

Review of the Sand-diving Goby Genus *Parkraemeria* (Perciformes: Gobiidae), with Descriptions of Two New Species from the Ryukyu Islands, Japan

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Abstract The West Pacific gobiid fish genus *Parkraemeria* is reviewed. The genus comprises three species, viz. *P. ornata* Whitley, 1951, *P. saltator* sp. nov. and *P. rhinoceros* sp. nov. *Parkraemeria saltator* sp. nov. and *P. rhinoceros* sp. nov. are described herein based on 6 and 5 specimens from the Ryukyu Islands, Japan, respectively. *Parkraemeria saltator*, previously misidentified as *P. ornata* in Japan, is readily distinguished from *P. ornata* by having the following features: 8 + 7 = 15 segmented caudal-fin rays (vs. 7 + 6 = 13 or 7 + 7 = 14 in *P. ornata*); 12–13 segmented dorsal-fin rays (vs. 14–15); 13 segmented anal-fin rays (vs. 14); 14–15 pectoral-fin rays (vs. 12–13); larger head 29–30% SL (vs. 24–27%), longer pectoral and caudal fins 20–22% and 21–23% SL (vs. each fin shorter, 14–16% and 15–19% SL), and a rounded caudal fin (vs. oblong). *Parkraemeria rhinoceros* is readily distinguished from congeners by having the following features: tip of upper lip with a small anteriorly directed skin projection (vs. absent); six large black blotches on lateral midline of body (vs. four such blotches); and spinous portion of dorsal fin with a conspicuous black curved mark following edge of fin (vs. no such marking). *Parkraemeria* is re-diagnosed, and *P. ornata* is re-described based on four specimens including the holotype. A key to the species of *Parkraemeria* is provided.

Key words: Perciformes, Gobiidae, *Parkraemeria*, two new species, sand-diving goby, West Pacific.

Parkraemeria is a West Pacific fish genus of the gobiid subfamily Gobiinae (*sensu* Pezold 1993), and was originally described by Whitley (1951) for his new species, *P. ornata*, from Australia. Since then, *Parkraemeria* has been considered monotypic.

Hayashi (1984) recorded *Parkraemeria ornata* from Ishigaki-jima Island, Yaeyama Group of Ryukyu Islands, Japan. This represented the first record of the species outside Australia, although subsequent authors revealed a broader distribution in Japan and Australia (Akihito *et al.* 1993, 2002; Hoese and Larson, 2006; Larson and Murdy, 2001; Suzuki and Shibukawa, 2004).

Recently, the first author examined the holo-

type of *Parkraemeria ornata*, housed in the Australian Museum. Although the holotype was indeed similar to the Japanese specimens in general physiognomy, the former differed from the latter in a number of features including counts of segmented rays of all fins except the pelvic fin. Based on subsequent examination of several additional specimens, we conclude that the Japanese population is a distinct species, described herein as a new species, *Parkraemeria saltator*.

Another undescribed species of *Parkraemeria* is known from Japan (*Parkraemeria* sp. *sensu* Suzuki and Shibukawa, 2004). We describe herein this new species of *Parkraemeria*, *P. rhinoceros*, characterized by the tip of the upper lip

possessing a small anteriorly directed skin projection, and the lateral midline of the body with 6 large black blotches.

The objectives of this study are to: rediagnose *Parkraemeria*, describe two new species of *Parkraemeria*, redescribe *P. ornata* based on four specimens including the holotype, and provide the key to the species of *Parkraemeria*

Materials and Methods

Type specimens of the new species are deposited in the Kanagawa Prefectural Museum of Natural History, Odawara (KPM), the National Museum of Nature and Science, Tsukuba (NSMT) and the Osaka Natural History Museum, Osaka (OMNH). All fish lengths given are standard lengths (SL). Measurements were made with a micrometer under a dissecting microscope to the nearest 0.1 mm. The methods for measurements followed those of Hubbs and Lagler (1958), with exceptions given below (the snout tip refers to the mid-anteriormost point of the upper lip); interorbital width was the least width between the innermost rims of the right and left eye lens; jaw length was measured between the snout tip and the posteriormost point of the lip; head length included the gill membrane; head width and depth represent maximum values; body depth was measured twice, at the pelvic- and anal-fin origins; caudal-peduncle length was measured from the rear base of the last ray of the anal fin to the caudal-fin base; predorsal, preanal and prepelvic lengths were measured from the snout tip to the origin of each fin; pectoral-fin length was measured from the base of the uppermost ray to the tip of the longest ray; pelvic-fin length was measured between the anterior base of the pelvic-fin spine and the distal tip of the longest segmented ray; and caudal-fin length was measured from the base to the tip of the middle caudal-fin ray. The methods of counting followed Akihito (1984), except that gill rakers including all rudiments were counted on the outer side of the first arch. Osteological features were observed from radiographs. The methods of

Akihito (1984) were used in describing the pattern of the interdigitation of the dorsal-fin pterygiophores between the neural spines ("P-V"). Cephalic sensory canals and papillae were observed on specimens stained with cyanine blue, and notations on them followed Akihito (1984). Information about the counts of gillrakers and tooth morphology was obtained from a paratype or a non-type specimen stained with alizarin red. Description of the color when fresh was based on color slide transparencies. Color descriptions when alive were based on the underwater photographs in Yano (2004), and/or the Image Database of Fishes in the Kanagawa Prefectural Museum of Natural History (KPM-NR) (<http://fishpix.kahaku.go.jp/fishimage/index.html>). The names of colors follow the recommendations of the Japan Color Research Institute (1995). Measurements are given in Table 1. In the description of species, data for the holotype are given first, followed by data for the paratype(s) in parentheses where different.

Parkraemeria Whitley, 1951

[Japanese name: Ginpo-haze zoku]

Parkraemeria Whitley, 1951: 402 (type species: *Parkraemeria ornata* Whitley, 1951, by original designation and monotypy).

Included species. *Parkraemeria* comprises 3 species, *P. ornata* (known from east coast of Australia), *P. saltator* sp. nov. (known from the Ryukyu Islands) and *P. rhinoceros* sp. nov. (known from the Ryukyu Islands).

Diagnosis. *Parkraemeria* is distinguished from the other gobiine genera in having the following combination of characters: both dorsal fins united by membrane; VI, 12–15 dorsal-fin rays, all segmented; anal fin without spine, consisting of 13–14 segmented rays; dorsal and anal fins separated from caudal fin; 10 + 16 = 26 vertebrae; P-V 3/II II I I 0/9; no scales on head and body; body elongate, cylindrical to somewhat compressed, its depth at anal-fin origin 9–13% of SL; mouth large and oblique; jaws extending posteriorly beyond vertical through posterior

margin of eye; gill opening extending anteriorly to vertical through posterior margin of preopercle; gill membranes broadly attached to isthmus; right and left sides of anterior oculoscapular canals fused medially in interorbital space; anterior narial pore and interorbital pore absent; posterior oculoscapular canal not developed; anterior oculoscapular canal with pores B', D (single) and F' and preopercular canal with pores N' and O'; longitudinal pattern of sensory-papillae rows; and head and body white to brown with many small dark spots, and some large dark marks along lateral midline of body.

Parkraemeria are small fishes, living in sand or muddy sand in shallow marine to estuarine areas (Whitley, 1951; in this study).

Description. Dorsal-fin rays VI, 12–15, fins joined by membrane; anal-fin rays 13–14; pectoral-fin rays 12–15; pelvic-fin rays I, 5; segmented caudal-fin rays $6-8+6-7=12-15$, branched caudal-fin rays $5-6+3-5=8-11$; gill rakers $0-2+9-11=9-13$; vertebrae $10+16=26$; P-V 3/II II I I 0/9; 1 epural; 2 anal-fin pterygiophores anterior to first haemal spine; no scales on head and body.

Body elongate, cylindrical to somewhat compressed, its depth at anal-fin origin 9–13% of SL. Head length 24–31% SL; head width subequal to head depth; head depth 46–58% head length. Snout short, shorter than eye diameter (snout length 5–16% of head length); snout not protruding beyond upper lip; dorsal profile steeply descending before eye. Eye placed antero-dorsally; reaching above dorsal profile; moderately large, its diameter 16–19% of head length. Interorbital space moderately narrow, its width narrower than pupil diameter and 3–6% of head length. No cutaneous ridge along dorsal midline of nape. Gape oblique. Mouth terminal; jaws subequal in *Parkraemeria saltator*, whereas lower jaw slightly protruding in *P. ornata* and *P. rhinoceros*; posterior end of jaws reaching beyond vertical through posterior margin of eye. Anterior narial opening at tip of short tube or with low rim; no fleshy flap at tip of anterior naris; posterior narial opening a pore. Tongue

free from floor of mouth; anterior margin weakly emarginate. Gill opening moderately wide, extending anteriorly to vertical through posterior margin of preopercle; gill membranes broadly attached to isthmus. No fleshy projections on lateral wing of shoulder girdle. No bony projections along posterior margin of preopercle. Gill rakers on outer surface of ventral arm of first arch well developed, long and thin, finger-like; gill rakers on outer surface of dorsal arm of first arch distinctly shorter than dorsalmost gill raker on outer surface of ventral arm of first arch. Caudal peduncle slender, its depth 66–88% of its length.

Dorsal fins united by membrane; bases long; uniting membrane weakly emarginate; dorsal profile of spinous fin convex, dorsal profile of soft-rayed portion straight; all dorsal-fin spines slender, flexible; fifth spine longest but not elongate; the tip(s) of fifth spine or fifth and sixth spines reaching beyond base of first segmented ray when adpressed; dorsal fin higher posteriorly than anteriorly; posterior segmented rays of dorsal fin branched. Anal-fin origin on vertical line between bases of first and third segmented rays of dorsal fin; height of anal fin slightly lower than dorsal fin; no anal-fin spine; posterior segmented rays of anal fin branched. Dorsal and anal fins separated from caudal fin, penultimate and antepenultimate segmented rays of both fins reaching to or beyond caudal-fin base when adpressed. Pectoral fin oblong, extending to beyond terminus of pelvic fins in *Parkraemeria saltator* and *P. rhinoceros*, whereas extending to centre of pelvic fin in *P. ornata*; all pectoral-fin rays branched, apart from 0–2 dorsalmost simple ray(s). Pelvic-fin origin on vertical line with base of pectoral fin; pelvic fins moderately long, 17–23% SL, not reaching posteriorly to vertical through anus; pelvic fins united medially by well-developed frenum (between spines) and well-developed basal membrane (between medialmost rays); disc broadly oblong, flat; pelvic frenum moderately thin, with smooth posterior margin; no distinct fleshy lobes developed around pelvic-fin spine; all segmented pelvic-fin rays branched; innermost ray longest. Caudal fin

rounded in *Parkraemeria saltator*, but oblong in *P. ornata* and *P. rhinoceros*; symmetrical dorso-ventrally; caudal-fin length 15–24% SL.

Teeth in both jaws conical, slender, more or less inwardly curved; both jaws with two rows of teeth anteriorly, narrowing to single row posteriorly; posterior teeth smaller in size than those anterior; teeth of upper jaw smaller than teeth of lower jaw; no teeth on vomer or palatine. Anterior part of vomer not projecting ventrally behind symphysis of upper jaw.

Cephalic sensory systems of three species of *Parkraemeria* are illustrated in Figs. 1, 4 and 7. Cephalic sensory canals present in three species, right and left sides of anterior oculoscapular canals fused medially in interorbital space, anterior narial pore and interorbital pore absent, posterior oculoscapular canal not developed, anterior oculoscapular canal with pores B', D (single) and F' and preopercular canal with pores N' and O'. All cephalic sensory-papillae rows uniserial or comprising a single papilla, not forming multiple lines nor aggregations; reduced longitudinal pattern of sensory-papillae rows in *Parkraemeria saltator* and *P. rhinoceros*, with more developed longitudinal pattern in *P. ornata*.

Head and body white to brown with many small dark spots, and some large dark markings along lateral midline of body.

Comparisons. *Parkraemeria* is similar in appearance to kraemariids, but differs in having no anal-fin spine (vs. single spine in kraemariids), more than 12 caudal-fin segmented rays (vs. 11), 12–15 pectoral-fin ray (vs. 3–9), complete pelvic-fin frenum (vs. absent), no forward projection on chin (vs. a prominent forward projection present), no small flaps along lower edge of preopercle (vs. present), opercle not expanded and not covering pectoral-fin base (expanded and covering), eyes moderate (minute) (Hoese, 1986; Larson, 2001). *Parkraemeria* is very similar to the genus *Croilia* Smith, 1955 (monotypic: *Croilia mossambica* Smith, 1955) from southern Africa, in having the following combination of features: counts of dorsal-, anal- and pectoral-fin rays; dorsal fins united by membrane; second

dorsal and anal fins without spines; dorsal and anal fins separated from caudal fin; no scales on head and body; body elongate, cylindrical to somewhat compressed; gill opening extending anteriorly to vertical through posterior margin of preopercle; tongue emarginate; right and left sides of anterior oculoscapular canals fused medially in interorbital space; anterior narial pore and interorbital pore absent; preopercular canal with pores; posterior oculoscapular canal not developed; longitudinal pattern of sensory-papillae rows; head and body tan with many small dark spots; and occurring in sand or muddy sand in shallow waters (Hoese, 1986; Smith, 1955). Therefore, *Croilia* might be closely related to *Parkraemeria*. However, this hypothesis needs to be tested by examining the type specimens of *C. mossambica*.

Parkraemeria saltator sp. nov.

(Japanese name: Ginpo-haze)

(Figs. 1–3, Table 1)

Parkraemeria ornata (non Whitley, 1951): Hayashi, 1984: 287, pl. 257-F; Akihito *et al.*, 1993: 1059, 1108, fig. 7; Akihito *et al.*, 2002: 1223, 1297; Suzuki and Shibukawa, 2004: 438–439.

Holotype. NSMT-P 110743, male, 33.7 mm SL, mouth of Urauchi-gawa River, Irimote-jima Island, Yaeyama Group of Ryukyu Islands, Japan, 13 Aug. 2010.

Paratypes. KPM-NI 31128, female, 33.9 mm SL, same data as holotype; OMNH-P 34758 (male, cleared and stained, 35.6 mm SL) and 35278 (male, 31.4 mm SL), tidal flat, Maeda, west coast of Okinawa-jima Island, Okinawa Group of Ryukyu Islands, Japan, 29 Aug. 2008 and 20 Aug. 2009; OMNH-P 35384 and 35385, 2 females, 26.1 and 31.1 mm SL, tidal flat, Oura Bay, east coast of Okinawa-jima Island, Okinawa Group of Ryukyu Islands, Japan, 19 Aug. 2009.

Images examined (all registered in the Image Database of Fishes of KPM). KPM-NR 77310 and 77311, mouth of Urauchi-gawa River, Irimote-jima Island, Yaeyama Group of Ryukyu Islands, Japan, 8 May 2011, Rika Ikoma;

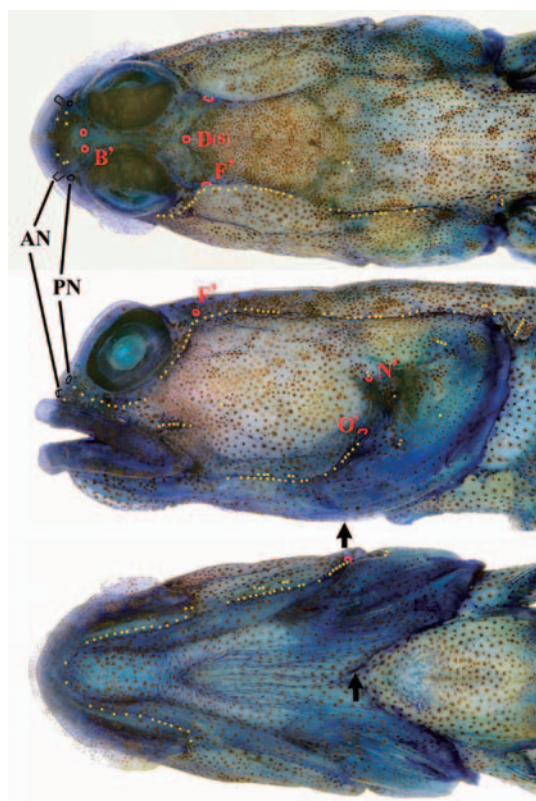


Fig. 1. Head of holotype of *Parkraemeria saltator* sp. nov., NSMT-P 110743, male, 33.7 mm SL, showing cephalic sensory pores and papillae. Top: dorsal view; middle: lateral view; bottom: ventral view. Red lines and red letters indicate sensory canal pores, and prime marks the terminal pores; AN: anterior narial pore; PN: posterior narial pore. Yellow dots represent the sensory papillae. Arrow shows position where gill membranes are attached to isthmus. Photographs and annotations by T. Suzuki.

KPM-NR 82542 and 94720, same locality as KPM-NI 77310, July 1999 and 14 June 2009, 1.5 m depth, Chikako Kasuga.

Diagnosis. *Parkraemeria saltator* differs from its congeners in the following combination of characters: dorsal-fin segmented rays 12–13; anal-fin segmented rays 13; pectoral-fin rays 14–15; caudal-fin segmented rays 8 + 7; large head 29–30% SL; long pectoral fin, reaching past end of pelvic fins, its length 20–22% SL; caudal fin long, 21–23% SL; snout long, 12–16% head

length; jaws subequal, posterior end of jaws reaching posteriorly to or beyond vertical at anterior oculoscapular canal pore F'; tip of upper lip without a small anteriorly directed skin projection; reduced longitudinal pattern of sensory-papillae rows; and caudal fin rounded.

Description. Dorsal-fin rays VI, 13 (12 in one paratype); anal-fin rays 13; pectoral-fin rays 14, all branched (15 in two paratypes, dorsalmost ray unbranched in three paratypes); pelvic fin I, 5; branched caudal-fin rays 6 + 5 (5 + 4 in one paratype); segmented caudal-fin rays 8 + 7; gill rakers 2 + 11 = 13 in one cleared and stained paratype; P-V 3/II II I I 0/9; vertebrae 10 + 16 = 26; 1 epural; 2 anal-fin pterygiophores anterior to first haemal spine.

Color when fresh. In male, ground color of head and body yellowish white with numerous minute black dots and many small yellowish-orange to reddish-orange spots. Head slightly blackish; cheek with a black blotch from eye to end of jaw; dorsal side of preopercle with a black blotch. Dorsal fin hyaline with many minute black dots and yellowish-orange margin; each ray with 2 to 4 small reddish-orange spots. Anal fin yellowish-orange with reddish-orange margin. Caudal fin pale pink; lower two thirds yellowish-orange; upper and lower margin reddish-orange; centre of fin with several short rows of small yellowish-orange spots. Pectoral fin light gray. Pelvic fins dark gray (Fig. 2A).

Female coloration resembles that of males except as follows: no numerous minute black dots on head, body, and dorsal, pectoral and pelvic fins; head and body except belly with many small yellowish-orange spots that overlie dark brown spots; body with 4 black blotches along lateral midline; dorsal, anal and caudal fins with reddish-orange margin and many small reddish-orange spots (Fig. 2C).

Color in alcohol. Yellow and red colors faded. Ground color of head and body white (Fig. 2B).

Nuptial color when alive. Similar to fresh coloration except as follows: head, body, and dorsal, pectoral and pelvic fins turn black in



Fig. 2. *Parkraemeria saltator* sp. nov. A: fresh, non-preserved holotype, NSMT-P 110743, male. B: alcohol-preserved holotype. C: fresh, non-preserved paratype, OMNH-P 35384, female, 31.1 mm SL. Photographs by T. Suzuki.

male; in female, head and body with many small white spots; 5 small white saddle-like marks crossing dorsum (Fig. 3).

Distribution. Okinawa-jima Island, Okinawa Group of Ryukyu Islands, Japan; and Iriomote-jima Island, Yaeyama Group of Ryukyu Islands, Japan. Also recorded from, Ishigaki-jima Island, Yaeyama Group of Ryukyu Islands, Japan (Hayashi, 1984).

Habitat. *Parkraemeria saltator* occurs on muddy bottoms of estuarine at depths of 0.5–2 m. They live in burrows dug by invertebrates. In the breeding season, males swim vertically above the burrows and display to females (Fig. 3A; Suzuki and Shibukawa, 2004).

Etymology. The specific name is the Latin

saltator meaning “dancer”, in allusion to the mating behavior of the male of this species.

Comparisons. *Parkraemeria saltator* differs from its congeners in having subequal jaws (vs. protruding lower jaw in *P. ornata* and *P. rhinoceros*), and rounded caudal fin (vs. oblong). Moreover, *P. saltator* differs from *P. rhinoceros* in having a longer snout, 12–16% head length (vs. 5–9% in *P. rhinoceros*), and the tip of the upper lip without a skin projection (vs. a small anteriorly directed skin projection present); it lives in burrows in muddy bottoms of tidal flats around river mouths at 0.5–2 m depth (vs. coral sand bottoms of bays at 5–12 m depth). *Parkraemeria saltator* differs from *P. ornata* in having dorsal-fin segmented rays 12–13 (vs. 14–15 in *P.*



Fig. 3. Underwater photograph of *Parkraemia saltator* sp. nov. A: male. B: female. Mouth of Urauchi-gawa River, Iriomote-jima Island, Japan, 1 m depth. Photographs by K. Yano.

ornata), anal-fin segmented rays 13 (vs. 14), pectoral-fin rays 14–15 (vs. 12–13), caudal-fin segmented rays 8 + 7 (vs. 7 + 6 or 7 + 7); larger head, 29–30% SL (vs. 24–27%), longer pectoral fin, reaching past end of pelvic fins, its length 20–22% SL (vs. reaching to centre of pelvic fin, 14–16%), longer caudal fin, 21–23% SL (vs. 15–19%), posterior end of jaws reaching posteriorly to or beyond vertical at anterior oculoscapular canal pore F' (vs. not reaching pore F').

***Parkraemia rhinoceros* sp. nov.**

(New Japanese name: Tengu-ginpo-haze)
(Figs. 4–6, Table 1)

Parkraemia sp. 1 Suzuki and Shibukawa, 2004: 440.

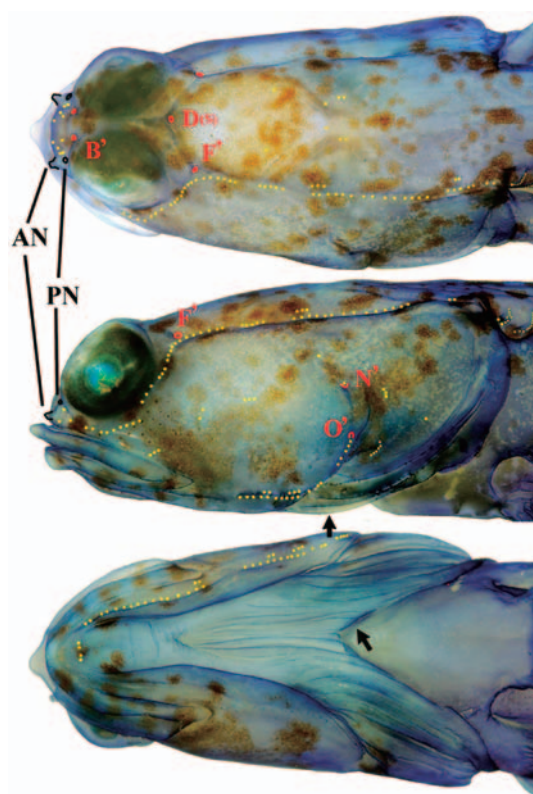


Fig. 4. Head of holotype of *Parkraemia rhinoceros* sp. nov., KPM-NI 31129, male, 25.8 mm SL, showing cephalic sensory pores and papillae. Top: dorsal view; middle: lateral view; bottom: ventral view. Red lines and red letters indicate sensory canal pores, and prime marks the terminal pores; AN: anterior narial pore; PN: posterior narial pore. Yellow dots represent the sensory papillae. Arrow shows position where gill membranes are attached to isthmus. Photographs and annotations by T. Suzuki.

Holotype. KPM-NI 31129, male, 25.8 mm SL, Nago Bay, Okinawa-jima Island, Okinawa Group of Ryukyu Islands, Japan, 5 m depth, 25 Sep. 2009.

Paratypes. NSMT-P 110744, female, 24.8 mm SL, same data as the holotype; OMNH-P 35166, female, 27.5 mm SL, cleared and stained, Kin Bay, Okinawa-jima Island, Okinawa Group of Ryukyu Islands, Japan, 8 m depth, 11 May 2009; OMNH-P 35283 and 35286, 2 males, 19.7–21.2 mm SL, 21 July 2009, same locality as the holotype.

Table 1. Measurement (% SL) for *Parakraemia saltator*, *P. rhinoceros* and *P. ornata*.

	<i>P. saltator</i>			<i>P. rhinoceros</i>			<i>P. ornata</i>		
	Holotype	Paratypes		Holotype	Paratypes		Holotype	Non-types	
	NSMT-P 110743 (male)	OMNH-P 34758 & 35278 (2 males)	3 females* ¹	KPM-NI 31128 (male)	OMNH-P 35283 & 35286 (2 males)	2 females* ²	AM I A 3777 (female)	AM I 23427 -001 (2 males)	AM I 23427 -001 (female)
Standard length (mm)	33.7	31.4 · 35.6	26.1–33.9	25.8	19.721.2	24.8 · 27.5	27.9	33.4 · 34.8	35.0
Head length	30	29 · 30	30	31	30 · 31	30 · 31	26	24 · 26	27
Head depth	15	15	15	15	14 · 17	15	13	12 · 14	13
Head width	16	14 · 17	14–15	15	13 · 14	13 · 15	12	13 · 14	12
Body depth of pelvic-fin origin	15	14 · 15	15–16	15	15	15 · 16	14	12 · 13	14
Body depth of anal-fin origin	11	10 · 12	11–13	11	10	11 · 12	11	9	12
Body width of anal-fin origin	11	7 · 9	7–8	7	6 · 7	6 · 8	7	6	7
Caudal-peduncle length	9	9	8–9	6	7	7 · 8	8	7	7
Caudal-peduncle depth	7	7 · 8	6–7	6	4 · 6	5 · 6	5	5 · 6	5
Predorsal length	36	36	37–38	36	35 · 36	36	37	34	37
Preanal length	55	54 · 55	59–61	57	58	58	55	52	56
Prepelvic length	31	29 · 31	31–32	29	30 · 31	29	28	26 · 28	29
Dorsal-fin base length	58	56 · 57	55–56	60	58 · 59	57 · 58	60	59 · 63	59
Longest dorsal-fin spine length (5th)	15	13	13–14	12	13 · 17	12 · 15	9	9 · 10	8
Longest dorsal-fin ray length	13 (12th)	14 (12th)	13 (9–11th)	14 (12th)	14 (12th)	14 (12th)	10 (13th)	11 · 12 (1st · 13th)	11 (13th)
Anal-fin base length	38	38	33–34	37	34 · 35	34 · 35	37	41 · 43	37
Longest anal-fin ray length	13 (12th)	12 · 14 (12th)	12 (11 · 12th)	14 (12th)	13 · 14 (12th)	12 · 13 (12th)	9 (13th)	12 (13th)	10 (11th)
Pectoral-fin length	20	21	20–22	21	19 · 20	18	16	15 · 16	14
Pelvic-fin length	22	23	20–21	20	20 · 22	20 · 21	20	17 · 19	17
Caudal-fin length	21	22 · 23	22–23	22	22 · 23	21 · 24	15	18 · 19	18
Snout length	4	4 · 5	4	2	2 · 3	2 · 3	2	2 · 3	2
Jaw length	11	10	10–11	11	11	11	7	8	9
Eye diameter	5	5 · 6	5–6	6	5 · 6	5 · 6	5	4	5
Pupil diameter	3	2 · 3	3	3	3	3	3	2	2
Fleshy interorbital width	2	1 · 2	1–2	1	1	1	1	1	2

*¹ KPM-NI 31128, OMNH-P 35384 & OMNH-P 35385; *² NSMT-P 110744 & OMNH-P 35166.

Images examined (all registered in the Image Database of Fishes of KPM). KPM-NR 33810, Iriomote-jima Island, Yaeyama Group of Ryukyu Islands, Japan, 12m depth, 1999, Korechika Yano; KPM-NR 69815, Miyako-jima Island, Miyako Group of Ryukyu Islands, Japan, 8–10m depth, 27 July 2003, Yoko Kobayashi; KPM-NR 89280, Kin Bay, Okinawa-jima Island, Okinawa Group of Ryukyu Islands, Japan, 9m depth, 17 Sep. 2005, Toru Seko.

Diagnosis. *Parkraemia rhinoceros* differs from congeners in the following combination of characters: dorsal-fin segmented rays 13; anal-fin segmented rays 13; pectoral-fin rays 14; large head 30–31% SL; long pectoral fin, reaching past end of pelvic fins, its length 18–21% SL; long caudal fin 21–24% SL; short snout 5–9% head length; lower jaw slightly protruding, posterior end of jaws reaching posteriorly to or beyond vertical at anterior oculoscapular canal pore F';

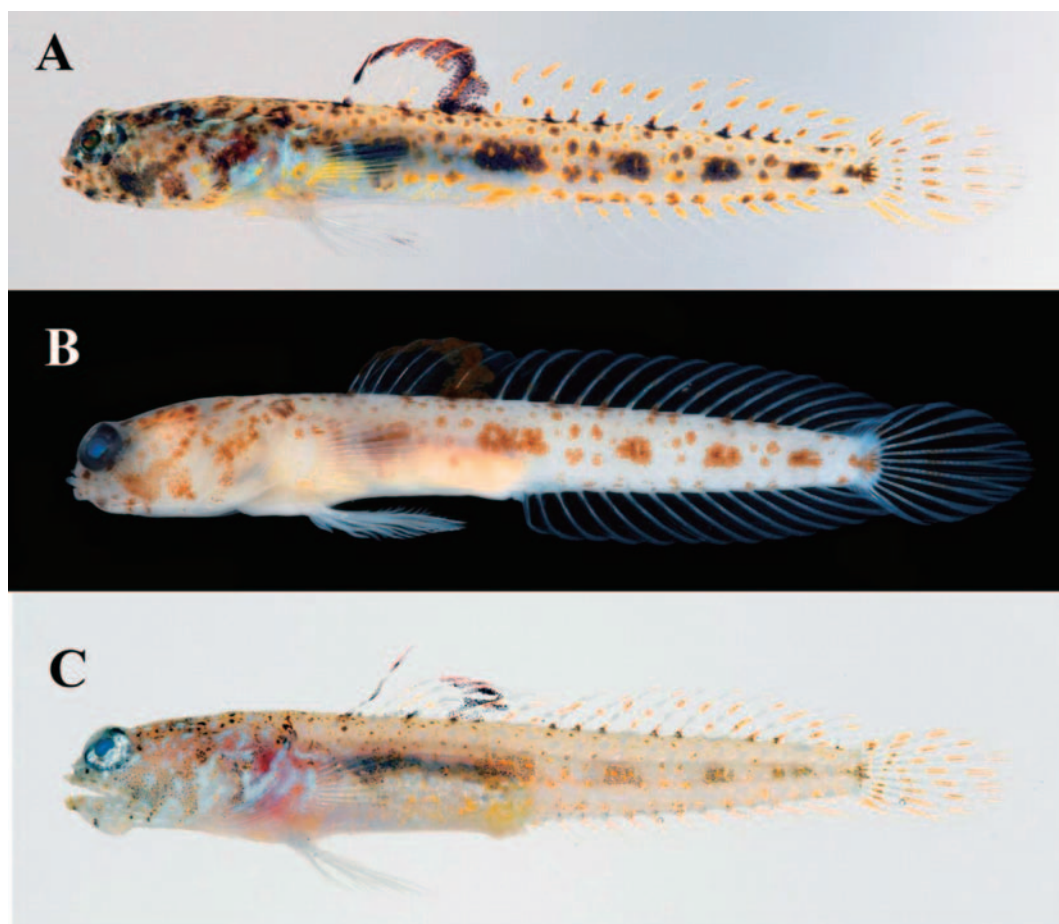


Fig. 5. *Parkraemeria rhinoceros* sp. nov. A: fresh, non-preserved holotype, KPM-NI 31129, male. B: alcohol-preserved holotype. C: fresh, non-preserved paratype, OMNH-P 35166, female, 27.5 mm SL. Photographs by T. Suzuki.

tip of upper lip with a small anteriorly directed skin projection; reduced longitudinal pattern of sensory-papillae rows; caudal fin rounded; 6 large black blotches along lateral midline of body; and spinous portion of dorsal fin with a conspicuous black curved mark along entire edge.

Description. Dorsal-fin rays VI, 13; anal-fin rays 13; pectoral-fin rays 14, dorsalmost ray unbranched (upper 2 rays unbranched in 1 paratype); pelvic fin I, 5; branched caudal-fin rays 5 + 4; segmented caudal-fin rays 6 + 6 (7 + 6 in 2 paratypes, 7 + 7 in 1 paratype and 8 + 7 in 1 paratype); P-V 3/II II I I 0/9; gill rakers 0 + 9 = 9 in 1 cleared and stained paratype; vertebrae 10 + 16 = 26; 1 epural; anal-fin 2 pterygiophores anterior

to first haemal spine.

Color when fresh. In males, ground color of head and body pale yellow with many small yellowish-orange spots that overlie black spots. Head with 3 large black blotches on cheek and opercle and many small pale blue spots. Posterior part of opercle, pectoral-fin base and belly pale-sky blue. Body with 6 large black blotches along lateral midline. Fins hyaline. Dorsal fin with a conspicuous black curved mark on spinous portion; each segmented ray with 2 small yellowish-orange spots that overlie black spots. Each anal-fin ray with small yellowish-orange spot near base. Caudal-fin rays with 1 to 3 small yellowish-orange spots that overlie black spots

(Fig. 5A).

Female coloration resembles that of males except as follows: head, body, and dorsal and caudal fins with many small white spots; and caudal-fin rays with 1 to 4 small yellowish-orange spots that overlie black spots (Fig. 5C).

Color in alcohol. Yellow, red and blue colors faded. Ground color of head and body white

(Fig. 5B).

Color when alive. Similar to fresh coloration except as follows: head, body, and dorsal fin with many small white spots; a conspicuous black curved mark on dorsal fin paler; in males, caudal fin with 4 yellowish-orange bands; in females, yellow color paler (Fig. 6).

Distribution. Okinawa-jima Island, Oki-

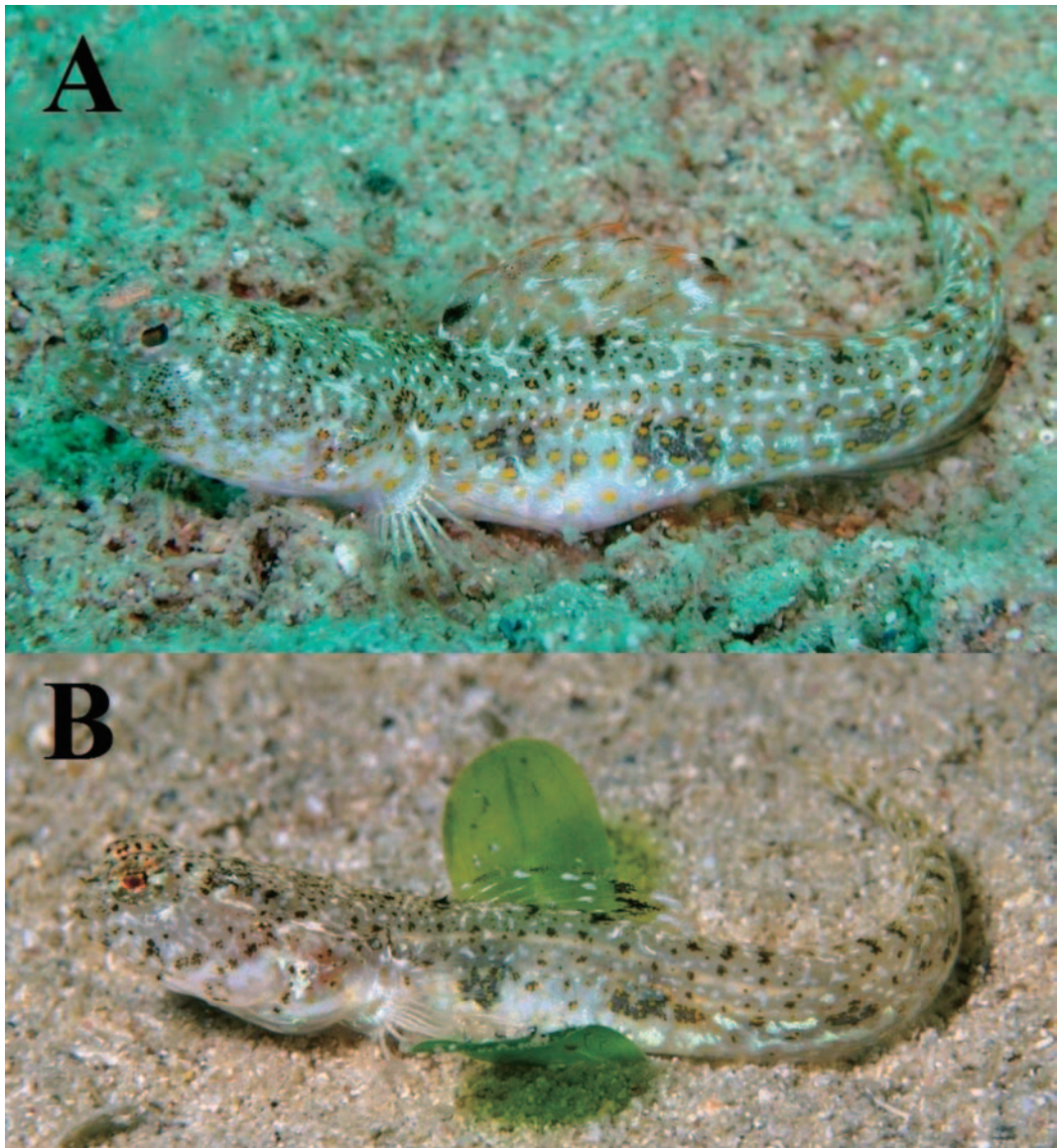


Fig. 6. Underwater photograph of *Parkraemeria rhinoceros* sp. nov. A: male, Nago Bay, Okinawa-jima Island, Japan, 5 m depth. Photograph by T. Seko. B: female, Uehara, Iriomote-jima Island, 12 m depth. Photographs by K. Yano.

nawa Group of Ryukyu Islands, Japan. In addition, Miyako-jima, Miyako Group (KPM-NR 69815), and Iriomote-jima Island, Yaeyama Group (KPM-NR 33810; Suzuki and Shibukawa, 2004), the Ryukyu Islands, Japan.

Habitat. *Parkraemeria rhinoceros* occurs on coral sandy bottoms of bays at depths of 5–12 m. They live on bottom, crawl into bottom directly and push out a head from the bottom (Suzuki and Shibukawa, 2004; this study).

Etymology. The specific name, *rhinoceros*, is from the Latin *rhino*, nose, and *keras*, horn, in allusion to the small anteriorly directed skin projection on the tip of the upper lip in the new species.

Comparisons. *Parkraemeria rhinoceros* differs from its congeners in having the tip of the upper lip with a small anteriorly directed skin projection (vs. absent in *P. saltator* and *P. ornata*), 6 large black blotches on the lateral mid-line of body (vs. 4 such blotches); and spinous portion of dorsal fin with a conspicuous black curved mark (vs. no dark marking). Moreover, *Parkraemeria rhinoceros* differs from *P. ornata* in having: dorsal-fin segmented rays 13 (vs. 14–15 in *P. ornata*); anal-fin segmented rays 13 (vs. 14); pectoral-fin rays 14 (vs. 12–13); larger head, 30–31% SL (vs. 24–27%); longer pectoral fin, reaching beyond terminus of pelvic fins, its length 18–21% SL (vs. reaching to centre of pelvic fin, 14–16%); longer caudal fin, 21–24% SL (vs. 15–19%); posterior end of jaws reaching posteriorly to or beyond vertical at anterior oculoscapular canal pore F' (vs. not reaching); and reduced longitudinal pattern of sensory-papillae rows (vs. relatively well-developed longitudinal pattern).

Parkraemeria ornata Whitley, 1951

(Figs. 7 and 8, Table 1)

Parkraemeria ornata Whitley, 1951: 403, Fig. 9 (type locality: Narrabeen Lagoon, Sydney, New South Wales, Australia).

Material examined. AMS IA.3777, female, holotype of *Parkraemeria ornata*, 27.9 mm SL,

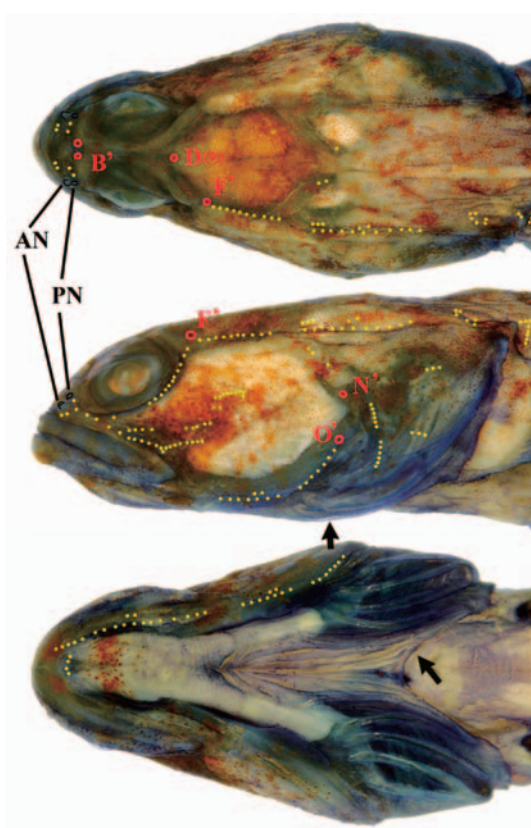


Fig. 7. Head of paratype of *Parkraemeria ornata*, one of AMS I.23427–001, female, 35.0 mm SL, showing cephalic sensory pores and papillae. Top: dorsal view; middle: lateral view; bottom: ventral view. Red lines and red letters indicate sensory canal pores, and prime marks the terminal pores; AN: anterior narial pore; PN: posterior narial pore. Yellow dots represent the sensory papillae. Arrow shows position where gill membranes are attached to isthmus. Photographs and annotations by T. Suzuki.

Narrabeen Lagoon, Sydney, New South Wales, Australia, Dec. 1928; one of AMS I. 123427–001 (male, cleared and stained, 34.3 mm SL), one of AMS I. 123427–001 (male, 33.4 mm SL) and one of AMS I. 123427–001 (female, 35.0 mm SL), Dee Why Lagoon, Sydney, New South Wales, Australia, 6 Jan. 1978.

Diagnosis. *Parkraemeria ornata* differs from congeners in the following combination of characters: dorsal-fin segmented rays 14–15;



Fig. 8. Alcohol-preserved specimens of *Parkraemeria ornata*. A: holotype, AMS IA.3777, male, 27.9 mm SL. B: one of AMS I.23427–001, male, 34.8 mm SL. C: one of AMS I.23427–001, female, 35.0 mm SL. Photographs by T. Suzuki.

anal-fin segmented rays 14; pectoral-fin rays 12–13; caudal-fin segmented rays 7 + 6 or 7 + 7; small head 24–27% SL; short pectoral fin, reaching to centre of pelvic fin, its length 14–16% SL; short caudal fin 15–19% SL; lower jaw protruding, posterior end of jaws reaching posteriorly to vertical between posterior margin of eye to anterior oculoscapular canal pore F'; tip of upper lip without a small anteriorly directed skin projection; relatively well-developed longitudinal pattern of sensory-papillae rows; and caudal fin oblong.

Description. Dorsal-fin rays VI, 14 (15 in 1 specimen); anal-fin rays 14; pectoral-fin rays 12, dorsalmost ray unbranched (13 in 2 specimens); pelvic fin I, 5; branched caudal-fin rays 5 + 4 (5 + 3 in 2 specimens); segmented caudal-fin rays 7 + 6 (7 + 7 in two specimens); gill rakers 2 + 10

= 12 in 1 cleared and stained specimen; P-V 3/I II II I 0/9 (3/II II I 0/9 in 1 specimen, 3/II II I 0/9 in 2 specimens); vertebrae 10 + 16 = 26; 1 epural; 2 anal-fin pterygiophores anterior to first haemal spine.

Color in alcohol (Fig. 8). Ground color of head and body yellowish brown with many small dark brown spots. Head with 3 large dark brown spots on cheek, opercle and occipital region. Body with 4 large black blotches on lateral midline. Fins hyaline; dorsal fin with many small dark brown spots; anal fin with broad dark brown stripe; caudal fin with some dark brown bands.

Distribution. New South Wales and Queensland, Australia.

Habitat. The specimens of *P. ornata* examined here were collected from lagoon habitats. In addition, the species is known from a large

coastal bay (Johnson, 1999).

genera: *Parkraemeria saltator* and *P. rhinoceros*.

Comparisons. See descriptions of the con-

Key to the Species of *Parkraemeria*

- 1a. A small anteriorly directed skin projection on the tip of the upper lip, and a conspicuous black curved mark along entire edge of spinous portion of dorsal fin present (Ryukyu Islands, Japan) *P. rhinoceros* sp. nov.
- 1b. Such skin projection and marking absent 2
- 2a. Dorsal-fin segmented rays 12–13, anal-fin segmented rays 13, pectoral-fin rays 14–15, larger head (its length 29–30% SL), longer pectoral fin (20–22% SL), and longer caudal fin (21–23% SL) (Ryukyu Islands, Japan) *P. saltator* sp. nov.
- 2b. Dorsal-fin segmented rays 14–15, anal-fin segmented rays 14, pectoral-fin rays 12–13, smaller head (its length 24–27%), shorter pectoral fin (14–16%), and shorter caudal fin (15–19%) (New South Wales and Queensland, Australia) *P. ornata*

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