

## Three New Species of the Genus *Parapercis* from the Western Pacific, with Redescription of *Parapercis hexophtalma* (Perciformes: Pinguipedidae)

Hisashi Imamura<sup>1</sup> and Tetsuo Yoshino<sup>2</sup>

<sup>1</sup>The Hokkaido University Museum, 3–1–1 Minato-cho, Hakodate, Hokkaido 041–8611, Japan

E-mail: imamura@museum.hokudai.ac.jp

<sup>2</sup>Department of Marine Sciences, Faculty of Science, University of the Ryukyus,

1 Senbaru, Nishihara, Okinawa 903–0213, Japan

**Abstract** Three new pinguipedid species, *Parapercis pacifica* from southern Japan to Timor Sea, *P. queenslandica* from Queensland, Australia, and *P. xanthogramma* from the Fiji Islands, Tonga, and Western Samoa, are described based on the specimens from the western Pacific. These species have been mistakenly identified as *P. hexophtalma* (Cuvier, 1829) previously. *Parapercis hexophtalma*, known only from the Indian Ocean, is redescribed. These 4 species are separable by morphological characters such as the number of pectoral fin rays, body and head coloration, and number of anal fin spots.

**Key words:** *Parapercis pacifica* sp. nov., *Parapercis queenslandica* sp. nov., *Parapercis xanthogramma* sp. nov., *Parapercis hexophtalma*, western Pacific.

In 1829, *Parapercis hexophtalma* was described by Cuvier (as *Percis hexophtalma*) based on a single specimen collected from the Red Sea. Cuvier in Cuvier and Valenciennes (1829) also described *Parapercis polyophtalma* (as *Percis polyophtalma*) on the basis of the specimens from the Red Sea. Both species names have been incorrectly emended to *hexophtalma* and *polyophtalma* by some authors (see synonymy below). These species were distinguished by having different color patterns on the cheek and body: several oblique brownish bands on the cheek and 3–4 ocelli on the lower portion of body in *Parapercis hexophtalma*; and many spots on the cheek and 7–8 ocelli on the body in *Parapercis polyophtalma* (e.g., Cantwell, 1964). However, as many authors have pointed out, the names refer to a single species and the color patterns of *Parapercis hexophtalma* and *Parapercis polyophtalma* are those of male and female phases, respectively, thus the latter is a junior synonym of the former (e.g., Heemstra, 1986; Randall, 2001, 2005). In addition, *Parapercis hex-*

*ophtalma* is known as a protogynous hermaphrodite (e.g., Clark *et al.*, 1991), as are several members of *Parapercis* (e.g., Randall, 1984, 2001).

Recently, Shimada (1993) reported *Paraperis polyophtalma* from Japan and recognized the validity of this species, because no specimens having the oblique bands on the cheek region have been found in these waters. However, *P. hexophtalma* and *P. polyophtalma* are 2 names for the same species with the reproductive behavior of *P. hexophtalma* (having oblique bands in cheek region) and *P. polyophtalma* (having many spots) as reported by Clark *et al.* (1991). We examined the specimens of “*P. hexophtalma*” collected from the Indian Ocean and western Pacific, including the Red Sea, the type locality of *P. hexophtalma* (and *P. polyophtalma*), and Japan. As a result, we conclude that the Japanese population is an undescribed species, as well as those from Queensland, and Fiji, Tonga, and Western Samoa; therefore, “*P. hexophtalma*” comprises of 4 species, including 3 that are undescribed. We herein describe these 3 new species and also re-

describe *Parapercis hexophthalma*.

### Materials and Methods

Measurements and counts were made according to Hubbs and Lagler (1958) and Randall (1984). When disagreements were found between these methods, the latter was used. Caudal fin length was measured from the middle of the caudal fin base to the posterior tip of the upper edge of the fin. Specimen lengths were expressed as standard length (SL, mm). Measurements were made with calipers to the nearest 0.1 mm. Sex was determined by the direct microscopic examination of gonads (no sectioning of gonads was undertaken), but inferred from the head and body coloration when the gonad was damaged or detached; in the latter case, the specimens were expressed as “male phase” or “female phase”. The terminology of snout and cheek spots in females and juveniles (and female phases) is shown in Fig. 1. Institutional abbreviations follow Leviton *et al.* (1985).

In the 4 species of *Parapercis* described here, a blackish or brownish spot is usually present on each anal fin membrane between the soft rays, except for some membranes on the anterior portion of the fin in adults. However, in some cases, 1 or 2 spots among the series are absent (e.g., “second” and/or “third” spot absent). To avoid confusion on the homology of the spot number, we counted the number of the membranes from

that with the first spot to that with the last spot (=last membrane) instead of the spots, and did not include the data of the specimens having 16 and 18 anal soft rays, although most specimens have 17 soft rays.

The snout and cheek spots, which are useful to identify females and juveniles of present 4 species, are mostly expressed by 60 mm SL. Therefore, we do not include specimens less than 60 mm SL as study material, as these specimens were impossible to clearly identify.

Abbreviations for counts and measurements are as follows: dorsal fin rays (D), anal fin rays (A), pectoral fin rays ( $P_1$ ), pelvic fin rays ( $P_2$ ), branched caudal fin rays (BC), lateral line scales (LLS), scales between first dorsal spine and lateral line (SDL), scales between lateral line and origin of anal fin (SLA), scale rows slanting posteroventrally before first dorsal spine (SBD), gill rakers (GR), head length (HL), snout length (SNL), orbital diameter (OD), interorbital width (IW), upper jaw length (UJ), lower jaw length (LJ), predorsal length (PD), preanal length (PA), length of dorsal fin base (DB), length of anal fin base (AB), caudal peduncle length (CPL), caudal peduncle depth (CPD), pectoral fin length (PIL), pelvic fin length (P2L), caudal fin length (CFL), length of first dorsal spine (1DS), length of longest dorsal spine (LDS), and length of anal spine (AS).

### *Parapercis hexophthalma* (Cuvier, 1829)

(Figs. 2, 3A)

*Percis cylindrica* Rüppell, 1828: 19, pl. 5, fig. 2 (original description, type locality: Jidda and Massawa, Red Sea) (preoccupied in Bloch, 1792).

*Percis hexophthalma* Cuvier in Cuvier and Valenciennes, 1829: 271 (original description, type locality: Massawa, Red Sea).

*Percis polyophthalma* Cuvier in Cuvier and Valenciennes, 1829: 272 (original description, type locality: Massawa, Red Sea).

*Percis caudimaculata* Rüppell, 1838: 8 (replacement name for *Percis cylindrica* Rüppell, 1828).

*Percis hexophthalma* (emendation): Day, 1876: 263, pl. 57, fig. 4 (description, Andaman Sea).

*Percis polyophthalma* (emendation): Klunzinger, 1870:

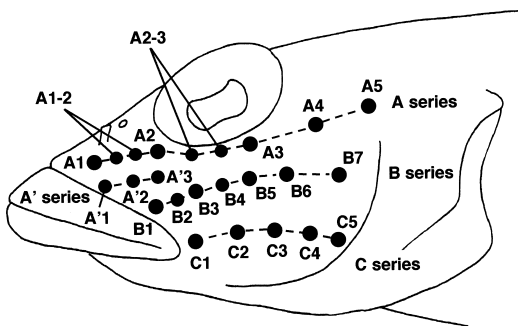


Fig. 1. Diagrammatic illustration showing pattern of spots on snout and cheek regions for 4 species of *Parapercis*.



Fig. 2. Photograph of *Parapercis hexophthalma*. A: ZMB 517, 159.3 mm, male phase, holotype; B: HUMZ 165319, 172.7 mm, male; C, RUSI 008028, 129.5 mm, female.

816 (description, east Africa).

*Parapercis hexophthalma* (emendation): Barnard, 1927: 442, pl. 19, fig. 1 (description, Mozambique); Cantwell, 1964: 268: figs. 1J, 3J, 9B (description, Red Sea and Zanzibar) (in part); Smith, 1965: 177, pl. 13, fig. 380 (short description, Durban northwards); Kumaran and Jones, 1980: 507, fig. 427 (description, Laccadive Archipelago); Heemstra, 1986: 739, fig. 234.1 (short description, Durban northwards); de Bruin *et al.*, 1994: 284, 2 unnumbered figs. (short comments on fisheries, habitat and biology, Sri Lanka); Somer *et al.*, 1996: 298, 2 unnumbered figs. (short comments on fisheries, habitat and biology, Somalia).

*Parapercis hexophthalma*: Randall, 1995: 305, figs. 859–860 (description, Oman); Kuitert and Tono-zuka, 2004: 574, fig. D (short description, Pulau Weh, Sumatra, Indonesia) (in part).

*Parapercis polyophthalma* (emendation): Cantwell, 1964: 268, figs. 1J, 3J (description, Red Sea and Zanzibar) (in part).

*Parapercis cylindrica* (non Bloch, 1792): Smith and Smith, 1963: 13, fig. 114 (list, Seychelles).

**Holotype.** ZMB 517 (159.3 mm SL, male phase),

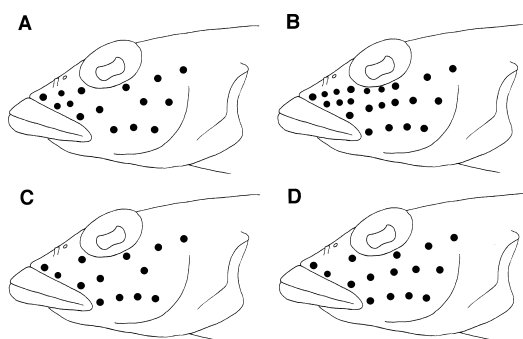


Fig. 3. Diagrammatic illustration showing typical or common arrangement pattern of spots in snout and cheek regions in 4 females in 4 species of *Parapercis*. A: *P. hexophthalma*; B: *P. pacifica* sp. nov.; C: *P. queenslandica* sp. nov.; D: *P. xanthogramma* sp. nov.

Massawa, Red Sea.

**Non-type material.** 19 specimens: AMS I. 33822-001 (192.5 mm, male), Gubal Island, Red Sea (27°40'N, 33°49'E), 10–20 m depth, 25 Jan. 1993; HUMZ 165320,

165335 (2,159.3–177.3 mm, males), Al-Wajh, Red Sea, fishing, 25 June 1999; HUMZ 165319 (172.7 mm, male), island off Al-Wajh, Red Sea, fishing, 17 June 1999; NSMT-P 54938 (138.9 mm, female), Ko Bon, Phuket, Thailand (7°45'S, 98°20.5'E), spear, 4 m depth, 4 Nov. 1986; NSMT-P 54939 (135.9 mm, female), Ko Hi, Phuket, Thailand (7°44'S, 98°22'E), spear, 5 m depth, 3 Nov. 1986; SAIAB 22468 (5,63.7–113.9 mm, juveniles and female), SAIAB 8028 (4, 87.3–144.5 mm, male, 2 females and juvenile), fish market, Ibo Island, Querimba, Mozambique (ca. 12°21'S, 40°40'E), date unknown; SAIAB 22470 (3, 164.0–182.5 mm, male phases), Zanzibar Island, Tanzania, 3 Sep. 1952; URM-P 14750 (164.1 mm, male), Hey Island, near Phuket, Thailand, spear, 15 m depth, 14 Apr. 1984; USNM 200743 (2,103.6–110.1 mm, juveniles), Resource Island, St. Joseph Islands, Amirante Islands, Seychelles (5°24'50"S, 53°19'43"E), 14 Sep. 1966.

**Diagnosis.** A species of *Parapercis* with usually 17 pectoral fin rays; 6–10 entire oblique brownish bands on the cheek region, 3–4 ocelli but lacking other distinct spots or patches on the lower portion of the body in males; 7 ocelli but usually lacking spots or patches between ocelli in females and juveniles; and 12 or fewer brownish anal fin spots in 90 mm or smaller juveniles.

**Description.** Data for the holotype are presented first, followed by matured non-types in parentheses: D V, 21 (V, 21); A I, 17 (I, 17); P<sub>1</sub> 1 (upper, unbranched)+16 (middle, branched)+0 (lower, unbranched)=17 (both sides) (1+15–17+0=16–18, usually 17 in both sides); P<sub>2</sub> I, 5 (I, 5); BC broken [8 (upper)+7–8 (lower) =15–16, usually 8+7]; LLS 59 (58–60); SDL 9 (8–10); SLA damaged (21–26); SBD ca. 13 (ca. 10–14); GR 5+8=15 (3–6+7–10 =12–16). Proportions as % SL: HL 28.5 (27.8–30.0); SNL 10.6 (10.4–12.5); OD 5.9 (5.2–6.6); IW 2.7 (2.3–4.0); UJ 11.4 (11.0–12.2); LJ 12.7 (12.2–13.7); PD 29.1 (29.2–32.4); PA 48.2 (47.7–52.1); DB 63.5 (60.9–65.4); AB 42.7 (41.9–46.5); CPL 9.9 (9.9–11.3); CPD 9.7 (9.1–10.8); P1L damaged (18.4–20.8); P2L 22.7 (21.9–25.7); CFL damaged (21.0–24.2); 1DS 3.8 (2.6–4.2); LDS (fourth) 7.0 (5.8–7.5); AS 5.7 (4.2–6.3). Proportions as % HL: SNL 37.2 (35.6–42.3); OD 20.8 (18.3–21.9); IW 9.5 (7.7–13.2); UJ 40.1 (36.8–41.3); LJ 44.5

(41.3–46.5).

Body elongate, cylindrical anteriorly and gradually compressed posteriorly. Head pointed anteriorly, 3.5 (3.3–3.6) in SL. Snout longer than orbital diameter, 2.7 (2.4–2.8) in HL. Orbital diameter more than 2 times interorbit, 4.8 (4.6–5.5) in HL. Interorbit broad and flat, 10.6 (7.6–13.0) in HL. Mouth slightly oblique and large, the maxilla reaching beyond a vertical through anterior margin of eye, length 2.5 (2.4–2.7) in HL; tip of lower jaw about equal to that of upper jaw, length of lower jaw 2.4 (2.2–2.4) in HL. Upper jaw with an outer row of canine teeth, becoming smaller posteriorly, and a medial tooth band comprised of small villiform teeth, narrowing to a single row posteriorly. Lower jaw with 4 recurved canine teeth anteriorly on each side (but anteriormost on right side detached), fourth largest. Subsequent tooth band on lower jaw of an outer row of canine teeth and medial villiform teeth; middle portion of outer row with several large canine teeth; villiform teeth restricted to anterior portion of lower jaw. Vomer with several rows of villiform teeth. Palatine without teeth. Gill membranes free of isthmus, with a broad free fold. Opercle with a single strong retrorse spine dorsally. Outer margin of preopercle smooth and that of subopercle with faint serrations in the middle portion. Lateral line slightly arched over pectoral fin, then extending along middle of body to the basal portion of the caudal fin. Scales on body and opercle ctenoid; those on nape and area around pelvic fin cycloid; abdomen with ctenoid and cycloid. Cheek with small embedded scales. Snout, interorbit, posterior portion of eye and lower surface of head without scales. Basal portion of pectoral fin with small ctenoid and cycloid scales. Caudal fin, except for posterior third, covered by small ctenoid and cycloid scales. Dorsal, anal and pelvic fins without scales. Origin of dorsal fin above third lateral line scale. Membrane of spinous dorsal connected to first soft dorsal ray opposite tip of last spine. Origin of anal fin below base of fifth soft dorsal ray. Pectoral fin broken (rounded, length 4.8–5.4 in SL). Pelvic fin anterior to origin of anal fin, length 4.4

(3.9–4.6) in SL. Caudal fin broken (weakly rounded, upper edge slightly elongated posteriorly, length 4.1–4.8 in SL).

*Color of holotype with male phase at present.*

Ground color of head and body light brown, except for light yellowish lower surface of body. Cheek region with 7 (right) and 8 (left) entire, oblique white bands; several bands on posterior portion of cheek extending to opercular region. Dorsal surface of posterior body with many small, brownish spots. Middle portion of body with 2 indistinct brown bands; 5 brownish spots between brown bands except for anterior portion of body. Lower portion of body above anal fin with 3 ocelli with white margin and dark brown center; other distinct spots or patches absent on body. Breast without spots. Spinous dorsal with a blackish spot basally. Soft dorsal with 2–4 rows of dark brown spots on each membrane between rays. Anal fin with a series of brownish spots on the middle portion from membranes between third and 17th rays (thus anal fin with 14 spots); base of anal fin without bands. Pectoral and pelvic fins pale. Caudal fin with a large dark brownish spot at middle, surrounded by several small dark brownish spots.

*Color of males* [based on preserved non-types (except for fresh coloration, see e.g., Randall, 1995)]. Ground color of head and body light brown or brown, except for light yellowish lower surface of body. Dorsal surface of snout, interorbit, and posterior portion of interorbit and eye with several dark brownish spots. Cheek region with 6–10 entire, oblique brown bands; several bands on posterior portion of cheek extending to opercular region. Dorsal surface of body, including base of pectoral fin, with many small, dark brownish spots. Middle portion of body from just behind pectoral fin axil to caudal peduncle with 8 elliptical light spots, with 1–5 brownish spots in center of each (some spots continuous); upper margin of light spots surrounded by brownish spots (spots continuous in several specimens), and lower margin by a distinct brownish band, and anterior and posterior margins by an indistinct brownish band. Lower portion of body

above anal fin with 3–4 ocelli with light margin (yellow when fresh) and blackish center; each ocellus located on a brownish band extending from the margin of the elliptical light spots on middle portion of body; other distinct spots or patches absent on body. Breast without spots. Spinous dorsal with a blackish spot basally and a brownish band near posterior margin. Soft dorsal with 2–5 longitudinal rows of dark brown or blackish spots on each membrane between rays. Anal fin with a series of brownish spots on the middle portion from membranes between second to fourth and 17th rays (thus anal fin with 13–15 spots); base of anal fin usually without bands, rarely with a faint brownish narrow band. Pectoral fin pale. Pelvic fin slightly dusky or pale. Caudal fin with a large blackish spot at middle, surrounded by several small blackish and brownish spots

*Color of females and juveniles in alcohol.*

Dorsal and lateral surfaces of head with many blackish or brownish spots, including the following spots on snout and cheek regions: 4–7 A series spots [A1, A2, A3, and A5 present, one A1-2 and A4 present or absent, and A2-3 usually absent (rarely single A2-3 present)], 1-2 A' series spots (A'1 present, A'2 present or absent, and A'3 absent), 3–6 B series spots [B1, B3, and B6 present, B2 and B4 spots usually absent (rarely either B2 or B4 present), B5 present or absent, and B7 usually present], and 3–4 C series spots

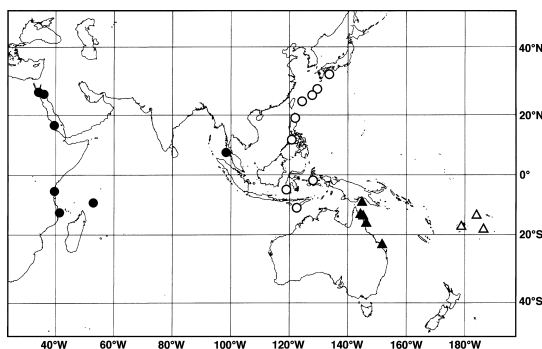


Fig. 4. Map showing sampling localities of *Parapercis hexoptalma* (●), *P. pacifica* sp. nov. (○), *P. queenslandica* sp. nov. (▲), and *P. xanthogramma* sp. nov. (△).

(C1 present or absent, C2 to C4 present, and C5 absent) (Table 1). Lower portion of body with 7 ocelli with light margin (yellow when fresh) and blackish center, each located on a brownish band; spots or patches between ocelli usually absent [present in only 2 juvenile specimens (USNM 200743, 103.6 mm and 110.1 mm)]. Anal fin with a series of brownish spots on the middle portion from membranes between rays 9–17 in ca. 65 mm specimen, 6–17 in ca. 80 mm specimen, 5–17 in ca. 88 mm specimen, and 2–4 (usually 3) to 17 in ca. 103 mm or larger specimens (thus number of anal fin spots 8 in ca. 65 mm, 11 in ca. 80 mm, 12 in ca. 88 mm, and 13–15 (usually 14) in ca. 103 mm or larger specimens) (Fig. 5). Other coloration similar to males.

**Distribution.** Known from the Indian Ocean, from Durban to Sumatra, including the Maldives, Somalia, Red Sea, Laccadives and Sri Lanka (e.g., Barnard, 1927; Cantwell, 1964; Kumaran and Jones, 1980; Heemstra, 1986; Randall, 1995; Kuitert and Tonozuka, 2004). Examined materials were collected from Mozambique, Zanzibar Island, Tanzania, Amirante Islands, Red Sea, and Phuket (Fig. 4).

**Remarks.** Rüppell (1828) described *Percis cylindrica* based on specimens collected from Jidda and Massawa, the Red Sea. Judging from his short description and illustration, this species is apparently conspecific with *Parapercis hexophtalma*, described by Cuvier in Cuvier and Valenciennes (1829). Although *Parapercis cylindrica* (Rüppell, 1828) has priority over *Parapercis hexophtalma*, the former is preoccupied by a pinguipedid, *Sciaena cylindrica* Bloch, 1792, now known as *Parapercis cylindrica*. Thus, *Parapercis cylindrica* (Rüppell, 1828) is a junior homonym of *Parapercis cylindrica* (Bloch, 1792). In such a case, when the rejected junior homonym has one or more available and potentially valid synonyms, the oldest of these becomes the valid name of the taxon with its own authorship and date, although Rüppell (1838) suggested *Percis caudimaculata* as a replacement name for *Percis cylindrica* Rüppell, 1828 (ICZN 1999: Art. 60.2). Therefore, *Parapercis hexoph-*

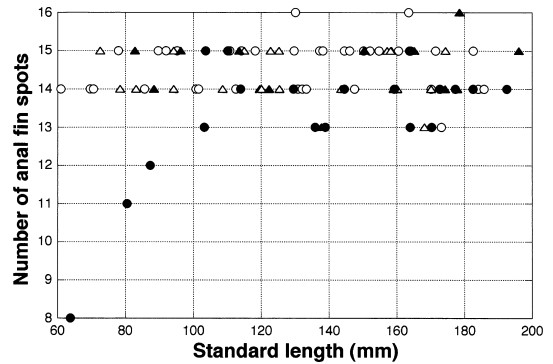


Fig. 5. Comparison of number of anal fin spots versus standard length in 4 species of *Parapercis*: *P. hexophtalma* (●), *P. pacifica* sp. nov. (○), *P. queenslandica* sp. nov. (▲), and *P. xanthogramma* sp. nov. (△).

*talma* is a valid name for the present species with Cuvier in Cuvier and Valenciennes (1829) as the author and date, as employed by many authors, although most of them were spelled as *Parapercis* “*hexophtalma*”.

de Beaufort and Chapman (1951) and Cantwell (1964) considered *Percis caudimaculatum* Haly, 1875 a junior synonym of *Parapercis hexophtalma*. However, we recognize *Percis caudimaculatum* having a dark brown spot at the upper portion of the caudal fin as in *Parapercis ommatura* Jordan and Snyder, 1902 (not at middle of caudal fin as in *Parapercis hexophtalma*) and the former as conspecific with the latter based on an examination of type specimens of both species which will be reported on in the near future.

The males of *Parapercis hexophtalma* are separable from those of *Parapercis pacifica* sp. nov., *Parapercis queenslandica* sp. nov., and *Parapercis xanthogramma* sp. nov., described below, in having 6–10 entire oblique brownish bands on the cheek region [vs. with a brownish semicircular or M-shaped band and many spots in *P. pacifica*, 2–6 brownish bands on the lower portion and several spots on the upper portion in *P. queenslandica*, and 4–7 entire pale bands (yellow when fresh) in *P. xanthogramma*], and the lower portion of the body with 3–4 ocelli but lacking other

distinct spots or patches (vs. 3–4 ocelli and several blackish or brownish spots or patches). The females and juveniles of *P. hexophtalma* have 7 ocelli and usually lack the spots or patches between the ocelli on the lower portion of the body (but rarely have the spots or patches), whereas the brownish spots or patches are present between the ocelli in the females of the other 3 species (but rarely spots and patches are absent in *P. pacifica*). Therefore, although intraspecific variation is recognized in *P. hexophtalma* and *P. pacifica*, this character is still useful to distinguish the females and juveniles in *P. hexophtalma* and the other 3 species. The snout and cheek spot pattern in the females and juveniles of *P. hexophtalma* has much variation (Table 1). However, there are no specimens having the patterns completely similar to those of *P. xanthogramma* (usually with 5A series, one A' series, 5B series, and 4C series spots). Therefore, the snout and cheek pattern is an important character to separate *P. hexophtalma* and *P. xanthogramma*, although there are a few specimens of the former having the same spot pattern as *P. pacifica* or *P. queenslandica*.

When comparing the ocelli in males and females of *P. hexophtalma*, it is considered that the anterior 4 ocelli in the females disappear when they become males. On the other hand, the position of the blackish spots on the lower portion of the body in males is consistent with that of the ocelli in females of *P. pacifica*, *P. queenslandica*, and *P. xanthogramma*. Therefore, it is assumed that the anterior 4 ocelli in the females of these 3 species change to blackish spots [thus the pale (yellow when fresh) margin of ocelli disappear]

when females become males.

The number of anal fin spots changes with growth in *P. hexophtalma*: viz. 8 in ca. 65 mm; 11 in ca. 80 mm; 12 in ca. 90 mm; and 13–15 (usually 14) in ca. 103 mm or larger specimens (Fig. 4). On the other hand, the number attains 13 or greater by ca. 60 mm in the other 3 species (Fig. 4). Therefore, the anal fin spot number is important in separating *P. hexophtalma* from the other 3 species in specimens ca. 90 mm or smaller.

In addition, the number of pectoral fin rays is helpful in separating *P. hexophtalma* from the other 3 species, although the counts in the 4 species are partially overlapping [16–18, usually 17 in *P. hexophtalma* vs. 17–19, usually 18 in other 3 species (*P. xanthogramma* rarely has 15 rays)] (Table 2). This difference is statistically significant (based on Kruskal-Wallis test and Dunn's procedure;  $p < 0.01$  between *P. hexophtalma* and the other 3 species).

We examined a single specimen (AMS I. 26735-007, 59.9 mm, juvenile) collected from the Timor Sea, although it is not included in the study material, because it is small and it is inferred that development of the spots on the snout and cheek region is not completed, thus it is indeterminate. Although *P. pacifica* occurs in the Timor Sea (see below), the present specimen differs from it in having 8 anal fin spots (vs. having at least 13 spots in *P. pacifica* by ca. 60 mm) (Fig. 4). In addition, the specimen has no spots or patches between the ocelli on the lower portion of the body. Our smallest specimen identified as *P. pacifica* (USNM 309434, 60.9 mm) from the Philippines has spots between the ocelli. Therefore, we consider this specimen from the Timor

Table 1. Comparison of selected spots on snout and cheek regions in females and juveniles of 4 species of *Parapercis*.

Spots	<i>P. hexophtalma</i> (n=10)	<i>P. pacifica</i> (n=17)	<i>P. queenslandica</i> (n=7)	<i>P. xanthogramma</i> (n=13)
A1-2	usually 1 (rarely 0)	usually 1–2 (rarely 0)	usually 0 (rarely 1)	0
A2-3	usually 0 (rarely 1)	usually 1–2 (rarely 0)	0	0
A' series	1–2	usually 2–3 (rarely 1)	usually 1 (rarely 0 or 2)	1
B4	present or absent	usually present	absent	absent
B5	present or absent	usually present	absent	present

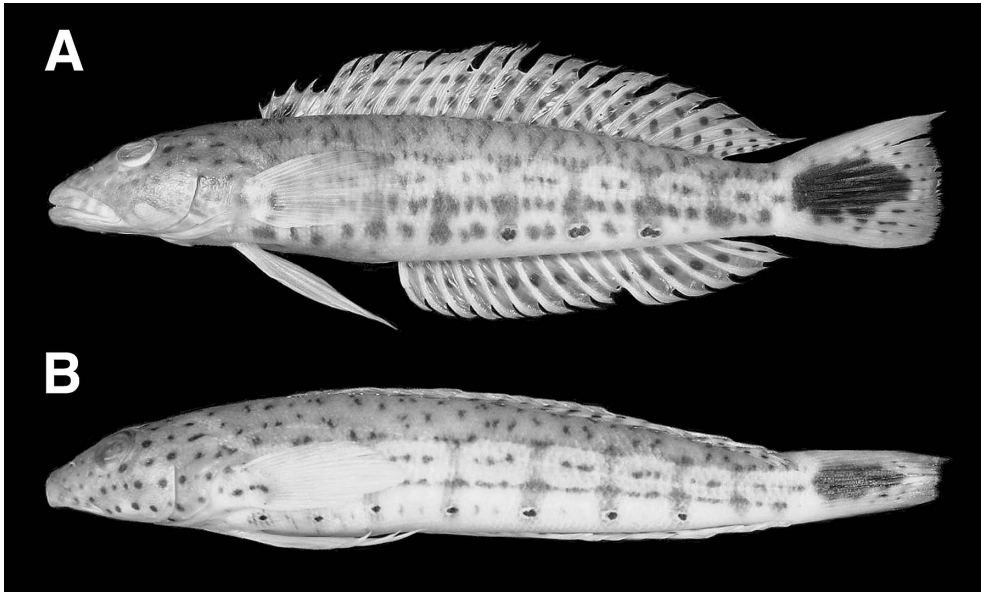


Fig. 6. Photograph of *Parapercis pacifica* sp. nov. A: URM-P 23500, 163.8 mm, male, paratype; B: NSMT-P 34936, 130.8 mm, female, paratype.

Sea is not *P. pacifica*. On the other hand, these characters agree well with those of *P. hexophthalma*. Although we could not identify this specimen, it is highly probable that it is *P. hexophthalma*.

Authors have reported “*Parapercis hexophthalma*” from many areas: e.g., Papua New Guinea (Bleeker, 1878; Munro, 1967; Kailola, 1987), Jakarta (Bleeker, 1845), and Lamakera (Weber, 1913). However, their descriptions are insufficient and it is unclear they are actually *P. hexophthalma* defined here.

***Parapercis pacifica* sp. nov.**

(Japanese name: Oguro-toragisu)

(Figs. 3B, 6–7, 8A)

*Percis hexophthalma* (emendation, non Cuvier in Cuvier and Valenciennes, 1829): Bleeker, 1853, 164 (description, Makassar).

*Percis caudimaculata* (non Rüppell, 1838): Bleeker, 1860: 45 (Makassar).

*Parapercis hexophthalma* (emendation, non Cuvier in Cuvier and Valenciennes, 1829): Jordan and Snyder, 1902: 466 (short description, Ryukyu Islands); Evermann and Seale, 1907: 103 (Bacon, Philippine Is-

lands); Snyder, 1913: 516 (description, Ryukyu Islands); Martin and Montalban, 1935: 219, pl. 2, fig. 1 (description, Luzon, Tablas, and Balabac, Philippines); Cantwell, 1964: 268, figs. 1J, 3J (description, Ryukyu Islands and Philippines) (in part); Kuitert, 1992: 209: pls. E–F in 209 p. (ecological information, Flores and Kerama Island); Chen *et al.*, 1997: 146, an unnumbered fig. (South China Sea).

*Cilias hexophthalma* (miss spelling in generic name, emendation in specific name, non Cuvier in Cuvier and Valenciennes 1829): Matsubara, 1955: 692 (key, Okinawa, Miyako-jima and Ishigaki-jima Islands, and Ryukyu Islands).

*Parapercis polyophthalma* (emendation, non Cuvier in Cuvier and Valenciennes, 1829): Cheng *et al.*, 1962: 683, fig. 558 (description, South China Sea); Cantwell, 1964: 268, figs. 1J, 3J (description, Ryukyu Islands and Philippines) (in part); Schroeder, 1980: 186, fig. 284 (short description, Philippines); Yoshino, 1984: 291, pl. 260-J (short description, Ryukyu Islands); Shen, 1993: 488, fig. 164-6 (short description, Taiwan); Shinohara, 2004: 552, 2 unnumbered figs. (short description, Ryukyu Islands).

*Parapercis hexophthalma* (non Cuvier in Cuvier and Valenciennes, 1829): Randall, 2001: 3507, unnumbered fig. (short description, western central Pacific) (in part); Broad, 2003: 155, 2 unnumbered figs. (short description, Alguay, Zamboanga del Norte, Mindanao, Philippines); Kuitert and Tonozuka, 2004: 574, fig. A and B



(short description, Bali and Flores) (in part).

*Parapercis polyophtalma* (non Cuvier in Cuvier and Valenciennes, 1829): Shimada, 2002: 1060, unnumbered fig. (pictorial key and short description, Hachijo-jima Island and Ryukyu Islands).

**Holotype.** NSMT-P 34936 (171.5 mm, male), Sakinome Beach, Amami-oshima Island, Ryukyu Islands. (28°11.2'N, 129°16'E), 5 m depth, hook and line, 11 June 1991.

**Paratypes.** 22 specimens: BMNH 1913.12.9.80 (2, 95.2–118.2 mm, females), Goram, Ceram Sea, Indonesia, date unknown; BSKU 54737 (154.8 mm, male), fish market, Makassar, Sulawesi, Indonesia, 10 Feb. 1985; BSKU 56592 (138.2 mm, male with intersexual color), Kashiwajima Island, Kochi, Japan, 16 Nov. 2001; BSKU 57239 (152.1 mm, male phase), Ishigaki-jima Island, Ryukyu Islands, Japan, 1.5 m, fishing, 29 Mar. 1999; HUMZ 39704 (182.6 mm, male), Itoman, Okinawa Island, Ryukyu Islands, 7 Mar. 1974; NSMT-P 70980 (2, 130.1–130.8 mm, females, formerly NSMT-P 34936), collected with holotype; NSMT-P 41458 (146.1 mm, male phase), Iye-jima



Fig. 7. Underwater photograph (KPM-NR 13396) of male of *Parapercis pacifica* sp. nov. (Y. Yamada; specimen not collected).

Island, Ryukyu Islands, 16 Sep. 1975; URM-P 11551 (150.2 mm, male), Chinen fishery market, Okinawa Island, Ryukyu Islands, 26 Aug. 1985; URM-P 15063 (173.2 mm, male), Manzanou, Onna Village, Okinawa Island, Ryukyu Islands, spear, 9 Nov. 1985; URM-P 23500 (163.8 mm, male), fish market, Yonashiro-cho, Okinawa Island, Ryukyu Islands, 15 Feb. 1990; URM-P 29755 (160.5 mm, male), fish market, Naha, Okinawa Island, Ryukyu Islands, 10 May 1993; URM-P 29933 (184.1 mm, male), Zampa Cape, Yomitan-cho, Okinawa Island, Ryukyu Islands, spear, 13 June 1993; URM-P 34839 (127.7 mm, female), Akazaki, Motobu-cho, Okinawa Island, Ryukyu Islands, spear, 10 Dec. 1995; USNM 228413 (2, 147.5–185.8 mm, male and intersexual specimen with female color), Cocoro Island, Cuyo Islands, Palawan Province, Philippine Islands, 0–2.1 m, 26 May 1978; USNM 309434 (4, 2 male phases and 2 female phases), Barrio Anqib, Santa Ana Municipality, Cagayan Province, Luzon Island, Philippine Islands, 18 May 1989; WAM P29046-007 (112.5 mm, female), Ashmore Reef, Timor Sea (12°12'S, 123°03'E), 5.0–5.5 m depth, 14 Sept. 1986.

**Non-types.** 14 specimens: BSKU 10217, 10281 (2, 129.7–133.3 mm, male and female), Okinawa Island, Ryukyu Islands, Nov. 1961; BSKU 10674, 10736 (2, 163.5–170.2 mm, males), Ishigaki-jima Island, Ryukyu Islands, Nov. 1961; BSKU 57241-57242 (2, 100.7–101.5 mm, females), collected with BSKU 57239; NSMT-P 49540 (70.5 mm, juvenile), Urasoko Bay, Ishigaki-jima Island, Ryukyu Islands, 2 m depth, 10 Dec. 1995; NTM S.11375-029 (89.6 mm, female), southwest of sandy islet, Scott Reef, Timor Sea (14°04'S, 121°46'E), 9 Sep. 1984; NTM S.123322-011 (91.9 mm, female), west side of West Pass, Ashmore Reef, Timor Sea (12°01'S, 123°00'E), 20 Sep. 1987; URM-P 6549 (85.6 mm, juvenile), in front of Sesoko Experimental Station, Sesoko Island, Ryukyu Islands, spear, 21 Aug. 1974; URM-P 6591 (132.1 mm, male), in front of Sesoko Experimental Station, Sesoko Island, Ryukyu Islands, spear, 14 July 1974; URM-P 34442 (69.5 mm, juvenile), Ishigaki Port, Ishigaki-jima Is-

Table 2. Comparison of number of pectoral fin rays in 4 species of *Parapercis*.

		15	16	17	18	19	Average
<i>P. hexophtalma</i> (n=19)	(L)	—	1	17	1	—	17.0
	(R)	—	0	17	2	—	17.1
<i>P. pacifica</i> (n=37)	(L)	—	—	6	27	4*	17.9
	(R)	—	—	2	30	5*	18.1
<i>P. queenslandica</i> (n=15)	(L)	—	—	4*	9	2	17.9
	(R)	—	—	4*	10	1	17.8
<i>P. xanthogramma</i> (n=20)	(L)	—	—	2	15*	3	18.1
	(R)	1	—	1	17*	1	17.9

Data includes those from holotype, paratypes and non types.

L, left side; R, right side. Asterisks indicate data including that of holotype.

land, Ryukyu Islands, fishing, 5 Aug. 1995; URM-P 34673 (77.9 mm, juvenile), Mashiki, Ginowan, Okinawa Island, Ryukyu Islands, spear, 11 Oct. 1995; USNM 385006 (60.9 mm, juvenile, formerly USNM 309434), collected with USNM 309434.

**Diagnosis.** A species of *Parapercis* with usually 18 pectoral fin rays; a brown semicircular or M-shaped band and many blackish spots on the cheek region, and 3–4 ocelli and several blackish and brownish spots on the lower portion of the body in males; and usually 1–2 A1-2 and A2-3 spots, 2–3 A' series spots, and B4 spot, and a series of 6–7 ocelli on the lower portion of the body with brownish spots or patches between them in females and juveniles.

**Description.** Data for the holotype are presented first, followed by paratype data in parentheses: D V, 21 (V, 21–22, usually 21, 22 in one); A I, 17 (I, 17–18, usually 17, 18 in one); P<sub>1</sub> 1 (upper, unbranched)+18 (middle, branched)+0 (lower, unbranched)=19 (both sides) (1+16–18+0–1=17–19, usually 18 in both sides); P<sub>2</sub> I, 5 (I, 5); BC 8 (upper)+7 (lower)=15 (8+7=15); LLS 59 (58–60); SDL 8 (7–9); SLA 23 (20–27); SBD ca. 14 (ca. 11–14); GR 6+9=15 (4–7+7–11=13–17). Proportions as % SL: HL 28.9 (27.8–31.2); SNL 11.2 (9.6–13.2); OD 5.9 (5.4–7.1); IW 2.7 (1.9–3.1); UJ 11.7 (10.5–12.2); LJ 12.8 (11.9–14.3); PD 31.0 (29.7–32.9); PA 48.7 (46.1–51.7); DB 61.6 (59.5–65.0); AB 45.2 (41.2–46.8); CPL 10.1 (8.8–11.2); CPD 9.4 (9.1–10.2); P1L 18.7 (17.6–20.9); P2L 22.7 (22.1–26.5); CFL 20.5 (19.5–25.0); 1DS 3.0 (2.7–4.0); LDS damaged (fourth longest) [fourth longest usually (5.6–7.6), third longest in 2 (6.5–7.1)]; AS 4.6 (4.2–5.8). Proportions as % HL: SNL 38.7 (33.0–42.5); OD 20.4 (18.6–25.5); IW 9.5 (6.1–10.5); UJ 40.3 (35.5–40.1); LJ 44.4 (40.5–49.5).

Body elongate, cylindrical anteriorly and gradually compressed posteriorly. Head pointed anteriorly, 3.5 (3.2–3.6) in SL. Snout longer than orbital diameter, 2.6 (2.4–3.0) in HL. Orbital diameter more than 2 times interorbit, 4.9 (3.9–5.2) in HL. Interorbit broad and flat, 10.5 (9.5–16.4) in HL. Mouth slightly oblique and large, the maxil-

la reaching beyond a vertical through anterior margin of eye, length 2.5 (2.5–2.8) in HL; tip of lower jaw about equal to that of upper jaw, length of lower jaw 2.3 (2.0–2.5) in HL. Upper jaw with an outer row of canine teeth, becoming smaller posteriorly, and a medial tooth band comprised of small villiform teeth, narrowing to a single row posteriorly. Lower jaw with 4 recurved canine teeth anteriorly on each side (but anteriormost on right side detached), fourth largest. Subsequent tooth band on lower jaw of an outer row of canine teeth and medial villiform teeth; middle portion of outer row with several large canine teeth; villiform teeth restricted to anterior portion of lower jaw. Vomer with several rows of villiform teeth. Palatine without teeth. Gill membranes free of isthmus, with a broad free fold. Opercle with a single strong retrorse spine dorsally. Outer margin of preopercle smooth and that of subopercle with faint serrations in the middle portion. Lateral line slightly arched over pectoral fin, then extending along middle of body to the basal portion of the caudal fin. Scales on body and opercle ctenoid; those on nape, abdomen and area around pelvic fin cycloid. Cheek with small embedded scales. Snout, interorbit, posterior portion of eye and lower surface of head without scales. Basal portion of pectoral fin with small ctenoid and cycloid scales. Caudal fin, except for posterior fourth, covered by small ctenoid and cycloid scales. Dorsal, anal and pelvic fins without scales. Origin of dorsal fin above third lateral line scale. Membrane of spinous dorsal connected to first soft dorsal ray opposite tip of last spine. Origin of anal fin below base of fifth soft dorsal ray. Pectoral fin rounded, length 5.3 (4.8–5.7) in SL. Pelvic fin reaching origin of anal fin, length 4.4 (3.8–4.5) in SL. Caudal fin weakly rounded, upper edge slightly elongated posteriorly, length 4.9 (4.0–5.1) in SL.

*Color of males* [based on preserved holotype and paratypes (except for a male with intersexual color) when variation recognized, and fresh coloration (see Shen, 1993)]. Ground color of head and body light brown (or brown in several paratypes), except for light yellowish lower sur-

face. Dorsal and lateral surfaces of head with many brownish or dark brownish spots, including the following spots on snout, and upper and middle cheek regions: 7 A series spots on both sides (A1 to A5, and one A1-2 and A2-3) (7–9); 3 A' series spots on both sides (or 2); 9 B series spots on left side and 7 on right (spots unidentified, because their homology unclear) (7–9); 2 spots on left and 3 on right between posterior A1 and B series spots (0–4); and about 12 spots (about 10–15) on both sides below B series spots. Lower cheek region with a semicircular (or M-shaped) brownish band. Posterior portion of upper lip with 3–4 brownish spots. Dorsal surface of body, including base of pectoral fin, with many small dark brownish spots. Middle portion of body from just behind pectoral fin axil to caudal peduncle with 8 elliptical light spots, each having 2–3 brownish spots in the center; upper and lower margins of light spots surrounded by brownish spots, and anterior and posterior margins by a brownish band. Lower portion of body above anal fin with 3 (3–4, usually 3) ocelli with light (yellow when fresh) margin and blackish center; each ocellus located on a brownish band extending from the margin of the elliptical light spots on the middle portion of body. Lower portion of body anterior to the ocelli with 11 (7–11) blackish or brownish spots or patches (anterior-most spot situated below to base of pectoral fin); and 1–2 brownish spots present on each space between ocelli. Breast without spots. Spinous dorsal with a blackish spot basally and brownish band near margin. Soft dorsal with 2–4 longitudinal rows of spots on each membrane between rays. Anal fin with a row of blackish spots on the middle portion of membranes between second (first to fourth, usually second or third) and 17th rays [thus anal fin with 15 spots in holotype, and 13–16 (usually 14–15) in paratypes], a narrow brownish band basally, and another brownish band near margin. Pectoral fin pale. Pelvic fin dusky. Caudal fin with a large blackish spot at middle, several small blackish spots posteriorly and a brownish band near posterior margin.

*Color of females and juveniles in alcohol*

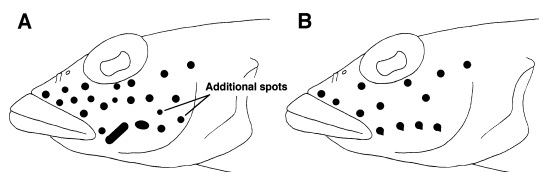


Fig. 8. Diagrammatic illustration showing markings of snout and cheek regions in *Parapercis pacifica* sp. nov., BSKU 56592, 138.2 mm, male, paratype (A) and *P. queenslandica* sp. nov., NSMT-P 70981, 174.3 mm, male, paratype (B).

(based on paratypes and non type specimens). Dorsal and lateral surfaces of head with many blackish or brownish spots, including the following spots on snout and cheek regions: 5–9 A series spots (A1 to A5 present and 1–2 A1-2 and A2-3 usually present [rarely A1-2 and/or A2-3 absent]); 1–3 A' series spots (A'1 present, A'2 usually present, and A'3 present or absent); 5–7 B series spots (B1, B3, B6, and B7 present, B4 and B5 usually present, B2 usually absent, and rarely a spot present between B6 and B7); and 3–5 (usually 4) C series spots (C1 to C4 present and C5 usually absent, rarely one spot present instead of C2 and C3) (Table 1). Single additional spot rarely present between posterior B and C series spots. Lower portion of body with 6–7 ocelli (usually 7) with light margin and blackish center, each located on a brownish band; 1–2 brownish spots on each space between ocelli usually (rarely no distinct spots between ocelli). Other coloration similar to males.

*Color of a male specimen with intersexual color* (paratype, BSKU 56592, 138.2 mm) (Fig. 8A). Lower cheek region with C1 to C4 spots; C1 and C4 circular, C2 oblique and elongate, and C3 elliptical. Two additional spots present between posterior B and C series spots. Other spots on snout, and middle and upper cheek regions similar to females. Lower portion of body with 7 ocelli with light margin and a blackish center, each located on a brownish band; one brownish spot or patch present at each space between ocelli.

**Distribution.** Widespread in the western Pa-

cific, including southern Japan (Kochi, and Ryukyu Islands), Philippines, Sulawesi, and Ceram and Timor Seas (Fig. 5). It is also known from the South China Sea (Cheng *et al.*, 1962; Shen, 1993) and Flores (Kuitert, 1992).

**Etymology.** The specific name derives from its distribution in the Pacific.

**Remarks.** *Parapercis pacifica* resembles *P. queenslandica* and *P. xanthogramma* in having usually 18 pectoral fin rays, 3 or 4 ocelli, and several blackish and brownish spots on the lower portion of the body in the males, and 7 ocelli and usually brownish spots or patches between them in the females (vs. usually 17 pectoral fin rays, 3–4 ocelli and no other spots on the lower portion of the body in the males, and 7 ocelli and usually no spots or patches between them in the females in *P. hexophthalma*). However, *P. pacifica* differs from these 2 species in having a brown semicircular or M-shaped band and many blackish spots on the cheek region in males [vs. with 2–6 oblique brownish bands in the male *P. queenslandica* and with 4–7 oblique pale (yellow when fresh) bands in the male *P. xanthogramma*], and usually 1–2 A1-2 and A2-3 spots, 2–3 A' series spots, and B4 spot in the females (vs. usually or always no A1-2 and A2-3 spots, one A' series spot, and no B4 spot in the females of these 2 species) (Fig. 3, Table 1).

Based on the coloration of the cheek region in both sexes, including the male with intersexual color, a semicircular (and M-shaped) brownish band is considered derived from C2, C3, and C4 spots in *P. pacifica*. The males of *P. pacifica* have many additional spots between B series spots and the semicircular band (thus previously "C series spots"). These many additional spots are absent in *P. queenslandica* and *P. xanthogramma*, as well as in *P. hexophthalma*. This character also separates *P. pacifica* from the other 3 species.

Cheng *et al.* (1962) described *P. hexophthalma* (as *P. hexophthalma*) from the South China Sea; however, judging from his male illustration, showing many spots on the cheek region, their description was based on *P. pacifica*. The specimens in Chen *et al.* (1997) from Taiwan and

Kuitert (1992) from Flores, have a semicircular brown band on the lower cheek region; therefore, we identify these as *P. pacifica*.

We found an intersexual specimen with female coloration (USNM 228413, 147.5 mm), having the gonad with an ovary anteriorly and testis posteriorly, and also a male specimen with the intersexual color (BSKU 56593, 138.2 mm). Therefore, it is assumed the coloration is started after or near completion of sex reversal in *P. pacifica*.

### *Parapercis queenslandica* sp. nov.

(Figs. 3C, 8B, 9)

*Parapercis hexophthalma* (emendation, non Cuvier in Cuvier and Valenciennes, 1829):

Grant, 1987: 328, fig. 698 (description, Great Barrier Reef).

*Parapercis hexophthalma* (non Cuvier in Cuvier and Valenciennes, 1829): Randall *et al.*, 1990: 360, unnumbered fig. (short description, Great Barrier Reef and Coral Sea); Randall, 2001: 3507, unnumbered fig. (short description, western central Pacific) (in part).

*Parapercis polyophthalma* (emendation, non Cuvier in Cuvier and Valenciennes, 1829): Fourmanoir and Laboute, 1976: 134, unnumbered fig. (description, New Caledonia).

**Holotype.** AMS I.15627-025 (178.5 mm, male), Capricorn Group, One Tree Island, Queensland, Australia (23°30'S, 152°05'E), 1 m depth, 10 Dec. 1966.

**Paratypes.** 8 specimens: AMS I.11964 (165.2 mm, male), Murray Island, Queensland (9°56'S, 144°04'E), 1907; AMS I.15610-004 (177.9 mm, male), Tryon Island, Capricorn Group, Queensland (23°30'S, 152°05'E), 1970; AMS I. 20527-001 (207.9 mm, male), One Tree Island, Queensland (23°30'S, 152°05'E), Oct. 1967; AMS I.23708-089 (150.3 mm, male), 150 m inside lagoon entrance on west side of channel, Lizard Island, Queensland (14°41'S, 145°27'E), 31 Dec. 1974; AMS I.25113-085 (122.3 mm, male with female color), Osprey Reef, Coral Sea (13°52'S, 146°33'E), 8 Nov. 1984; AMS IB.3108 (196.1 mm, male), off Cairns, Green Island, Queensland (23°30'S, 152°05'E), 1953; HUMZ 193572 (113.5 mm, female, formerly AMS I.25113-085), collected with AMS I.25113-085; NSMT-P 70981 (174.3 mm, male with intersexual color, formerly AMS I.20527-001), collected with AMS I.20527-001.

**Non-types.** 6 specimens: AMS I.20201-042 (96.3 mm, juvenile), One Tree Island, Queensland, 0–2 m depth, 29 Sep. 1971; AMS I.20205-012 (150.6 mm, female), One Tree Island, Queensland, 1–2 m depth, 27 Sep. 1968;



Fig. 9. Photograph of *Parapercis queenslandica* sp. nov. A: AMS I.15627-025, 178.5 mm, male, holotype; B: AMS I.20205-012, 150.6 mm, female.

AMS I.20755-022 (82.8 mm, juvenile), northeast of Eves Reef, off Cape Melville, Queensland (13°56'S, 144°36'E), 9 Feb. 1979; AMS I.22613007 (159.1 mm, male), Escape Reef, Queensland (15°49'S, 145°50'E), 27 m depth, 1 Nov. 1981; AMS I.22621-010 (88.4 mm, juvenile), Escape Reef, Queensland, 5–8 m depth, 27 Nov. 1980; AMS I.34173-036 (137.8 mm, female), One Tree Island, Queensland, 1 Dec. 1979.

**Diagnosis.** A species of *Parapercis* with usually 18 pectoral fin rays; 2–6 oblique brownish bands on the lower cheek region, 3–4 ocelli and a series of several blackish and brownish spots on the lower portion of the body in males; and no B5 spot on cheek, 7–8 ocelli and brownish spots or patches between ocelli in females and juveniles.

**Description.** Data for the holotype are presented first, followed by paratype data in parentheses: D V, 21 (V, 21); A I, 17 (I, 16–17, usually 17, 16 in one); P<sub>1</sub> 1 (upper, unbranched)+16 (middle, branched)+0 (lower, unbranched)=17 (both sides) (1+15–17+0–1=17–18, usually 1+17+0=18 in both sides); P<sub>2</sub> I, 5 (I, 5); BC 8 (upper)+7 (lower)=15 (8+7=15); LLS 60 (57–60); SDL 9 (7–8); SLA 23 (22–24); SBD ca. 14 (ca. 12–15); GR 6+10=16 (4–6+9–12

=14–17). Proportions as % SL: HL 29.5 (29.0–30.1); SNL 12.6 (10.0–12.4); OD 5.9 (5.7–7.2); IW 2.6 (2.1–3.4); UJ 11.9 (11.3–12.4); LJ 12.0 (12.6–13.3); PD 31.8 (29.6–31.8); PA 49.1 (47.3–52.7); DB 63.9 (59.9–64.2); AB 42.0 (42.9–46.9); CPL 9.8 (10.0–11.2); CPD 10.2 (9.5–10.9); P1L 20.4 (19.0–21.3); P2L 22.2 (21.6–26.3); CFL 22.1 (19.6–22.5); IDS 3.3 (2.9–4.4); LDS damaged (fourth longest) (5.0–7.8, fourth longest); AS 4.6 (4.2–5.8). Proportions as % HL: SNL 42.7 (34.2–42.0); OD 20.1 (19.2–24.6); IW 8.7 (7.2–11.5); UJ 40.2 (37.6–41.8); LJ 40.6 (42.9–45.7).

Body elongate, cylindrical anteriorly and gradually compressed posteriorly. Head pointed anteriorly, 3.4 (3.3–3.4) in SL. Snout longer than orbital diameter, 2.3 (2.4–2.9) in HL. Orbital diameter more than 2 times interorbit, 5.0 (4.1–5.2) in HL. Interorbit broad and flat, 11.5 (8.7–13.9) in HL. Mouth slightly oblique and large, the maxilla reaching beyond a vertical through anterior margin of eye, length 2.5 (2.4–2.7) in HL; tip of lower jaw about equal to that of upper jaw, length of lower jaw 2.5 (2.2–2.3) in HL. Upper jaw with an outer row of canine teeth, becoming smaller posteriorly, and a medial tooth band comprised of

small villiform teeth, narrowing to a single row posteriorly. Lower jaw with 4 recurved canine teeth anteriorly on each side (but anteriormost on right side detached), fourth largest. Subsequent tooth band on lower jaw of an outer row of canine teeth and medial villiform teeth; middle portion of outer row with several large canine teeth; villiform teeth restricted to anterior portion of lower jaw. Vomer with several rows of villiform teeth. Palatine without teeth. Gill membranes free of isthmus, with a broad free fold. Opercle with a single, strong, retrorse spine dorsally. Outer margin of preopercle smooth and that of subopercle with serrations in the middle portion. Lateral line slightly arched over pectoral fin, then extending along middle of body to the basal portion of the caudal fin. Scales on body and opercle ctenoid; those on nape, abdomen and area around pelvic fin cycloid. Cheek with small embedded scales. Snout, interorbit, posterior portion of eye and lower surface of head without scales. Basal portion of pectoral fin with small ctenoid and cycloid scales. Caudal fin, except for posterior third, covered by small ctenoid and cycloid scales. Dorsal, anal and pelvic fins without scales. Origin of dorsal fin above third lateral line scale. Membrane of spinous dorsal connected to first soft dorsal ray opposite tip of last spine. Origin of anal fin below base of fifth soft dorsal ray. Pectoral fin rounded, length 4.9 (4.7–5.3) in SL. Pelvic fin reaching origin of anal fin, length 4.5 (3.8–4.6) in SL. Caudal fin weakly rounded, upper edge slightly elongated posteriorly, length 4.5 (4.4–5.1) in SL.

*Color of males in alcohol* [based on holotype and paratypes (except for a male with female color) when variation recognized]. Ground color of head and body light brown (or brown in several paratypes), except for light yellowish lower surface. Anterior portion of interorbit with one indistinct pale bracket-like band (several pale spots present anterior to interorbit and eye or band and spots absent). Dorsal and lateral surfaces of head with many brownish or dark brownish spots, including the following spots on snout, and upper and middle cheek regions: 5

(left) and 6 (right) A series spots, A1 to A5 (and one A1-2 on left) (3–6 in paratypes, A1 to A3 present or absent, A4 and A5 present); one A' series spots (zero to one); and 5 B series spots [B3, B5 to B7, and an additional spot posterior to B7 present on left side (B1 continuous with anteriormost brownish band and not recognized as isolated spot), and B3, B5, B6, a small spot near B5, and an additional spot posterior to "B7 spot" position present on right] (2–5, B1, B3, B6, and B7 present or absent, B2 and B4 absent, B5 usually absent, and a spot near B5 and that between B6 and B7 present or absent). Lower cheek region with 4 (2–6) oblique brownish bands; posterior band one (0–2) extending to lower portion of opercular region. Two additional brownish oblique bands (0–1) present on lower portion of opercular region. Dorsal surface of body, including base of pectoral fin, with many small dark brownish spots. Middle portion of body from just behind pectoral fin axil to caudal peduncle with 9 elliptical light spots (separation of last posterior 2 somewhat indistinct), having 2–3 brownish spots in center of each; upper and lower margins of light spots surrounded by brownish spots arranged continuously and the anterior and posterior margins by a brownish band. Lower portion of body above anal fin with 3 ocelli (or 4) with light margin and blackish center; each ocellus surrounded by light brownish band extending from the margin of the elliptical light spots on middle portion of body. Lower portion of body anterior to ocelli with 8 (5–11) blackish or brownish spots or patches (anteriormost spot situated below base of pectoral fin). No spots (or 1–2 brownish spots) present on each space between ocelli. Breast without spots. Spinous dorsal with a blackish spot basally and brownish band near margin. Soft dorsal with 3–5 longitudinal rows of blackish spots on each membrane between rays. Anal fin with a row of blackish spots on middle portion of membranes between first (second or third) and 17th rays (thus anal fin with 16 spots in holotype and 14–15 in paratypes), a narrow, faint brownish band basally (pigment scattered basally and distinct band not recog-

nized), and another brownish band near margin. Pectoral and pelvic fins pale. Caudal fin with a large blackish spot at middle, surrounded by several small blackish spots, and a brownish band near posterior margin.

*Color of females and juveniles in alcohol* (based on paratype and non type specimens). Dorsal and lateral surfaces of head with many blackish to brownish spots, including the following spots on snout and cheek regions: 3–6 A series spots [A1 and A4 usually present, A1-2 usually absent (rarely one spot present), A2, A3, and A5 present, and A2-3 absent]; 0–2 (usually one) A' series spots (A'1 present, A'2 usually absent, and A'3 absent); 3–4 B series spots (B1, B3 and B6 present, B2, B4 and B5 absent, and B7 present or absent); and 3–4 C series spots (C1 present or absent, C2 to C4 present, and C5 absent) (Table 1). Lower portion of body with 7–8 blackish ocelli with light yellowish margin, each located on a brownish band; usually 1–2 brownish spots or patches present at each space between ocelli (rarely no spots or patches present at space between last 2 ocelli).

*Color of male with intersexual color* (based on a paratype, NSMT-P 70981, 174.3 mm) (Fig. 8B). C1 to C4 spots slightly extended posterovertrally. Other coloration similar to males.

**Etymology.** The specific name derives from the type locality.

**Distribution.** Present species was collected only from Queensland, Australia (Fig. 5). It is also known from New Caledonia (Fourmanoir and Laboute, 1976).

**Remarks.** The males of *Parapercis queenslandica* and *P. xanthogramma* can be distinguished from each other by the coloration of the cheek region: the former has 2–6 oblique brownish bands restricted to the lower cheek region, whereas the latter has 4–7 oblique pale (yellow when fresh) entire bands distributed on the cheek region. The female *P. queenslandica* is also separable from that of *P. xanthogramma* in lacking a B5 spot on the cheek region (vs. present) (Fig. 3, Table 1).

We identify Fourmanoir and Laboute's (1976)

photograph of "*Parapercis polyophthalma*", having 5 brown oblique bands on the lower cheek region, as that of *P. queenslandica*, although their photograph of "*Parapercis hexophthalma*" is based on the male of *Parapercis xanthozona* (Bleeker, 1849).

We recognized 2 male specimens with the intersexual color (NSMT-P 70981, 174.3 mm) and with the female color (AMS I. 25113-085, 122.3 mm). It is assumed the coloration change begins after termination of sex reversal in *P. queenslandica*.

### *Parapercis xanthogramma* sp. nov.

(Figs. 3D, 10–11)

*Parapercis hexophthalma* (emendation, non Cuvier in Cuvier and Valenciennes, 1829): Cantwell, 1964: 268: figs. 1J, 3J, 9B (description, Fiji Islands) (in part).

*Parapercis polyophthalma* (emendation, non Cuvier in Cuvier and Valenciennes, 1829): Cantwell, 1964: 270, figs. 1J, 3J, 9C (description, Rennell Islands) (in part).

*Parapercis hexophthalma* (non Cuvier in Cuvier and Valenciennes, 1829): Randall, 2005: 464 (short description, South Pacific, including New Caledonia, Vanuatu, Fiji Islands, and Tonga) (in part–).

**Holotype.** URM-P 33394 (158.5 mm, male), Vavau Island, Tonga, fishing, 13 Feb. 1992.

**Paratypes.** 13 specimens: AMS I.18354-034 (108.6 mm, female), Suva Harbour, Viti Levu Island, Fiji Islands (18°08'S, 178°25'W), 6 m, 9 July 1974; AMS I.18356-001 (120.1 mm, female), Suva Point, Viti Levu Island, Fiji Islands (18°08'S, 178°25'W), 5 Aug. 1974; AMS I.34728-009 (168.2 mm, male), Wallis Island, Western Samoa (13°05'S, 176°00'W), 2 Dec. 1975; HUMZ 193573 (122.8 mm, female, formerly URM-P 33516), Vavau Island, Tonga, fishing, 31 July 1993; NSMT-P 70982 (160.2 mm, male, formerly URM-P 28654), Vavau Island, Tonga, fishing, 22 Apr. 1991; USNM 200749 (174.4 mm, male), Wailangilala Island, Fiji Islands (16°45'S, 179°07'W), 0.3–2.1 m, 26 May 1965; USNM 256520 (158.2 mm, female), Yanutha Islet, Ono Ilap, Lau Group, Fiji Islands, 30 Apr. 1982; USNM 337653 (3, 119.6–170.2 mm, male and females), Ofolamga Island, Ha'apai Group, Tonga (19°36'11"S, 174°27'54"W), 12 Nov. 1993; USNM 336524 (115.0 mm, female), Uoleva Island, Ha'apai Group, Tonga (19°51'36"S, 174°25'06"W), 11 Nov. 1993; URM-P 33397 (157.2 mm, male), Vavau Island, Tonga, fishing, 16 Mar. 1992; URM-P 33509 (125.4 mm, female), Vavau Island, Tonga, fish-



Fig. 10. Photograph of *Parapercis xanthogramma* sp. nov. A: URM-P 33394, 158.5 mm, male, holotype; B: URM-P 33509, 125.4 mm, female, paratype.

ing, 11 June 1993

**Non-types.** 6 specimens: USNM 385003 (2,78.4–94.2 mm, juveniles, formerly USNM 256520), collected with USNM 256520; USNM 385005 (3,72.5–94.2 mm, juveniles, formerly USNM 336524), collected with USNM 336524; URM-P 28655 (143.6 mm, male), collected with NSMT-P 70982.

**Diagnosis.** A species of *Parapercis* with usually 18 pectoral fin rays; 4–7 oblique, pale (yellow when fresh) entire bands on the cheek region, and 3–4 ocelli and a series of several blackish and brownish spots on the lower portion of the body in males; B5 spot on the cheek region, 6–8 ocelli and brownish spots or patches between ocelli in females and juveniles.

**Description.** Data for the holotype are presented first, followed by paratype data in parentheses: D V, 21 (V, 21); A I, 17 (I, 17); P<sub>1</sub> 1 (upper, unbranched)+17 (middle, branched)+0 (lower, unbranched)=18 (both sides) (1+16–18+0–1=17–18, usually 1+17+0=18 in both sides); P<sub>2</sub> I, 5 (I, 5); BC 7 (upper)+7 (lower)=14

(7–8+7=14–15, usually 15); LLS 60 (58–60); SDL-(7–9); SLA 21 (20–25); SBD ca. 13 (ca. 10–15); GR 6+10=16 (4–7+10–11 =14–18). Proportions as % SL: HL 28.8 (28.3–30.9); SNL 10.9 (9.9–12.0); OD 6.2 (5.7–7.1); IW 2.6 (1.9–2.8); UJ 11.1 (10.3–11.8); LJ 12.5 (12.0–13.5); PD 31.0 (30.2–34.3); PA 46.2 (46.4–51.5); DB 63.8 (60.1–64.2); AB 44.5 (41.9–46.6); CPL 11.2 (10.1–11.5); CPD 9.3 (8.8–10.3); P1L 18.2 (19.0–21.6); P2L damaged (21.4–26.0); CFL damaged (19.3–24.6); 1DS 3.0 (2.5–4.1); LDS 6.2 (fourth) [usually fourth longest (5.5–7.7), third longest in one (7.2)]; AS 4.4 (4.3–6.9). Proportions as % HL: SNL 37.9 (34.9–40.9); OD 21.7 (19.6–23.8); IW 9.0 (6.3–9.7); UJ 38.5 (34.7–40.9); LJ 43.3 (40.2–46.6).

Body elongate, cylindrical anteriorly and gradually compressed posteriorly. Head pointed anteriorly, 3.5 (3.2–3.5) in SL. Snout longer than orbital diameter, 2.6 (2.4–2.9) in HL. Orbital diameter more than 2 times interorbit, 4.6 (4.2–5.1) in



HL. Interorbit broad and flat, 11.1 (10.3–15.9) in HL. Mouth slightly oblique and large, the maxilla reaching beyond a vertical through anterior margin of eye, length 2.6 (2.4–2.9) in HL; tip of lower jaw about equal to that of upper jaw, length of lower jaw 2.3 (2.1–2.5) in HL. Upper jaw with an outer row of canine teeth, becoming smaller posteriorly, and medial tooth band comprised of small villiform teeth, narrowing to a single row posteriorly. Lower jaw with 4 recurved canine teeth anteriorly on each side (but anteriormost on left side detached), fourth largest. Subsequent tooth band on lower jaw comprised of an outer row of canine teeth and medial villiform teeth; middle portion of outer row with several large canine teeth; villiform teeth restricted to anterior portion of lower jaw. Vomer with several rows of villiform teeth. Palatine without teeth. Gill membranes free of isthmus, with a broad free fold. Opercle with a single, strong retrorse spine dorsally. Outer margin of preopercle and subopercle on left side smooth, that of subopercle on right side with serrations in middle portion. Lateral line slightly arched over pectoral fin, then extending along middle of body to the basal portion of the caudal fin. Scales on body and opercle ctenoid; those on nape, abdomen and area around pelvic fin cycloid. Cheek with small embedded scales. Snout, interorbit, posterior portion of eye and lower surface of head without scales. Basal portion of pectoral fin with small ctenoid and cycloid scales. Anterior half of caudal fin covered by small ctenoid and cycloid scales. Dorsal, anal and pelvic fins without scales. Origin of dorsal fin above third lateral line scale. Membrane of spinous dorsal connected to first soft dorsal ray opposite tip of last spine. Origin of anal fin below base of fifth soft dorsal ray. Pectoral fin rounded, length 5.5 (4.6–5.3) in SL. Pelvic fin reaching to origin of anal fin (length 3.8–4.7 in SL). Caudal fin weakly rounded (posterior portion of upper caudal fin broken) (upper edge slightly elongated posteriorly, length 4.1–5.2 in SL).

*Color of males in alcohol* (based on holotype and paratypes, and also those, when fresh, Fig.



Fig. 11. Underwater photograph (KPM-NR 28215) of male of *Parapercis xanthogramma* sp. nov. (Masahumi Tanaka; specimen not collected).

11 and Randall, 2005: right fig., p. 464). Ground color of head and body brown, except for light yellowish lower surface of body. Dorsal surface of snout, interorbit, and posterior portion of interorbit and eye with several pale spots; anterior portion of interorbit with one pale, bracket-like band (spots and bracket-like band yellow when fresh). Cheek region with 6 (left) or 5 (right) entire, oblique pale bands (yellow when fresh) (4–7 in paratypes); 2 (0–3) bands on posterior portion of cheek extending to opercular region. Dorsal surface of body, including base of pectoral fin, with many small, dark brownish spots. Middle portion of body from just behind pectoral fin axil to caudal peduncle with 9 elliptical light spots (separation of last posterior 2 somewhat indistinct), with 1–3 brownish spots in center of each; margin of light spots brownish. Lower portion of body above anal fin with 4 (3–4) ocelli with light margin (yellow when fresh) and blackish center; each ocellus located on a brownish band extending from the margin of the elliptical light spots on middle portion of body. Lower portion of body anterior to ocelli with a series of 9 (5–10) blackish or brownish spots or patches (anterior-most spot situated below base of pectoral fin); and 1–2 brownish spots on each space between ocelli. Breast without spots. Spinous dorsal with a blackish spot basally and a brownish band near posterior margin. Soft dorsal with 4–5 longitudinal rows of dark brown (or blackish) spots on each membrane between rays. Anal fin with a

row of dark brown (or blackish) spots on middle portion of membranes between second (second to fourth) and 17th rays, and a narrow brownish band basally (or pigment scattered basally, and another brownish band near margin). Pectoral fin pale. Pelvic fin dusky (or pale). Caudal fin with a large blackish spot at middle, surrounded by several small blackish spots.

*Color of females and juveniles in alcohol* (based on paratypes and non type specimens). Dorsal and lateral surfaces of head with many blackish to brownish spots, including the following spots on snout and cheek regions: 4–6 A series spots (A1 to A4 present, A1-2 and A2-3 spots absent, A5 usually present, and rarely a spot present between A3 and A4); one A' series spot (A'1 present, and A'2 and A'3 absent); 4–6 (usually 5) B series spots (B1, B3, and B5 to B6 present, B7 usually present, and rarely a spot present between B6 and B7); and 4–5 (usually 4) C series spots (C1 to C4 present and C5 usually absent) (Table 1). No distinct pale spots or bracket-like band present on dorsal surface of head. Lower portion of body with 6–8 blackish ocelli with pale margin located on a brownish band; 1–2 brownish spots between the ocelli. Other coloration similar to males.

**Etymology.** The specific name derives from the yellow bands on the cheek region in the males of this species.

**Distribution.** Present species was collected only from the Fiji Islands, Tonga, and Western Samoa (Fig. 5). It is also known from the Rennell Islands (Cantwell, 1964).

**Remarks.** Rofen (1958) listed "*Parapercis hexophthalma*" from Rennell Island. Cantwell (1964) examined a female specimen (CAS 6018, 161 mm), identified as "*P. polyophthalma*", collected from the island and provided a photograph of the specimen. This photograph is clear and the specimen has the following spots on the snout and cheek regions: 5 A series (A1 to A5), single A' series (A'1), 5 B series (B1, B3, and B5–7), and 4 C series (C1 to C4) spots. In addition, this specimen bears the dark spots and patches between the ocelli on the lower side of the body.

Thus, we identify this specimen as *P. xanthogramma*.

Randall (2005), who considered his "*P. hexophthalma*" as a single species, mentioned the head of the females with the scattered small black spots, of males with the oblique black lines that were yellow in large males in the species. However, the largest male examined here is 192.5 mm SL in *P. hexophthalma* and 207.9 mm SL in *P. queenslandica*, whereas the smallest male is 143.6 mm SL in *P. xanthogramma*. Therefore, the difference of the cheek color in these species apparently does not depend on body size.

### Acknowledgments

We sincerely thank K. Matsuura (NSMT) for providing us an opportunity to submit this study for the special publication of NSMT. We are grateful to M. E. Anderson (South African Institute of Aquatic Biodiversity) for a critical reading of the manuscript. Our special thanks also go to H. Senou (Kanagawa Prefectural Museum of Natural History), who allows us to use the underwater photographs deposited in the museum (KPM-NR 13396 and 28215). We also thank to the following persons for loans of study materials: H. Endo (BSKU), James Maclaine (BMNH), H. Larson (NTM), M. McGrouther (AMS), J. Williams (USNM), M. E. Anderson (SAIAB) and G. Moore (WAM). Finally, the senior author express sincere thank to P. Bartsch (ZMB) for his helpful support when he visited at the museum to examine the specimens, including the holotype of *Parapercis hexophthalma*. This study was partially supported by the 21st Century COE program of the University of the Ryukyus.

### Literature Cited

- Barnard, K. H. 1927. A monograph of the marine fishes of South Africa. Part II (Teleostei-Discocephali to end. appendix.). *Annals of the South African Museum*, 21: 419–1065, pls. 18–37.
- Bleeker, P. 1845. Bijdragen tot de geneeskundige topographie van Batavia. Generisch overzicht der fauna. *Natuurkundig en Geneeskundig Archief voor Nederlandsch*

- Indië*, 2: 505–528.
- Bleeker, P. 1849. Bijdrage tot de kennis der Percoïden van den Malajio-Bolukschen Archipel, met beschrijving van 22 nieuwe soorten. *Verhandelingen van het Bataviaasch Genootschap Kunsten en Wetenschappen*, 22: 1–64.
- Bleeker, P. 1853. Vierde bijdrage tot de kennis der ichthyologische fauna van Celebes. *Natuurkundig Tijdschrift voor Nederlandsch Indië*, 5: 153–174.
- Bleeker, P. 1860. Dertiende bijdrage tot de kennis der vischfauna van Celebes. Visschen van Bonthain, Badjoa, Sindjai, Lagoesi en Pompenoea. *Acta Societatis Scientiarum Indo-Neëlandicae*, 8: 1–60.
- Bleeker, P. 1878. Quatrième mémoire sur la faune ichthyologique de la Nouvelle-Guinée. *Archives Néerlandaises des Sciences Exactes et Naturelles*, 11: 35–66, pls. 2–3.
- Bloch, M. E. 1792. Naturgeschichte der Ausländischen Fische. Berlin, 6: i–xii+1–126, pls. 289–323.
- Broad, G. 2003. Fishes of the Philippines. A Guide to Identification of Families. Anvil Publishing, Inc., Pasig City. xii+510 pp.
- Cantwell, G. E. 1964. A revision of the genus *Parapercis*, family Mugiloididae. *Pacific Science*, 18: 239–280
- Chen, Q.-C., Y.-Z. Cai, and X.-M. Ma. 1997. Fishes from Nansha Islands to South China Coastal Waters. 1. Science Press, Beijing. xx+202 pp.
- Cheng, Q.-T., C.-X. Wang, M.-C. Tain, W.-H. Yang, and B.-L. Sun. 1962. Mugiloididae. Pages 681–688 in Institute of Zoology, Academia Sinica, Institute of Oceanology, Academia Sinica, and Shanghai Fisheries College, eds. Fishes of the South China Sea. Science Press, Beijing.
- Clark, E., M. Pohle and J. Rabin. 1991. Stability and flexibility through community dynamics of the spotted sandperch. *National Geographic Research and Exploration*, 7: 138–155.
- Cuvier, G. and A. Valenciennes. 1829. Histoire Naturelle des Poissons. Tome Troisième. Suite du Livre Troisième. Des Percoides à Dorsale Unique à Sept Rayons Branchiaux et à Dents en Velours Ou en Cardes. Histoire Naturelle des Poissons. i–xxviii+2 pp.+1–500.
- Day, F. 1876. The Fishes of India; Being a Natural History of the Fishes Known to Inhabit the Seas and Fresh Waters of India, Burma, and Ceylon. Part 2, pp. 169–368, pls. 41–78.
- de Beaufort, L. F. and Chapman, W. M. 1951. Fishes of the Indo-Australian Archipelago. IX. Percomorphi, Blennoidea. E. J. Brill, Leiden. xi+484 pp.
- de Bruin, G. H. P., B.C. Russell and A. Bogusch. 1994. FAO Species Identification Field Guide for Fishery Purposes. The Marine Fishery Resources of Sri Lanka. FAO, Rome. x+400 pp., pls. 32.
- Evermann, B. W. and A. Seale. 1907. Fishes of the Philippine Islands. *Bulletin of the Bureau of Fisheries*, 26: 49–110.
- Fourmanoir P. and P. Laboute. 1976. Poissons des Mers Tropicales: Nouvelle Calédonie-Nouvelles Hébrides. Les édition du Pacifique, Papete, Tahiti. 376 pp.
- Grant, E. M. 1987. Fishes of Australia. E. M. Grant Pty Ltd., Scarborough, Queensland, 480 pp.
- Haly, A. 1875. Descriptions of new species of fish in the collection of the British Museum. *Annals and Magazine of Natural History, Including Zoology, Botany and Geology. Fourth Series*, 15: 268–270.
- Heemstra, P. C. 1986. Family No. 234: Mugiloididae. Pages 739–741 in M. M. Smith and P. C. Heemstra, eds. Smiths' Sea Fishes. Springer-Verlag, Berlin.
- Hubbs, C. L. and K. F. Lagler. 1958. Fishes of the Great Lakes region. Bulletin of Cranbrook Institute of Science, 26: 1–213.
- ICZN. 1999. International Code of Zoological Nomenclature. Fourth edition. The International Trust for Zoological Nomenclature, London, xxix+306 pp.
- Jordan, D. S. and J. O. Snyder. 1902. A review of the trachinoid fishes and their supposed allies found in the waters of Japan. *Proceedings of the United States National Museum*, 24: 461–497.
- Kailola, P. J. 1987. The Fishes of Papua New Guinea: A Revised and Annotated Checklist. Vol. II. Scorpaenidae to Callionymidae. Research Section, Department of Fisheries and Marine Resources, Port Moresby, Research Bulletin, 41: i–xxii+195–418.
- Klunzinger, C. B. 1870. Synopsis der Fische des Rothen Meeres. I. Theil. Percoiden–Mugiloiden. *Verhandlungen der Kaiserlich-Königlichen Zoologisch-Botanischen Gesellschaft in Wien*, 20: 669–834.
- Kuiter, R. H. 1992. Tropical Reef-fishes of the Western Pacific. Indonesia and Adjacent Waters. PT Gramedia Pustaka Utama, Jakarta. xiii+314.
- Kuiter, R. H. and T. Tonzuka. 2004. Pictorial Guide to: Indonesian Reef Fishes. PT Dive & Dive's. vi+893 pp.
- Kumaran, M. and S. Jones. 1980. Fishes of the Laccadive Archipelago. Mathrubhumi Press, Cochin. xii+760 pp.
- Leviton, A.E., R. H. Gibbs, Jr., E. Heal, and C. E. Dawson. 1985. Standards in herpetology and ichthyology: part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia*, 1985(3): 802–832.
- Martin, C. and H. R. Montalban. 1935. Philippine Parapercidae. *The Philippine Journal of Science*, 55: 221–229, 3 pls.
- Matsubara, K. 1955. Fish Morphology and Hierarchy. Ishizaki Shoten, Tokyo. Vol. 1, xvi+789 pp. (In Japanese.)
- Munro, I. S. R. 1967. The Fishes of New Guinea. Victor C. N. Blight, Government Printer, Sydney. xxxvii+651

- pp., 78 pls.
- Randall, J. E. 1984. Two new Indo-Pacific mugiloid fishes of the genus *Parapercis*. *Freshwater and Marine Aquarium*, 7 (Dec.): 41–49.
- Randall, J. E. 1995. Coastal Fishes of Oman. Univ. Hawaii Press, Honolulu. xiii+2 maps+439 pp.
- Randall, J. E. 2001. Pinguipedidae. Pages 3501–3510 in K. E. Carpenter and V. H. Niem, eds. *FAO Species Identification Guide for Fishery Purposes. The Living Marine Resources of the Western Central Pacific. Vol. 6. Bony Fish Part 4 (Labridae to Latimeriidae)*. FAO, Rome.
- Randall, J. E. 2005. Reef and Shore Fishes of the South Pacific. Univ. Hawaii Press, Honolulu. ix+map+707 pp.
- Randall J. E., G. R. Allen, and R. C. Steene. 1990. Fishes of the Great Barrier Reef and Coral Sea. Crawford House Publishing Pty Ltd., Australia. xx+507 pp.
- Rofen, R. R. 1958. The Marine Fishes of Rennell Island. *The Natural History of Rennell Island, British Solomon Islands*, 1, pp. 149–218, 11 pls.
- Rüppell, W. P. E. S. 1828. Atlas zu der Reise im nördlichen Afrika. Fische des Rothen Meeres. Frankfurt am Main, Part 1: 1–26, pls. 1–6.
- Rüppell, W. P. E. S. 1838. Neue Wirbelthiere zu der Fauna von Abyssinien gehörig. Fische des Rothen Meeres. Frankfurt am Main, Part 4: 81–148, pls. 22–33.
- Sommer, C., W. Schneider and J.-M. Poutiers. 1996. *FAO Species Identification Field Guide for Fishery Purposes. The Living Marine Resources of Somalia*. FAO, Rome. vii+376 pp., pls. 32.
- Schroeder, R. E. 1980. Philippine Shore Fishes of the Western Sulu Sea. National Media Production Center, Manila. xv+map+266 pp.
- Shen, S. C. 1993. Pinguipedidae (Mugiloididae). Pages 485–489 in S. C. Shen, ed. *Fishes of Taiwan*. Department of Zoology, National Taiwan University, Taipei.
- Shimada, K. 1993. Pinguipedidae. Pages 898–913, 1343–1345 in T. Nakabo, ed. *Fishes of Japan with Pictorial Keys to the Species*, Tokai University Press, Tokyo. (In Japanese.)
- Shimada, K. 2002. Pinguipedidae. Pages 1059–1064, 1586–1587 in T. Nakabo, ed. *Fishes of Japan with Pictorial Keys to the Species*, English edition. Tokai University Press, Tokyo.
- Shinohara, N. 2004. Mugiloididae. Pages 549–553 in O. Okamura and K. Amaoka, eds. *Sea Fishes of Japan*, third edition. Yama-Kei Publishers, Tokyo, 784 pp. (in Japanese.)
- Smith, J. L. B. 1965. *The Sea fishes of Southern Africa*. 5th ed. Cape & Transvaal Printer Ltd., Cape Town. xvi+map+580 pp., pls. 107.
- Smith, J. L. B. and M. M. Smith. 1963. *The Fishes of Seychelles*. Cape & Transvaal Printers Ltd., Cape Town. 215 pp.
- Snyder, J. O. 1913. The fishes of Okinawa, one of the Riu Kiu Islands. *Proceedings of the United States National Museum*, 42: 487–519, pls. 62–70.
- Weber, M. 1913. Die Fische der Siboga-Expedition. *Siboga-Expeditie*, 57: xii+710, pls. 1–12.
- Yoshino, T. 1984. *Parapercis polyophtalma* (Cuvier). Page 291, pl. 260-J in H. Masuda, K. Amaoka, C. Araga, T. Uyeno, and T. Yoshino, eds. *The Fishes of the Japanese Archipelago*. Tokai University Press, Tokyo.

Manuscript received 16 January 2006; revised 26 December 2006; accepted 4 January 2007.

Associate editor: S. Kimura.