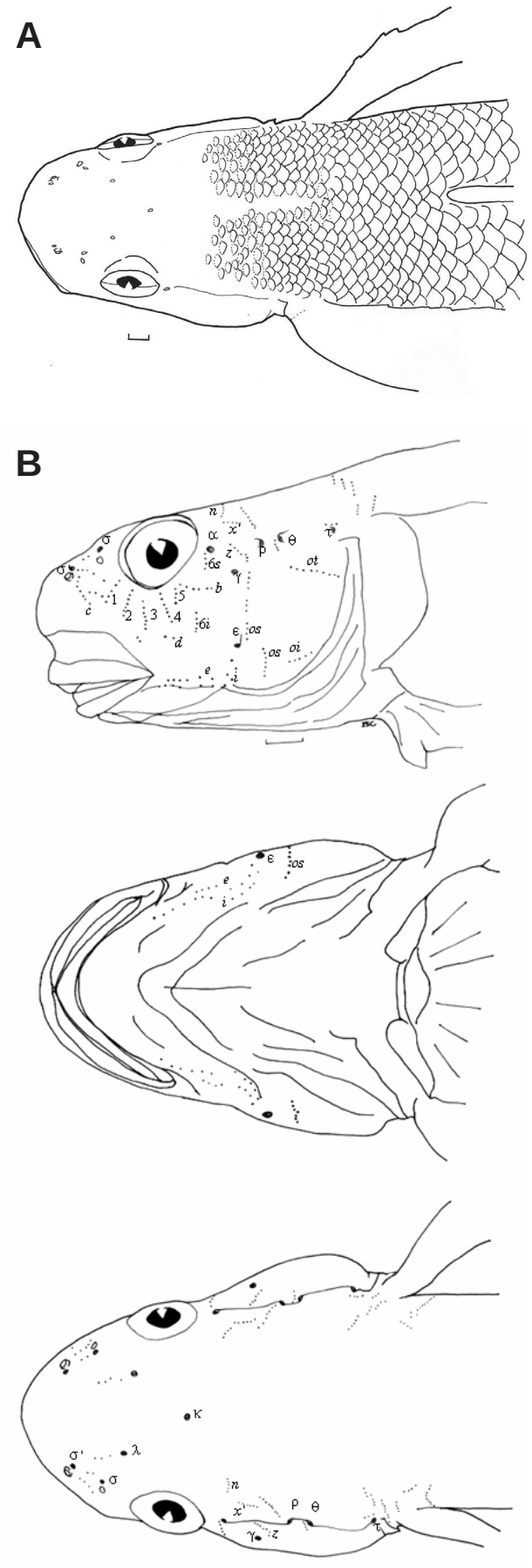

Fig. 5. A. Head squamation drawing (female; scale bar = 1 mm); B. Head pore pattern drawing (male; lateral, ventral and dorsal views, scale bar = 1 mm).

yellow, longitudinal stripe absent in male, a broad longitudinal, dark brown stripe present in lateral midline of female. Ten narrow dark brown cross-bars in body side of male which much narrower than its inter-space, four bars before second dorsal fin origin, six bars below second dorsal fin base to caudal peduncle; nine to ten light brown or indistinct bars in female. Upper half of lateral side with a longitudinal, blackish brown line behind eye to upper tip of caudal fin base. Dorsal part from nape to caudal fin origin with nine dark blotches, and scales on the blotches usually with distal dark brown spot. Ventral side of body creamy yellow. Head creamy yellow; greyish brown in snout to interorbital region, anterior cheek and opercle in male; a short black bar below eye, a horizontal, brown line surrounding lower part of snout to opercle. Interorbital region to dorsal part of snout with three pairs of dark brown spots in female. Upper lip greyish brown and lower lip whitish. First dorsal fin whitish with dark brown rays and posterior membrane behind fifth fin ray dusky brown in male; whitish with brown fin rays in which the first having two basal spots in female. Second dorsal fin greyish with darker rays in male; whitish in having three longitudinal rows of dark brown spots in female. Pelvic fin with dark grey membrane with whitish rays in male; whitish with a distal, narrow, longitudinal greyish black stripe in female. Pectoral fin whitish with a prominent longitudinal dark bar in female but indistinct in male; with ten to twelve vertical rows of brownish black dots on its fin rays. Caudal fin with six to eight vertical rows of black stripes in male, but usually separated as spots in posterior rows in female. Upper distal area of caudal fin whitish and lower one third dark grey in male.

Etymology. **–** From the combination of the Latin *aureus*, golden, and *rostrum*, snout. This is in allusion to the golden longitudinal band on the anterior and lateral aspects of snout on both sexes in life. Used as a noun in apposition.

***Distribution.* –** *Stiphodon aureorostrum* is known only from the freshwater streams of Pulau Tioman, Peninsular Malaysia. It is found in the lower reaches of Sungai Keliling, Juara Bay, eastern Tioman; however an individual was observed by ISC in the lower reaches of Sungai Paya on the western side of the island. This species appears to be rare in the type locality, which seems to be predominated by *Glossogobius celebius* (Gobiidae).

***Field observations.* –** *Stiphodon aureorostrum* was observed in-situ (Fig. 2) grazing on the gravel substratum in Sungai Keliling, usually in a group of 8 to 10 individuals, usually with one or two *Glossogobius celebius* or *Lutjanus argentimaculatus* (Lutjanidae) following closely behind. This species appears to prefer areas of slow to moderate water flow, whereas its sympatric congener, *S. atropurpureus* seems to prefer faster flowing water amongst large rocks. *Stiphodon aureorostrum* can also be found in areas of faster water flow but in smaller groups of 3 to 4 individuals. The genus *Stiphodon* was not found further upstream, possibly due to competition with *Puntius lateristriga* (Cyprinidae). Nocturnal observations were attempted. *Stiphodon aureorostrum* were not seen, only *Clarias leiacanthus* (Clariidae) was active.

Table 1. Morphometric data of *Stiphodon aureorostrum*.

	Holotype	male specimens (n=5)		female specimens (n=6)	
SL (mm)	52.0	41.2-55.1		38.9-60.3	
% SL		range	average	range	average
head length	23.4	22.4-23.4	22.9	21.1-22.5	21.6
snout to first dorsal fin length	34.0	32.9-35.5	34.2	33.9-36.3	34.5
snout to second dorsal fin length	55.8	54.7-57.8	56.0	55.2-58.0	56.5
snout to anus length	52.4	49.8-52.4	51.1	50.0-57.6	53.5
snout to anal fin origin length	56.1	53.6-56.2	54.9	55.9-59.0	57.4
prepelvic length	23.3	22.7-23.4	23.1	19.9-23.6	21.1
caudal peduncle length	19.1	18.4-19.6	18.9	16.7-20.0	18.4
caudal peduncle depth	10.6	10.4-12.2	11.2	10.2-11.5	10.8
first dorsal fin base length	18.1	16.4-20.1	17.7	15.3-19.6	17.0
second dorsal fin base length	27.2	26.6-28.8	27.8	23.5-24.8	24.2
anal fin base length	28.2	27.6-31.3	29.2	25.6-26.9	26.3
pectoral fin length	21.8	20.6-24.0	22.3	18.3-22.5	20.8
caudal fin length	27.7	23.1-29.5	25.7	20.3-23.1	21.5
pelvic fin length	15.4	14.3-16.8	15.3	13.3-16.1	14.7
body depth at pelvic fin origin	13.8	13.5-14.9	14.1	12.5-15.3	13.6
body depth at anal fin origin	14.4	14.2-16.8	15.5	14.8-17.5	16.0
body width at anal fin origin	13.8	13.1-15.5	14.2	10.0-16.4	12.3
distance between pelvic fin origin and anus	28.8	28.8-30.0	29.4	30.6-33.9	32.3
% HL					
snout length	41.8	35.4-41.8	37.8	18.8-43.1	37.1
eye diameter	21.2	17.3-21.2	20.0	21.4-43.4	26.1
cheek diameter	24.1	23.2-26.2	24.1	21.1-31.4	24.7
postorbital length	40.0	40.0-50.5	44.3	37.7-49.8	45.5
maximal head width	73.6	68.8-73.6	70.8	61.9-76.7	71.3
head width at upper margin of gill-opening	58.5	56.4-59.6	58.4	55.0-65.9	61.1
fleshy-int	43.6	39.3-43.8	42.1	38.8-46.0	41.8
lower jaw length	40.0	36.7-40.0	38.6	35.8-42.7	38.6
% caudal peduncle length					
caudal peduncle depth	55.6	55.6-65.5	59.0	55.9-64.5	58.8

***Comparison with related species.* –** Among its congeners, the new species *Stiphodon aureorostrum* most resembles *S. multisquamus* Wu & Ni, 1985, from Hainan Island. They have similar pattern of spotted pectoral fin and several meristic features, but *S. aureorostrum* differs from *S. multisquamus* in the following characters: 1) larger body size (vs. smaller); and more elongated first dorsal fin rays in males (vs. less elongate); 2) predorsal squamation with more scale extension to anterior region (vs. fewer scale extension); 3) body more slender and elongated (vs. less slender and elongated); 4) absence of any blue on head and the lateral side in stead of golden snout in former male (vs. distinct blue background); and 5) narrower dark transverse bars in former male (vs. iridescent blue).

Stiphodon aureorostrum is also rather similar to the large sized Ryukyu endemic species – *S. imperiorientis* Watson & Chen, 1998, in sharing the spotted pectoral fin and distinct sexually dimorphic predorsal scale pattern. However, *S. aureorostrum* can be distinguished from *S. imperiorientis* by the following features: 1) larger body size (vs. smaller); 2) first dorsal fin with third spine longest in males (vs. fourth dorsal spine longest); 3) with more numerous (about 12) and broader dark bars on body in male (vs. fewer and narrower dark bars); 4) golden stripe across snout in life male (vs. snout and cheek iridescent blue); 5) caudal fin red in upper distal region in male (vs. no pattern); and 6) distinct dark bars on body of female (vs. absence of bars).

***Remarks*. –** There is still a need to investigate the true diversity of the giant *Stiphodon* species found in the hill stream habitats of different river basins draining into the South

Table 2. Frequency of selected meristic counts of *Stiphodon aureorostrum*.

	pectoral fin rays		longitudinal scale row					transverse scale row		predorsal scales							
	15	**16**	**33**	**34**	**35**	**36**	**37**	**9**	**10**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
male	9	1	1	3	4	2	-	3	2	3	1	1	-	-	-	-	-
female	10	2	-	-	5	4	3	4	2	-	-	-	1	1	2	1	1

	scales between origin of first dorsal fin and upper margin of pectoral fin base						maximal extension of predorsal scale series											
	11	**12**	**13**	**14**	**15**	**16**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
male	1	2	2	-	-	-	1	1	1	2	-	-	-	-	-	-	-	-
female	-	-	1	2	1	2	-	-	-	-	-	-	-	-	2	2	1	1

Male (n=5), female (n=6)

China Sea. There are most probably several unnamed species in this region (Chen, in preparation).

Comparative material

Stiphodon imperiorientis Watson & Chen, 1998 – Holotype: NSMT.P 48063, 48.1 mm SL; Japan: Ryukyu Islands, Okinawa; Iriomote Island, Nakama River, Yaemama-gun; 2 Sep.1986. Paratypes: BLIH 19811202, 42.7 mm SL, same locality as above (10 Jul.1981); BLIH 1986400, 43.4 mm SL, same locality as above (2 Nov.1986).

Stiphodon multisquamus Wu & Ni, 1985 – ISP- uncatalogued, 2 ex., 38.6-45.3 mm SL; China: Guangdong Province, Hainan Island: Linshuei River basin, hill stream near Paoting; I-S. Chen, 1 Aug 1996.

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