

Three New Species of the Ptereleotrid Fish Genus *Parioglossus* (Perciformes: Gobioidae) from Japan, Palau and India

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Abstract Three new species of the ptereleotrid fish genus *Parioglossus*, *P. caeruleolineatus*, *P. senoui* and *P. winterbottomi* are described based on specimens from Japan, Palau and India. *Parioglossus caeruleolineatus* (8 specimens, 20.4–27.1 mm SL, Amami-oshima Island, Japan) differs from all other congeners in having a moderately oblique mouth at an angle of 51–58° (average 55°) to longitudinal axis of body, and a bright blue stripe running from nape to dorsum of caudal peduncle in male when fresh or alive. *Parioglossus senoui* (8 specimens, 17.5–22.9 mm SL, Babeldaob Island, Palau, and Iriomote-jima Island, Japan) differs from all other congeners in having three segmented pelvic-fin rays. *Parioglossus winterbottomi* (2 specimens, 31.0 and 37.8 mm SL, West Bengal, India) differs from all other congeners in having cheek and opercular scales, and the first dorsal fin shaped like a horse's mane in males. A revised key to the species of *Parioglossus* is provided.

Key words: *Parioglossus*, new species, Ptereleotridae, Japan, Palau, India.

The species of *Parioglossus* (Perciformes, Gobioidae, Ptereleotridae) form a group of small fishes that inhabit the warm temperate to tropical regions of the western Pacific and Indian Oceans, and are normally found around the roots of mangroves or algae in estuaries, or in tidal areas of rivers and coastal coral reefs. *Parioglossus* can be recognized by having the following combination of characters: separate pelvic fins with I, 3–4 rays in each; somewhat compressed head and slender body; oblique, protractile mouth; first dorsal pterygiophore formula 3/II II I I 0/9; gill opening narrow to moderate, ending ventrally at a vertical midway between posterior margin of preoperculum and posterior margin of operculum; interorbital head pores paired laterally when present; second dorsal fin with I, 13–19 rays (Rennis and Hoese, 1985; Keith *et al.*, 2004; Wang and Winterbottom, 2006; present study).

Parioglossus was established by Regan (1912)

for the type species *Parioglossus taeniatus* Regan, 1912, and now contains the following 18 species (Keith *et al.*, 2004; Wang and Winterbottom, 2006): *Parioglossus aporos* Rennis and Hoese, 1985, *Parioglossus dotui* Tomiyama, 1958, *Parioglossus formosus* (Smith, 1931), *Parioglossus galzini* Williams and Lecchini, 2004, *Parioglossus interruptus* Suzuki and Senou, 1994, *Parioglossus lineatus* Rennis and Hoese, 1985, *Parioglossus marginalis* Rennis and Hoese, 1985, *Parioglossus multiradiatus* Keith, Bosc and Valade, 2004, *Parioglossus neocaledonicus* Dingerkus and Séret, 1992, *Parioglossus nudus* Rennis and Hoese, 1985, *Parioglossus palustris* (Herre, 1945), *Parioglossus philippinus* (Herre, 1945), *Parioglossus rainfordi* McCulloch, 1921, *Parioglossus raoi* (Herre, 1939), *Parioglossus sinensis* Zhong, 1994, *Parioglossus taeniatus* Regan, 1912, *Parioglossus triquetrus* Rennis and Hoese, 1985, and *Parioglossus verti-*

calis Rennis and Hoese, 1985.

In Japan, 9 valid species and 2 unnamed species of *Parioglossus* were reported by Suzuki *et al.* (1994) and Suzuki and Shibukawa (2004): *P. dotui*, *P. formosus*, *P. interruptus*, *P. lineatus*, *P. palustris*, *P. philippinus*, *P. rainfordi*, *P. raoi*, *P. taeniatus*, *Parioglossus* sp. *sensu* Suzuki *et al.*, 1994, and *Parioglossus* sp. *sensu* Suzuki and Shibukawa, 2004. In this paper, we describe *Parioglossus* sp. of Suzuki *et al.* (1994) and *Parioglossus* sp. of Suzuki and Shibukawa (2004) as new species under the names of *Parioglossus senoui* and *Parioglossus caeruleolineatus* respectively. *Parioglossus senoui* was recently collected also from Babeldaob Island, Palau. In addition, a third unnamed species, herein described as *Parioglossus winterbottomi*, was collected from West Bengal, India. A revised key to the species of *Parioglossus* is given, based on the key proposed by Wang and Winterbottom (2006).

Materials and Methods

Institutional abbreviations follow Leviton *et al.* (1985), except for KPM (Kanagawa Prefectural Museum of Natural History, Japan).

Methods of counting and measurements follow Rennis and Hoese (1985), except as follows. Head depth and width were taken at the posterior margin of the preopercle. Body depth and width were taken at the origin of the anal fin. Longitudinal scale counts were taken along the lateral midline of the body from the base of the caudal fin to the pectoral-fin axil or above this point. With respect to the dorsal-fin spine appearance, we use the term “filamentous” to describe the spine(s) having the filamentous distal part free from the fin membrane.

Counts and measurements were made on the holotype, and 4 paratypes of each species (one paratype in *P. winterbottomi*) that were in good condition. Fin-ray branching and the cephalic sensory system were described from preserved material stained with cyanine blue solution. Vertebrae were counted from radiographs. Information on the branchiostegal rays, gill rakers, num-

ber and distribution of the scales, teeth and procurent caudal rays were obtained from 1 paratype of each species stained with alizarin red.

The notation of the pattern of interdigitation of the dorsal-fin proximal pterygiophores between the neural spines (P–V) and cephalic sensory canals follow Akihito (1984). Descriptions of fresh coloration were based on color slides of each species; live coloration was based on underwater or aquarium photographs in the Image Database of Fishes in the Kanagawa Prefectural Museum of Natural History (KPM-NR) (<http://research.kahaku.go.jp/zoology/photoDB/>). The names of colors follow the recommendations of the Japan Color Research Institute (1995).

Measurements are given in Table 1. In each description, data for the holotype are given first, followed by data for the paratype (s) in parentheses where different.

Specimens of *P. senoui* from Palau were collected under permit RE07-04 (2007) and exported to Japan under an export permit 46417-B (2008).

Parioglossus caeruleolineatus sp. nov.

(New Japanese name: Kujaku-haze)

(Figs. 1–4)

Parioglossus sp.: Suzuki and Shibukawa, 2004: 500 (underwater photograph, Amami-oshima Island, Amami Group of the Ryukyu Islands, Japan, 0.5 m depth).

Holotype. OMNH-P 35160, male, 27.1 mm SL, Uchiumi, Amami-oshima Island, Amami Group of the Ryukyu Islands, Japan, 28°17'20"N, 129°26'43"E, 0.5 m depth, T. Yonezawa, 2 May 2003.

Paratypes. KAUM-I. 21465, male, 26.5 mm SL; OMNH-P 35162, female, 20.4 mm SL, cleared and stained; KAUM-I. 21466, female, 22.6 mm SL; KPM-NI 23891, female, 21.2 mm SL; NSMT-P 96052, female, 22.0 mm SL; OMNH-P 35161, female, 23.0 mm SL; ROM 84674, female, 26.1 mm SL, all collected with the holotype.

Photographic records from the Image Database of Fishes. KPM-NR 94529, male, May 2005; KPM-NR 94530, male, May 2007; KPM-NR 94531, female, Nov. 2002, T. Yonezawa, same locality as type specimens.

Table 1. Measurement (% SL) for *Parioglossus caeruleolineatus*, *P. senouii* and *P. winterbottomi*.

	<i>P. caeruleolineatus</i>				<i>P. senouii</i>				<i>P. winterbottomi</i>			
	Holotype		Paratypes		Holotype		Paratypes		Holotype		Paratype	
	OMNH-P 35160 (male)	KAUM-I 21465 (male)	3 females* ¹	OMNH-P 35163 (male)	KPM-NI. 23892 (male)	3 females* ²	ROM 84676 (male)	NSMT-P 97463 (female)				
Standard length (mm)	27.1	26.5	22.6–26.1	22.2	21.5	19.0–22.9	37.8	31.2				
Head length (include meb.)	20.6	21.4	21.3–25.4	23.8	22.3	21.3–24.0	18.3	20.9				
Head depth of preopercular margin	12.1	12.7	13.6–16.3	16.9	14.7	14.9–16.2	14.5	15.7				
Head width of preopercular margin	10.3	10.1	11.4–12.5	11.7	16.1	10.9–11.5	10.4	12.0				
Body depth of anal-fin origin	12.1	12.0	11.8–16.7	15.2	16.1	14.1–15.9	15.0	16.0				
Body width of anal-fin origin	8.5	8.0	9.6–11.7	7.4	7.1	6.7–7.2	9.1	9.8				
Caudal-peduncle length	10.6	8.7	10.7–12.5	19.5	17.0	14.6–18.3	13.7	13.5				
Caudal-peduncle depth	8.2	8.3	8.5–10.8	10.4	9.8	8.9–9.6	11.4	11.7				
Longest first dorsal-spine	18.1 (3rd)	17.8 (3rd)	7.4–8.8 (3rd)	11.7 (5th)	12.1 (5th)	11.1–13.0 (5th)	31.7 (2nd)	14.5 (2nd)				
3rd first dorsal-spine	18.1	17.8	7.4–8.8	9.5	9.8	8.5–13.1	28.7	12.3				
Longest second dorsal-ray	9.9 (3rd)	10.5 (3rd)	10.7–12.1 (3rd)	14.7 (3rd)	13.4 (3rd)	9.8–13.0* ³	24.8 (3rd)	14.5 (2nd)				
Pectoral fin length	14.9	17.0	15.4–17.9	17.3	15.2	15.7–17.2	14.5	14.5				
Pelvic fin length	12.8	10.9	9.9–11.7	11.3	10.7	9.8–11.7	17.8	11.7				
Caudal fin length	17.0	16.3	15.8–19.6	20.8	20.1	18.3–20.7	24.6	18.2				
Snout length	5.3	5.4	5.5–6.4	5.6	5.8	4.0–5.5	5.3	5.5				
Eye diameter	5.7	5.8	6.3–7.1	6.1	7.1	6.4–8.0	6.1	6.5				
Upper jaw length	8.2	8.0	8.5–10.0	8.7	8.0	8.1–9.0	10.9	7.7				
Bony interorbital width	2.5	2.9	2.9–3.4	3.9	2.7	2.9–3.8	3.6	4.0				

*1: KAUM-I. 21466, OMNH-P 35161 & ROM 84674; *2: OMNH-P 35164, KPM-NI 23893 & ZUMT 60443; *3: 2nd or 3rd

Diagnosis. *Parioglossus caeruleolineatus* differs from all other congeners in having a gently oblique mouth at an angle of 51–58° (average 55°) to longitudinal axis of body, and a bright blue stripe running from nape to dorsum of caudal peduncle in male when fresh or alive.

Description. Dorsal fin VI-I, 15; anal fin I, 15 (16 in three); pectoral fin 19 (20 in two); pelvic fin I, 4; segmented caudal-fin rays 9+8; branched caudal-fin rays 7+6; P-V 3 /II II I I 0 / 9; vertebrae 10+16=26. The following meristic characters are described based on the cleared and stained paratype (OMNH-P 35162): longitudinal scales 57; transverse scales 20; predorsal scales 0; procurrent caudal fin rays 8+8; gill rakers 3+12=15; branchiostegals 5.

Anterior naris a simple pore with swollen surrounds, posterior naris a simple pore. Mouth oblique at an angle of 52° to longitudinal axis of body (51, 57, 58° in 3 paratypes). Upper jaw reaching posteriorly slightly beyond a vertical through anterior edge of eye. Sexual dimorphism not apparent in maxilla length. Nuchal crest low, but distinct, extending forward to above middle of operculum. Gill opening moderate, reaching anteroventrally to a vertical through middle of operculum.

The following characters are described based on the cleared and stained paratype (OMNH-P 35162). Head, pectoral-fin base and breast without scales. Scales of body small cycloid, nonimbricate and embedded; scales covering body from the upper side of posterior margin of operculum to end of caudal peduncle, including dorsally and ventrally on caudal peduncle, excluding narrow areas along bases of dorsal and anal fins, and ventral midline of belly. Teeth in both jaws conical, inwardly curved. Upper jaw with 2 rows of teeth anteriorly, narrowing to a single row posteriorly; outer row with 8 large teeth preceding 2 medium-sized teeth; inner row with 17 or 18 small teeth. Lower jaw with 2 rows of teeth anteriorly, narrowing to a single row posteriorly; outer row with 2 large teeth; inner row with 4 to 6 large teeth, followed by a row of 8 medium-sized teeth.

Anterior oculoscapular canal with pores B', C, D, E and F'; preopercular canal absent; three sensory papillae in mandibular symphyseal row (Fig. 1).

First dorsal fin higher than second dorsal fin (lower in females); shape of fin pointed (triangular in females); second to fifth spines elongate and filamentous (not elongate and filamentous in females); third spine longest, reaching posteriorly to interspace between base of first and second segmented rays of second dorsal fin when adpressed (reaching to base of second segmented ray of second dorsal fin in male; not reaching to origin of second dorsal fin in females); first dorsal fin attached to second dorsal fin via low membrane (not attached in 4). Distal margins of second dorsal and anal fins straight (slightly concave in 3); all except first segmented rays of dorsal and anal fins branched; third segmented ray

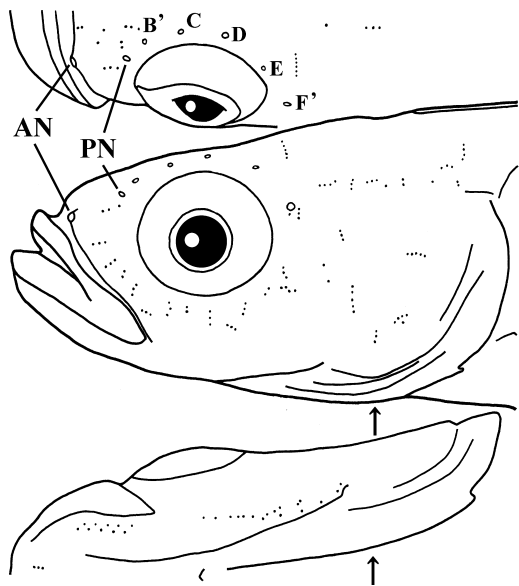


Fig. 1. The cephalic sensory system of *Parioglossus caeruleolineatus*, KAUM-I. 21466, paratype, 22.6 mm SL. Dorsal (top), lateral (middle) and ventral (bottom) views of head. The letters indicate the cephalic sensory canal pores. Dots represent the sensory papillae. AN and PN indicate anterior and posterior naris respectively. Arrows show position where gill membrane is attached to isthmus.

longest in second dorsal and anal fins; last ray of second dorsal and anal fins reaching to procurrent caudal-fin rays when adpressed (not reaching in females); height of anal fin equal to second dorsal fin; anal-fin origin at a vertical through interspace between bases of first and second segmented rays of second dorsal fin. Pectoral-fin margin rounded; all rays branched except for uppermost 1 and lowermost 2 rays (all but uppermost and lowermost rays branched in one; all but uppermost 2 and lowermost 2 rays branched in 1); pectoral fin reaching posteriorly to a vertical through interspace between bases of fifth and sixth spines of first dorsal fin. First 3 segmented pelvic-fin rays branched; fourth segmented ray unbranched; third segmented ray longest, not elongate, reaching posteriorly to a vertical through base of fifth spine of first dorsal fin when adpressed (reaching to a vertical through base of third spines in 1; base of fourth spines in 2); no pelvic-fin fraenum; no basal membrane. Caudal fin nearly truncate with round corners and a slight indent at center of posterior margin.

Color when fresh (Fig. 2). In male, background color of head and body dull yellow. Belly white; no dark stripe on ventral midline of belly; upper part grayish. A medium gray stripe running from posterior part of interorbital space along dorsal midline to dorsum of caudal peduncle; along lower margin of this stripe, a bright blue stripe running from nape to dorsolateral caudal peduncle. Head densely pigmented by minute medium gray dots. Bright blue spots and blotches on cheek, operculum, pectoral-fin base and at end of caudal peduncle. Anus pale. First dorsal fin bright blue. Second dorsal fin vivid greenish-yellow with clear anterior margin and medial stripe. Anal fin vivid greenish-yellow with clear anterior margin and bright blue basal stripe. Pectoral fin hyaline. Pelvic fin bright blue. Caudal-fin base with a black triangular or oblong blotch between sixth and 11th or 12th segmented rays; a pale lilac stripe running from dark blotch on base to near tips of ninth or 10th and 12th segmented rays of caudal fin; upper lobe of caudal fin with 2 oblique vivid greenish-yellow stripes;



Fig. 2. *Parioglossus caeruleolineatus*, fresh specimens. A: OMNH-P 35160, holotype, male, 27.1 mm SL; B: OMNH-P 35161, paratype, female, 23.0 mm SL. Uchiimi, Amami-oshima Island, the Ryukyu Islands, Japan. Photos by T. Yonezawa.

lower lobe of caudal fin with a vivid greenish-yellow stripe; remaining part of caudal fin bluish.

Female coloration resembles that of male except as follows. Belly bright blue posterolaterally. A medium gray stripe along dorsal midline breaking up into series of dashes below second dorsal fin and on dorsal area of caudal peduncle; along lower margin of this stripe, a medium gray stripe running from nape to dorsum of caudal peduncle. Snout, jaws and chin with many minute medium gray dots; upper operculum and pectoral-fin base with scattered medium gray blotches. Second dorsal fin with light yellow stripes on basal and distal margins. Base of caudal fin with a medium gray short band and oblong blotch between third and eleventh segmented rays; middle of fin dull yellow. Remaining fins hyaline.

Color in alcohol (Fig. 3). Bright yellow, blue and lavender colors faded in both sexes. Head and body pale yellow. Gray stripes, blotches and dots becoming deep yellowish-brown.

Color when alive (Fig. 4). Similar to fresh coloration except as follows. In males, head and body light gray; stripes and spots bright light bluish-green to sky-blue; a dark blotch on caudal-fin base with a dark red stripe. In female, head and body pale beige, semitranslucent; a series of light yellow and dark grayish-brown blotches along dorsal part of vertebral column.

Distribution and Habitat. Amami-oshima Island, Amami Group of the Ryukyu Islands, Japan. Although members of the genus *Parioglossus* normally swim in schools during high tide, this species hides in holes on muddy bottoms mixed with pebbles around the roots of mangroves in river mouths. During low tide, they leave the holes and gather in schools in the mangroves at a depth of about 60 cm (Suzuki and Shibukawa, 2004).

Etymology. The specific name is a combination of the Latin *caeruleo* meaning “blue,” and *lineatus* meaning “line,” in allusion to the distinctive bright blue stripe running from nape to dorsum of caudal peduncle in males when fresh or alive.

Remarks. *Parioglossus caeruleolineatus* is

most similar to *P. triquetrus*, which has 15–17 and 17–19 second dorsal-fin and pectoral-fin segmented rays respectively; 2–5+11–14 gill rakers; a simple pore-like anterior naris; moderate-sized gill opening reaching anteroventrally to a vertical through middle of operculum; no scales on nape and breast; anterior oculoscapular canal with 5 pores; no preopercular canal; no elongate spines of first dorsal fin in female; branched second dorsal and anal segmented rays except for first segmented ray; no stripe laterally on body in males; a dark stripe along dorsal midline; no dark stripe along ventral midline of belly; pale anus (Rennis and Hoese, 1985). But *P. caeruleolineatus* differs from *P. triquetrus* in having 15–16 anal-fin segmented rays (vs. 17–18 segmented rays in *P. triquetrus*, see Rennis and Hoese, 1985); 57 longitudinal scales (vs. 83–95); oblique mouth at an angle of 51–58° to longitudinal axis of body (vs. 65–75°); scales nonimbricate (vs. imbricate at least anteriorly); anterior extent of predorsal scales to above posterior margin of operculum (vs. middle of operculum); no scales on narrow areas along bases of dorsal fins, base of pectoral fin and ventral midline of belly (vs. present); second to fifth spines of first dorsal fin elongate in males (vs. second to sixth spines elongate in males); third spine longest in both sexes (vs. fourth spine longest in males, second to fifth spines subequal in females); first dorsal fin attached to second dorsal fin via low membrane occasionally (vs. never attached); pelvic fin without elongate, filamentous rays (vs. third and fourth segmented ray elongate, filamentous); caudal fin with a medium gray short band and oblong blotch on base of third to eleventh segmented rays in females (vs. triangular blotch on base of sixth to eleventh segmented rays); a pale lilac stripe on lower lobe of caudal fin in males (vs. no stripe in either sex); no small black spots just anterior to caudal blotch (vs. one or two small spots present, see Rennis and Hoese, 1985).



Fig. 3. *Parioglossus caeruleolineatus*, alcohol preserved specimens. A: OMNH-P 35160, holotype; B: OMNH-P 35161, paratype. Photos by T. Suzuki.

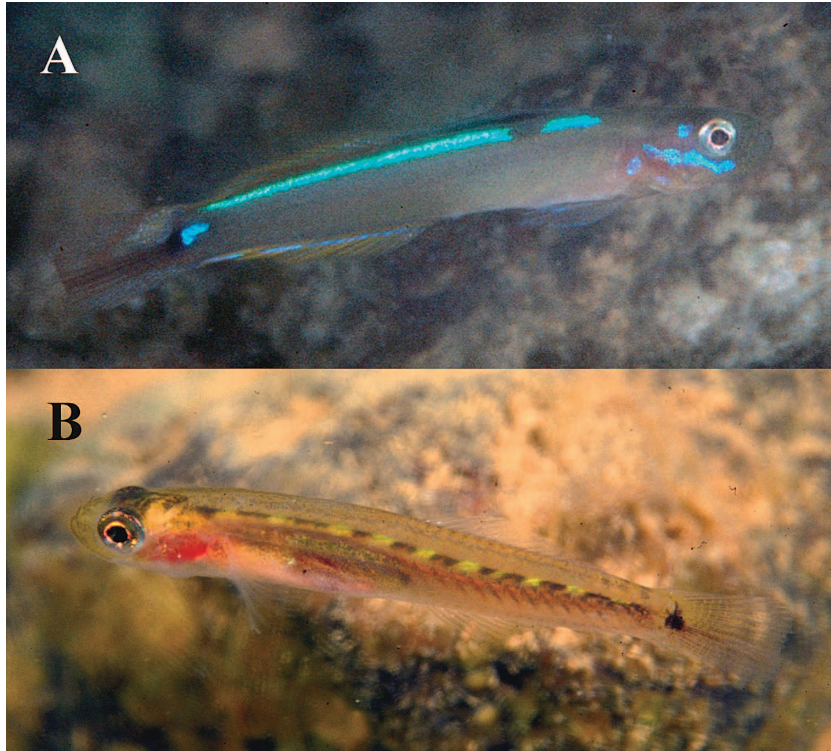


Fig. 4. *Parioglossus caeruleolineatus*, live. A: KPM-NR 94530, male, May, 2007; B: KPM-NR 94531, female, Nov. 2002. Uchiumi, Amami-oshima Island, the Ryukyu Islands, Japan, 0.5 m depth. Photos by T. Yonezawa.

***Parioglossus senoui* sp. nov.**

(Japanese name: Musume-haze)

(Figs. 5–8)

Parioglossus sp.: Suzuki *et al.*, 1994: 4, figs. 5, 6 (Iriomote-jima Island, Yaeyama Group of the Ryukyu Islands, Japan); Suzuki and Senou, 1994: 285 (Iriomote-jima Island, Yaeyama Group of the Ryukyu Islands, Japan); Akihito *et al.*, 2002: 126 (Iriomote-jima Island, Yaeyama Group of the Ryukyu Islands, Japan)

Holotype. OMNH-P 35163, male, 22.2 mm SL, Ngermetengel, Ngaremlengui State, Babeldaob Island, Palau, 07°31'8.88"N, 134°30'7.50"E, 0.5 m depth, J. Sakaue, 9 Dec 2007.

Paratypes. KPM-NI 23892, male, 21.5 mm SL; OMNH-P 35164, female, 22.9 mm SL; KPM-NI 23893, female, 22.6 mm SL; NSMT-P96053, female, 20.2 mm SL; OMNH-P 35165, female, 21.1 mm SL, cleared and stained; ROM 84675, male, 17.5 mm SL, collected with the holotype; ZUMT 60443, female, 19.0 mm SL, Hoshizuma-no-hama Beach, Iriomote-jima Island, Yaeyama Group of the Ryukyu Islands, Japan, 24°26'12.8"N, 123°46'30.8"E, 0.5 m depth, T. Suzuki, 23 Aug. 1989.

Photographic records from the Image Database of Fishes. KPM-NR 94522-94526, same data as holotype.

Diagnosis. *Parioglossus senoui* differs from all other congeners in having three pelvic-fin segmented rays.

Description. Dorsal fin VI-I, 13 (VII in one [ROM 84675]; 14 in three); anal fin I, 12 (13 in two, 14 in one); pectoral fin 16 (15 in one); pelvic fin I, 3; segmented caudal-fin rays 9+8; branched caudal-fin rays 7+6 (6+6 and 6+5 in each one); P-V 3 / II II I I 0 / 9 (3 / II II I I I / 9 in ROM 84675); vertebrae 10+16=26 (10+17=27 in ROM 84675). The following meristic characters are described based on the cleared and stained paratype (OMNH-P 35165): longitudinal scales 53; transverse scales 13; predorsal scales 0; procurrent caudal fin rays 8+8; gill rakers 2+11=13; branchiostegals 5.

Anterior naris with a short tube, posterior naris a simple pore. Mouth strongly oblique; (angle of 66, 66, 68, 72° to longitudinal axis of body in 4 paratypes). Upper jaw not reaching posteriorly to a vertical through anterior edge of eye (reaching to a vertical through anterior edge of eye in 2). Sexual dimorphism not apparent in length of

maxilla. Nuchal crest low, but distinct, extending forward to above middle of operculum. Gill opening moderate, reaching anteroventrally to a vertical through posterior third of operculum (reaching to a vertical through middle of operculum in 4).

The following characters are described based on the cleared and stained paratype (OMNH-P 35165). Head, pectoral-fin base and breast without scales. Scales of body small cycloid, nonimbricate; and embedded; scales covering from the upper side of posterior margin of operculum to end of caudal peduncle, excluding dorsal side of body, belly, and dorsal and ventral areas of caudal peduncle. Teeth in both jaws conical, inwardly curved. Upper-jaw teeth in a single row; 6 to 7 large teeth anteriorly, followed by 1 or 2 medium-sized teeth and 4 small teeth. Lower jaw with 2 rows of teeth anteriorly, narrowing to a single row posteriorly; outer row with 3 medium-sized teeth; inner row with a single small tooth preceding 2 or 3 large teeth, followed by a row of 10 to 12 small teeth.

No sensory canals and pores on head; a single sensory papillae in mandibular symphyseal row (Fig. 5). The cephalic lateral-line system of ZUMT 60443 was previously illustrated by Suzuki *et al.* (1994: fig. 3).

First dorsal fin rectangular, lower than second dorsal fin; fourth to sixth spines slightly elongate but not filamentous; fifth spine longest, not reaching posteriorly to origin of second dorsal fin when adpressed; posteriormost spine of first dorsal fin reaching posteriorly to interspace between origin and base of first segmented ray of second dorsal fin when adpressed (reaching to origin of second dorsal fin in 2; base of first segmented ray in 1); first dorsal fin attached to base of second dorsal fin via low membrane. Distal margins of second dorsal and anal fins slightly concave; all except first segmented rays of second dorsal and anal fins branched (second, third and fourth segmented rays branched in 1); third segmented ray longest in second dorsal and anal fins (second segmented ray longest in 1); last ray of second dorsal and anal fins not reaching to end of caudal

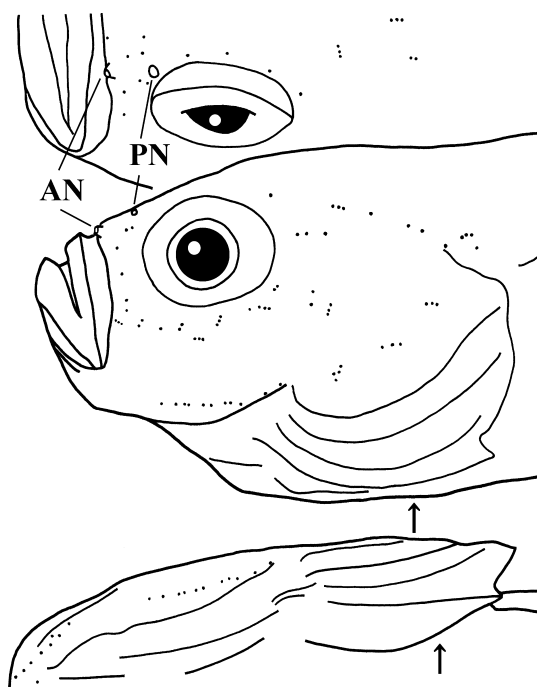


Fig. 5. The cephalic sensory system of *Parioglossus senoui*, OMNH-P 35163, holotype, 22.2 mm SL. Dorsal (top), lateral (middle) and ventral (bottom) views of head. Dots represent the sensory papillae. AN and PN indicate anterior and posterior naris respectively. Arrows show position where gill membrane is attached to isthmus.

peduncle when adpressed. Anal fin slightly lower than second dorsal fin (equal to second dorsal fin in 4); anal-fin origin at a vertical through base of second segmented ray of second dorsal fin (interspace between base of second and third segmented rays in 1). Pectoral-fin margin rounded; all segmented rays branched except for uppermost 1 and lowermost 2 rays (all but uppermost and lowermost rays branched in 1; all but uppermost 2 and lowermost 2 rays branched in 2); pectoral fin reaching posteriorly to a vertical through interspace between base of fifth and sixth spines of first dorsal fin (reaching to a vertical through interspace between bases of fourth and fifth spines in 2; reaching to a vertical through base of fifth spine in 2). First 2 segmented pelvic-fin rays branched; third segmented ray unbranched; second segmented ray longest, not elongate, reach-

ing posteriorly to a vertical through base of fifth spine of first dorsal fin when adpressed (reaching to a vertical through interspace between bases of third and fourth spines in 2; reaching to a vertical through base of fourth spine in 1); no pelvic-fin fraenum; no basal membrane. Caudal fin nearly truncate with a slight indent at center of posterior margin.

Color when fresh (Fig. 6). In male, background color of head and body pale yellow, semi-translucent. Ventral surface of head and belly white; no dark stripe on ventral midline of body. Head, body except for ventral surface of caudal peduncle, dorsal fins except for margins, anterior part of anal fin and pelvic fin densely pigmented by minute olive dots; an olive mid-dorsal stripe sometimes running from nuchal crest, along dorsal midline to dorsum of caudal peduncle. A subcutaneous diffuse, broad, medium gray stripe running midlaterally or somewhat ventrolaterally on head and body from posterior part of eye, through upper operculum and pectoral-fin base, to bases of ninth to 15th segmented rays of caudal fin; this stripe becoming darker in color on caudal peduncle, being connected to a black spot on base of caudal fin. A vivid yellow stripe on caudal fin, running from posterior end of the lateral dark stripe on body to posterior tips of ninth to 12th segmented caudal-fin rays. Anus pale, sometimes with black ring. Dorsal side of caudal peduncle and anterior part of upper lobe of caudal fin light yellow; remaining part of caudal fin hyaline. Anal and pectoral fins hyaline.

Female coloration resembles male, except as follows. Background color of head and body grayish. Yellow areas of caudal peduncle smaller and paler. Belly tinged with green posterolaterally. A medium gray stripe running from posterior end of the dark stripe on body to posterior tips of 10th and 11th segmented caudal-fin rays.

Color in alcohol (Fig. 7). Bright yellow, olive and green colors faded. Head and body pale yellow. A diffuse, broad dark grayish-brown stripe running ventrolaterally on body to center of caudal fin; this stripe becoming darker in color on caudal peduncle, being connected to a black spot



Fig. 6. *Parioglossus senoui*, fresh specimens. A: OMNH-P 35163, holotype, male, 22.2 mm SL; B: OMNH-P 35164, paratype, female, 22.9 mm SL. Ngermetengel, Babeldaob Island, Palau. Photos by J. Sakaue.



Fig. 7. *Parioglossus senoui*, alcohol preserved specimens. A: OMNH-P 35163, holotype; B: OMNH-P 35164, paratype. Photos by T. Suzuki.

on base of caudal fin.

Color when alive (Fig. 8). Similar to fresh coloration except as follows. Head and body light gray; dorsal fins yellowish; upper margin of cau-

dal fin bright blue. In male, bright blue spots present under eye and at end of caudal peduncle. In female, belly bluish-white with bright blue upper margin.

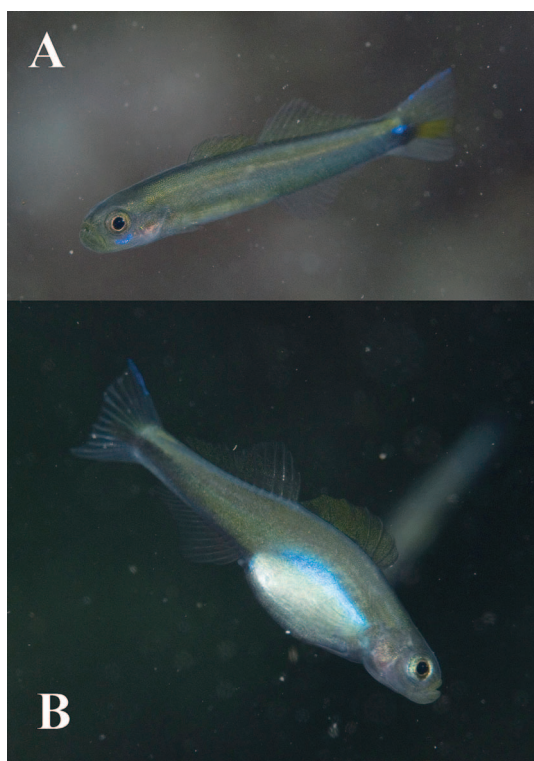


Fig. 8. *Parioglossus senoui*, live. A: KPM-NR 94526, male; B: KPM-NR 94523, female. Ngermetengel, Babeldaob Island, Palau. Photos by J. Sakaue.

Distribution and Habitat. Iriomote-jima Island, Yaeyama Group of the Ryukyu Islands, Japan; Babeldaob Island, Palau. This species gathers in schools around the bases of rock-islands in coral reef habitats at depths of about 20–60 cm.

Etymology. The new species is named after Dr. H. Senou (KPM), in honor of his great contribution to our knowledge of systematics and distribution of the fishes of Japan.

Remarks. *Parioglossus senoui* is most similar to *P. aporos*, which has 13–15, 13–14, and 15–16 segmented rays of second dorsal fin, anal fin and pectoral fin respectively; 2+10–13 gill rakers; moderate-sized gill opening extending anteroventrally to a vertical through middle of operculum; scales nonimbricate; anterior extent of predorsal scales to above posterior margin of opercle; no scales on nape, breast, base of pectoral fin, dorsal

surface of body and ventral midline of belly; no cephalic sensory canals and associated pores; all except first segmented second dorsal- and anal-fin rays branched in specimens greater than 22 mm SL; a diffuse dark stripe running ventrolaterally on tail, through bases of ninth to 15th segmented rays of caudal fin to posterior tips of 10th and 11th segmented rays (Rennis and Hoese, 1985). But *P. senoui* differs from *P. aporos* in having pelvic fin with three segmented rays (vs. four pelvic-fin segmented rays in *P. aporos*, see Rennis and Hoese, 1985); 53 longitudinal scales (vs. 63–75); anterior naris with a short tube (vs. a simple pore); rectangular first dorsal fin (vs. triangular in males at least), fourth to sixth spines of first dorsal fin slightly elongate and fifth spine longest in both sexes (vs. third to fifth spines elongate and fourth spine longest in males; no elongate spines and second to fifth spines subequal in females); first dorsal fin attached to second dorsal fin via a low membrane (vs. not attached); dorsal lobe of caudal fin without dark stripes (vs. a dark stripe present).

***Parioglossus winterbottomi* sp. nov.**

(Figs. 9–12)

Holotype. ROM 84676, male, 37.8 mm SL, Matla mudflats, Canning at South 24 Parganas District, West Bengal, India, 22°04'N, 88°38'E, from aquarium fish supplier in Kolkata, March 2009.

Paratype. NSMT-P 96054, female, 31.0 mm SL, collected with the holotype.

Diagnosis. *Parioglossus winterbottomi* differs from all other congeners in having scales on the cheek and operculum, and the first dorsal fin shaped like a horse's mane in males.

Description. Dorsal fin VI-I, 16; anal fin I, 17 (16); pectoral fin 17; pelvic fin I, 4; segmented caudal-fin rays 9+8; branched caudal-fin rays 7+6; P-V 3 / II II I I 0 / 9; vertebrae 10+16=26. The following meristic characters are described based on the cleared and stained paratype: longitudinal scales 104; transverse scales 30; predorsal scales 0; procurrent caudal fin rays 8+8; gill

rakers 4+12=16; branchiostegals 5.

Anterior naris with short tube, posterior naris a simple pore. Mouth strongly oblique at angle of 71° to longitudinal axis of body (66°). Upper jaw not reaching posteriorly to a vertical through anterior edge of eye (reaching to a vertical through anterior edge of eye). Nuchal crest low, but distinct, extending forward to above middle of operculum. Gill opening moderate, reaching anteroventrally to a vertical through middle of operculum.

The following characters are described based on the cleared and stained paratype. Cheek with 2 embedded, small cycloid scales posterodorsally; anterodorsal part of operculum, pectoral-fin base and breast with nonimbricate, embedded, small cycloid scales. Anterior extent of predorsal scales to above posterior preopercular margin, covering posteriorly and dorsally to origin of first dorsal fin. Scales of tail and area along lateral midline of trunk imbricate; remainder of body nonimbricate; scales on body extending posteriorly onto caudal-fin base as well as covering narrow areas along bases of dorsal and anal fins, ventral midline of belly, and dorsal and ventral areas of caudal peduncle. Teeth in both jaws conical, inwardly curved. Upper jaw with 2 rows of teeth anteriorly, narrowing to a single row posteriorly; outer row with 9 or 10 large teeth; inner row with 8 or 9 medium-sized teeth, followed by a row of five small teeth posteriorly. Lower jaw with 2 rows of teeth anteriorly, narrowing to a single row posteriorly; outer row with 2 large teeth; inner row with 1 or 2 medium-sized teeth preceding 3 large teeth, followed by a row of 9 or 10 medium- to small-sized teeth posteriorly.

Anterior oculoscapular canal with pores B', C, D, E and F' (C', D, E and F'); preopercular canal absent (present with pores N' and O'); a single sensory papillae in mandibular symphyseal row (Fig. 9).

First dorsal fin with membranes deeply incised, shaped like a horse's mane (triangular), higher than second dorsal fin; first to sixth spines elongate (slightly elongate); first to fifth spines filamentous (slightly filamentous); second spine

longest, reaching posteriorly to base of fourth segmented ray of second dorsal fin when adpressed (not reaching to second dorsal fin); sixth spine reaching posteriorly to beyond origin of second dorsal fin when adpressed (not reaching); first dorsal fin attached to base of second dorsal fin via low membrane (not attached). Distal margin of second dorsal fin convex (distal margins of second dorsal and anal fins concave); all segmented rays of second dorsal and anal fins unbranched except for third segmented ray of dorsal fin (except for third segmented ray of dorsal fin and second to fifth segmented rays of anal fin); sixth segmented ray of second dorsal fin longest (third segmented rays of second dorsal and anal fins longest); last ray of second dorsal and anal fins reaching to procurrent caudal fin rays when adpressed (not reaching to procurrent caudal fin rays); state of fin margin and ray lengths of anal

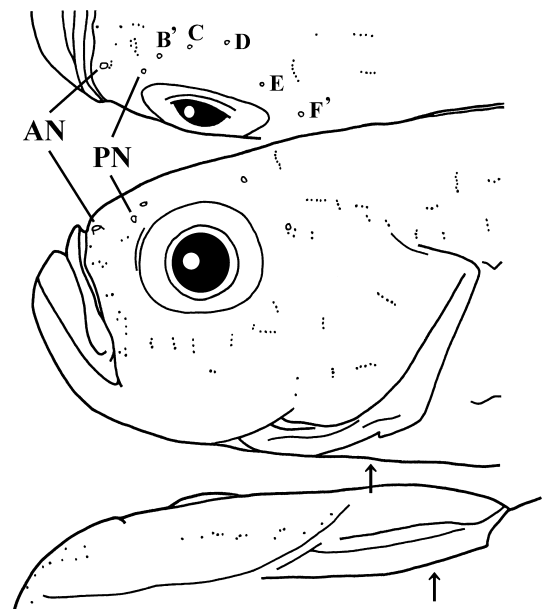


Fig. 9. The cephalic sensory system of *Parioglossus winterbottomi*, ROM 84676, holotype, 37.8 mm SL. Dorsal (top), lateral (middle) and ventral (bottom) views of head. The letters indicate the cephalic sensory canal pores. Dots represent the sensory papillae. AN and PN indicate anterior and posterior naris respectively. Arrows show position where gill membrane is attached to isthmus.

fin unclear due to broken middle rays. Anal fin not as high as second dorsal fin (equal); anal-fin origin at a vertical through base of second segmented ray of second dorsal fin. Pectoral-fin margin rounded; all segmented rays branched except for uppermost 1 and lowermost 2 rays; pectoral fin reaching posteriorly to a vertical through interspace between bases of fourth and fifth spines of first dorsal fin (reaching to a vertical through base of fourth spine). First 3 segmented pelvic-fins rays branched; fourth segmented ray unbranched; fourth segmented ray on left side broken; fourth segmented ray on right side longest, but not elongate, reaching posteriorly to a vertical through base of fifth spine of first dorsal fin when adpressed (reaching posteriorly to a vertical through base of fourth spine); no pelvic-fin fraenum; no basal membrane. Caudal fin nearly emarginate with round corners (round with a

slight indent at center of posterior margin).

Color when fresh (Figs. 10, 11). In male, background color of head and trunk bright greenish-yellow, tail dull yellow. Ventrolateral head and belly white. Upper and lower side of eye, posterior part of upper lip and ventral part of cheek bright red. A board, bright blue stripe running midlaterally on head and trunk from suborbital and postorbital areas, through upper part of operculum and pectoral-fin base, to tail. Scale pockets on dorsal side of body with light brown margins. A pink diffuse stripe running from above origin of pelvic fin, along ventral midline of body, to base of 13th segmented ray of caudal fin. Anus surrounded with black. Dorsal fins bright red with many sky-blue rounded spots; basal and posterior dots of second dorsal fin greenish; second dorsal fin with sky-blue margin. Basal and anterior parts of anal fin sky-blue; posterior part

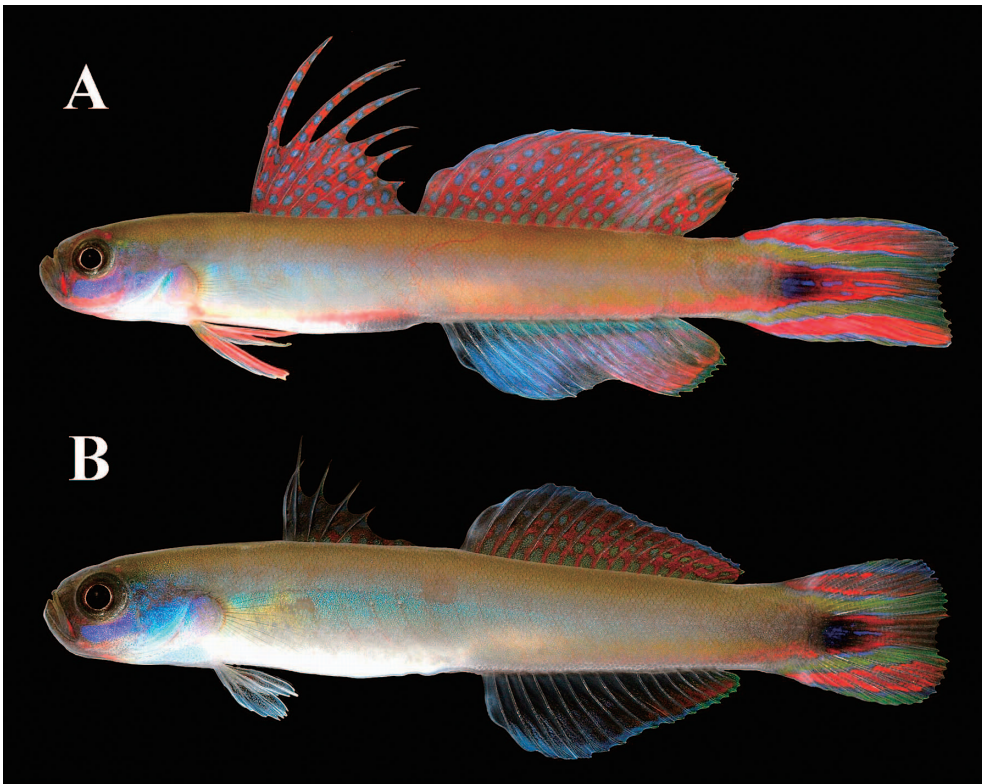


Fig. 10. *Parioglossus winterbottomi*, fresh specimens. A: ROM 84676, holotype, male, 37.8 mm SL; B: NSMT-P 97463, paratype, female, 31.0 mm SL. Matla mudflats, Canning at South 24 Parganas District, West Bengal, India. Photos by T. Suzuki.

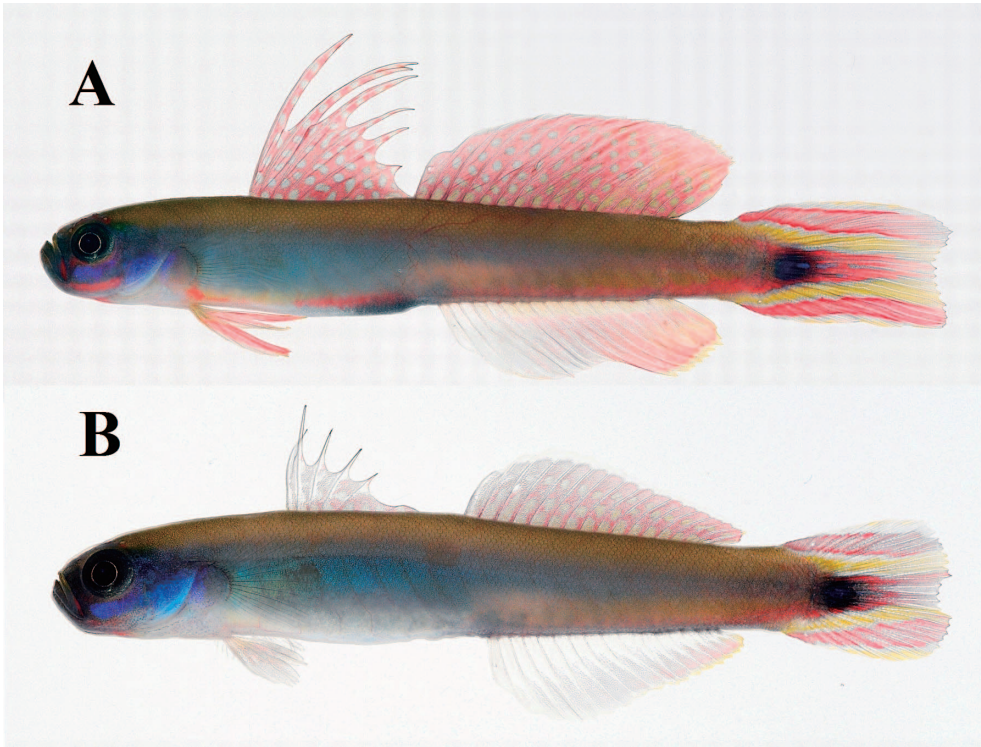


Fig. 11. *Parioglossus winterbottomi*, fresh specimens. A: ROM 84676, holotype, male; B: NSMT-P 97463, paratype, female. Photos by T. Suzuki.

pink with pale green margin. Caudal fin with three bright blue-margined, broad, bright red stripes and a strong purplish-blue oblong blotch between eighth and 12th segmented ray bases; upper stripe running from upper procurrent rays to tips of fifth and sixth segmented rays; middle stripe running from bases of eighth to 13th segmented rays to tip of ninth segmented ray; lower stripe running from lower procurrent rays to tips of 12th and 13th segmented rays; remaining part of caudal fin light yellow. Pelvic fin pink with white anterior margin. Pectoral fin hyaline.

Female coloration resembles that of male except as follows. No stripe on belly. Anus pale. Colors and markings of fins are paler. The middle stripe on caudal fin running from bases of eighth to 14th segmented rays to tips of eighth to 10th segmented rays of caudal fin; an oblong blotch between eighth and 13th segmented ray bases. Pelvic fin white.

Color in alcohol. Bright yellow, red and blue

colors faded. Head, body and fins, except for pectoral fin, yellowish-gray. Posterior part of head medium gray. An oblong blotch at base of caudal fin black.

Color when alive (Fig. 12). The live colors and markings are much brighter than fresh except as follows. Cheeks bright pale green. An oblong blotch on caudal-fin base absent. Deep pink stripe on ventral side of body running from above origin of pelvic fin to tip of ninth segmented ray of caudal fin.

Distribution. Matla mudflats, Canning at South 24 Parganas District, West Bengal, India.

Etymology. The new species is named after Dr. R. Winterbottom (ROM), in honor of his great contribution to our knowledge of the systematics of the Gobioidaei.

Remarks. *Parioglossus winterbottomi* is most similar to *P. palustris*, which has 16–17, 16–18 and 16–19 segmented rays of second dorsal, anal and pectoral fins respectively; anterior naris with

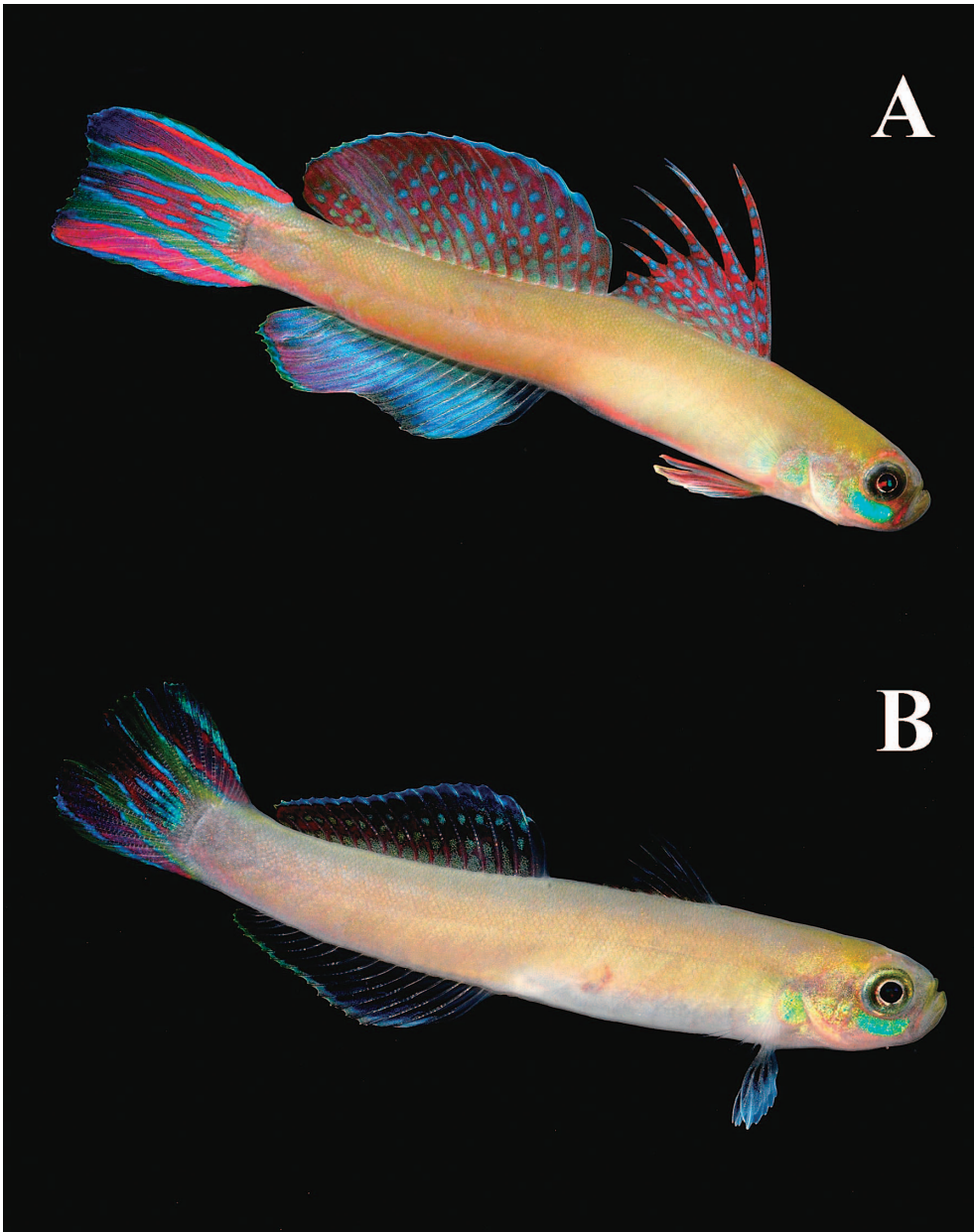


Fig. 12. *Parioglossus winterbottomi*, live. A: ROM 84676, holotype; B: NSMT-P 97463, paratype. Aquarium photos by T. Suzuki.

a short tube; scales on pectoral-fin base, breast, narrow areas along bases of dorsal and anal fins, ventral midline of belly, and dorsal and ventral areas of caudal peduncle; posterior rays of second dorsal and anal fins unbranched; no dark stripe on body; and a dark round blotch at base of

caudal fin (Rennis and Hoese, 1985; Suzuki *et al.*, 1994). But *P. winterbottomi* differs from *P. palustris* in having 104 longitudinal scales (vs. 78–89 in *P. palustris*, see Rennis and Hoese, 1985 and Suzuki *et al.*, 1994); 4+12 gill rakers (vs. 3+13–15); moderate-sized gill opening

reaching anteroventrally to a vertical through middle of operculum (vs. narrow, reaching to a vertical through posterior quarter of operculum); scales of tail and an area along lateral midline of trunk imbricate, remainder of head and body scales nonimbricate (vs. all scales on head and body imbricate); scales on cheek and operculum (vs. absent); anterior extent of predorsal scales to above posterior margin of preopercle (vs. middle of operculum); no scales on nape (vs. present); membranes of first dorsal fin deeply incised, shaped like a horse's mane, first to fifth spines of first dorsal fin filamentous, and second spine longest in male (vs. pointed, second or third to

fifth spines elongate but not filamentous, and fourth spine longest); second spine slightly elongate and longest in female (vs. third to fourth spines slightly elongate and third spine longest); first dorsal fin attached to second dorsal fin via low membrane in male (vs. not attached); dorsal fins with many sky-blue round spots when both fresh and alive (vs. without many rounded spots); a round dark blotch at base of middle caudal-fin rays when fresh (vs. a round dark blotch at base of lower lobe of caudal fin); three stripes on caudal fin (vs. two stripes); anus black in male, pale in female (vs. pale to lightly spotted in both sexes).

Key to the Adult of Species of *Parioglossus*

- 1a. Pelvic fin I, 3 (Palau, Ryukyu Islands) *P. senoui* sp. nov.
- 1b. Pelvic fin I, 4 2
- 2a. Head pores absent 3
- 2b. Head pores present 4
- 3a. Branched caudal-fin rays 7+6; body scaled; anal fin I, 13–14 (usually I, 14) (Indonesia)
..... *P. aporos*
- 3b. Branched caudal-fin rays 6+5; body naked; anal fin I, 16–17 (Fiji, Solomon Islands, Papua New
Guinea, Palau, Philippines) *P. nudus*
- 4a. 12–14 vertical bars laterally on body below second dorsal fin 5
- 4b. No vertical bars on body 6
- 5a. Scales nonimbricate; freshwater (New Caledonia) *P. neocaledonicus*
- 5b. Scales imbricate; marine (Caroline Islands) *P. verticalis*
- 6a. Distinct, dark lateral stripe present on body 7
- 6b. Lateral stripe absent or obscure stripe present without distinct dorsal and ventral margins 13
- 7a. Posterior nasal pore absent; scales imbricate or nonimbricate 8
- 7b. Posterior nasal pore present; scales nonimbricate 11
- 8a. Dorsal and anal fins usually I, 17–18 (rarely I, 16); posterior dorsal- and anal-fin rays unbranched
(Papua New Guinea, Papua, Ryukyu Islands) *P. interruptus*
- 8b. Second dorsal fin usually I, 14–15 (rarely I, 16); posterior dorsal- and anal-fin rays branched 9
- 9a. Dorsal edge of lateral stripe below lateral midline of body; black spot at base of dorsal spines 5
and 6; circumorbital pores 2–4; (Fiji, Caroline Islands, Papua, Indonesia, Philippines, Andaman
Islands, Singapore, Ryukyu Islands) *P. raoi*
- 9b. Dorsal edge of lateral stripe along midline; no black spot at base of dorsal spines 5 and 6; four
circumorbital pores 10
- 10a. Preopercular pores absent; scales non-imbricate; longitudinal scale count 97–107 (China)
..... *P. sinensis*
- 10b. Preopercular pores present; scales imbricate; longitudinal scale count 76–86 (Fiji, Palau, Philip-
pines, Aldabra, Ryukyu Islands) *P. taeniatus*
- 11a. Dorsal stripe on caudal fin present, extending obliquely downward to tips of rays above middle of

- fin; no dark vertical bar at base of caudal fin; preopercular pores present in specimens greater than 20 mm; anterior nasal opening a short tube (Fiji, Palau, Ryukyu Islands, Taiwan, Gulf of Thailand, Australia, Papua New Guinea, Indonesia, Philippines) ······ *P. formosus*
- 11b. No dark stripe on caudal fin; dark vertical bar at base of caudal rays; preopercular pores absent; anterior nasal opening a simple pore ······ 12
- 12a. Longitudinal scale count 75–83; dorsal and anal fins I, 15–16; marine (Palau, Solomon Islands, Ryukyu Islands) ······ *P. lineatus*
- 12b. Longitudinal scale count 98–109; dorsal fin I, 16–17 and anal fin I, 17–18; tidal area and fresh-water (Seychelles) ······ *P. multiradiatus*
- 13a. Branched caudal-fin rays 6+5, fifth dorsal-fin spine elongate in males over 20 mm, not elongated in females; gill opening narrow, ending ventrally just below lower pectoral-fin base; posterior dorsal- and anal-fin rays usually unbranched, occasionally branched but rarely all rays branched (Australia, Papua New Guinea, Philippines, Gulf of Thailand, India, Madagascar, Japan) ······
······· *P. philippinus*
- 13b. Branched caudal-fin rays usually 7+6, rarely 6+6 ······ 14
- 14a. Posterior dorsal- and anal-fin rays unbranched; preopercular pores present in specimens greater than 20 mm ······ 15
- 14b. Posterior dorsal- and anal-fin rays branched in specimens greater than 22 mm; preopercular pores present or absent ······ 16
- 15a. No scales on the cheek and operculum; the first dorsal fin pointed in males (Australia, Papua New Guinea, Borneo, Philippines, Ryukyu Islands) ······ *P. palustris*
- 15b. Scales on the cheek and operculum; the first dorsal fin shaped like a horse's mane in males (India) ······ *P. winterbottomi* sp. nov.
- 16a. Narrow gill opening, reaching to a vertical through posterior quarter of operculum; preopercular pores present (sometime absent in specimens less than 19 mm) (Australia, Papua New Guinea, Papua, Caroline Islands, Palau, Indonesia, Philippines, Ryukyu Islands) ······ *P. rainfordi*
- 16b. Moderate-sized gill opening, reaching anteroventrally to a vertical through middle of operculum; preopercular pores absent ······ 17
- 17a. Anterior nasal opening a simple pore; caudal fin with a triangular spot on base of caudal-fin rays ······ 18
- 17b. Anterior nasal opening a short tube; caudal fin with a stripe, a round to elongate spot, or several vertical bars ······ 20
- 18a. Longitudinal scale count 100–112 (Rapa) ······ *P. galzini*
- 18b. Longitudinal scale count 57–95 ······ 19
- 19a. Scales imbricate at least anteriorly, longitudinal scale count 83–95; mouth angle 65–75° to longitudinal axis of body (Fiji) ······ *P. triquestrus*
- 19b. Scales nonimbricate, longitudinal scale count 57; mouth angle 51–58° to longitudinal axis of body (Ryukyu Islands) ······ *P. caeruleolineatus* sp. nov.
- 20a. No dark stripe posterior to eye; fifth dorsal-fin spine elongate in males; males and females without distinct round to horizontally elongate spot on middle caudal-fin rays, males with stripe on middle rays of caudal fin extending to tips of rays, females with three to four vertical bars on middle rays; second dorsal and anal fins usually I, 17–18 (New South Wales, Australia)
······· *P. marginalis*
- 20b. Dark stripe posterior to eye; no dorsal-fin spines elongate in males; males and females with distinct round to horizontally elongate spot on middle caudal-fin rays, sometimes extending to tips of middle caudal-fin rays; second dorsal and anal fins usually I, 16–17 (Japan) ······ *P. dotui*

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