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A Review of the Genus *Parioglossus*, with Descriptions of Six New Species (Pisces: Gobioidae)

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ABSTRACT. Fourteen species of *Parioglossus* are recognized from the warm temperate to tropical western Pacific and Indian Oceans: *P. aporos* n. sp., *P. dotui*, *P. formosus*, *P. lineatus* n. sp., *P. marginalis* n. sp., *P. nudus* n. sp., *P. palustris*, *P. philippinus*, *P. rainfordi*, *P. raoi*, *P. taeniatus*, *P. triquetrus* n. sp., *P. verticalis* n. sp., *P. sp.* Synonymies, general morphology and osteology of the genus are described, and a key for separating the species is included. Diagnoses, descriptions, distributions, comparisons, line drawings and photographs of each species are given as well as synonymies of previously described species. Notes on ecology and food preferences are included when known. Tables of meristics and morphometrics are included for the holotypes and for all other material. Different characteristics of the species are compared in a separate table. Similarities between *Parioglossus* and related genera, in the subfamily Ptereleotrinae, are discussed. Provisionally, the subfamily is placed in the family Microdesmidae.

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Keywords: Gobioidae, *Parioglossus*, taxonomy, Indo-Pacific, coral reefs, mangroves.

The genus *Parioglossus* consists of fourteen species that inhabit warm temperate to tropical regions of the western Pacific and Indian Oceans. These fishes are normally found around the roots of mangroves, or around algae in estuaries and coastal coral reefs. Only a few of the species appear to be widespread, however all the species are small sized (size range of mature fish varies from 17.4 mm for *P. nudus*, to 39 mm for *P. marginalis*) and sampling of their usual habitats is normally avoided by collectors. Our experience and that of V. Springer (*in litt.*) suggest that the fish are difficult to collect in mangroves. When collected with rotenone, the fishes rise to the surface only briefly and then disappear into the muddy waters. It is likely that as tropical mangrove zones are sampled more extensively, the distribution range of many of the species will be found to be greater than now appears. Few of the species occur around coral reefs, which have been sampled more extensively. Presently only *P. philippinus* and *P. taeniatus* are known from the western Indian Ocean to the western Pacific. Several of the species are known to occur in schools. Gut contents indicate that zooplankton, mainly copepods, comprise their diet.

Tomiya (1958, 1959) reviewed and Senou and Suzuki are revising the *Parioglossus* species of Japan, but there is no comprehensive revision of this genus available. Tomiya (1958, 1959) was apparently unaware that *Herreolus* and *Andameleotris* are synonyms of *Parioglossus*, and Herre (1945a) ignored species of *Parioglossus*. As a result the same species has sometimes been described as new in different genera.

Parioglossus was defined by Regan (1912) on the basis of its separate pelvics, strongly compressed head and body, oblique, protractile mouth, small body scales, vertical gill openings and dorsal and anal fins consisting of one spine and 15-16 rays. Several genera that we regard here as junior synonyms of *Parioglossus* have been described. Smith (1931a) erected the genus *Herrea*, which was found to be preoccupied and was replaced first by *Herreolus* (Smith 1931b) and subsequently (see Smith, 1945) by *Herreichthys* (Koumans 1931). Herre (1939) described *Andameleotris*, as a subgenus of *Amblyeleotris* and incorrectly reported it as having one spine, three rays in the pelvic fin and six branchiostegals. *Andameleotris* was subsequently recognized as a genus with the description of *A. palustris* (Herre 1945a). In

recognizing *A. palustris* as the type of *Andameleotris*, it could be argued that Herre (1945a) effectively created a primary homonym of his earlier (1939) useage of the name *Andameleotris* with *Amblyeleotris raoi* as the type-species by monotypy. However, under strict interpretation of the International Code of Zoological Nomenclature Articles 43, 61, 67 and 68, the designation of *Andameleotris palustris* as the type-species is invalid, since it is clear that Herre (1945a) was elevating his previous subgenus to a genus. Both useages are listed in the generic synonymy for completeness.

With the exception of *P. nudus*, which differs from other species in lacking scales on the body and being found to depths of 37m, well beyond the known depth of the other species, the members of the group are very similar in meristics and morphology. Since some features, such as head pores, vary with size as well as geographically, the easiest way to distinguish a species is by coloration, which varies little within each species over its geographic range. Sexual dichromatism, however, is apparent in several of the species and is most pronounced in *P. marginalis*.

Miller (1971) described the osteology of *Parioglossus* and concluded the genus was gobioid rather than eleotrid in structure, with the separation of the pelvic disc having been derived secondarily from the typical fused fins of gobioids. However, no known relative possesses a pelvic disc and the separation of the pelvic fins may indicate the retention of a primitive condition. *Parioglossus* shares several specializations with *Ioglossus* Bean, *Ptereleotris* Gill, *Oxymetopon* Bleeker, and *Nemateleotris* Fowler (all of which have separate pelvic fins), including the development of a long, posterior pelvic process, an oblique and often almost vertical protrusible mouth, the absence of a separate articular process on the premaxilla, and usually a single pterygiophore (rather than two) preceding the first hemal spine. Hoese (in press) placed these genera in the subfamily Ptereleotrinae and provisionally placed the subfamily in the family Microdesmidae.

Ptereleotrine gobioid fishes are unusual and, possibly, unique among gobioid fishes, in having a highly protrusible mouth. Normally in gobioid fishes the rostral cartilage is oval, flattened anteriorly and ventrally, and tightly bound to the back side of the ascending processes of the premaxillae. The cartilage is also connected to the anterior end of the maxilla. In these fishes the jaws cannot be pulled far forward without tearing the connections. However, in *Ptereleotris* and *Parioglossus*, the rostral is flattened laterally and attached only to the upper tip of the ascending processes of the premaxillae as well as to the anterior ends of the maxillae. When the jaw is pulled forward the rostral rotates, with the dorsal end of the rostral remaining close to the ascending processes of the premaxillae and the ventral end between the upper ends of the maxillae, allowing the jaws to move forward. In *Nemateleotris* the rostral is tightly bound to the premaxillae and does not rotate, and the jaw is only slightly protrusible.

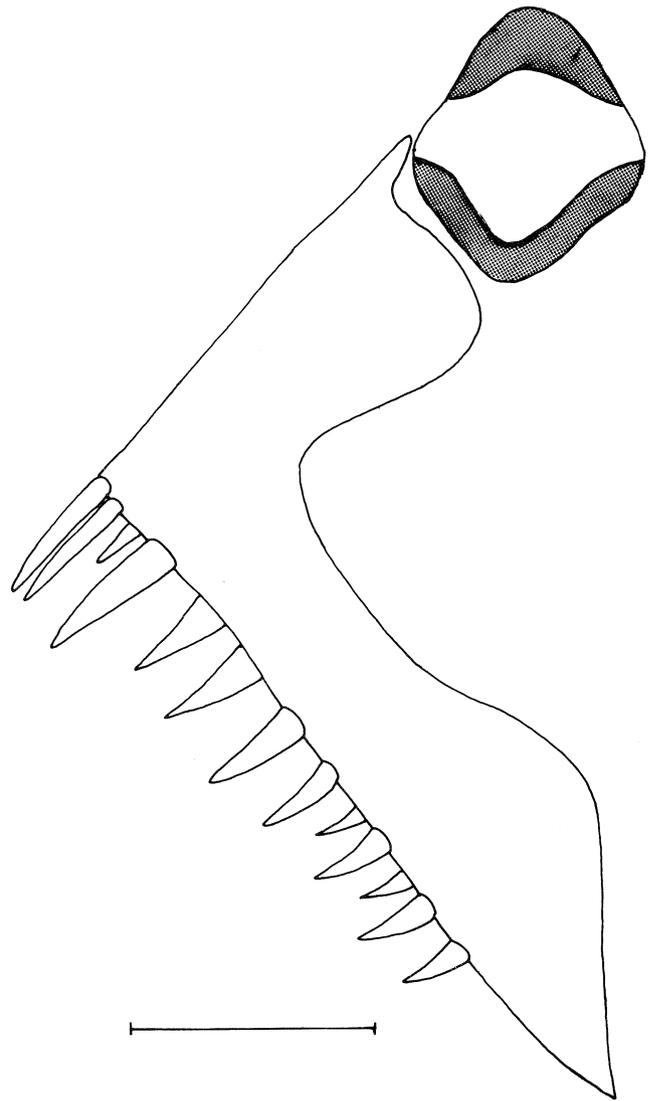


Fig. 1. Premaxilla and rostral bone of *Parioglossus formosus* (20 mm), with jaw partly protruded. Shaded area indicates cartilage on rostral. Scale = 0.5 mm.

Parioglossus is unusual in that seven of the 11 species for which the osteology was examined have some ossification of the rostral (Fig. 1). Of the few species of *Ptereleotris* and *Nemateleotris* examined none has an ossified rostral. Two of the seven species of *Parioglossus* with an ossified rostral were counter stained with alcian blue and found to have a broken median ring of cartilage around the bone. In other species the entire structure is composed only of cartilage.

Springer (1983) recorded an ossified rostral in *Xenisthmus*, *Tyson* and one species of *Kraemeria*, and partial ossification in one species of microdesmid. In *Tyson* and *Xenisthmus* the rostral is elongate and structurally unlike the rostral in ptereleotrines. In *Kraemeria* the rostral is oval, as is typical of most other gobioid fishes, but lies slightly behind the ascending processes of the premaxillae. Since *Nemateleotris*, which has a cartilagenous rostral, appears to be more primitive

among ptereleotrine in having five pelvic rays, a less protrusible mouth and large ctenoid scales, it appears likely that the ossification of the rostral in *Parioglossus* has evolved independently.

Parioglossus is readily distinguishable from other ptereleotrine gobioids by the following combination of characters: pelvics I,4; first dorsal pterygiophore formula (as defined by Birdsong, 1975) 3(22110); gill opening narrow to moderate, ending ventrally below the operculum; interorbital head pores paired laterally when present; second dorsal I,13–19. *Parioglossus* is most similar to *Ptereleotris*, which differs in having a broader gill opening reaching ventrally to below the posterior preopercular margin, dorsal pterygiophore formula of 3(32010) and second dorsal I,24–39. *Ioglossus* agrees in all the features listed for *Ptereleotris*, except that Atlantic species have two pterygiophores preceding the first hemal arch. At present it is unclear whether *Ioglossus* warrants generic recognition.

Nemateleotris differs from other ptereleotrine genera in having five pelvic segmented rays, and extensive development of ctenoid scales (presumably primitive features) and filamentous anterior dorsal spines. *Oxymetopon* differs from other genera in the subfamily in having a strongly compressed head and body, and a bony median crest behind and sometimes between the eyes. *Orthostomus* Kner is often placed close to *Oxymetopon*, but its status is uncertain. Of the genera in the subfamily only two have been reviewed recently, *Nemateleotris* by Randall and Allen (1973) and *Oxymetopon* by Klauswitz & Conde (1981).

Seven of the 14 species of *Parioglossus* have been described previously: *P. dotui*, *P. formosus*, *P. palustris*, *P. philippinus*, *P. rainfordi*, *P. raoi* and *P. taeniatus*. Six new species are described here: *P. aporos*, *P. lineatus*, *P. marginalis*, *P. nudus*, *P. triquetrus* and *P. verticalis*. One species will be described by Senou and Suzuki (in press): *P. sp.*

Methods

Measurements and counts follow those described by Hubbs and Lagler (1974) except as noted below. All lengths are in mm standard length and all measurements, including standard length, were taken with an ocular micrometer and are expressed as percent of standard length unless otherwise stated. Rays refer to segmented soft rays. Body depth was taken at the anal fin origin. Head pores include both circumorbital pores (above and behind eye) and preopercular pores, and the counts are from one side of the head (Fig. 2). Typical head papillae pattern is shown in Fig. 3. Gill-raker count refers to the outer face of the first gill arch upper + (angle + lower). Branchiostegals were counted from ventral to dorsal (i.e. branchiostegal 1 is the most ventral ray, branchiostegal 5 is the most dorsal). Longitudinal scale counts were taken from the upper posterior edge of the pectoral-fin base to the last scale on the caudal peduncle, excluding scales on the base of

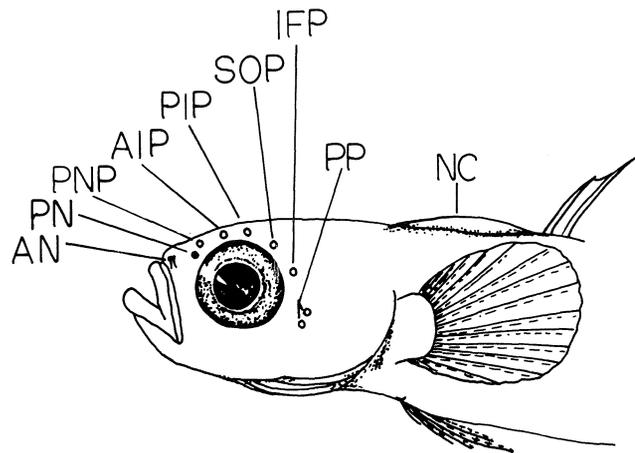


Fig. 2. Head pore terminology and nuchal crest of *Parioglossus*: anterior interorbital pore (AIP); anterior nostril (AN); infraorbital pore (IFP); nuchal crest (NC); posterior interorbital pore (PIP); posterior nostril (PN); posterior nasal pore (PNP); preopercular pore (PP); supraorbital pore (SOP).

the caudal fin. The last dorsal and anal ray as counted is branched through the base. Vertebrae and procurent caudal rays were counted for specimens of all species from radiographs. All colour descriptions refer to colour in alcohol unless noted otherwise. Comparison of characters (Table 3), morphometrics of the holotypes (Table 4), morphometrics of all material (Table 5), meristics of the dorsal fins and anal fin (Table 6), pectoral and caudal fins (Table 7), and procurent caudal-fin rays (Table 8), longitudinal scale counts (Table 9) and total gill-raker counts (Table 10) are given for each species. The osteology of 11 species was examined from specimens cleared with trypsin and stained with alizarin. Specimens of 5 species (*Parioglossus dotui*, *P. formosus*, *P. marginalis*, *P. philippinus* and *P. raoi*) were counter stained with alcian blue.

Material was examined from the following institutions: Australian Museum, Sydney (AMS); Academy of Natural Sciences, Philadelphia (ANSP); British Museum (Natural History), London (BMNH); Bishop Museum, Honolulu (BPBM); California Academy of Sciences, San Francisco (CAS); Stanford University (specimens now held in CAS) (CAS-SU); Kanadi Fisheries Research Station, Papua New Guinea (FO); Institute of Oceanic Research and Development, Tokai University, Japan (IORD); Laboratory of Ichthyology, The Crown Prince's Palace, Tokyo (LICPP); National Science Museum, Tokyo (NSMT); Northern Territory Museum, Darwin (NTM); Queensland Museum, Brisbane (QM); Rijksmuseum van Natuurlijke Historie, Leiden (RMNH); Royal Ontario Museum, Toronto (ROM); Subtropical Marine Laboratory, Irimote Marine Research Station, Tokai University, Japan (SMLVO); National Museum of Natural History, Washington, D.C. (USNM); Western Australian Museum, Perth (WAM); Instituut voor Taxonomische Zoölogie (Zoölogisch Museum), Amsterdam (ZMA).

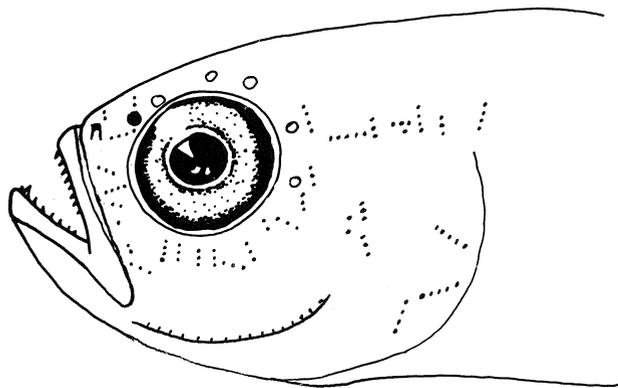


Fig. 3. Typical head papillae pattern of *Parioglossus* based on a composite.

The descriptions and key have been prepared largely from the larger and best specimens. In some cases characters change with size. For example, the head pores are incompletely developed in small specimens, generally below 15 mm. Similarly, the second dorsal and anal rays are often branched in large specimens of some species but largely unbranched or only with a narrow branch at the distal tip in small specimens. Colour can also change slightly with size, with the lateral stripe often most prominent in small specimens. Although the changes may be related to maturity, in many cases small females with eggs do not have fully developed characters. Other features were often difficult to determine from all specimens. For example, the presence or absence of scales on the belly, pectoral-fin base, predorsal and prepelvic areas often could not be determined without dehydrating or staining the specimens. The scales in this region are minute, deciduous, and often covered with mucous. Similarly the development of the nuchal crest was determined with considerable subjectivity, apparently varying to some degree with the state of preservation of the specimen. Little material was available from the Indian Ocean. The material that was available indicated that additional species, or geographical variants of the species recognized here, may exist in that region. Similarly material of some species from Japan was not available to us and information on these species was provided by H. Senou.

Parioglossus Regan

Parioglossus Regan, 1912: 302 (type-species, *P. taeniatus* Regan, by monotypy).

Herrea Smith, 1931a: 40 (type-species, *Herrea formosa* Smith, by monotypy), preoccupied by *Herrea* Whitley, 1930.

Herreolus Smith, 1931b: 190 (replacement for *Herrea* Smith).

Herreichthys Koumans, 1931: 163 (replacement for *Herrea* Smith).

Amblyeleotris (*Andameleotris*) Herre, 1939: 346 (type-species, *A. raai* Herre, by monotypy).

Andameleotris Herre, 1945a: 2 (designated type-species, *A. palustris* Herre, by original designation, an invalid designation).

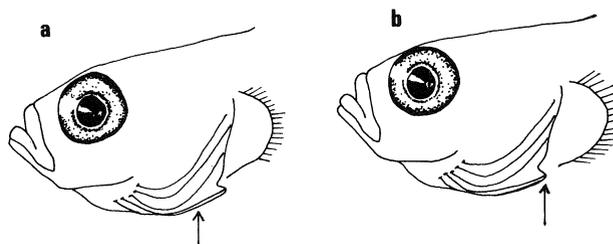


Fig. 4. Extent of gill openings in *Parioglossus*. Arrow indicates position of lower attachment of gill membrane to isthmus: a wide opening of *P. dotui* (a) and a narrow opening of *P. philippinus* (b).

Diagnosis. Head and body compressed; body elongate; ventral and dorsal profiles straight; cheek, preoperculum and operculum naked; body scaled or not, when scaled, scales cycloid, imbricate or nonimbricate in 61–109 vertical rows; mouth terminal, highly protractile, inclined at angle of 55–90° to longitudinal axis of body; maxilla reaching posteriorly to a point below anterior edge of eye; snout short, blunt, less than eye diameter; anterior nostril a shortened tube or a simple pore; posterior nostril a simple pore; no teeth on vomer, tongue or palatines; teeth conical; upper jaw with two rows of teeth anteriorly, outer row enlarged, widely spaced, 1–2 rows posteriorly; lower jaw uniserial posteriorly and 2–3 rows of closely spaced, enlarged teeth anteriorly, inner row with 1–3 notably enlarged teeth on either side of midline; tongue tip truncate to slightly round; circumorbital and preopercular pores present or absent; head papillae present, varying in number and size depending on species; median nuchal crest, formed by low fold of skin from first dorsal spine onto head, low to prominent; gill opening vertical, extending ventrally from point immediately above upper pectoral-fin base to point just below lower pectoral base to an eye diameter anterior to pectoral base, below operculum (Fig. 4); interorbital about ½ diameter of eye; total gill-rakers on first arch 12–20, compressed, elongate; all rakers ossified; rakers on second, third and fourth arches tuberculate with dorsal spiny projections; 2 dorsal fins, first dorsal fin V–VI, second dorsal fin I, 13–19; anal fin I, 13–19; pectoral fin 15–20; segmented caudal rays usually 9+8 (occasionally 8+7 or 9+7); branched caudal rays usually 7+6 or 6+5; pelvic fins separate I, 4; vertebrae 10+16; branchiostegals 5.

Osteology. Lacrimal small poorly ossified; rostral, an ossified bone or cartilage not strongly bound to premaxilla and not broadly attached to the dorsoposterior margin of the ascending process of the premaxilla (Fig. 1); nasal bone poorly ossified; ascending and articular processes not individually distinguishable (Fig. 1) on each premaxilla; metapterygoid very slender and elongate, not reaching ventrally to quadrate; no mesopterygoid; preoperculum with prominent anterior process articulating with dorsal end of symplectic; posterior flange of hyomandibular sometimes with a short ventral process connected to dorsal margin of preoperculum; sphenotic small, with a prominent dorsal flange sometimes meeting supraoccipital but often with pterotic extending between

supraoccipital and sphenotic; frontal large forming dorsal and posterodorsal part of orbit; supraoccipital diamond-shaped with prominent median posterodorsal flange; posttemporal forked; cleithrum bifid dorsally; no dorsal postcleithrum; ventral postcleithrum present or absent; ventral intercleithral and pelvic intercleithral cartilage present (as defined by Springer, 1983); scapula cartilagenous; lateral flanges of pelvic bone longer than conical portion; posterior pelvic process extending well behind bases of pelvic rays; base of pelvic spine with dorsal and ventral processes; neural spines on vertebrae 1–21, and hemal spines on vertebrae 11–21 originating on anterior edge of centrum, on 22 on central surface, on 23–25 on posterior edge; parapophysis of precaudal vertebra 10 longest; precaudal vertebrae 1 and 2 with epipleural ribs only, vertebrae 3–10 with epipleural and

pleural ribs; epipleural ribs sometimes present on caudal vertebrae 1–4; precaudal vertebrae 2–10 with dorsal prezygapophyses; all but last 3–4 caudal vertebrae with prezygapophyses; dorsal postzygapophyses present or absent; 2 pterygiophores between neural spines 3 and 4, 2 between neural spines 4 and 5, 1 between neural spines 5 and 6, 1 between neural spines 6 and 7 [3(22110)]; 1 anal pterygiophore precedes first hemal arch; last dorsal and anal pterygiophore each support 2 rays; urostyle completely fused to upper hypural plate; lower hypural plate articulates anteriorly to urostyle; parhypural tapered with small dorsal and large ventral flange; hypural 5 with small dorsal and ventral flange; 7 segmented rays on upper plate, 6 on lower; 1 segmented ray on hypural 5, 1 on single epural, 1 on parhypural, 1 on last hemal spine.

Key to Species of *Parioglossus*

1. No head pores.....2
 —Head pores present.....3
2. Branched caudal rays 6 + 5; body naked; anal I,16–17 (usually I,16) . . . Fiji, Solomon Islands, Papua New Guinea, Palau, Philippines.....*P. nudus* n. sp.
 —Branched caudal rays 7 + 6; body scaled; anal I,13–14 (usually I,14) . . . Indonesia.....*P. aporos* n. sp.
3. 13 vertical bars on side below second dorsal fin; scales imbricate; dark ring around anus of males . . . Caroline Islands.....*P. verticalis* n. sp.
 —No vertical bars below second dorsal fin; scales imbricate or nonimbricate; dark ring around anus present or absent.....4
4. Distinct, dark lateral stripe present on body (Figs 7, 15).....5
 —Lateral stripe absent or diffuse stripe present, but without distinct dorsal and ventral margins (Figs 5, 6).....9
5. Scales imbricate; posterior nasal pore usually absent.....6
 —Scales nonimbricate; posterior nasal pore present.....8
6. Dorsal and anal fins usually I,15 (rarely I,16); posterior dorsal and anal rays branched.....7
 —Dorsal and anal fins usually I,17–18 (rarely I,16); posterior dorsal and anal rays unbranched (preopercular pores present in specimens greater than 17 mm; large round spot at base of middle to ventral caudal rays; no black spot at base of dorsal spines 5 and 6) . . . Papua New Guinea, Irian Jaya, Japan.*P. sp.*
7. Dorsal edge of lateral stripe below midline of side of body; black spot at base of dorsal spines 5 and 6; circumorbital pores 2–4; preopercular pores present or absent . . . Fiji, Caroline Islands, Irian Jaya, Indonesia, Philippines, Japan, Andaman Islands*P. raoi* (Herre)
 —Dorsal edge of lateral stripe along midline; no black spot at base of dorsal spines 5 and 6; circumorbital pores usually 4, rarely 5; preopercular pores present . . . Fiji, Vanuatu, Palau, Philippines, Aldabra*P. taeniatus* Regan
8. 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; dorsal and anal fins I,13-15, usually I, 14; pectoral fin 15-17; dorsal spines 3 and 4 longest in males; anterior nostril a short tube...Fiji, Vanuatu, Palau, Australia, Papua New Guinea, Indonesia, Philippines, Japan.....*P. formosus* (Smith)
- No dark stripe on caudal fin; dark vertical bar at base of caudal rays; preopercular pores absent; dorsal and anal fin I, 15-16; pectoral fin 18-20; dorsal spines 4 and 5 longest in males; anterior nostril a simple pore...Palau, Solomon Islands.....*P. lineatus* n. sp.
9. Branched caudal rays usually 6 + 5, rarely 6 + 6; posterior dorsal and anal rays usually unbranched, occasionally branched but rarely are all rays branched; gill opening narrow, ending ventrally just below lower pectoral base (Fig. 4b)...Australia, New Britain, Philippines, Gulf of Thailand, India, Madagascar.....*P. philippinus* (Herre)
- Branched caudal rays 7 + 6, rarely 6 + 6; posterior dorsal and anal rays branched or unbranched; gill opening ending ventrally from below pectoral base to below middle of operculum.....10
10. Large, round spot on base of ventral caudal rays (usually rays 9-15); posterior dorsal and anal rays unbranched; preopercular pores present in specimens greater than 20 mm...Australia, Papua New Guinea, Borneo, Philippines, Japan.....*P. palustris* (Herre)
- No large round spot confined to base of ventral caudal rays (if spot present, extending above midline); posterior dorsal and anal rays branched in specimens greater than 22 mm; preopercular pores present or absent.....11
11. Gill opening narrow, lower attachment of branchiostegal membrane just below pectoral base (Fig. 4b); preopercular pores present (sometime absent in specimens less than 19 mm); mouth angle 85-90° to longitudinal axis of body; (anterior nostril a simple pore; males with a vertical bar at base of caudal rays, ventral portion of bar extending posteriorly towards tips; females with a round spot on rays 4-12)...Australia, Papua New Guinea, Irian Jaya, Caroline Islands, Palau, Indonesia, Philippines, Japan.....*P. rainfordi* McCulloch
- Gill opening wide, lower attachment of branchiostegal membrane below middle of operculum (Fig. 4a); preopercular pores absent; mouth angle of 60-75° to longitudinal axis of body.....12
12. Anterior nostril a simple pore; females with pale anus; caudal fin with a triangular to rectangular spot on base of caudal rays, often with 1-2 smaller spots on caudal peduncle anterior to caudal fin spot; caudal fin truncate, males larger than 20 mm with rays 13-14 elongate...Fiji.*P. triquetrus* n. sp.
- Anterior nostril a short tube; females with black ring around anus; caudal fin with a stripe, round to elongate spot or several vertical bars; caudal fin truncate to emarginate, males larger than 20 mm without rays 13-14 elongate or, if rays elongate, some dorsal caudal rays elongate as well.....13
13. Dark stripe posterior to eye; no dorsal spines elongate in males; males and females with distinct round to horizontally elongate spot on middle caudal rays, sometimes extending to tips of middle caudal rays; second dorsal and anal fins usually I,16-17; nuchal crest low in both sexes... Japan.....*P. dotui* Tomiyama
- No dark stripe posterior to eye; dorsal spine 5 elongate in males; males and females without distinct round to horizontally elongate spot on middle caudal rays, males with stripe on middle rays of caudal fin extending to tips of rays, females with 3-4 vertical bars on middle rays; second dorsal and anal fins usually I,17-18; nuchal crest prominent in both sexes... New South Wales, Australia.....*P. marginalis* n. sp.

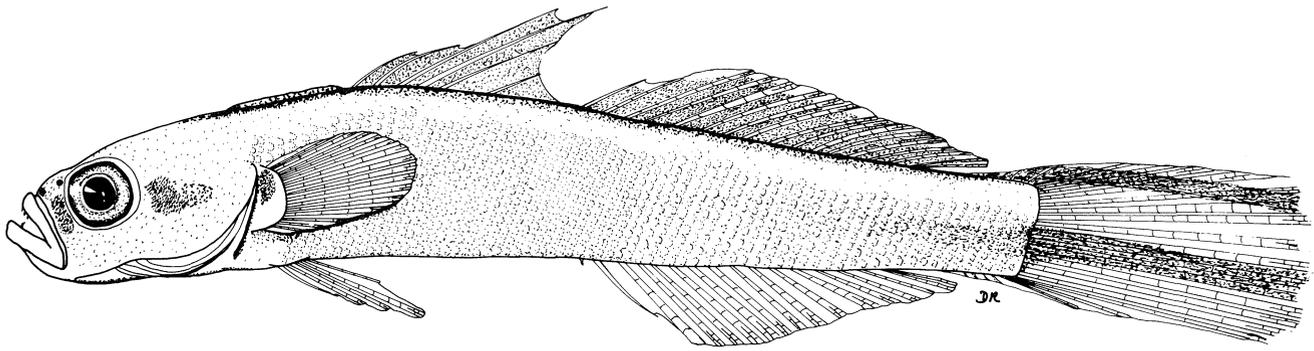


Fig. 5. *Parioglossus aporos*, holotype, male 24.2 mm, Indonesia, USNM 257045 (body slightly arched, caudal fin damaged).

***Parioglossus aporos* n. sp.**

Figs 5, 19, 33

Type material. HOLOTYPE: USNM 257045, Tandjung Paprekama, Teluk Buton, Indonesia, 5°24'30''S, 122°37'28''E, 1–8 m depth, 25 March 1974, collected by V. G. Springer and M. F. Gomon, male, 24.2mm. PARATYPES: AMS I.24319-001, type locality, 3(14–22 mm), cleared and stained, 1(21 mm); USNM 260326, type locality, 13(10–22 mm), cleared and stained, 1(22 mm).

Diagnosis. Dorsal fins VI + I, 13–15 (usually I, 14); anal fin I, 13–14; pectoral fin 15–16 (usually 15); branched caudal rays 7 + 6; longitudinal scale count 63–75, scales nonimbricate; gill opening moderate, extending ventrally to just below lower margin of pectoral base and behind middle of operculum; gill rakers 2 + 10–13; no head pores; nuchal crest a low fold in both sexes, extending forward to above middle of operculum; dorsal spines 3–5 elongate in males over 21 mm, none elongate in females; second dorsal and anal rays branched in two specimens (22–24mm), unbranched in specimens 13–21 mm, except rays 2 to 4 or 5, sometimes branched; caudal fin truncate to slightly emarginate in females, males with dorsal and ventral lobes elongate; blackish lateral stripe absent or diffuse anteriorly; black stripe ventral to midline present from above anal fin extending to caudal fin at base of caudal rays 9–15 and to tip of rays 10–11.

Description. Rostral bone present; ventral postcleithrum present. Scales present from opercular margin to end of caudal peduncle, absent from dorsolateral surface of body, midline of belly, prepelvic area and pectoral-fin base. Mouth inclined at angle of 60–70° to longitudinal axis of body; anterior nostril a simple pore. Males with dorsal spines 1–4 increasing progressively in length, spine 4 longer than spine 5, 5 longer than 6; dorsal spines 3–5 elongate in males over 21 mm, spine 4 reaching to beyond second dorsal origin; no spines elongate in females, spines 2–5 about equal in length, longer than spines 1 and 6; anterior dorsal and anal rays 2–4 longest in males, posterior rays decreasing slightly in length to last ray, which is longer than penultimate ray; anterior dorsal and anal rays 3–5 longest in females, rays decreasing in length posteriorly; last rays not reaching beyond caudal peduncle in either sex; pectoral fins oblong, less than

head length; only innermost pelvic ray unbranched, others branched, pelvic ray 3 longest.

Colour in alcohol. Body brown, head dusky; dark stripe on dorsal midline from nuchal crest extending to caudal fin, diagonally across caudal rays 1–6; dusky to dark patch behind eye, on operculum and upper edge of pectoral fin; first dorsal dark, second dorsal dark with white edge; other fins pale.

Distribution. Coastal waters of Indonesia.

Comments. This species is similar in fin-ray counts and caudal-fin coloration to *P. formosus*; however, the lack of any head pores in *P. aporos* easily distinguishes the larger specimens of this species. Specimens of *P. formosus* and *P. raoi* smaller than 15 mm may lack head pores so colour pattern differences are then the best way for separating *P. aporos* from those species. *Parioglossus formosus* has a distinct lateral stripe and *P. raoi* has no middorsal stripe (except in specimens from Japan). Specimens of *P. raoi* from Japan also sometimes lack head pores but differ from *P. aporos* in having a tubular anterior nostril and a black spot near the end of the first dorsal fin. Smaller specimens of *P. raoi* have an enlarged caudal-fin spot that extends dorsal to the midline. *Parioglossus aporos* also tends to have lower pectoral-fin ray counts (mode of 15 in *P. aporos*, 16–17 in *P. formosus*, 16 in *P. raoi*). *Parioglossus aporos* is known only from a single collection.

Etymology. From the Greek, *a* = without and *poros* = pores, named for the lack of head pores.

***Parioglossus dotui* Tomiyama**

Figs 6, 20, 34

Parioglossus taeniatus.—Dôtu, 1956: 489, 3 text figs (Kyushu and Shikoku, Japan).

Parioglossus dotui Tomiyama, 1958: 1179, pl. 230, fig. 582 (Mogi, Nagasaki Prefecture, Japan).—Tomiyama, 1959: 103 fig. 4 (Chiba Prefecture, Japan); Hayashi, Suzuki, Ito, and Senou, 1981: 14, pl. 11, fig. 147 (Urauchigawa River, Japan).

Material examined. AMS I.23491-001, Hirakubo River, Ishigakijima, Okinawa Prefecture, Japan, 2(15–18 mm); AMS I.23698-001, mouth of Shimonokae River, Koochi Prefecture, Japan, 60(20–25 mm), cleared and stained, 5(20–24 mm); IORD 77-497-501, Udara River, Amitori Bay, Iriomotejima,

Okinawa Prefecture, Japan, 5(20–22 mm); LICPP 1951019, Mogi, Nagasaki Prefecture, Japan, 2(30–31 mm); LICPP 1981063, Ayanda River, Iriomotejima, Okinawa Prefecture, Japan, 3(12–18 mm); NSMT-P6037-6043, Mizusaki, Asaji Bay, Tsushima Island, Nagasaki Prefecture, Japan, 7(25–29 mm); SMLVO 77-221-225, Udara River, Amitori Bay, Iriomotejima, Okinawa Prefecture, Japan, 4(18–25 mm).

Diagnosis. Dorsal fins VI + I, 16–17; anal fin I, 16–18; pectoral fin 17–20; branched caudal rays usually 7 + 6, occasionally 6 + 6; longitudinal scale count 74–88, scales nonimbricate; gill opening moderate, extending ventrally to below middle of operculum; gill rakers 3–4 + 13–15; 5 head pores above and behind eye, no preopercular pores; nuchal crest a low fold in both sexes, extending forward to above middle of operculum; no dorsal spines elongate in either sex; dorsal and anal rays, excluding first ray of each fin, branched in specimens larger than 22mm; caudal fin truncate to emarginate; females with prominent black ring around anus; males with narrow dark ring around anus; prominent dark stripe present from posterior margin of eye to upper pectoral-fin base and from caudal peduncle to tips of rays 9–10; faint stripe on side of body ventral to midside.

Description. Rostral cartilage not replaced by bone; ventral postcleithrum absent. Anterior extent of predorsal scales from above middle of operculum in a straight line to just below dorsal spine 2; scales on body extending posteriorly onto caudal-fin base, not present immediately below dorsal fins; belly and pectoral-fin base scaled, prepelvic naked or with few scales. Mouth inclined at angle of 60–70° to longitudinal axis of body; anterior nasal tube short; head pores 5: posterior nasal pore, anterior interorbital pore, posterior interorbital pore, supraocular pore, infraorbital pore. Membrane from dorsal spine 6 to second dorsal fin low in both sexes; dorsal spines increasing in length to spine 5 which is longer than spine 6; second dorsal and anal rays 3 and 4 longest, posterior rays decreasing in length gradually; last ray not reaching beyond caudal peduncle; pectoral fins oblong, length of fins less than head length; inner pelvic ray unbranched, others branched, pelvic ray 3 longest, but not elongate.

Colour in alcohol. Body yellowish; head dusky; dusky to dark stripe across snout, posterior to eye, over upper edge of operculum and pectoral-fin base, continuing across body ventral to midside (usually faded) to caudal peduncle (usually dark), onto caudal

fin at bases of rays 8–12 to tips of rays 9–10; dusky to black stripe on dorsal midline from head to posterior caudal peduncle; dorsal fins dusky; outer half of anal fin dark (often faded) in males; other fins pale. Tomiyama (1958) noted that in life this fish has a silvery operculum and a pale green body with a dark stripe along the side.

Distribution. Estuarine to marine in bays and coastal waters of Japan.

Comments. *Parioglossus dotui* has been confused with *P. philippinus* by Miller (1971) and *P. taeniatus* by Dôtu (1956) due to a similarity in body coloration. The black anus in females of *P. dotui* is a distinguishing characteristic. The only other species with a black anus in females is *P. marginalis* which can be separated on the basis of fin ray counts and body coloration. Because both *P. philippinus* and *P. dotui* may have 6 + 6 branched caudal rays and *P. dotui* smaller than 22 mm have unbranched posterior dorsal and anal rays, problems may arise in separating these species, especially when body colour has faded. *Parioglossus philippinus* has a narrower gill opening extending ventrally to just below the pectoral base, a ventral postcleithrum (versus absent), average higher dorsal-fin ray counts (usually I, 17–18 versus usually I, 16–17), lower longitudinal scale counts (usually 61–72 versus 74–88), higher procurent caudal-ray counts, usually unbranched posterior dorsal and anal rays, less extensive development of anterior scales, a naked pectoral-fin base, longer pelvic fins in males and a more elongated fifth dorsal spine in males. *Parioglossus taeniatus* and *P. formosus* can be distinguished from *P. dotui* by fin-ray counts, differences in male dorsal-spine lengths, and the absence of preopercular pores in *P. dotui*. Miller (1971) identified specimens from Ratnagiri, India as *P. dotui* on the basis of dorsal and anal fin counts and longitudinal scales; however, upon examining these specimens, the characteristics are those of *P. philippinus* rather than *P. dotui*. The possibility exists that *P. dotui* and *P. philippinus* merely represent different populations of the same species. *Parioglossus dotui* is restricted to Japan, occurring as far south as the southern Ryukyu Islands, and *P. philippinus* is known from the Indian Ocean and western Pacific. However, since the two species are apparently sympatric in Japan (Senou, personal communication), and the morphological differences appear to be consistent, the two species are regarded here as distinct. Specimens of

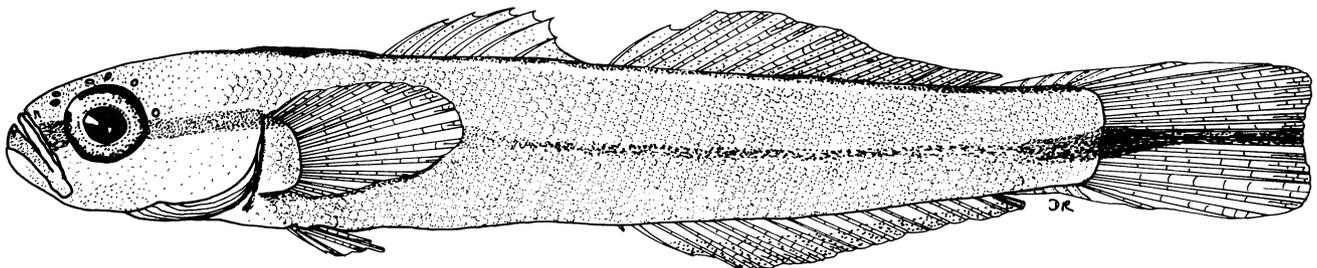


Fig. 6. *Parioglossus dotui*, male, 20 mm, AMS I.23698-001, Japan.

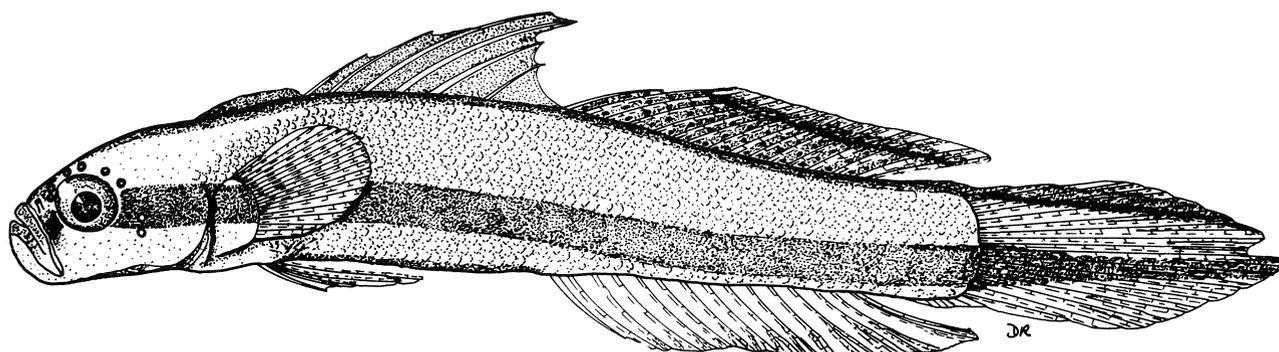


Fig. 7. *Parioglossus formosus*, male, 35 mm, CAS 36932, Gulf of Thailand (body arched).

P. dotui also resemble those of *P. verticalis* in meristic counts and width of the gill opening, but body coloration differs considerably.

Dôtu (1956) noted that this species (identified as *P. taeniatus*) lives a gregarious and semi-pelagic life feeding on planktonic copepods. The spawning season extends from July to September in the Amakusa Islands, Kyushu, Japan.

Parioglossus formosus (Smith)

Figs 1, 7, 21, 35

Herrea formosa Smith, 1931a: 40 (Koh Chula, Chantabun River, Gulf of Siam, Siam).

Herreolus formosus.— Smith, 1931b: 190 (replacement for *Herrea*); Herre, 1940: 364, pl. 6 (in part, Dumaguete, Philippines).

Herreichthys formosus.— Koumans, 1931: 163 (replacement for *Herrea*).

Ptereleotris taeniata taeniata.— Abe, 1939: 569 (Iwayama Bay, Palau Islands).

Parioglossus taeniatus.— Tomiyama, 1958: 1187, pl. 231, fig. 584 (Iwayama Bay, Palau Islands); Tomiyama, 1959: 103, fig. 3 (Iwayama Bay, Palau Islands); Hayashi and Itoh, 1978: 31, pl. 4, fig. 84 (Iriomotejima, Sumiyoshi, Japan).

Type material. NEOTYPE: USNM 119611, Koh Samet, Thailand, male, 23.5 mm.

Additional material. AMS IA.769, Vanuatu, 8(22–24 mm), cleared and stained, 3(24–30 mm); AMS IB.2958, Heron Island, Queensland, 1(20 mm); AMS I.19180-012, Fiji, 2(22–24 mm); AMS I.20392-001, Lizard Island, Queensland, 6(9–21 mm); AMS I.20785-008, Hartleys Creek, Queensland, 1(11 mm); AMS I.22138-001, Pandora Reef, Queensland, 4(12–26 mm); AMS I.23499-002, Ishigakijima, Japan, 16(16–24 mm); BPBM 9237, Palau Islands, 3(26–29 mm); CAS 27451, Goh Samet Island, Gulf of Thailand, 2(20–22 mm); CAS 29090, Ciagba Bay, Negros Island, Philippines, 1(18 mm); CAS 36927, Iwayama Bay, Palau Islands, 7(17–26 mm); CAS 36931, Goh Sak Island, Gulf of Thailand, 1(22 mm); CAS 36932, Hinson Chalam, Gulf of Thailand, 56(7–35 mm); CAS-SU 33116, Dumaguete, Philippines, 7(12–14 mm); LICPP 1980034, Arakawa, Ishigakijima, Japan, 5(20–24 mm); USNM 245268, Ravad Island, Papua New Guinea, 8(15–25 mm); USNM 257047, Palau Islands, 1(10 mm); USNM 257052, Philippines, 5(9–18 mm); USNM 260325, Buton Island, Indonesia, 2(10–20 mm); WAM P.24077, Kendrew Island, Western Australia, 1(16 mm).

Diagnosis. Dorsal fins V–VI + I, 13–15 (usually VI + I, 14); anal fin I, 13–15 (usually I, 14); pectoral fin 15–17 (usually 16–17); branched caudal rays 7 + 6; longitudinal scale count 66–78, scales nonimbricate; gill opening narrow, extending ventrally to just below lower margin of pectoral base and below rear quarter of operculum; gill rakers 3–4 + 12–14; 5 head pores around top and rear margins of each eye and 2 preopercular pores; nuchal crest a prominent fold in males, a low fold in females, extending forward to above middle to front of operculum; dorsal spines 3 and 4 elongate in males, none elongate in females; second dorsal and anal rays branched, except for first ray of each fin often unbranched; caudal fin truncate to slightly emarginate in females; caudal fin of males with upper and lower lobes elongate, lower lobe longer than upper in large males; wide, dark, lateral stripe extending across body (ventral to midside) to tip of caudal fin; second dark stripe along dorsal midline.

Description. Rostral bone present; ventral postcleithrum present. Anterior extent of predorsal scales from just anterior to posterior opercular margin, extending dorsally and posteriorly in a line with first dorsal spine to just below first dorsal fin; scales on body extending posteriorly to end of caudal peduncle; scales absent from area immediately below dorsal fin, pectoral-fin base, prepelvic area and midline of belly. Mouth at angle of 55–60° to longitudinal axis of body; anterior nostril a short tube; head pores: posterior nasal pore, anterior interorbital pore, posterior interorbital pore, supraocular pore, infraorbital pore, 2 preopercular pores (not always present in specimens less than 20 mm). Membrane from dorsal spine 6 not attached to base of spine of second dorsal fin in females, attached in males. Males over 20 mm with spines 1–3 increasing in length, spines 3 and 4 elongate, reaching to or beyond origin of second dorsal fin, spine 5 shorter than spine 4, longer than spine 6, spine 6 reaching to second dorsal origin; females with spines 1–3 increasing in length, spines 3 and 4 about equal, spine 5 shorter than spine 4, longer than spine 6; no spines prolonged, none reaching to second dorsal origin; all second dorsal and anal rays of males approximately equal in length, last rays reaching to beyond caudal fin base; second dorsal and anal segmented rays 3 and 4 longest in

females, decreasing in length posteriorly; pectoral fin oblong, length less than head length; innermost pelvic ray only unbranched, others branched; pelvic rays 3 and/or 4 elongate in males, not reaching to anus; pelvic rays 3 and 4 not prolonged in females; caudal fin with rays 8–9 slightly shorter than rays 7 or 10; caudal fin of males with rays 6–7 and 10–11 elongate, rays 10–11 longer than 6–7.

Colour of fresh material. Body brown, belly white; dark stripe extending from behind eye onto pectoral-fin base and continuing behind pectoral fin to tip of caudal-fin rays on dorsal half of lower lobe; ventral half of lower lobe clear; dark stripe extending from nuchal crest along dorsal midline to tip of caudal-fin rays of dorsal lobe; dorsal margin of caudal fin and membrane between dorsal and ventral stripes clear; bluish green spot below eye; blue spot on base of middle caudal rays; dorsal fins dark, other fins pale.

Colour in alcohol. Dark stripe (width over anal fin greater than half diameter of eye and much greater than width of light area above anal fin) from lower jaw, across snout, continuing posterior to eye and extending over upper half of pectoral-fin base, along side of body (ventral to midline) to caudal fin on rays 9–16 at base and rays 10–11 at tip; narrower stripe along dorsal midline from tip of snout to caudal-fin base and extending obliquely to tip of caudal rays 5–7; narrow dark stripe on ventral midline of belly from behind pelvic-fin base to anus, often continuing along body just above base of anal fin; first dorsal fin dark; second dorsal fin dark with light edge; membrane of second dorsal fin sometimes with spots forming 4–5 transverse rows; pelvic, pectoral, anal, and dorsal and ventral edges of caudal fin, and portion between stripes on caudal fin, pale.

Distribution. Widespread from the Gulf of Thailand to Fiji, and Japan to Australia; found in shallow water of mangroves or coastal reefs, often in schools.

Comments. *Parioglossus formosus* is often collected with *P. raoi* and *P. taeniatus* and closely resembles these two in coloration. *Parioglossus formosus* generally has fewer dorsal- and anal-fin rays (I, 15 usually in *P. raoi* and *P. taeniatus*) and has 5 circumorbital pores whereas *P. taeniatus* usually has 4 and *P. raoi* usually has 2–3. In smaller specimens, where head pores are not fully developed, fin ray counts and differences in coloration will help to separate these species. *Parioglossus formosus* has a wider lateral stripe and distinct mid-dorsal stripe, which is absent in both *P. taeniatus* and *P. raoi*, with the exception of Japanese specimens of *P. raoi*. *Parioglossus formosus* is similar to *P. aporos* in fin-ray counts but *P. aporos* can be distinguished by the lack of head pores and the narrower lateral stripe prominent only from above the anal fin onto the caudal peduncle.

Smith (1945) noted that the original type material was lost and designated a neotype.

Parioglossus lineatus n. sp.

Figs 8, 22, 36

Type material. HOLOTYPE: CAS 36928, mangrove zone, Babelthuap Island, Arakitaoch Stream, Palau Islands, 7°23'24"N, 134°31'07"E, 30 October 1956, collected by Sumang, Marbou, and Fehlmann, male, 33.4 mm. PARATYPES: CAS 52779, cleared and stained, type locality, 1(31 mm); CAS 53330, type locality, 2(24.7–25.1 mm); AMS I.24320, 1(25 mm), and USNM 257043, 1(25 mm), possibly Guadalcanal Island, Solomon Islands, data uncertain.

Diagnosis. Dorsal fins VI + I, 15–16; anal fin I, 15–16; pectoral fin 18–20; branched caudal rays 7 + 6; longitudinal scale count 75–83 scales nonimbricate; gill opening narrow, ending ventrally just below lower pectoral-fin base and below rear quarter of operculum; gill rakers 3–4 + 15–16; 5 circumorbital pores around dorsal and posterior margins of each eye, no preopercular pores; nuchal crest a prominent fold in males, a low fold in females, extending forward to above middle of operculum; dorsal spines 4 and 5 elongate to filamentous in both sexes; second dorsal and anal fin rays branched, except first segmented ray of each fin often unbranched; caudal fin truncate in females, truncate to emarginate in males, lobes equal; dark lateral stripe present, dorsal edge of band along midside; vertical dark bar on base of caudal fin; dark stripe on dorsal midline.

Description. Rostral cartilage not replaced by bone; ventral postcleithrum absent. Anterior extent of predorsal scales from over posterior preopercular margin extending dorsally and posteriorly in line to below dorsal spine 1; scales on body extending posteriorly onto base of caudal fin; no scales immediately below first dorsal fin; belly and prepelvic area scaled; pectoral-fin base naked or with few scattered scales. Mouth inclined at angle of 65–75° to longitudinal axis of body; anterior nostril a simple pore; head pores: posterior nasal pore, anterior interorbital pore, posterior interorbital pore, supraocular pore, infraorbital pore. Males (25–33 mm) with dorsal spines 4 and 5 longest, spines 4–6 extending to or beyond origin of second dorsal fin; females (25 mm) with dorsal spines 4 and 5 elongate, spine 5 reaching to about origin of second dorsal fin; dorsal and anal rays approximately equal length in males, except last ray of each fin which is slightly elongate, usually reaching to end of caudal peduncle; dorsal and anal ray 3 longest in females, rays decreasing in length posteriorly; pectoral-fin margin round, fin less than head length; innermost ray of pelvics unbranched and elongate in both sexes, not reaching to anus, other rays branched.

Colour in alcohol. Body yellow; brown lateral stripe (width above anal fin about equal to diameter of pupil) extending from behind eye, across upper operculum and pectoral-fin base, along trunk and tail with dorsal edge of stripe along midside and terminating at end of caudal peduncle (sometimes fading slightly before end of peduncle); brown vertical bar on bases of caudal rays

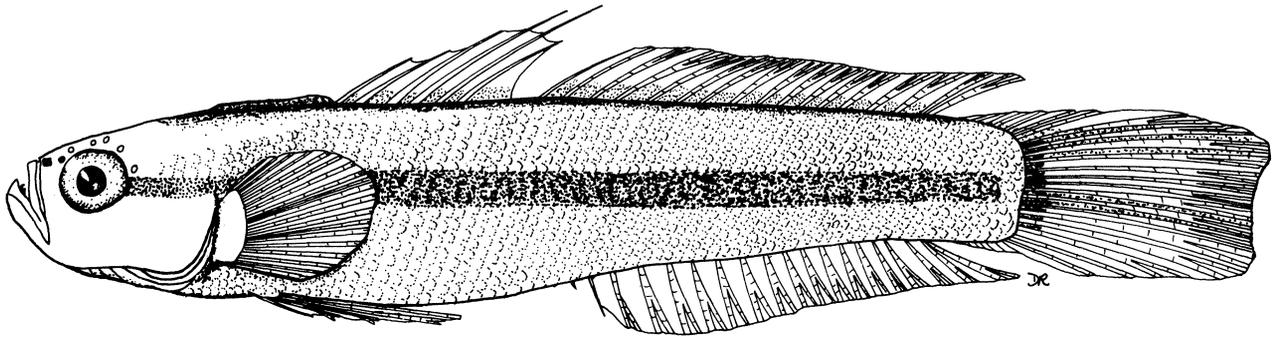


Fig. 8. *Parioglossus lineatus*, holotype, male, 33.4 mm, CAS 36928, Palau Islands.

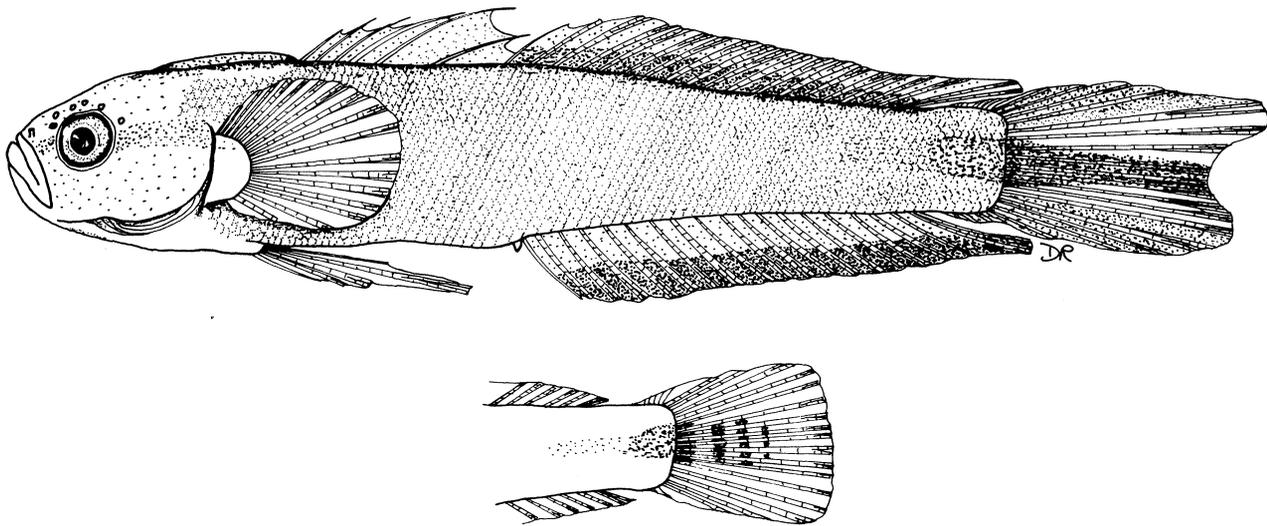


Fig. 9. *Parioglossus marginalis*, holotype, male, 35.5 mm, AMS I. 17459-007, and caudal pigment of female.

4–14; brown stripe on dorsal midline from beginning of nuchal crest to caudal fin extending onto caudal-fin rays 1–5; fins pale.

Distribution. Found in mangrove zones of the Palau Islands and possibly the Solomon Islands.

Comments. The prominent dorsal and lateral stripes and caudal bar and the high pectoral-fin ray and gill-raker counts distinguish this species from all others. The absence of preopercular pores and the elongate dorsal spines in both males and females will separate *P. lineatus* from *P. rainfordi* (males of which have a bar on the base of the caudal fin).

Etymology. From the Latin, *lineatus* = line, named for the two distinctive stripes and vertical band found on the body.

***Parioglossus marginalis* n.sp.**

Figs 9, 23, 34

Type material. HOLOTYPE: AMS I.17459-007, Audley National Park, Port Hacking, New South Wales, 34°4'S, 151°5'E, 5 January 1974, collected by R. Kuitert, male, 35.5 mm. PARATYPES: AMS I.17443-001, Sydney Harbour, New

South Wales, 33°51'S, 151°16'E, collected by R. Kuitert, 2(35–40 mm); AMS I.17459-004 type locality, 3(37–39 mm); AMS I.18241-013, Oakes Bay, Port Hacking, New South Wales, 34°04'S, 151°08'E, 0–6m, 14 November 1974, collected by D. Hoese and party, 48(21–38 mm), cleared and stained, 4(28–33 mm); AMS I.23876-001, no data, 1(37 mm); the following have the same data as AMS I.18241-013: BMNH 1983.7.25: 1–3, 3(28–33 mm); BPBM 29185, 4(29–34 mm); CAS 52780, 4(29–35 mm); QM I.20295 3(29–32 mm); USNM 260323, 4(30–34 mm); WAM P.28011-001, 3(32–33 mm).

Additional material. AMS IB.12 Port Hacking, New South Wales, 1(20 mm), in poor condition.

Diagnosis. Dorsal fins VI (rarely V) + I, 16–18 (usually I, 17–18); anal fin I, 17–18; pectoral fin 17–19 (usually 18–19); branched caudal rays 7 + 6; longitudinal scale count 90–105, scales imbricate on body, occasionally nonimbricate on caudal peduncle; gill opening moderate, extending forward to below and just behind middle of operculum; gill rakers 3–4 + 14–15; 5 circumorbital pores along dorsal and rear margins of each eye, no preopercular pores; nuchal crest a prominent fold in both sexes reaching forward to above middle of operculum, or to above posterior preopercular

margin in large specimens; dorsal spine 5 elongate in males; no spines elongate in females; posterior segmented dorsal- and anal-fin rays branched; caudal fin truncate to slightly emarginate in females, emarginate in males; rim around anus of females black; rim around anus of males pale; dark stripe from caudal peduncle to tip of middle caudal rays in males, females with 3–4 vertical bars on caudal fin.

Description. Rostral cartilage not replaced by bone; ventral postcleithrum absent. Anterior extent of predorsal scales from above middle of operculum extending dorsally to near nuchal crest (but excluding midline) and posteriorly to first dorsal spine; scales on body extending posteriorly onto base of caudal fin; no scales immediately below dorsal fins; top of caudal peduncle scaled; midline of belly, prepelvic area and pectoral-fin base naked. Mouth inclined at angle of 60–70° to longitudinal axis of body; anterior nostril a short tube; head pores: posterior nasal pore, anterior interorbital pore, posterior interorbital pore; supraocular pore; infraorbital pore. Membrane from sixth dorsal spine attached by membrane to spine of second dorsal fin above base; first dorsal fin low, spines increasing in height to spine 5, spine 6 shorter than 5; spine 5 elongate in males, reaching to first or second ray when depressed, not reaching to origin of second dorsal in females; females with dorsal and anal ray 3 longest, posterior rays decreasing in length; males with dorsal and anal rays approximately equal in length, except last ray which is slightly elongate, reaching beyond end of caudal peduncle; pectoral-fin margin round, fins slightly shorter than head length; only innermost pelvic ray unbranched, others branched; pelvic ray 3 elongate in males, not reaching to anus, slightly elongate in females; caudal fin of males with lower lobe equal to upper (in 6 out of 11 specimens) longer than upper (in 3 specimens), or shorter than upper (in 2 specimens).

Colour of live and fresh material. Body brownish dorsally with purple stripe above black mid-lateral stripe; belly white; cheek, operculum and pectoral-fin base with greenish-blue patches; males with margin of second dorsal fin and upper and lower lobes of caudal fin purple, outer half of anal fin black, and mid-lateral stripe extends to tips of middle caudal rays; females with dorsal and anal fins pale, dorsal half of caudal fin dusky, and 3–4 solid to broken black vertical bands along middle caudal rays.

Colour in alcohol. Body yellowish to brown; a diffuse, greyish stripe from snout to eye and from posterior margin of eye along upper preoperculum and operculum, fading on trunk (sometimes discernible) and appearing again on caudal peduncle; stripe extends onto base of caudal rays 6–12 and to tips of rays 8 – 10 or 11 in males; in females stripe extends to base of caudal rays 6–12 breaking into about 3 vertical bars on rays 8–11; males with dark stripe on dorsal and ventral caudal rays, and clear area between these and midcaudal stripe; dorsal midline with diffuse, greyish stripe; first

dorsal dusky; males with basal half of second dorsal fin dark; males with outer half of anal fin membrane dusky to black; second dorsal and anal fins of females pale to dusky; pectoral and pelvic fins pale.

Distribution. Associated with sand and rocky substrates in shallow water of estuarine and coastal marine habitats; found in Port Hacking and Sydney Harbour, Sydney, New South Wales, Australia; seen in Wagonga estuary, southern New South Wales.

Comments. This is one of the two warm-temperate species of *Parioglossus*. It is a large species, reaching a length of 39mm, and exhibits a high degree of sexual dimorphism. In body coloration, males of *P. marginalis* are somewhat similar to *P. philippinus* and *P. dotui* whereas the females differ in coloration from these two species as well as from the males of *P. marginalis*. However, *Parioglossus philippinus* usually has 6 + 5 branched caudal rays and a lower longitudinal scale count, and has a ventral postcleithrum, and *P. dotui* has a lower average fin-ray count (I, 16–17 for both dorsal and anal fins) and a lower longitudinal scale count.

Etymology. From the Latin, *marginalis* = border, edge, named for the dark margins of the dorsal and ventral caudal lobes and margin of anal fin in males, and dark margin around the anus of the females.

Parioglossus nudus n. sp.

Figs 10, 24, 33

Type material. HOLOTYPE: CAS 36930, about 125 m northeast of southwest arm of Auluptagel Island, along reef which runs northeast to larger island in Risong Bay, Palau Islands, 7°17'59"N, 134°28'48"E, collected by H. DeWitt, Sumang, Sengich, and Exley, 29 November 1957, female, 19 mm. PARATYPES: AMS 1.24321-001, wreck of Japanese warship, 23 km west of Honiara, Guadalcanal, Solomon Islands, 20–22 m, 8(11–19 mm); CAS 36929, small coral filled bay formed by a finger of Usa Island, Auluptagel Island, and Ryugu Island, 7°18'47"N, 134°29'22"E, Palau Islands, 1(22 mm); CAS 52781, type locality, cleared and stained, 1(21 mm); CAS 53329, type locality, 5(17–21 mm); LICPP 1977056, Malipano, Samal, Mindanao, Philippines, 5 m, 1(17 mm); ROM 42573, data same as AMS 1. 23421-001, 76(10 – 22 mm); ROM 42575, Bonagi Island, west of Honiara, Guadalcanal, Solomon Islands, 20 m, 3(10–14 mm); ROM 42576, locality same as ROM 42575, 18–22 m, 8(11 – 19 mm); USNM 235991, Viti Levu, Fiji, 18°25'S, 178°45'W, 0–37 m, 4(11–20 mm); USNM 257055, Jalun Island, Hermit Islands, Papua New Guinea, 1°31'12"S, 145°01'30"E, 0–15 m, 1(16 mm); USNM 261553, Oriental Negros, just off Bonbonon Point, Philippines, 9°2'45"N, 123°7'37"E, 0 – 12 m, 1(22 mm); USNM 261557, Balicasag Island, Philippines, 9°31'14"N, 123°40'E, 0–25 m, 1(19 mm).

Diagnosis. Dorsal fins VI + I, 15–18 (usually I, 16–17); anal fin I, 16–17 (usually I, 16); pectoral fin 16–18; branched caudal rays 6 + 5; body naked; gill opening narrow, ending ventrally just below lower pectoral-fin base and below posterior quarter of operculum; gill-rakers 1–3 + 10–12 (= 12–14); no head

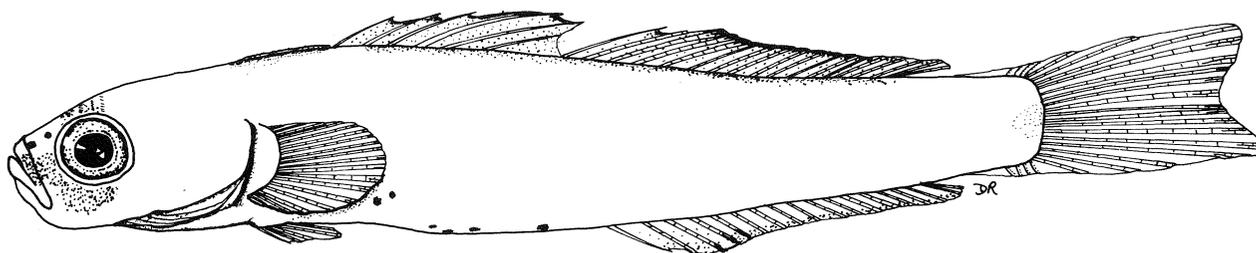


Fig. 10. *Parioglossus nudus*, holotype, female, 19.0 mm, CAS 36930, Palau Islands (body colour faded).

pores; nuchal crest usually low in both sexes, extending forward to above middle of operculum; dorsal spines 4 and 5 longest but not elongate in either sex; second dorsal and anal segmented rays 2–4 or 5 branched, rest unbranched; caudal fin forked; large spots or small, closely spaced spots present on belly.

Description. Rostral bone present; ventral postcleithrum present. Mouth inclined at angle of 65–75° to longitudinal axis of body; anterior nostril a simple pore. Dorsal spines increasing in length to spine 4, spines 4 and 5 about equal and may reach to spine of second dorsal or slightly beyond (in specimens >17 mm), spine 6 shorter than spine 5; females and males with dorsal and anal rays 2 and 3 longest, posterior rays decreasing in length; males with last ray of each fin slightly elongate not reaching to end of caudal peduncle; pectoral-fin margin round, fins less than head length; innermost and outermost pelvic rays unbranched; middle 2 rays branched in specimens over 16 mm; pelvic ray 3 longest but not prolonged in either sex.

Colour in alcohol. Body yellow; dusky patch on midside of posterior caudal peduncle extending onto bases of caudal rays 8–11 (often faded); preorbital, interorbital and suborbital dusky to black; diffuse black stripe on upper edge of preoperculum (often faded); first dorsal fin dusky; females with narrow black stripe along nuchal crest and margin of first and second dorsal fins; second dorsal and anal fins dusky, bases of dorsal and anal fins sometimes dark; base of pectoral fins dark; closely spaced, small brown spots or sometimes large, well-separated spots usually present on gut of both males and females.

Distribution. Found on coral reefs from depths of 5 to 37 m from Fiji, Solomon Islands, Papua New Guinea, Palau Islands, and the Philippines.

Comments. *Parioglossus nudus* differs in several characters from other species in the genus. The lack of scales, head pores and distinctive pigmentation, which could be regarded as juvenile features, are maintained in mature specimens. Individuals of the species are small (the largest specimen being 21.9 mm and a female with eggs as small as 17.4 mm) relative to other members of the group. *Parioglossus nudus* is known from depths much greater than those of other species of *Parioglossus*, but it also occurs at shallower depths.

Etymology. From the Latin, *nudus* = naked, named for the lack of scales on the body.

Parioglossus palustris (Herre)

Figs 11, 25, 36

Ptereleotris microlepis evides.— Abe, 1939 (not Jordan and Hubbs): 569 (Palau Islands).

Andameleotris palustris Herre, 1945a: 2 (Zamboanga, Philippines).

Parioglossus borneensis Koumans, 1953: 363, fig. 89 (Balikpapan Bay, Borneo).— Tomiyama, 1958: 1191, pl. 231, fig. 585 (Palau Islands); Tomiyama, 1959: 102, fig. 2 (Palau Islands).

Type material. HOLOTYPE: CAS-SU 36808, from a pool in a nipa swamp near the fisheries station, Mindanao, Philippines, collected by A.W. Herre, 10 September 1940, male, 24 mm. PARATYPES: CAS-SU 36809, type locality, 3(17.9–19.5 mm). Holotype of *P. borneensis*, ZMA 110.139, Borneo, female (21.7 mm); paratype of *P. borneensis*, RMNH 17094, Borneo, female (21.3 mm).

Additional material. AMS I. 17541-003, Konedobu mangroves, Port Moresby, Papua New Guinea, 2(14–21 mm); AMS I. 22055-004, Bailey Creek, Cape Tribulation, Queensland, 1(25 mm); AMS I. 22849-002, Great Keppel Island, Queensland, 14(11–27 mm), cleared and stained, 2(23–24 mm); AMS I. 23936-002, East Arm, Darwin, Northern Territory, 125(11–28 mm); BPBM 15915, Port Moresby, Papua New Guinea, 2(21–24 mm); WAM P.28158, Bristow Island, Papua New Guinea, 6(20–28).

Diagnosis. Dorsal fins VI + I, 16–17; anal fin I, 16–18 (usually I, 17); pectoral fin 16–19 (usually 16–17); branched caudal rays usually 7 + 6; longitudinal scale count 78–89, scales imbricate; gill opening narrow, extending ventrally to just below lower pectoral-fin base and below posterior quarter of operculum; gill rakers 3 + 13–15; 5 pores along upper and rear margin of eye, and 2 preopercular pores; nuchal crest a low fold in both sexes, extending forward to above and between anterior quarter of operculum and rear end of eye; dorsal spines 3, 4 and 5 elongate in males over 20 mm; spines 2, 3 and 4 longest in females but not elongate; second dorsal and anal segmented rays 2–4 or 5 and last ray branched, rest usually unbranched; caudal fin round to slightly emarginate; no dark lateral stripe on body; dark round spot at base of ventral caudal rays.

Description. Rostral bone present; ventral postcleithrum present. Anterior extent of predorsal scales from above posterior preopercular margin, extending dorsally to nuchal crest, excluding midline; scales on body extending posteriorly onto base of caudal fin; belly, prepelvic area and pectoral-fin base scaled

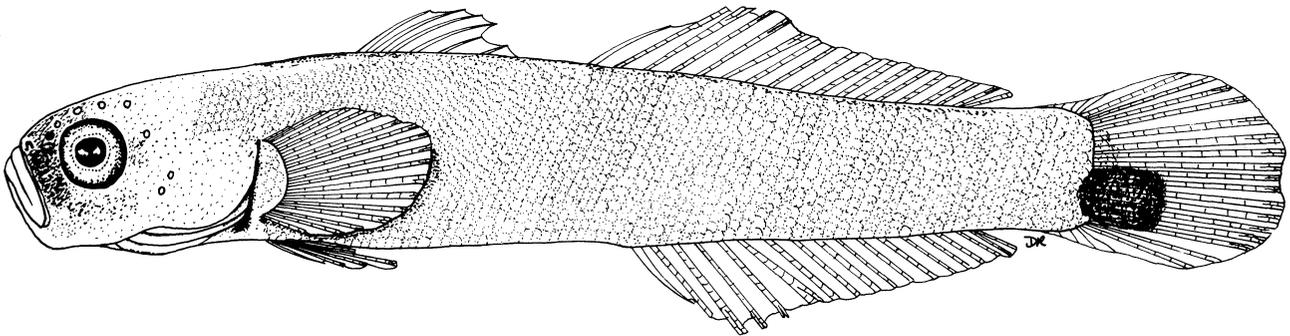


Fig. 11. *Parioglossus palustris*, female, 21 mm, AMS 1.17541-003, Papua New Guinea.

(sometimes sparsely). Mouth inclined at angle of 80–85° to longitudinal axis of body; anterior nostril a short tube; head pores: posterior nasal pore, anterior interorbital pore, posterior interorbital pore, supraocular pore, infraorbital pore, 2 preopercular pores (not always present in specimens under 20 mm). Membrane from dorsal spine 6 not connected to base of second fin in either sex; dorsal spines 3, 4 and 5 longest in males larger than 20 mm, reaching to second dorsal origin, spine 6 reaching to second dorsal origin; spines 2–4 longest in females not reaching to second dorsal origin; females with dorsal and anal rays 2–4 longest, posterior rays decreasing in length; males larger than 20 mm with dorsal and anal rays approximately equal in length, last ray not reaching end of caudal peduncle; pectoral-fin margin oblong, fin less than head length; only innermost pelvic ray unbranched, others branched; pelvic ray 3 longest not reaching beyond tip of pectoral fin in either sex; caudal fin of females round to slightly emarginate, rays 8–9 or 10 shorter than surrounding caudal rays; rays 5–7 or 8 and 10–11 elongate in males larger than 20 mm.

Colour of fresh material. Body brown to reddish with dark black spot at base of lower caudal rays; dorsal, anal and pelvic fins reddish with white to yellowish margin; 2 reddish stripes extending to tips of upper and lower caudal rays leaving dorsal and ventral margins white to yellow; head with several red patches on cheek, interorbital and snout; blue-green iridescent rectangular spot ventral to eye; snout and operculum dusky; thin reddish lines along myomere septa on ventral half of body.

Colour in alcohol. Body brown; dark round spot at base of caudal rays 9–15; small black spots (about 13–16 pairs) sometimes present on either side of second dorsal and anal fins; dusky patch sometimes present posterior to eye just below infraorbital pore; females frequently with dark, closely spaced, small spots in 2 longitudinal rows on either side of gut; second dorsal fin dusky, upper rays of caudal fin dusky, other fins pale; anus pale to brown.

Distribution. Found in shallow waters of mangrove zones of Borneo, Philippines, Papua New Guinea, and northern Australia. This species is known from Japan (Senou, personal communications).

Comments. The distinctive caudal-fin spot and the lack of a mid-lateral stripe along the body easily distinguishes *P. palustris* from other species of *Parioglossus*. *Parioglossus palustris* has been collected with *P. sp.* but body coloration will separate the two species. Specimens of *P. raoi* under 17 mm have a large caudal-fin spot which may, at first glance, resemble that of *P. palustris*. However, *P. raoi* has a distinct black spot on the first dorsal fin and a stripe (sometimes faded) on the lateral surface of the body, markings which are not present on *P. palustris*.

Parioglossus philippinus (Herre)

Figs 12, 26, 34

Herreolus formosus (in part).— Herre, 1940: 364 (Port Holland, Basilan, Philippines).

Herreolus philippinus Herre, 1945b: 14 (Santa Maria, Zamboanga Province, Mindanao, Philippines).

Ptereleotris stigmaturus Smith, 1945: 511, Fig. 102 (Chantabun River Estuary, S.E. Thailand).

Type material. HOLOTYPE: CAS-SU 36812, Santa Maria, Zamboanga Province, Mindanao, Philippines, collected by A.W. Herre, 21 September 1940, female, 23.7 mm. PARATYPES: CAS-SU 36813, type locality, 1(20.5 mm); CAS-SU 36814, type locality, 2(23 mm). Holotype of *Ptereleotris stigmaturus*, USNM 119639, Chantabun Estuary, Thailand, male (22 mm). Paratype of *P. stigmaturus*, USNM 119640, Chantabun Estuary, Thailand, 1(22 mm).

Additional material. AMS 1.24223-001, Rabaul Yacht Club, New Britain, 2(13–19 mm); BMNH 1960.8.29:6-9, Ratnagiri, Bombay, India, 4(24–25 mm); BMNH 1960.12.30:32-61, Ratnagiri, Bombay, India, 28(22–25 mm); CAS-SU 69 000, Port Holland, Basilan, Philippines, 1(30 mm); NTM S. 10004-022, Sandy Island, Coburg Peninsula, Northern Territory, 1(18 mm); USNM 261549, Pt. Fievre, Madagascar, 1(19 mm). The following material is all from the Gulf of Thailand: AMS 1.24322-001, Prachuap Kiri Khan Province, west side of Goh Luem, 10(24–32 mm); AMS 1.24323-001, northwest side of Goh Maprao, Chumphon Province, 8(19–30 mm); CAS 36933, Ban Angtong Bay, west side of Goh Samui Island, 3(21–23 mm); CAS 36934, Aoa Kating Bay, 4(19–22 mm); CAS 36935, south side of Goh Proet Island, 5(17–23 mm); CAS 36936, southwest shore of Ko Chang, 4(19–22 mm); CAS 36937, southeast of Ban Pae fisheries station, Rayong Province, 11(17–28 mm); CAS 36938, northwest side of Koh Samet Island, Rayong Province, 1(16

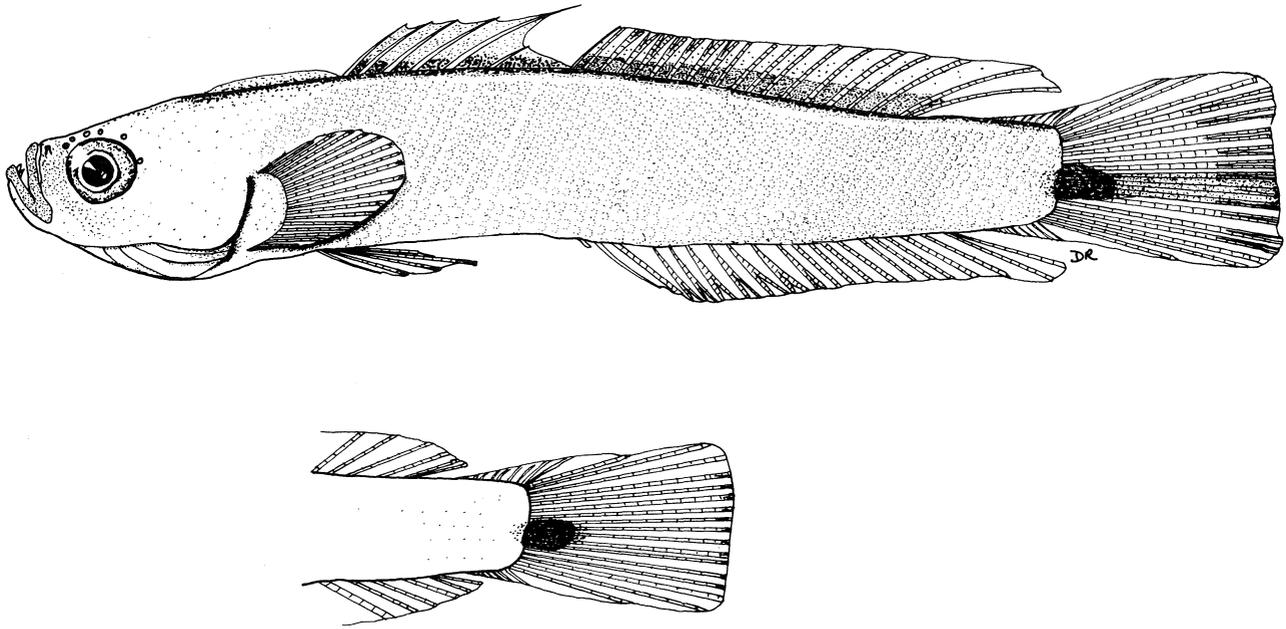


Fig. 12. *Parioglossus philippinus*, male, 32 mm, CAS 36948, Gulf of Thailand, and caudal pigment of female.

mm); CAS 36939, Ko Kroi Island, Rayong Province, 4(19–22 mm); CAS 36941, Prond Bay, southwest corner of Goh Samed, Chumphon Province, 60(15–29 mm), cleared and stained, 3(20–24 mm); CAS 36942, northwest side of Goh Maprao, Chumphon Province, 67(15–31 mm); CAS 36943, Chumphon Province, northeast end of Goh Kawtian, 2(19–26 mm); CAS 36944, southwest of Kau Larn, Chumphon Province, 3(23–28 mm); CAS 36945, southwest point on Goh Chorakhav, Chumphon Province, 9(16–24 mm); CAS 36946, north tip of Goh Chorakhav, Chumphon Province, 1(22 mm); CAS 36947, northwest side of Goh Raed, Prachuap Kiri Khan Province, 1(16 mm); CAS 36948, west side of Goh Luem, Prachuap Kiri Khan Province, 21(15–32 mm); CAS 36950, west side of Goh Luem, Prachuap Kiri Khan Province, 154(10–32 mm); CAS 36951, northwest side of Goh Raed, Prachuap Kiri Khan Province, 18(13–28 mm).

Diagnosis. Dorsal fins VI + I, 16–19 (usually I, 17–18); anal fin I, 16–19 (usually I, 17–18); pectoral fin 17–20 (usually 18–19); branched caudal rays usually 6+5 (occasionally 6+6); procurrent caudal rays 8–11+8–10; longitudinal scale count 61–81, scales nonimbricate; gill opening narrow, extending ventrally to just below lower margin of pectoral-fin base, and below and just in front of posterior opercular margin; gill rakers 2–3+12–14; 5 head pores along upper and rear margins of each eye, no preopercular pores; nuchal crest a moderate to prominent fold in males, a low fold in females, extending forward to above front quarter of operculum or to above eyes in large males; spine 5 of males over 20mm longest; all dorsal spines of females lower than anterior rays of second dorsal fin; second dorsal and anal rays 2 to 8 or 9 branched, others usually unbranched (sometimes posterior rays branched, but rarely all rays branched); caudal fin truncate to emarginate; round to elongate black spot at base of middle caudal rays; males with faint narrow grey ring

around anus.

Description. Rostral cartilage not replaced by bone; ventral postcleithrum present. Anterior extent of predorsal scales from over rear of operculum, extending in straight line to below dorsal spine 2; scales on body extending posteriorly to end of caudal peduncle; no scales on back immediately below dorsal fins and on dorsal midline of caudal peduncle; belly sparsely scaled; prepelvic area and pectoral-fin base naked. Mouth inclined at angle of 75–85° to longitudinal axis of body; anterior nostril a simple pore, with slightly elevated margin; head pores: posterior nasal pore, anterior interorbital pore, posterior interorbital pore, supraocular pore, infraorbital pore; preopercular pores absent. Membrane of dorsal spine 6 of males attached to base of spine of second dorsal fin, not attached in females; first dorsal fin low in both sexes, spine 5 of males larger than 20 mm extending to origin of second dorsal or slightly beyond; spines of females all lower than anterior rays of second dorsal fin, not reaching to second dorsal fin; dorsal and anal rays of males about equal in length from beginning to middle of fins, posterior rays increasing in length gradually, last ray of each fin extending beyond end of caudal peduncle; females with dorsal and anal rays 2–3 longest, posterior rays decreasing in length; pectoral fin margin oblong, fin shorter than head length; only innermost ray of pelvic fins unbranched, others rays branched; pelvic ray 3 elongate in males, sometimes extending to anus, only slightly longer than ray 2 in females; caudal fin truncate or emarginate, specimens larger than 20mm may have elongate dorsal and ventral caudal lobes.

Colour in alcohol. Body brown to yellow; dorsal midline from behind eyes to caudal peduncle and base of anal fin dusky to black; round to elongate black spot

on base of caudal rays 8–12, frequently extending as a stripe to tip of rays 9–11; males with basal half of dorsal fins dusky, other fins pale; females with pale fins; males with a narrow dark ring around anus (often faded); females with anus pale to brown.

Distribution. Associated with sand and coral reefs to 10 m; widespread in the southwestern Pacific and Indian Oceans from the Northern Territory (Australia), New Britain, Philippines, Gulf of Thailand, India, and Madagascar.

Comments. *Parioglossus philippinus* and *P. dotui* are very similar. There can be considerable difficulty in separating these species as there is slight overlap in some distinguishing characteristics, such as numbers of dorsal and anal rays, branched caudal rays and procurent caudal rays, longitudinal scale counts, and branching of posterior dorsal and anal rays. Body colour of the two species is very similar. Differences between the two species include a diffuse mid-lateral stripe on body in *P. dotui* (no stripe in *P. philippinus*), a more distinct spot on the caudal fin of *P. philippinus* (the spot of *P. dotui* often extending to the tips of the fin rays), and the absence of a horizontal stripe posterior to the eye in *P. philippinus*.

The branched caudal-ray number, which is one of the most distinctive differences between the species, is occasionally 6+6 in both species. Two of the 16 specimens from the Ryukyu Islands have this number and there is the possibility that hybrids or integrades occur in the Ryukyu Islands. However, Senou (personal communication) has indicated that he has examined material of both species from the same collection from Shikoku Island, Japan. The two species differ in the width of the gill opening, with *P. dotui* having a much broader gill-opening, and at present there is no evidence that the two species overlap in this feature.

Ranade and Sankolli (1962) identified *P. philippinus* from Ratnagiri, India, as *P. taeniatus* but Miller (1971) identified it as *P. dotui*. Miller suggested the possibility of *P. philippinus* (as *P. dotui*) and *P. taeniatus* being different colour phases of the same species; however, as he also noted, morphological differences of mature males and females between the species indicate that *P. philippinus* and *P. taeniatus* are distinct. *Parioglossus taeniatus* and *P. formosus* can be distinguished from *P. philippinus* by fin-ray counts, differences in male dorsal spine lengths and the absence of preopercular pores in *P. philippinus*. The only other species that has a black anus in females is *P. marginalis* which can be distinguished from *P. philippinus* by the presence of imbricate scales, higher longitudinal scale count and differences in coloration. *Parioglossus philippinus* also resembles *P. verticalis* in meristic counts, but body coloration differs considerably.

Both *Herreolus philippinus* Herre and *Ptereleotris stigmaturus* Smith were described in 1945. *Herreolus philippinus* Herre (1945b) appears to be the oldest available name with a listed publication date of 21 March. Ernest A. Lachner has informed us that the copy

of Smith (1945) in the Division of Fishes (USNM) library was date stamped 13 November upon receipt from the U.S. government printing office.

***Parioglossus rainfordi* McCulloch**

Figs 13, 27, 37

Pariglossus (sic) *rainfordi* McCulloch, 1921: 471, pl. 61, fig. 4 (Bowen, Queensland).

Ptereleotris taeniatus rainfordi.— Abe, 1939: 569 (Palau Islands).

Herreolus formosus.— Herre, 1940: 364 (in part, Port Holland, Basilan, Philippines).

Parioglossus rainfordi.— Tomiyama, 1958: 1183, pl. 230, fig. 583 (Palau Islands); Tomiyama, 1959: 102, fig. 1 (Palau Islands).

Type material. HOLOTYPE: AMS IA.176, from bored timber, Bowen, Queensland, 20°01' S, 148°15' E, collected by E.H. Rainford, 13 April 1921, male, 35 mm. PARATYPES: AMS IA.177 type locality, 4(28–36mm).

Additional material. AMS IA.231, Bowen, Queensland, 20(21–38 mm); AMS IA.6325, Lindeman Island, Queensland, 8(30–38 mm), cleared and stained, 2(28–37 mm); AMS I.17541–004, Konedobu mangroves, Port Moresby, Papua New Guinea, 1(25 mm); AMS I.22849–001, Great Keppell Island, Queensland, 4(14–36 mm); BPBM 18614, Ambon, Moluccas, Indonesia, 1(22 mm); BPBM 28946, Port Moresby, Papua New Guinea, 2(28–32 mm); CAS 56021, Palau Islands, 3(22–23 mm); CAS–SU 33117, Port Holland, Basilan, Philippines, 2(14–31 mm); USNM 257051, Kranket Island, Papua New Guinea, 1(25 mm); USNM 257053, Negros Oriental, Philippines, 1(17 mm); USNM 260322, Ponape, Caroline Islands, 1(21 mm); USNM 261550, Kairiru swamp, Muschu Island, Papua New Guinea, 1(18 mm); USNM 262202, Basilaki Island, Papua New Guinea, 30(24–32 mm); USNM 264337, Misool, Irian Jaya, 1(27 mm); USNM 264339, Batanta Island, Irian Jaya, 7(16–25 mm).

Diagnosis. Dorsal fins V–VI + I, 14–17 (usually I, 15–16); anal fin I, 14–16 (usually I, 15); pectoral fin 16–18 (rarely 16); branched caudal rays 7+6; longitudinal scale count 90–109, scales nonimbricate or imbricate; gill opening narrow, extending ventrally to just below lower pectoral-fin base and below posterior quarter of operculum; gill rakers 3–4 + 14–15; 5 head pores above and behind each eye; 2 preopercular pores; nuchal crest a low fold in both sexes, extending forward to above operculum; dorsal spine 3 elongate to filamentous in both sexes; second dorsal- and anal-fin rays branched, except first ray of each fin often unbranched; caudal fin round to truncate; males with grey to brown vertically elongate bar at base of caudal fin rays 2–14, females and immature males with dark, roundish spot at base of caudal rays 4–12.

Description. Rostral bone present; ventral postcleithrum present. Anterior extent of predorsal scales from just above middle of operculum extending posteriorly and dorsally in line to below dorsal spine 3; scales on body extending posteriorly onto base of caudal fin, excluding area immediately below first dorsal fin; belly scaled, prepelvic area and pectoral-fin base

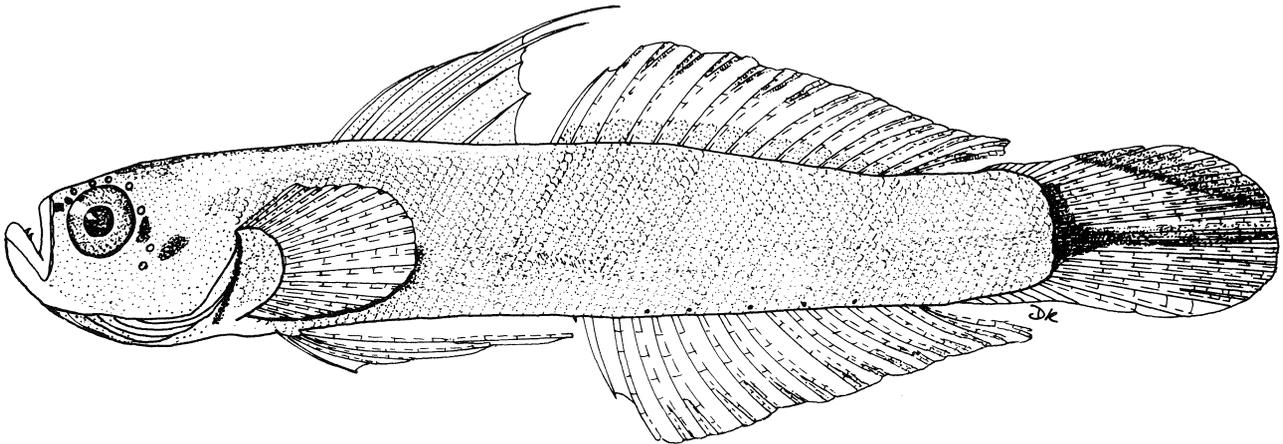


Fig. 13. *Parioglossus rainfordi*, male, 32 mm, BPBM 28946, Papua New Guinea.

naked or sparsely scaled. Mouth almost vertical, at angle of 85–90° to longitudinal axis of body; anterior nostril a simple pore, with a raised rim; head pores: posterior nasal pore, anterior interorbital pore, posterior interorbital pore, supraocular pore, infraorbital pore, 2 preopercular pores (not always present in specimens under 19 mm). Membrane from dorsal spine 6 not attached to base of second dorsal fin; dorsal spine 3 elongate to filamentous in both sexes, reaching beyond second dorsal origin in specimens larger than 30 mm; dorsal spine 4 may be elongate to filamentous, spine 6 reaching to second dorsal origin in males; dorsal and anal rays 2 and 3 longest in females, posterior rays decreasing in length; males with dorsal and anal rays about equal in length, last rays of each fin reaching to about end of caudal peduncle or slightly anterior to end; pectoral-fin margin round, fin less than head length; only innermost pelvic ray unbranched, others branched; innermost ray of pelvic fin longest in males, reaching to anus in males over 25 mm, not elongate in females.

Colour in alcohol. Body dusky to yellow; dark grey to brown patch behind eye and similar patch on upper half of operculum; males with elongate greyish to brown vertical bar at base of caudal-fin rays 2–14, frequently with a horizontal, thin extension reaching to tip of caudal fin on rays 9–11; dark diagonal bar along upper and/or lower part of caudal fin sometimes present; females and immature males with dark grey to brown round spot at base of caudal rays 4–12; females with dusky mid-lateral stripe sometimes present (usually very diffuse) from origin of pectoral fin to about end of caudal peduncle, usually more prominent anterior to second dorsal origin; outer edge of scales often black; fins dusky to light; second dorsal fin with basal quarter of membrane dark; several pairs of small black spots on either side of anal fin.

Distribution. Found in shallow water around mangroves of northern Queensland (Australia), Papua New Guinea, Indonesia, Caroline Islands, Palau Islands and the Philippines. This species is also known from Japan (Senou, personal communication).

Comments. *Parioglossus rainfordi* is often found with *P. formosus*. The distinct mid-lateral stripe of the latter and the difference in caudal-fin coloration are distinguishing characteristics. Some confusion may occur in separating the males of *P. rainfordi* from those of *P. lineatus*, both of which have bars at the base of the caudal fin. In larger specimens, the presence of preopercular pores in *P. rainfordi* will distinguish the two species. In smaller specimens, the differences in pectoral-fin ray counts, longitudinal scale counts, size of nuchal crest and length of dorsal spine 3 will separate the two species. Herre (1940) reported 4 specimens of *P. formosus* (as *Herreolus formosus*) from Port Holland, Basilan; we have reidentified 2 of these as *P. rainfordi*. According to Herre, these fish live in the growth around pilings and swim in schools.

Parioglossus raoi (Herre)

Figs 14, 28, 36

Amblyeleotris (*Andameleotris*) *raoi* Herre, 1939: 346 (West coast, Guitar Island, Middle Andaman, Andaman Islands).

Parioglossus sp.— Hayashi, Suzuki, Ito, and Senou, 1981: 14, pl. 11, fig. 148 (Yonadagawa River, Japan).

Type material. PARATYPES: CAS-SU 37149, Guitar Island, Middle Andaman Island, collected by H.S. Rao, 22 March 1934, 17(10–16 mm).

Additional material. AMS I.23499–001, Arakawa, Ishigakijima, Japan, 3(21–25 mm); LICPP 1976017, Kabira Bay, Ishigakijima, Japan, 4(18–20 mm); LICPP 1979095, Hoshtzunanohama, Iriomotejima, Japan, 2(20–21 mm); ROM 42980, Fiji, 3(19–20 mm); ROM 42981, Fiji, 9(14–22 mm); USNM 211056, Saparua, Moluccas, Indonesia, 4(14–17 mm); USNM 223240, Ponape, Caroline Islands, 2(19–20 mm); USNM 235992, Great Astrolabe Reef, Fiji, 4(9–10 mm); USNM 236663, Viti Levu, Fiji, 1(20 mm); USNM 236664, southwest corner of Kavala Bay, Fiji, 56(8–21 mm), cleared and stained, 6(18–22 mm); USNM 257049, Siquijor Island, Philippines, 1(14 mm); USNM 257056, South Bais Bay, Oriental Negros, Philippines, 6(16–20 mm); USNM 260324, Buton Island, Indonesia, 3(8–17 mm); USNM 261546, Kumbuna Creek, Suva, Fiji, 1(18 mm); USNM 261552, Biak

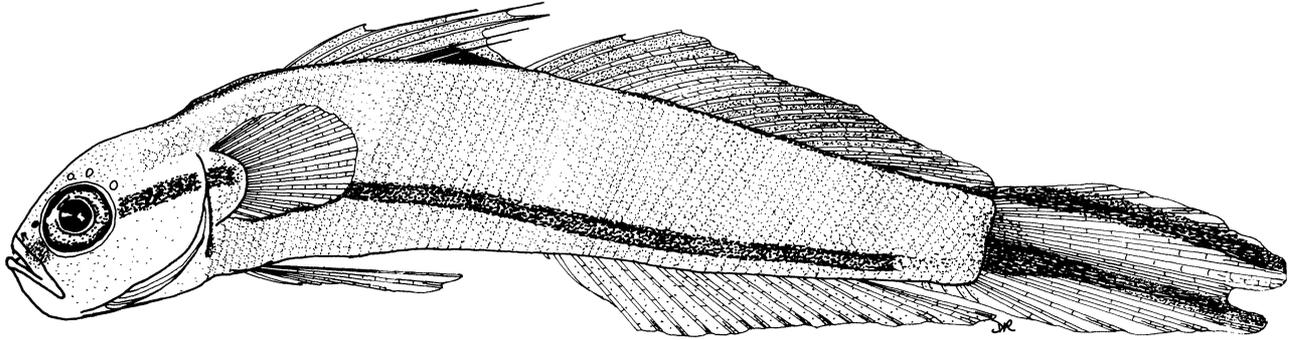


Fig. 14. *Parioglossus raoi*, male, 20 mm, USNM 223240, Caroline Islands (body arched).

Island, Schouten Island, Korido Bay, Irian Jaya, 22(10-17); USNM 264338, Misool, Irian Jaya, 1(15 mm); USNM 264340, Batanta Island, Irian Jaya, 5(13-19 mm).

Diagnosis. Dorsal fins VI + I, 14-16 (usually I, 15); anal fin I, 14-16 (usually I, 15); pectoral fin 15-18 (usually 16-17); branched caudal rays usually 7 + 6; longitudinal scale count 70-85, scales imbricate, occasionally nonimbricate; gill opening narrow, extending ventrally just below lower margin of pectoral-fin base and below posterior quarter of operculum; gill rakers 3-4 + 12-14 (= 15-17); 2-6 head pores; nuchal crest a prominent fold in males, a low fold in females, extending forward to above operculum or rear of operculum; dorsal spines 3 and 4 longest in males, no spines prolonged in females; second dorsal and anal rays branched, except first ray in each fin in specimens over 20 mm, only anterior rays (excluding first ray) branched in specimens under 20 mm; inner pelvic ray elongate; caudal fin truncate to slightly emarginate in females; caudal fin emarginate in males, with dorsal and ventral lobes about equal or ventral lobe slightly longer; black stripe present from pectoral fin base to caudal peduncle, arching ventrally posteriorly and continuing just above anal fin, becoming diffuse and disappearing on caudal peduncle; width of stripe about equal to space between stripe and anal fin base.

Description. Rostral bone present; ventral postcleithrum present. Anterior extent of predorsal scales from above operculum extending posteriorly and dorsally in line to below dorsal spine 1; scales on body extending posteriorly onto caudal-fin base, excluding area immediately below first dorsal fin; belly, preopercular area and pectoral-fin base scaled. Mouth inclined at angle of 70-75° to longitudinal axis of body; anterior nasal tube short; head pores varying from 2 to 6: 2 pores—supraocular pore, infraorbital pore; 3 pores—posterior interorbital pore, supraocular pore, infraorbital pore; 4 pores— anterior interorbital pore, posterior interorbital pore, supraocular pore, infraorbital pore; 5 pores—posterior interorbital pore, supraocular pore, infraorbital pore, 2 preopercular pores; 6 pores— anterior interorbital pore, posterior interorbital pore, supraocular pore, infraorbital pore, 2 preopercular pores; head pores may not be present in specimens smaller than 15 mm. Dorsal spines elongate to slightly filamentous in males, spines 3 and 4 about equal in length, extending beyond second dorsal origin,

spine 5 shorter than spine 4 and longer than spine 6; no spines elongate in females, spines increasing in length to spine 3, spine 4 shorter than spine 3, none reaching second dorsal origin; dorsal and anal rays 1-4 longest in males, posterior rays decreasing slightly in length; last ray of each fin extending to posterior part of caudal peduncle or beyond; females with dorsal and anal ray 2 and 3 longest, posterior rays decreasing in length, last rays not reaching beyond caudal peduncle; pectoral-fin margin oblong, fin less than head length; only innermost pelvic ray unbranched, others branched; innermost pelvic ray longest, not reaching anus; caudal fin truncate to slightly emarginate in females, males with caudal rays 5 or 6-7 and 10 or 11-12 elongate, dorsal and ventral lobes about equal in length or lower lobe longer.

Colour of fresh material. Body yellow to brown; black stripe (width less than pupil diameter) extends posteriorly from behind eye, across body ventral to midside to tip of caudal fin; snout dusky; upper and lower caudal lobes dusky (upper darker than lower), separated by clear patch between dusky lobes and dark stripe; lateral part of belly and lower half of pectoral-fin base silver to white; ventral portion of belly dark; dorsal fins dusky to dark; large, bright blue spot between dorsal spines 5 and 6 and extending on membrane to attachment to body.

Colour in alcohol. Body brown; snout and interorbital dark; greyish to black (width less than diameter of pupil) stripe extending posteriorly from behind eye across upper operculum and pectoral-fin base, continuing on body from behind upper pectoral base (dipping ventrally under pectoral fin) along trunk and tail ventral to midside (midway between midside and anal fin to closer to anal fin) to end of anal fin where stripe frequently fades until caudal fin where stripe continues at base of caudal rays 9-14 to tips of rays 10-11 (in specimens under 16mm, caudal pigment is frequently a large, brownish spot on rays 7-15); midline of belly frequently dark; rear edge of scales often outlined in black; nuchal crest black (in Japanese specimens) or same colour as body; narrow, dusky, mid-dorsal stripe sometimes present; oblique, dusky bar across upper 7 caudal fin rays, extending to tips; oblique dusky bar sometimes present on lower caudal rays; dorsal fins dusky to dark; large black spot on membrane at base of first dorsal fin extending from dorsal spine 5 to behind dorsal spine 6; anal, pectoral, and pelvic

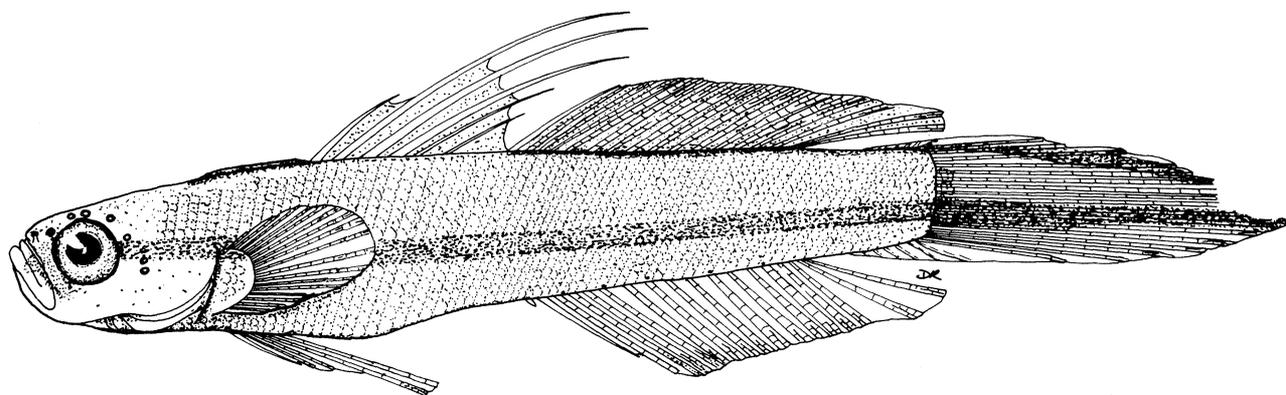


Fig. 15. *Parioglossus taeniatus*, male, 24.4 mm, AMS I.23506, Vanuatu (tail broken).

fins pale.

Distribution. Shallow water in mangroves, estuaries, and coastal marine habitats, associated with mud, sand and rock; widespread from Fiji to the Andaman Islands and from Japan to Indonesia.

Comments. Some features of *P. raoi* appear to vary with geographical location as well as with size of fish. Circumorbital pores are present in specimens over 13mm, but it is unlikely that the number of pores present at this size represents the full complement at maturity. For example, in Table 2, the greatest number of pores tends to occur in the largest specimens within each locality. At 18 mm, populations from the Caroline Islands, Fiji, Irian Jaya and the Philippines tend to have 3 pores, while those from Japan usually have 2 (Tables 1, 2). However, specimens from the Andaman Islands ranging in size between 13 and 15 mm have 3 pores. Whether 2 pores represent the average number for Japanese specimens or whether more pores develop in larger specimens is uncertain, since pores could possibly be added with increasing size. Preopercular pores are found more frequently in *P. raoi* from Fiji than elsewhere and occur in some specimens as small as 16 mm. The presence of preopercular pores will lead to some confusion in separating *P. taeniatus* from *P. raoi*; however coloration differences distinguish these species.

There is some geographic and size variation in colour. Specimens of *P. raoi* from Japan have a darker dorsal midline compared to specimens from other areas, though Herre (1939) stated that there is a narrow dark stripe on each side of the dorsal base from specimens collected from the Andaman Islands. These stripes are not present on the paratypes examined, though presumably they have faded. The large, roundish, dark spot on the caudal fin in specimens under 17 mm appears to contract in larger specimens. The smaller specimens, at first glance, resemble those of *P. palustris*, however specimens of *P. raoi*, even at 10 mm, have the distinct black spot near the end of the first dorsal fin and a lateral stripe (quite faded in many specimens), markings that are never present in *P. palustris*. *Parioglossus* sp., which has the low lateral stripe similar to that of *P. raoi* but has a more rounded fin spot compared to the elongated one of *P. raoi*, has a higher

dorsal- and anal-fin ray count. Herre (1939) stated that *P. raoi* has a dorsal- and anal-fin ray count of I,15-17 and I,15-18 respectively, however, dorsal- and anal-fin counts of 10 paratypes examined were I,14-15 and I,14-16, respectively.

Some confusion might occur in distinguishing specimens of *P. raoi* from those of *P. taeniatus*. Differences in head pore counts and coloration will separate these two species; *P. taeniatus* has 4 circumorbital pores in specimens over 15 mm and *P. raoi* has the lateral stripe located more ventrally along the body and a black dorsal-fin spot.

Before the formation of the head pores, small specimens of *P. raoi* may resemble small specimens of *P. aporos*. These two species can be differentiated by the larger caudal-fin spot of *P. raoi* (fin spot of *P. raoi* on rays 5-7, while that of *P. aporos* is ventral to the midrays) and by the absence of a distinct mid-dorsal stripe in *P. raoi* (except in specimens from Japan).

Parioglossus taeniatus Regan

Figs 15, 29, 37

Parioglossus taeniatus Regan, 1912: 302 (Pacard Lagoon, Aldabra).

Type material. SYNTYPES: BMNH 1912.5.3: 28-29, Pacard Lagoon, Aldabra, collected by J.C. Fryer, 1 male, 23.1 mm, 1 female, 19.0 mm.

Additional material. AMS I.19180-016, Vei Sari River, Fiji, 1(21 mm), cleared and stained, 3(13-24 mm); AMS I.23506, Vanuatu, 1(24 mm); ANSP 64236, Suva Bay, Fiji, 1(19 mm); CAS 36926, Babelthuap Island, Palau Islands, 1(22 mm); CAS-SU 38553, Zamboanga, Mindanao, Philippines, 5(13-20 mm); ROM 42979, Fiji, 6(16-24 mm); USNM 257050, Palawan Province, Cuyo Island, Philippines, 1(12 mm); USNM 261545, Kumbuna Creek, Suva, Fiji, 1(19 mm).

Diagnosis. Dorsal fins VI + I,14-16 (usually 15); anal fin I, 15-16; pectoral fin 16-19 (rarely 19); branched caudal rays 7 + 6; longitudinal scale count 76-86, scales imbricate; gill opening narrow extending ventrally to just below lower margin of pectoral-fin base and below posterior third of operculum; gill rakers 3-4 + 13-15 (= 17-18); 4 head pores above and behind each eye and 2 preopercular pores (in specimens >19 mm); nuchal

crest a prominent fold in males, a low fold in females, extending forward to above operculum; dorsal spines 2, 3 and 4 elongate to filamentous in males; dorsal spine 3 longest in females, not prolonged; segmented dorsal- and anal-fin rays branched, except first segmented ray of each fin; caudal fin round to slightly emarginate in females, dorsal and ventral lobes elongate in males; greyish to brown lateral stripe, with dorsal edge along midline of side of body, extending along body to tip of caudal fin.

Description. Rostral bone present; ventral postcleithrum present. Anterior extent of predorsal scales from above posterior preopercular margin, extending dorsally to nuchal crest, excluding midline; scales on body extending posteriorly onto caudal-fin base (including area immediately below dorsal fins); belly, prepelvic area and pectoral-fin base scaled. Mouth inclined at angle of 70–80° to longitudinal axis of body; 4 head pores in specimens over 15 mm, 6 in specimens over 19 mm: anterior interorbital pore, posterior interorbital pore, supraocular pore, infraorbital pore, 2 preopercular pores (in specimens >19 mm). Dorsal spines 2, 3 and 4 elongate in males, about equal in length, extending beyond second dorsal origin, spine 5 longer than spine 6, spine 1 about equal in length to spine 6; spines 1–3 of females increasing in length posteriorly, not extending to second dorsal fin, spine 4 shorter than spine 3 and longer than spine 5, spine 5 longer than spine 6; segmented dorsal and anal rays 2–3 longest in females, posterior rays decreasing in length; males with segmented dorsal and anal rays 2–4 longest, posterior rays decreasing in length, last ray of each fin longer than penultimate ray and extending beyond caudal peduncle; pectoral-fin margin oblong, fin less than head length; only innermost pelvic ray unbranched, others branched; pelvic rays 3 and 4 longest, about equal in length, not reaching anus; males with several dorsal and ventral caudal rays elongate, easily broken, ventral rays 10–13 filamentous in specimens larger than 22 mm.

Colour in alcohol. Body yellowish to brown; snout dark; brown stripe (width above anterior part of anal fin less than ½ diameter of eye) extending posteriorly from behind eye, over upper edge of operculum and pectoral-fin base, along trunk and tail (upper edge of stripe along midside) to tip of caudal fin on rays 9–14 or 15 at base and 10–11 at tips; stripe narrower than space between stripe and anal fin; diagonal bar across upper lobe of caudal fin present on rays 1–6; dorsal and ventral midlines of body and nuchal crest light; small brown to black spots often present on anal fin; dorsal fins dark, other fins dusky; females with densely spaced, small, brown spots in 2 longitudinal rows, one on either side of gut.

The syntypes of *P. taeniatus* from Aldabra are faded, and it is uncertain whether the colour described here is typical of Indian Ocean material.

Distribution. Found in areas of sand, silt and rocks in estuaries, mangroves and coastal waters of Fiji,

Vanuatu, the Palau Islands, the Philippines and Aldabra.

Comments. The similarity in coloration of *P. taeniatus* with *P. formosus* and *P. raoi* has caused some confusion in past identifications, especially as these species may occur together. Of the material we have examined, which formed the basis of previous records of the species in the literature, all records (except that of the original description) have been based on other species. Differences between *P. taeniatus* and *P. formosus* include a higher fin ray count, fewer head pores and a narrower lateral stripe in *P. taeniatus*, while *P. raoi* can be distinguished by usually having fewer head pores, a lower lateral stripe, which fades on the caudal peduncle, and a black dorsal-fin spot.

Parioglossus triquetrus n. sp.

Figs 16, 30, 37

Type material. HOLOTYPE: ROM 43041, mangrove swamp in a creek 10 miles West of Lauri, Fiji, 18°14'48"S, 178°04'E, 0–1 m, collected by R. Winterbottom and R. McKinnon, 21 April 1983, male, 20.0 mm. PARATYPES: AMS I.24324–001, data as for type, 3(14–22 mm); ROM 43042, type locality, 6(11–23 mm); USNM 235990, Naikorokoro Creek about 15 km southwest of Suva, Viti Levu, Fiji, 0–1 m, 9 May 1982, 1(18 mm).

Diagnosis. Dorsal fins VI + I, 15–17 (usually 16–17); anal fin I, 17–18 (usually 17); pectoral fin 17–19; branched caudal rays 7 + 6; longitudinal scale count 83–95, scales imbricate anteriorly, occasionally nonimbricate posteriorly; gill opening moderate, extending ventrally to below middle of operculum; gill rakers 2–4 + 11–14; 5 head pores above and behind each eye, no preopercular pores; nuchal crest a low fold in both sexes, extending forward to above operculum or posterior preopercular margin; dorsal spines 2–5 filamentous in males over 20 mm; females with no prolonged spines; second dorsal and anal segmented rays branched (in specimens over 19 mm), except first segmented ray of each fin; caudal fin truncate in females, truncate in males except for rays 13–14 which are elongate in specimens larger than 18 mm; black, usually triangular spot on base of caudal rays 6–11.

Description. Anterior extent of predorsal scales from above middle of operculum extending posteriorly to below first dorsal spine; scales on body extending posteriorly onto caudal-fin base, excluding area immediately below first dorsal fin; belly and pectoral-fin base scaled; prepelvic area naked. Mouth at angle of 65–75° to longitudinal axis of body; anterior nostril a simple pore; head pores: posterior nasal pore, anterior interorbital pore, posterior interorbital pore, supraocular pore, infraorbital pore. Dorsal spines 3–5 filamentous, in males over 20 mm spines often reaching to third quarter of second dorsal fin, spine 1 shorter than spine 2, spine 6 reaching to beyond second dorsal origin; females with spine 1 shorter than spine 2, spine 2–5 about equal, spine 6 shorter than spine 5, not

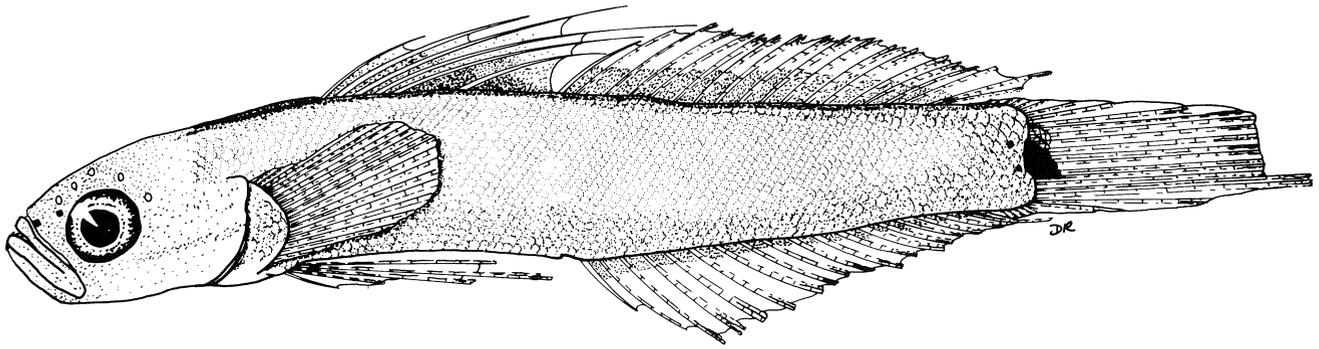


Fig. 16. *Parioglossus triquetrus*, holotype, male 20 mm, ROM 43041, Fiji.

reaching to second dorsal origin; segmented dorsal rays 2 and 3 longest, posterior rays decreasing in length; last ray of second dorsal and anal fins longer than penultimate ray and extending to base of caudal fin; pectoral-fin margin oblong, fin shorter than head length; only innermost pelvic ray unbranched, others branched; pelvic rays 3 and 4 filamentous in males, ray 3 often reaching to anus in specimens over 20 mm; no rays prolonged in females.

Colour in alcohol. Body tan; posterior edge of scales frequently black; head dusky; brown stripe on dorsal midline from snout to caudal fin (often faded); females sometimes with diffuse dusky stripe on lateral midline of trunk; first dorsal fin dusky, membrane darker between spines 5 to end; basal half of membrane of second dorsal dark in males, pale in females; basal third of membrane of anal fin dark in males, pale in females; caudal and pectoral fins dusky; black, triangular (occasionally rectangular) spot on caudal rays 6–11, highest point of triangle on ray 10 or 11; frequently with 1–2 smaller black spots just anterior to caudal spot.

Distribution. Found in mangroves of Fiji to depths of about 1.5 m.

Comments. This species is similar in coloration to females of *P. rainfordi*; however, differences such as higher fin-ray counts, lack of preopercular pores, truncated caudal fin and extremely filamentous dorsal-fin spines in males of *P. triquetrus* separate these two species.

A single 18 mm female (USNM 261547), from the Seychelles, appears close to this species. The specimen has only the anterior dorsal and anal rays branched, as in comparable sized specimens from Fiji. However, the specimen differs in having second dorsal fin I,15, anal fin I,16, a larger spot on the caudal-fin base covering bases of rays 2–12, and a thin dark stripe discernible posteriorly on the body. Otherwise the specimen agrees with the specimens from Fiji. Since it may represent a different species it is not regarded as a type.

Etymology. From the Latin, *triquetrus* = three-sided, named for the shape of the caudal-fin pigment.

Parioglossus verticalis n. sp.

Figs 17, 31, 35

Type material. HOLOTYPE: USNM 257089, north or northeast coast of Ponape, Caroline Islands, 6°57'30"N, 159°08'E or 6°59'45"N, 158°11'E (2 stations accidentally combined), 0–1.5 m, collected by V.G. Springer, 4 September 1980, male 21.4 mm.

Diagnosis. Based on one male specimen, 21.4 mm. Dorsal fins VI + I,17; anal fin I,17; pectoral fin 18; branched caudal rays 7 + 6; longitudinal scale count 103, scales imbricate; gill opening moderate, extending ventrally to below middle of operculum; gill rakers 4 + 15; 5 pores above and behind each eye; no preopercular pores; nuchal crest a low fold; no elongate dorsal-fin spines; segmented second dorsal and anal rays branched, except for first ray of each fin; caudal fin truncate; dusky to black spot at base of caudal rays 5–13, extending to tips of rays 8–10; black ring around anus; 13 dark vertical bands along dorsal half of body under second dorsal fin; outer half of anal fin black.

Description. Anterior extent of predorsal scales from above posterior preopercular margin extending dorsally and posteriorly in line to below dorsal spine 2; scales on body extending posteriorly onto caudal-fin base, excluding area immediately below first dorsal fin; belly scaled, prepelvic, and pectoral-fin base naked. Anterior nostril a simple pore, head pores: posterior nasal pore, anterior interorbital pore, posterior interorbital pore, supraocular pore, infraorbital pore. No elongate spines, spines 2–6 about equal in length; last ray in second dorsal and anal fins slightly elongate, not reaching end of caudal peduncle; pectoral-fin margin oblong, fin less than head length; only innermost pelvic ray unbranched, others branched; pelvic ray 3 longest not reaching to anus.

Colour in alcohol. Body dusky; dark stripe present across snout, continuing posteriorly from eye to across operculum; stripe fades along midside of body, forming dark spot on caudal peduncle to base of caudal rays 5–13; spot extending as stripe to tips of rays 8–10; upper and lower caudal rays dark; 13 dark vertical bands along dorsal half of body, first just before second dorsal fin, last on caudal peduncle; dorsal midline dark from

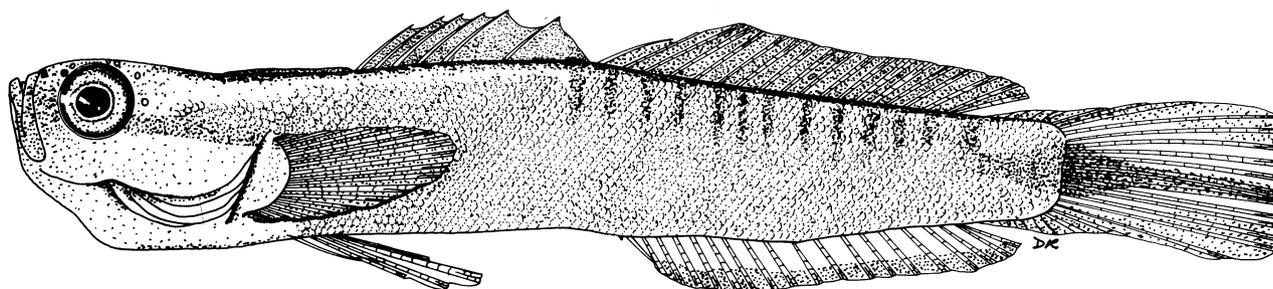


Fig. 17. *Parioglossus verticalis*, holotype, male, 21.4 mm, USNM 257089, Caroline Islands.

interorbital to end of caudal peduncle; ventral midline light; dorsal fins and pectoral fins dusky; outer half of anal fin dusky to black; narrow dark edge around anus.

Distribution. One specimen from shallow coastal water of the Caroline Islands.

Comments. Except for the vertical bands of *P. verticalis*, this species is very similar in body coloration and fin counts to *P. philippinus* and *P. dotui*. The major differences which have prompted the placement of this specimen into its own group are the higher number of longitudinal series of scales, the presence of imbricate rather than nonimbricate scales, and the vertical bands which have not been seen in any other species of *Parioglossus*.

Etymology. From the Latin, *verticalis* = upright, named for the vertical bands on the body.

Parioglossus sp.

Figs 18, 32, 33

Material examined. AMS I.17541-007, Port Moresby, Papua New Guinea, 1(20 mm); BPBM 29184, Port Moresby, Papua New Guinea, 3(16-26 mm); FO 1658, Lea Lea, Papua New Guinea, 2(22-26 mm); USNM 261551, on mainland in lee of Samei island, Irian Jaya, Indonesia, 3(20-23 mm); USNM 261554, Cape Ward Hunt, Papua New Guinea, 2(14-22 mm); USNM 261555, south coast of Misool, Irian Jaya, 1(18 mm); USNM 261556, Batanta Island, Irian Jaya, 3(17-19 mm).

Diagnosis. Dorsal fins V-VI (usually VI) + I, 16-18; anal fin I, 16-18; pectoral fin 16-17; branched caudal rays 7+6; longitudinal scale count 71-95, scales imbricate; gill opening narrow, extending ventrally to just below lower pectoral base and below posterior third of operculum; gill rakers 3-4 + 13-15 (= 16-18); usually 4 pores above and behind eyes, posterior nasal pore absent; preopercular pores present in specimens larger than 17 mm; nuchal crest a low fold in both sexes, extending forward to above operculum; dorsal spines 3 and 4 elongate in males; spine 3 longest in females but not prolonged; segmented dorsal and anal rays 2-8 branched, posterior rays unbranched, last ray usually branched in specimens over 20 mm, unbranched in smaller specimens; caudal-fin margin round to emarginate; dorsal and ventral caudal rays slightly

filamentous in males; narrow brown stripe along body present below midside, extending from pectoral-fin base to about middle of second dorsal fin; width of stripe narrower than space between stripe and anal fin; round to oblong, brown to black spot at base of caudal rays 6-15 or 16; dark, diagonal bar along upper and sometimes lower caudal-fin rays.

Description. Anterior extent of predorsal scales from above posterior preopercular margin extending dorsally and posteriorly to nuchal crest, excluding predorsal midline; scales on body extending posteriorly onto base of caudal fin, excluding area immediately below first dorsal fin; belly, prepelvic area and pectoral-fin base scaled (at least in some specimens). Mouth inclined at angle of 80-85° to longitudinal axis of body; anterior nostril a short tube; 6 head pores (rarely 7, posterior nasal pore usually absent): anterior interorbital pore, posterior interorbital pore, supraocular pore, infraorbital pore, 2 preopercular pores (in specimens larger than 17 mm). Dorsal spines 3 and 4 elongate in males reaching beyond second dorsal origin, spines 2 and 5 about equal, longer than spines 1 and 6, spine 6 (when present) just reaching to base of second dorsal fin; females with spines increasing in length to third spine, spine 3 longer than spine 4, spines decreasing in length to spine 6, no spines reaching to second dorsal origin; females with dorsal and anal rays 2 and 3 longest, posterior rays decreasing in length; males with all dorsal and anal rays approximately equal in length, last ray of each fin reaching to end of caudal peduncle; pectoral-fin margin round, less than head length; only innermost pelvic ray unbranched, others branched, pelvic ray 3 longest, not reaching anus; caudal-fin margin round to emarginate, males with caudal rays 6-7 and 10-11 slightly filamentous, females with rays 5-7 slightly longer than others.

Colour in alcohol. Body yellow to brown; head dusky; upper half of pectoral-fin base dark; brown stripe extending along side of body, from pectoral-fin base to below middle of second dorsal fin, dorsal edge of stripe below midside; large, round to oblong, brown spot at base of caudal rays 6 to 13-16, sometimes extending to tips of rays 10-11 as thin stripe; brown oblique stripe present along caudal rays 1-7 and a second stripe along caudal rays 13-17 (ventral stripe

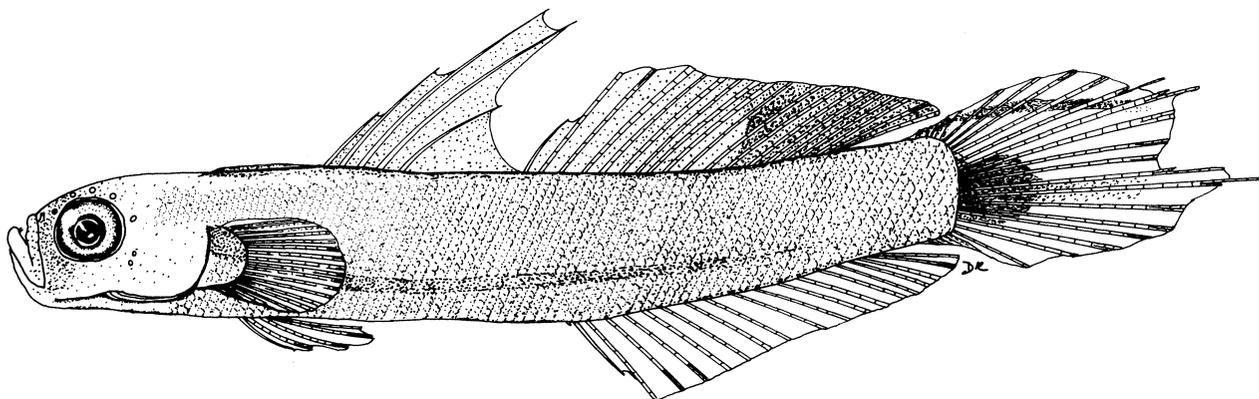


Fig. 18. *Parioglossus* sp., male, 25.6 mm, BPBM 29184, Papua New Guinea (normally 6 dorsal spines).

frequently faded); dorsal fins dusky, posterior half of second dorsal darker than anterior half; other fins pale; females with closely spaced, brown spots forming 2 longitudinal rows, one on either side of gut; 10–15 pairs of tiny black spots frequently present on body on either side of dorsal and anal fin bases.

Distribution. Shallow water in mangroves of Papua New Guinea and Irian Jaya. This species is also known from Japan (Senou, personal communication).

Comments. This species is often found with *P. palustris*. The presence of a dark lateral stripe in *P. sp.* easily separates the two species. The low number of circumorbital pores may cause some confusion in distinguishing this species from *P. raoi* which also has a low lateral stripe; however, dorsal- and anal-fin ray counts of *P. raoi* are lower. *Parioglossus rainfordi* also inhabits mangroves of Papua New Guinea and faded specimens of *P. sp.* may be mistaken for that species, especially as both species may have 5 or 6 spines in the first dorsal fin. The lower dorsal- and anal-fin counts and 5 circumorbital pores of *P. rainfordi* are the best characteristics for distinguishing these two species.

This species will be described by Mr. Hiroshi Senou and Mr. Toshiyuki Suzuki.

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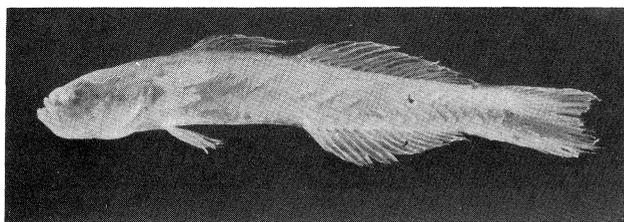


Fig. 19. *Parioglossus aporos*, holotype, male, 24.2 mm, USNM 257045, Indonesia.

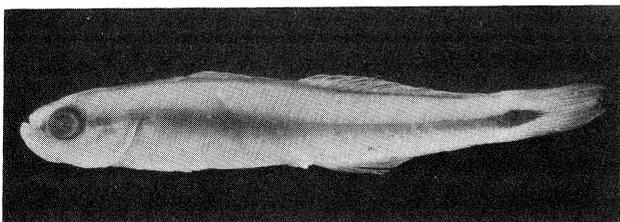


Fig. 20. *Parioglossus dotui*, female, 25.7 mm, SLMV 6037-6043, Nagasaki Prefecture, Japan.

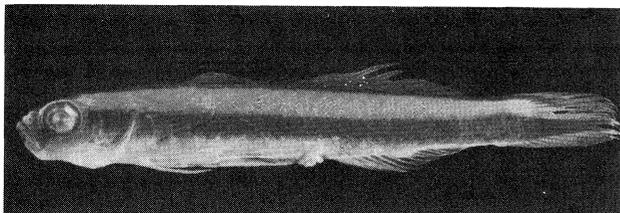


Fig. 21. *Parioglossus formosus*, female, 21.4 mm, AMS I.20392-001, Lizard Island, Australia.

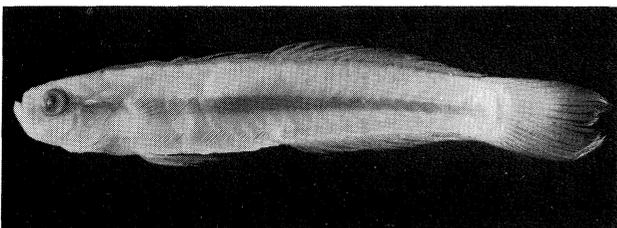


Fig. 22. *Parioglossus lineatus*, holotype, male, 33.4 mm, CAS 36928, Palau Islands.

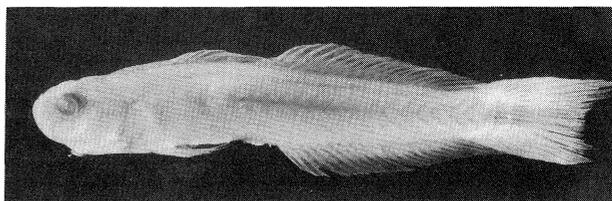


Fig. 23. *Parioglossus marginalis*, holotype, male, 35.5 mm, AMS I.17459-007, Port Hacking, New South Wales, Australia.



Fig. 24. *Parioglossus nudus*, holotype, female, 19.0 mm, CAS 36930, Palau Islands.

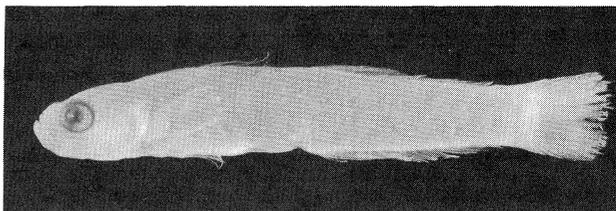


Fig. 25. *Parioglossus palustris*, paratype, male, 18.4 mm, CAS-SU 36809, Mindanao, Philippines.

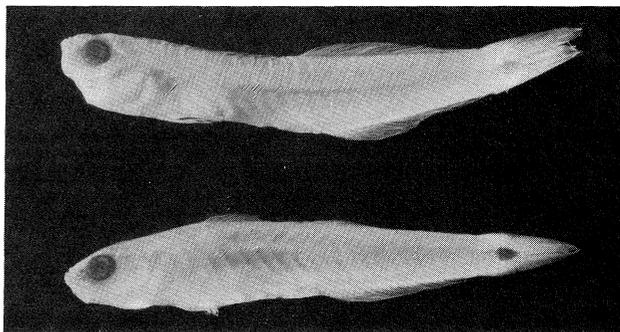


Fig. 26. *Parioglossus philippinus*, paratypes, 2 females, 23.1 and 23.8 mm, CAS-SU 36814, Mindanao, Philippines.

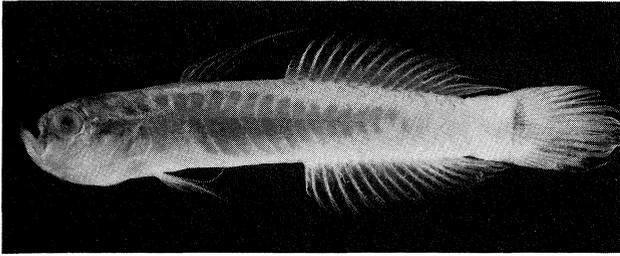


Fig. 27. *Parioglossus rainfordi*, male, 32 mm, BPBM 28946, Papua New Guinea.

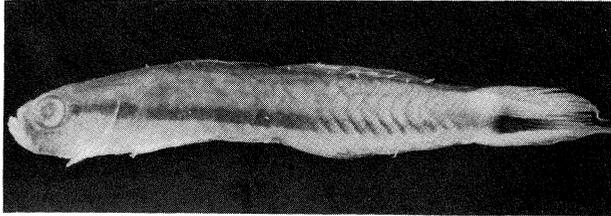


Fig. 28. *Parioglossus raoi*, male, 20.3 mm, ROM 42980, Fiji.

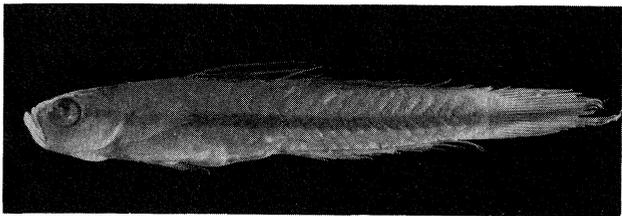


Fig. 29. *Parioglossus taeniatus*, male, 24.4 mm, AMS I. 23506, Vanuatu.

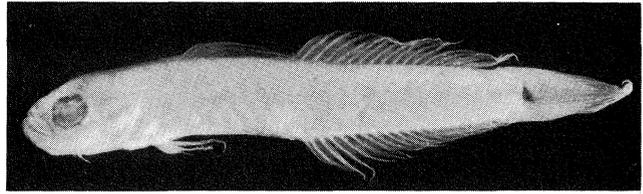


Fig. 30. *Parioglossus triquetrus*, holotype, male, 20 mm, ROM 43041, Fiji.

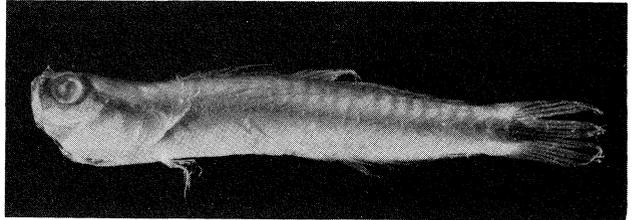


Fig. 31. *Parioglossus verticalis*, holotype, male 21.4 mm, USNM 257089, Caroline Islands.

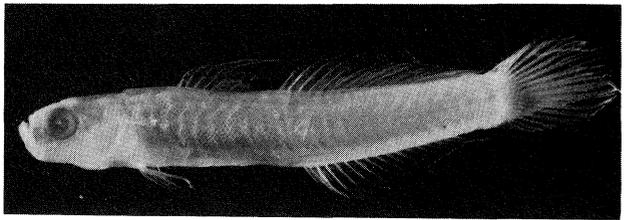


Fig. 32. *Parioglossus* sp., 25.6 mm, BPBM 29184, Papua New Guinea.

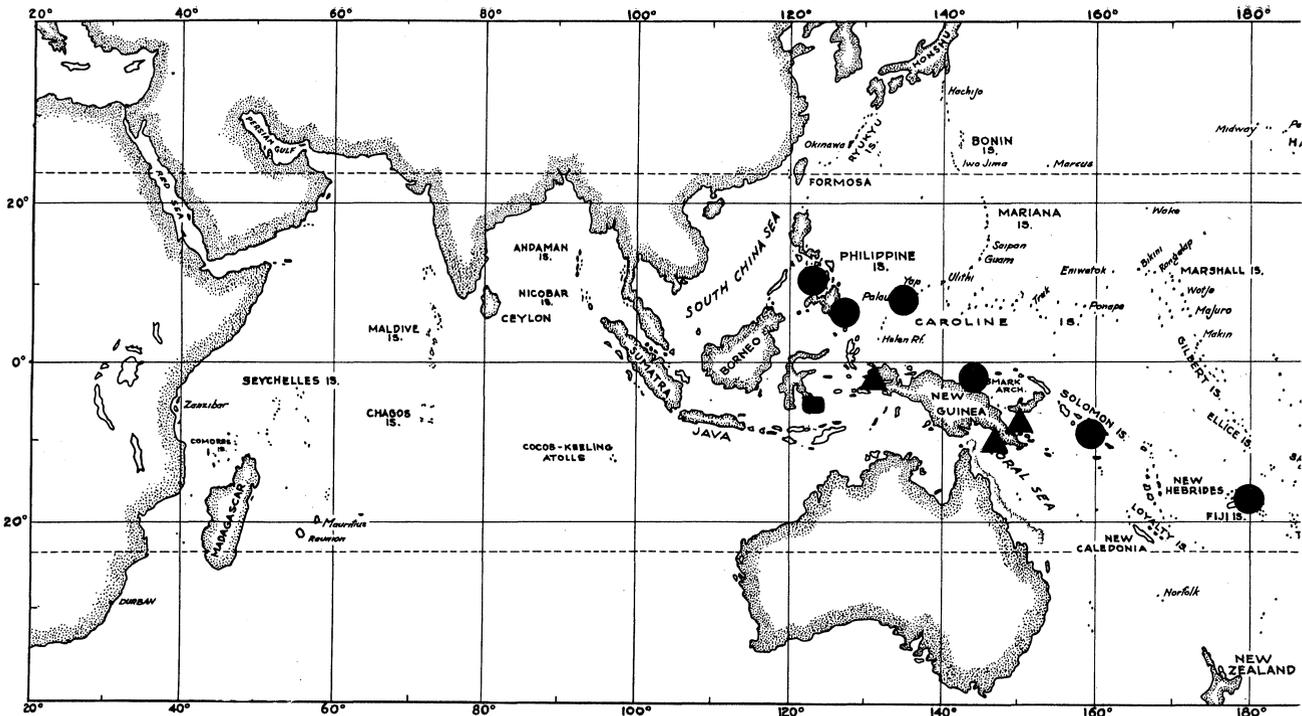


Fig. 33. Distribution of *Parioglossus aporos* (rectangles), *P. nudus* (circles), and *P. sp.* (triangles).

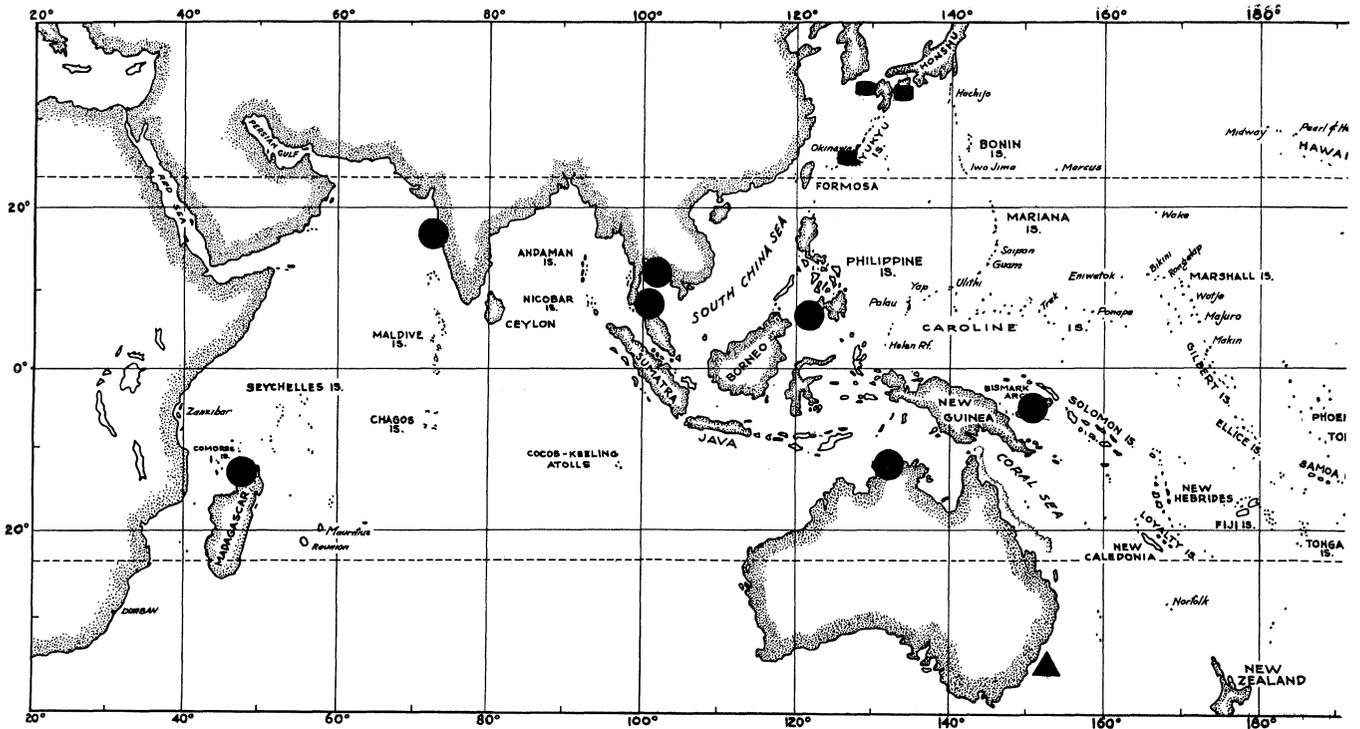


Fig. 34. Distribution of *Parioglossus dotui* (rectangles), *P. philippinus* (circles), excluding Japan as material not available to us, and *P. marginalis* (triangles).

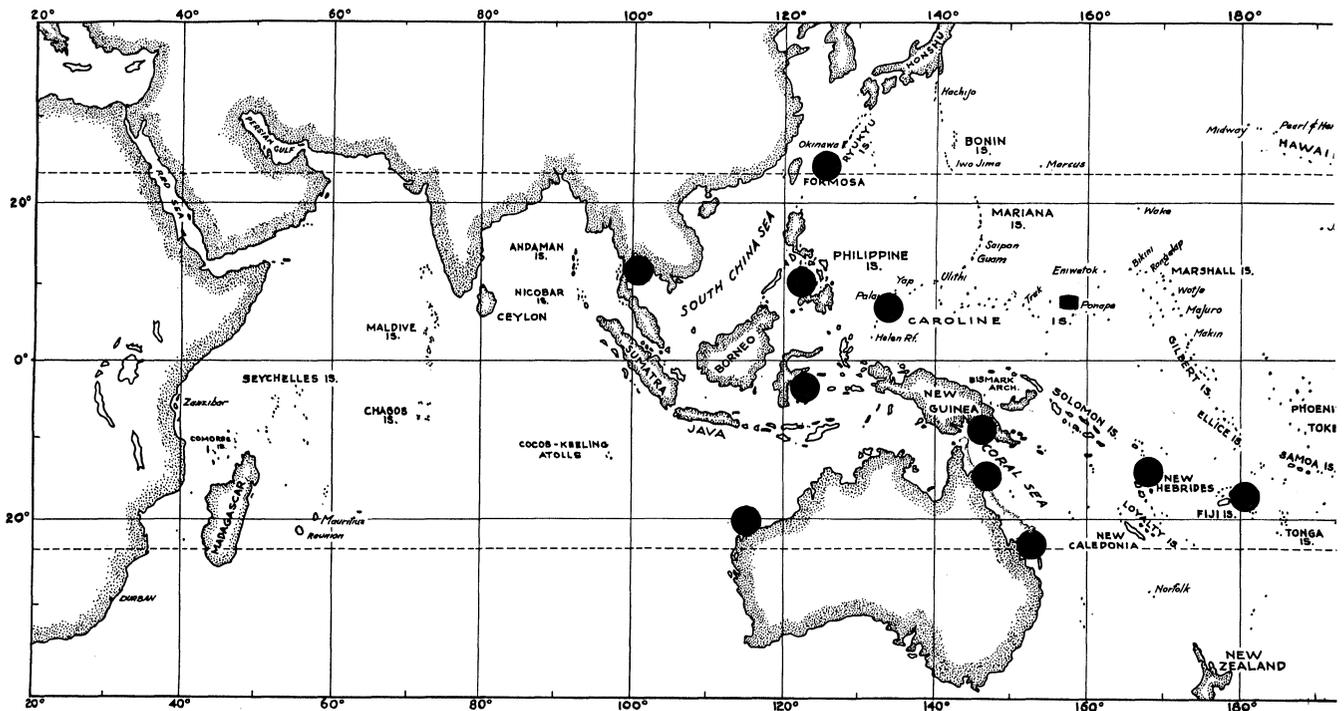


Fig. 35. Distribution of *Parioglossus formosus* (circles) and *P. verticalis* (rectangles).

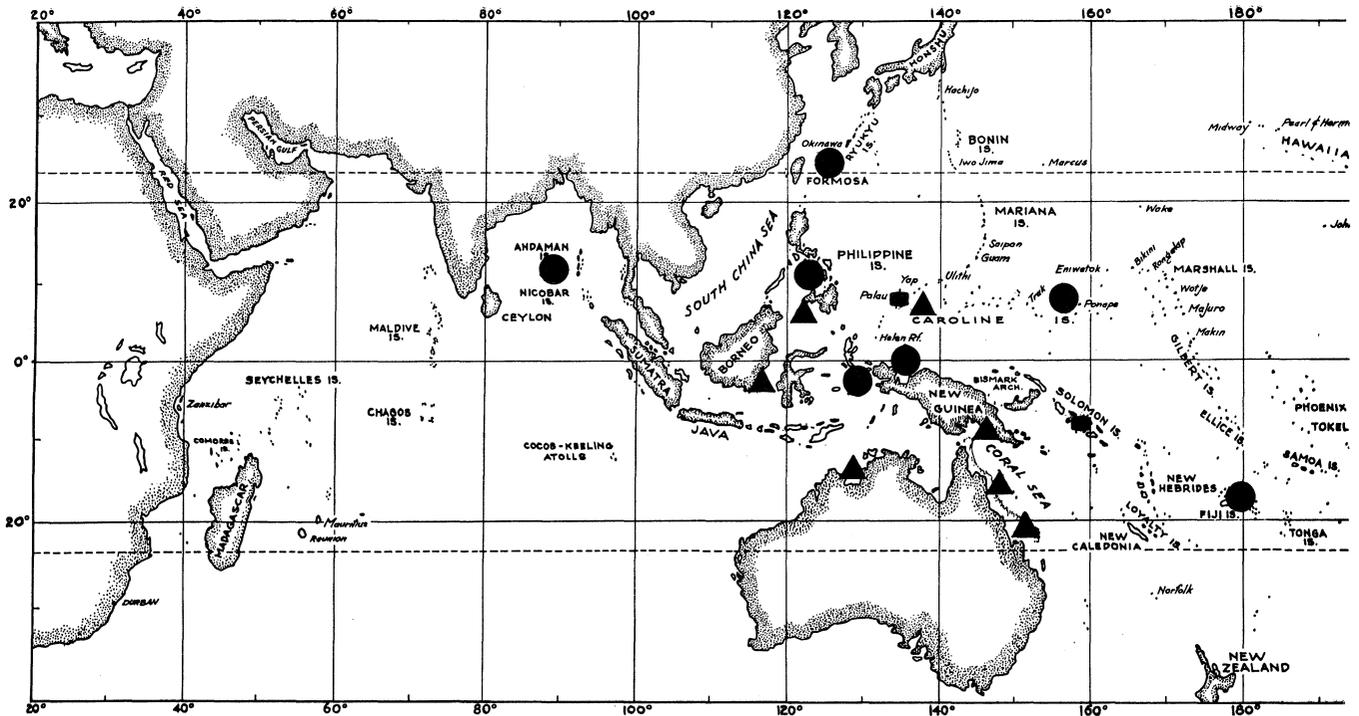


Fig. 36. Distribution of *Parioglossus lineatus* (rectangles), *P. raii* (circles) and *P. palustris*, excluding Japan (triangles).

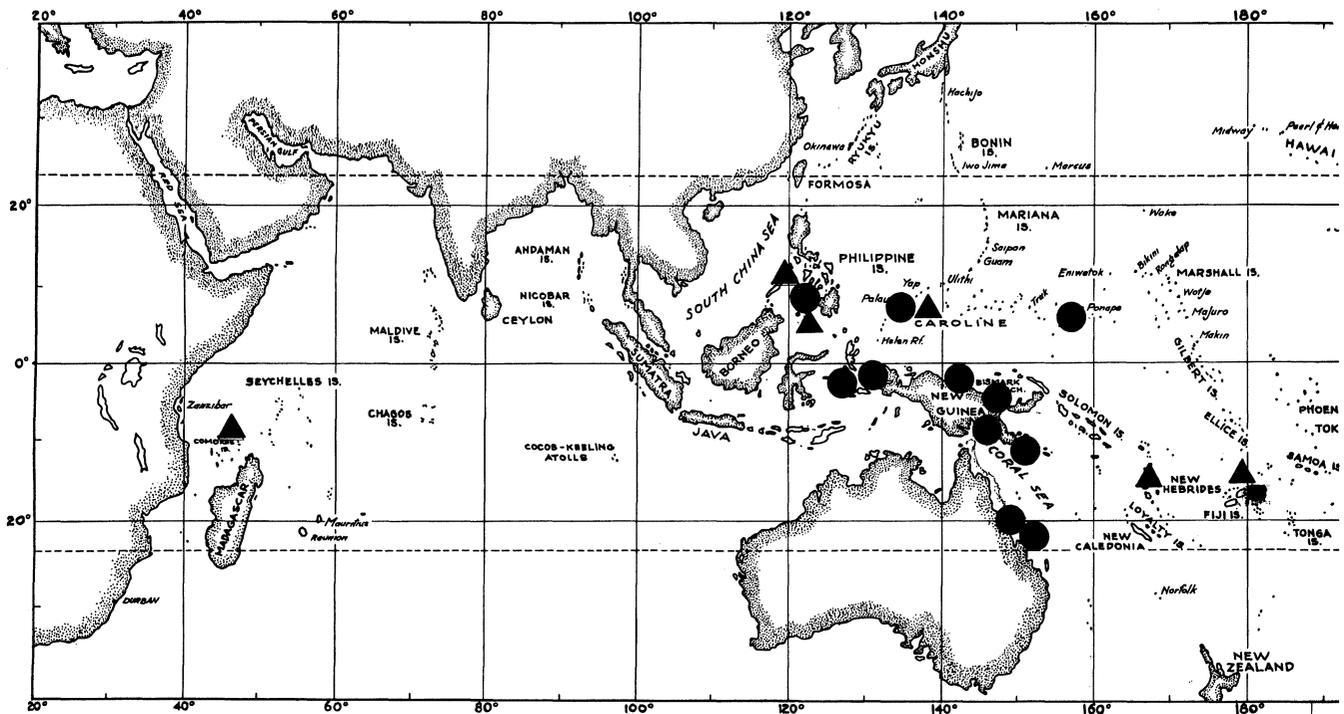


Fig. 37. Distribution of *Parioglossus rainfordi*, excluding Japan (circles), *P. triquetrus* (rectangles), and *P. taeniatus* (triangles).

Table 1. Frequency distributions of number of head pores in various populations of *P. raoi*.

Location	Average Size (mm)	Circumorbital Pores				Preopercular Pores	
		0	2	3	4	0	2
Andaman Islands	12.5	2	4	3		9	0
Caroline Islands	18.4			2		2	0
Fiji	17.5	2	4	21	5	20	12
Irian Jaya	15.4	1	6	8		15	0
Japan	18.7	4	4	1		9	0
Moluccas	14.9	3		1		4	0
Philippines	17.5		3	4		6	1

Table 2. Frequency distributions of number of head pores in *P. raoi*, in relation to fish length and geographical locality (pore number: 5 pores = 3 circumorbital and 2 preopercular pores, 6 pores = 4 circumorbital and 2 preopercular pores).

Head Pores	Standard Length in mm													
	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Andaman Islands														
0	2													
2			1	3		1								
3				1	1	1								
Caroline Islands														
3									1	1				
Fiji														
0		1	1	1	1									
2					2									
3						1	1	7	2	1	1	1		
5									1	1	3	1	1	
6							1		1	1	1			1
Irian Jaya														
0				1										
2				1	2		3							
3						3	2	1	1	1				
Japan														
0							2	2						
2											2	1		1
3											1			
Moluccas														
0					2	1								
3						1								
Philippines														
2					1		1	1						
3									1	1		1		
5									1					

Table 3. Comparison of some characters of *Parioglossus* species (F, female; I, imbricate; M, male; NI, nonimbricate).

Species	Circum-orbital Pores (>15 mm)	Elongated Dorsal Spine	Caudal Pigment	Lateral Stripe	Anal Pigment	Gill Opening	Scales	Posterior Branched Dorsal/anal Rays (excluding last ray)	Mouth Angle (degrees)	Nuchal Crest	Pre-opercular Pores (>20 mm)	Anterior Nostril Tube
<i>P. aporos</i>	0	3-5 (M) none (F)	stripe	diffuse	pale	moderate	NI	branched (>21 mm)	60-70	low	0	absent
<i>P. dotui</i>	5	none	spot	diffuse	dark ring (M) black (F)	moderate	NI	branched (>22 mm)	60-70	low	0	present (short)
<i>P. formosus</i>	5	3,4 (M) none (F)	stripe	present	pale	narrow	NI	branched	55-60	prominent	2	present
<i>P. lineatus</i>	5	4,5 (M,F)	bar	present	pale	narrow	NI	branched	65-75	prominent (M) low (F)	0	absent
<i>P. marginalis</i>	5	5 (M) none (F)	stripe (M) bars (F)	diffuse	pale (M) black (F)	moderate	NI, I	branched	60-70	prominent	0	present
<i>P. nudus</i>	0	none	none	absent	pale	narrow	—	unbranched	67-75	low-moderate	0	absent
<i>P. palustris</i>	5	3-5 (M) none (F)	spot	absent	pale to lightly spotted	narrow	I	unbranched	80-85	low	2	present
<i>P. philippinus</i>	5	5 (M) none (F)	spot	absent	dark ring (M) pale to lightly spotted (F)	narrow	NI	unbranched	75-85	prominent (M) low (F)	0	absent
<i>P. rainfordi</i>	5	3 (M,F)	bar (M) spot (F)	absent— sometimes diffuse	pale	narrow	NI, I	branched	85-90	low	2	absent
<i>P. raoi</i>	2-4	3,4 (M) none (F)	stripe	present	pale	narrow	I	branched	70-75	prominent (M) low (F)	0-2	present
<i>P. taeniatus</i>	4	2-4 (M) none (F)	stripe	present	pale	narrow	I	branched	70-80	prominent (M) low (F)	2	present
<i>P. triquetrus</i>	5	3-5 (M) none (F)	spot	absent (M) diffuse (F)	pale	moderate	NI, I	branched (>19 mm)	65-75	low	0	absent
<i>P. verticalis</i>	5	none (M)	spot (M)	diffuse (M)	dark ring (M)	moderate	I	branched	—	low (M)	0	absent
<i>P. sp.</i>	4	3,4 (M) none (F)	spot	present	pale to lightly spotted	narrow	I	unbranched	80-85	low	2	present

Table 4. Measurements of the holotypes (exception: paratype of *P. raoi* and syntype of *P. taeniatus*) of *Parioglossus* species (in mm).

Character	<i>P. aporos</i>	<i>P. formosus</i>	<i>P. lineatus</i>	<i>P. marginalis</i>	<i>P. nudus</i>	<i>P. palustris</i>	<i>P. philippinus</i>	<i>P. rainfordi</i>	<i>P. raoi</i>	<i>P. taeniatus</i>	<i>P. triquetrus</i>	<i>P. verticalis</i>
Sex	M	M	M	M	F	M	F	M	M	M	M	M
Standard length	24.2	23.5	33.4	35.5	19.0	24.0	23.7	35.0	13.0	23.1	20.0	21.4
Head length	5.7	5.2	7.2	7.0	4.2	5.0	5.1	7.2	3.4	4.9	4.4	5.2
Head width	2.6	—	3.8	4.2	1.3	—	—	3.8	1.7	2.1	2.1	3.0
Body depth	3.7	—	5.9	6.0	2.5	—	—	6.5	2.1	3.5	3.1	3.7
Predorsal length	7.8	—	10.0	10.4	5.9	—	—	10.9	4.7	7.8	6.6	6.6
Mouth	2.1	—	3.3	2.9	1.5	—	—	2.8	1.2	2.2	1.8	2.2
Eye	1.7	—	2.2	2.1	1.4	—	—	2.4	1.3	1.7	1.6	1.7
Snout	1.0	—	1.5	1.5	.7	—	—	1.2	.5	.8	.7	.8
Caudal peduncle length	3.4	—	3.8	3.3	2.5	—	—	4.8	1.6	3.4	2.1	2.8
Caudal peduncle depth	2.5	—	4.0	3.8	1.7	—	—	4.2	1.4	2.2	2.1	2.2
Pectoral fin length	4.4	—	5.7	6.6	3.3	—	—	5.7	2.4	3.7	3.5	3.8
Pelvic fin length	3.9	—	6.3	6.4	2.1	—	—	9.0	1.6	3.9	3.4	3.4
Caudal fin length	5.7	—	8.0	9.7	4.3	—	—	7.9	—	4.3	5.8	4.5
Third dorsal spine length	4.5	—	5.0	3.1	2.1	—	—	7.4	—	3.3	4.4	2.1

Table 5. Standard lengths (mm) and

Character	<i>P. aporos</i>
Standard length (mean length)	13.0–24.2 (20.0)
Head length	24.5–26.2 (13–16 mm) 22.4–23.6 (21–24 mm)
Head width	8.5–11.7
Body depth	14.8–17.4
Predorsal length	34.8–35.4 (13–16 mm) 32.2–33.8 (21–24 mm)
Mouth	7.6–9.2
Eye	7.0–9.2
Snout	3.2–4.6
Caudal peduncle length	13.5–15.6
Caudal peduncle depth	8.5–10.8
Pectoral fin length	17.4–19.2
Pelvic fin length	13.2–16.1
Caudal fin length	20.1–23.6
Third dorsal spine length	11.4–13.2 (females) 14.0–18.6 (males)

Character	<i>P. philippinus</i>
Standard length (mean length)	16.4–31.6 (23.4)
Head length	23.5–26.0 (16–20 mm) 18.7–25.4 (21–32 mm)
Head width	8.9–14.8
Body depth	12.3–17.9
Predorsal length	28.6–35.9
Mouth	7.0–8.9
Eye	6.2–8.8
Snout	3.1–5.0
Caudal peduncle length	8.4–13.1
Caudal peduncle depth	8.1–12.0
Pectoral fin length	15.3–19.4
Pelvic fin length	10.1–15.0 (females) 13.3–28.3 (males)
Caudal fin length	18.1–21.9
Third dorsal spine length	7.4–10.0 (females) 7.1–12.7 (males)

morphometric proportions (percent of S.L.) for species of *Parioglossus*.

<i>P. dotui</i>	<i>P. formosus</i>	<i>P. lineatus</i>	<i>P. marginalis</i>	<i>P. nudus</i>	<i>P. palustris</i>
15.9–28.7 (23.4)	11.0–35.1 (21.5)	24.7–33.4 (26.6)	27.0–39.0 (33.8)	12.9–21.9 (17.3)	13.2–28.1 (20.1)
24.0–26.4 (16–20 mm) 21.3–25.1 (21–29 mm)	21.9–26.7 (11–16 mm) 19.1–24.2 (20–35 mm)	20.8–23.5	18.9–23.4	21.9–25.9	21.5–26.5 (13–20 mm) 19.6–22.4 (21–28 mm)
9.6–12.6	9.2–14.6	11.4–13.4	9.6–13.0	9.0–13.7	10.0–12.9
14.8–18.1	14.3–19.2	16.2–19.1	16.6–20.0	12.5–16.8	13.2–17.3
31.4–34.7	33.1–38.4 (11–16 mm) 30.5–36.1 (20–35 mm)	29.9–33.9	28.1–34.0	30.0–36.0	32.3–36.4 (13–20 mm) 29.9–33.3 (21–28 mm)
7.0–10.1	7.1–9.6	8.8–10.1	7.6–9.6	6.7–9.7	7.0–9.6
7.8–10.1 (16–20 mm) 6.7–8.6 (21–29 mm)	7.5–10.6	6.6–7.6	5.4–7.3	6.7–9.5	7.9–9.9 (13–20 mm) 6.8–7.8 (21–28 mm)
3.1–5.7	2.4–5.0	4.0–4.6	3.0–4.4	3.0–5.0	3.0–4.9
10.1–13.5	12.7–16.9	11.4–13.4	8.2–10.6	10.2–14.0	8.8–11.6
9.3–11.5	8.6–11.6	11.2–12.0	9.4–12.5	7.7–11.5	9.5–12.1
16.2–19.5	14.5–17.3	17.1–18.8	16.1–18.6	15.3–18.5	15.1–20.3 (13–20 mm) 14.2–18.4 (21–28 mm)
13.1–17.2	10.4–14.3 (females) 12.4–19.9 (males)	17.1–18.9	12.0–14.6 (females) 16.4–22.7 (males)	8.6–14.1	12.4–16.5 (13–20 mm) 11.5–14.4 (21–28 mm)
17.8–24.5	13.1–22.8 (females) 22.6–37.1 (males)	19.8–19.9 (females) 22.8–24.0 (males)	17.4–19.3 (females) 18.4–27.3 (males)	19.5–25.8	12.5–20.8 (females) 10.6–18.6 (males 13–19 mm) 20.5–23.7 (males 20–28 mm)
7.0–11.6	9.0–14.4 (females) 15.0–21.2 (males)	10.1–12.7 (females) 13.2–15.0 (males)	6.4–9.7 (females) 8.2–11.6 (males)	7.1–11.2 (13–18 mm) 9.0–14.7 (19–22 mm)	10.0–12.5 (females) 12.3–14.5 (males)

<i>P. rainfordi</i>	<i>P. raoi</i>	<i>P. taeniatus</i>	<i>P. triquetrus</i>	<i>P. sp.</i>
21.0–36.6 (29.0)	12.9–23.0 (19.0)	16.4–24.4 (21.9)	18.0–23.1 (19.9)	14.2–26.0 (20.9)
19.7–24.5	23.6–26.4 (13–17 mm) 21.9–25.0 (18–23 mm)	27.8 (16.4 mm) 21.7–25.0 (19–24 mm)	22.0–26.4	21.5–24.5
9.5–13.4	7.9–13.2	8.6–14.7	10.0–13.5	9.4–12.7
14.1–18.6	14.0–17.7	15.8–19.6	15.5–18.5	13.8–16.9
31.1–34.2	34.5–36.4 (13–17 mm) 27.3–34.5 (18–23 mm)	32.0–35.3	31.7–34.1	29.2–34.9
7.9–9.7	7.6–10.3	7.7–10.4	8.7–9.0	7.4–9.9
6.5–8.9	7.4–10.1	7.4–10.4	7.7–9.3	7.3–10.6
2.6–4.2	3.1–4.7	3.3–4.7	3.5–4.9	3.1–4.5
12.3–16.3	10.3–14.2	11.9–14.5	9.4–11.4	10.8–14.2
10.8–13.2	8.1–11.8	9.8–12.3	9.2–10.9	10.0–11.8
14.1–18.3	15.5–19.6	15.0–18.8	17.5–21.7	14.8–17.4
12.7–17.9 (females) 15.1–29.2 (males)	13.3–15.8 (females) 17.1–23.2 (males)	13.7–16.7 (females) 18.0–27.5 (males)	12.6–15.0 (females) 17.0–28.6 (males)	10.8–16.4
19.6–26.1	17.4–23.6 (females) 22.0–36.0 (males)	21.0–24.1 (females) 37.7–42.5 (males)	18.7–19.5 (females) 23.9–29.0 (males)	17.6–18.9 (females) 21.2–27.0 (males)
8.8–16.4 (females, 21–27 mm) 20.0–24.9 females, 31–33 mm) 13.8–21.2 (males, 21–30 mm) 21.1–32.0 (males, 31–37 mm)	10.3–15.8 (females) 16.4–29.1 (males)	10.7–16.7 (females) 25.9–37.5 (males)	9.2–10.2 (females) 14.7–43.3 (males)	9.8–12.3 (females) 16.9–26.2 (males)

Table 6. Dorsal and anal fin element counts for species of *Parioglossus* (* indicates holotype count, paratype for *P. raoi* and syntype for *P. taeniatus*).

Species	First Dorsal Fin		Second Dorsal Fin							Anal Fin						
	V	VI	I,13	I,14	I,15	I,16	I,17	I,18	I,19	I,13	I,14	I,15	I,16	I,17	I,18	I,19
<i>P. aporos</i>		10*	5	11	2*					7	11*					
<i>P. dotui</i>		23				12	11						9	11	3	
<i>P. formosus</i>	1	25*	1	24*	6					1*	24	5				
<i>P. lineatus</i>		5*			3*	2						1	4*			
<i>P. marginalis</i>	1	20*				1	11	9*						8	13*	
<i>P. nudus</i>		23*			1	13*	8	1					18*	3		
<i>P. palustris</i>		18*				13*	8						3	17*	1	
<i>P. philippinus</i>		48*				5*	23	37	6				6	30*	30	2
<i>P. rainfordi</i>	13*	22		4	23	7*	1				5	26*	3			
<i>P. raoi</i>		29*		4	26*	1					3	26*	2			
<i>P. taeniatus</i>		13*		2	16	1*						12*	7			
<i>P. triquetrus</i>		8*			1	2	5*							7*	1	
<i>P. verticalis</i>		1*					1*							1*		
<i>P. sp.</i>	1	14				2	9	4					2	9	4	

Table 7. Pectoral and caudal fin ray counts for species of *Parioglossus* (* indicates holotype count, paratype for *P. raoi*, syntype for *P. taeniatus*).

Species	Segmented Caudal Rays			Branched Caudal Rays					Pectoral Fin Rays					
	8+7	9+7	9+8	6+5	6+6	7+5	7+6	7+7	15	16	17	18	19	20
<i>P. aporos</i>			7*				7*		8*	3				
<i>P. dotui</i>			25		3	1	21					12	5	1
<i>P. formosus</i>	2		20*				26*		2	5*	13			
<i>P. lineatus</i>			5*				5*					1	2*	2
<i>P. marginalis</i>			16*				20*				1	13*	5	
<i>P. nudus</i>			23*		23*					5	10	6*		
<i>P. palustris</i>			22*		1	1	21*	1		7	14	2	1*	
<i>P. philippinus</i>		1	64*		63*	3	1				3	21	14*	1
<i>P. rainfordi</i>			35*				35*			4	15	10*		
<i>P. raoi</i>			27*			2	20		1	12	8*	2		
<i>P. taeniatus</i>			13*				13*			7*	4	2	1	
<i>P. triquetrus</i>		1*	8				8*				1	4	3*	
<i>P. verticalis</i>			1*				1*					1*		
<i>P. sp.</i>			12				12			4	9			

Table 8. Procurrent caudal fin ray counts for species of *Parioglossus*.

Species	7+6	7+7	8+7	8+8	8+9	9+8	9+9	10+9	10+10	11+10
<i>P. aporos</i>			1	1		1				
<i>P. dotui</i>		7		5	1		4			
<i>P. formosus</i>	4	4	5							
<i>P. lineatus</i>			1	3		1				
<i>P. marginalis</i>			7	1		12				
<i>P. nudus</i>				1						
<i>P. palustris</i>	4	2	3							
<i>P. philippinus</i>				5		4	4	12	4	1
<i>P. rainfordi</i>	1	6	2	12	1					
<i>P. raoi</i>			4	2						
<i>P. taeniatus</i>	2	2	8			1				
<i>P. verticalis</i>		1								
<i>P. sp.</i>	1	1	2							

Table 9. Longitudinal scale counts of *Parioglossus* species (* indicates holotype).

Species	0	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-100	101-105	106-110
<i>P. aporos</i>		4*	3	1							
<i>P. dotui</i>				1	6	6	4				
<i>P. formosus</i>			1	7	4						
<i>P. lineatus</i>				2	2*	1					
<i>P. marginalis</i>							3*	5	7	1	
<i>P. nudus</i>	13*										
<i>P. palustris</i>					5*	5	3				
<i>P. philippinus</i>		2	11	3		1					
<i>P. rainfordi</i>							1	2	2	5*	4
<i>P. raoi</i>			1	5	7	2					
<i>P. taeniatus</i>					3	8	1				
<i>P. triquetrus</i>						3	3*	2			
<i>P. verticalis</i>										1*	
<i>P. sp.</i>				3	3		3	1			

Table 10. Total gill raker counts on outer face of first arch for species of *Parioglossus* (* indicates holotype).

Species	Gill Rakers									
	12	13	14	15	16	17	18	19	20	
<i>P. aporos</i>	1	3	1	3*						
<i>P. dotui</i>					2	11	4	2		
<i>P. formosus</i>				4	4	2	2			
<i>P. lineatus</i>							1	2	1*	
<i>P. marginalis</i>						4*	5	4		
<i>P. nudus</i>	1	8	6*							
<i>P. palustris</i>					3	9	1			
<i>P. philippinus</i>			1	8	10	3				
<i>P. rainfordi</i>						9	3	2		
<i>P. raoi</i>				1	5	2				
<i>P. taeniatus</i>						1	5			
<i>P. triquetrus</i>		1	2*	3		2				
<i>P. verticalis</i>									1*	
<i>P. sp.</i>					3	5	3			