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A review of the *Cryptocentrus strigilliceps* complex (Teleostei: Gobiidae), with description of a new species

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Abstract

Cryptocentrus altipinna, n. sp. is described as a new species, distinguished from other species of *Cryptocentrus* in having ctenoid scales on the body, a high first dorsal fin, and the predorsal area without scales. The species is known only from a few specimens from the Indian Ocean and appears closest to *C. caeruleomaculatus*, which is not found in the central or western Indian Ocean. The new species is most similar to *C. caeruleomaculatus* and *C. strigilliceps*, forming a complex characterized mainly by having ctenoid scales posteriorly on the body (vs. all cycloid), among a set of other features. These latter two species are redescribed based on examination of material in several institutions.

Key words: fishes, taxonomy, systematics, ichthyology, coral-reef fishes, gobies, Indian Ocean, *Cryptocentrus altipinna.*

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Introduction

Hoese & Larson (2004) characterized the genus *Cryptocentrus* and divided the group into at least 5 morphological groups. They indicated that the groups were established for convenience of identification and may

not represent monophyletic groups. They also noted that the genus is poorly defined and difficult to separate from *Myersina*. Agorreta *et al*. (2013) presented evidence from molecular studies that *Mahidolia* lineages fall within those of species of *Cryptocentrus*, further suggesting that *Cryptocentrus*, as currently recognized, is probably paraphyletic.

Allen & Randall (2011) recently described two new species with unique dentition within the genus: one species with vomerine teeth and the other with large fangs anteriorly in both jaws. Greenfield & Allen (2018) described a second species with vomerine teeth, from Fiji, bringing the total number of species in the genus to 35.

The present study is a revision of the three species of the *Cryptocentrus strigilliceps* complex, distinguished within the genus mainly by having ctenoid scales posteriorly on the body (vs. all cycloid in other *Cryptocentrus*).

Materials and Methods

Institution abbreviations for material examined follows Sabaj Pérez (2016). After the institution's catalogue number, the number of specimens is given, followed by the size range in mm SL (standard length). Counts for the holotype are marked with an asterisk. All measurements were taken with dial calipers or ocular micrometer and are expressed in percent standard lengths. Proportions are based on all specimens for the new species, and only on specimens 30–55 mm SL for the two other species. The holotypes of the two previously described species are not included, due to their poor condition. For each character for the new species, the proportion of the holotype is given first, followed by the range for the other specimens. Secondary literature is not treated here, because of difficulties identifying species from underwater photos.

Methods of counts and measurements follow Hoese & Larson (2004). The transverse scale count (TRB) is taken from the anal-fin origin upward to the base of the second dorsal fin. Vertebral counts include the urostyle. The pterygiophore formula follows Birdsong (1975).

Head pore terminology follows Hoese (1986). The pores are defined as follows, with the terminology of Akihito & Meguro (1980) in parentheses: PN=posterior nasal pore, adjacent to posterior nostril (B'); AIO=anterior interorbital pore, median between front quarter of eyes (C); PIO=posterior interorbital pore, median between rear of eyes (D); PO=postorbital pore, behind dorsoposterior margin of eye (E); IF=infraorbital pore behind middle of eye (F'); LC1=lateral canal pore above preoperculum (G); TLC=terminal lateral canal pore above preopercular margin (H'); LCT=lateral canal tube above operculum with pore at each end (K' & L'); POP=preopercular pores (M', N, O'). A more detailed comparison of various naming system for pores is found in Hoese *et al*. (2017).

Terminology for papillae follows Hoese (1983) and Wongrat & Miller (1991). In describing each papilla line, the first letter of the abbreviation indicates the orientation of the line on the head (L=along the axis of the body, T=at right angles to the axis of the body, and O=oblique); the second letter refers to the orientation of the papillae in relation to the axis of that line of papillae: L=along the axis and T=transverse, at right angles to the axis of the line. In *Cryptocentrus*, there are typically 5 vertical lines extending from the eye (VT lines), with an upper horizontal line (LT line or row *b* of Wongrat & Miller [1991]) reaching forward to the second vertical line. A second horizontal LT line extends backward from the jaws onto the preoperculum (row *d* of Wongrat & Miller [1991]) below the vertical lines. These two lines are indicated on the illustration, but no attempt is made to name other lines, because of difficulties in determining homologies of the various lines.

Cryptocentrus strigilliceps species complex

The three species in this complex differ from other groups defined by Hoese & Larson (2004) in having ctenoid scales covering the posterior half or more of the body. Other species in the genus have only cycloid scales on the body, except for one or two species with ctenoid scales posteriorly in juvenile stages only. In addition, the complex shares the following features: a robust head and body; mental frenum absent; the mouth moderate, not reaching beyond the posterior end of the eye; the cheeks slightly bulbous; a very narrow fleshy interorbital, about half pupil diameter; the cheek and operculum naked; some transverse rows of mandibular papillae; and second dorsal-fin elements usually I,10; anal-fin elements usually I,9; and pectoral-fin rays 16 or 17.

Cryptocentrus altipinna, n. sp.

Highfin Shrimpgoby

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Figures 1–3A & B, 4 & 5A

Holotype. NSMT P.65933, 54.1 mm SL male, Thailand, Andaman Sea, Trang Province, Libong Island, K. Shibukawa, 9 March 2003.

Paratypes. AMS I.38461-001, 48 mm SL female, Tanzania, Mafia Island, J.E. Randall, 7 December 1973; BPBM 42362, 55 mm SL, male, Sri Lanka, Trincomalee, J.E. Randall, 2 April 1995; USNM 438445, 24.7 mm SL male & 28.7 mm SL female, Sri Lanka; NSMT-P.65934, 59.1 mm SL female, taken with holotype; NSMT-P.70552, 50.1 mm SL female, taken with holotype.

Non-type material. NSMT-P.65937, 26 mm SL & NSMT-P.65990, 30 mm SL, Thailand, Andaman Sea, Trang Province, Libong Island, K. Shibukawa, 9& 10 March 2003.

Diagnosis. All features of the C. *strigilliceps* complex, plus first dorsal fin very high, much higher than second dorsal fin and about 1.2–1.5 times higher than body depth at anal-fin origin in adults and equal to depth at anal-fin origin in juveniles, with pointed margin, second to fourth spines distinctly longer than other spines, fourth spine longest in adult (second or third longest in juveniles), but not distinctly prolonged into a filament. Mouth moderate, ending below posterior lower quarter of eye, just behind pupil; jaws forming angle of 24–26° with body axis; upper margin of upper jaw in line with point about one-quarter to one-third pupil diameter below eye. Gill opening reaching to below a point just under and before posterior preopercular margin. Head papillae minute and not on distinct ridges. Scales ctenoid posteriorly on body, becoming cycloid anteriorly on midside below posterior end of first dorsal fin, as illustrated in Fig. 4. Predorsal area naked, with scales reaching forward to a curved line from first dorsal-fin origin to upper pectoral-fin insertion. Sides of head with irregularly shaped elongate spots and numerous small bluish white spots (black in preservative). Sides of body with scattered, minute, bluish white spots and with irregularly shaped spots on midside with faint bands extending ventrally from spots. Pelvic fins fused, with a frenum, and large, reaching to or just short of anus. Longitudinal scale count=18–22 cycloid scale rows anteriorly plus 39–43 ctenoid scale rows posteriorly, total=59–65; transverse scale count (TRB)=20–22.

Description. (based on 7 specimens, 24.7–59.1 mm SL; *=holotype for counts, number of specimens in following parentheses) First dorsal-fin spines VI* (7); second dorsal-fin elements I,10* (7); anal-fin elements, I,9* (7); pectoral-fin rays 16 (2), 17* (5); longitudinal scale count (anterior cycloid+posterior ctenoid) 18+38=56 (1), 18+40=58 (1), 20+38=58 (1), 22+43=65* (1), 18+41=59 (1), 21+39=60 (1); transverse scale count (TRB) 20 (1), 22* (2), 23 (1), 24 (2); gill rakers on outer face of first arch 2+1+9 (1); gill rakers on outer face of second arch 2+1+11 (1); segmented caudal-fin rays 9/8* (6); branched caudal-fin rays 7/6* (5), 7/7 (1); vertebrae 10+16* (2), 10+17 (1), anterior zygapophyses prominent of vertebrae 1 to 10–12.

Head strongly compressed; head length 31.8 (28.4–30.5)% SL; head width at preopercular margin 17.6 (15.4–17.1)% SL. Snout rounded in dorsal view; steeply oblique (slightly convex) in side view, 9.2 (7.2–8.5)% SL. Eye relatively small and elevated, no groove behind eye, eye slightly less than snout length, 6.1 (5.9–7.4)% SL. Anterior nostril at end of short tube, just above upper margin of upper lip (by less than a nostril diameter). Posterior nostril a large pore anterior to lower part of eye, midway between anterior nostril and eye and about 3 nostril diameters from eye and anterior nostril. Preoperculum short, horizontal distance from end of eye to upper posterior preopercular margin 10.9 (9.8–11.4)% SL, subequal to distance from snout to middle to posterior margin of eye. Postorbital long 18.1 (18.4–19.8)% SL, slightly shorter than distance from tip of snout to posterior preopercular margin. Body moderately robust, depth at anal-fin origin 19.8 (19.0–19.6)% SL. Upper jaw relatively short, 14.2 (13.2–13.8)% SL, reaching to below a point between posterior margin of eye and just in front of posterior margin of eye.

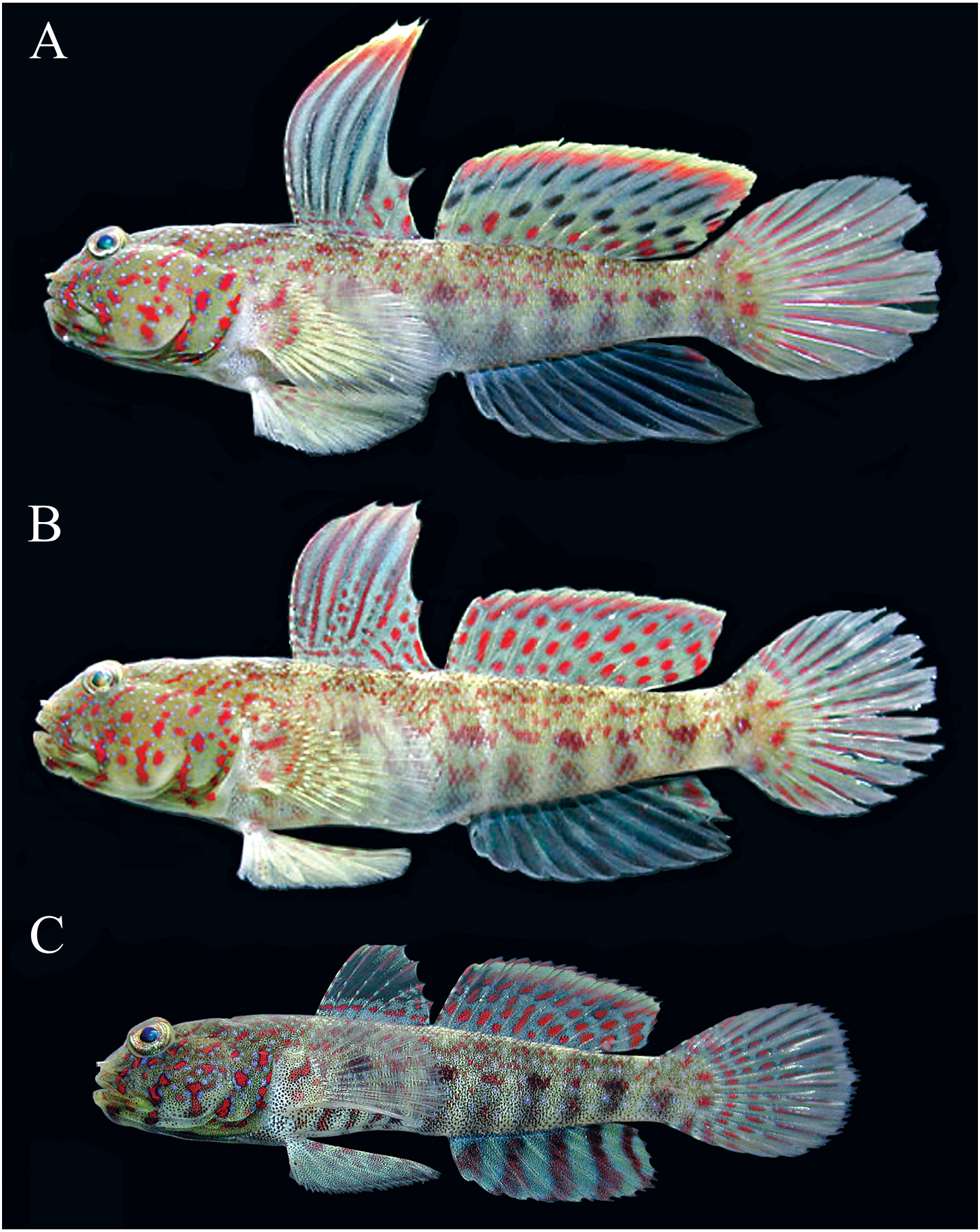

Figure 1. *Cryptocentrus altipinna*, Libong Island, Thailand, fresh specimens, A) male holotype, NSMT P.65933, 54.1 mm SL; B) female paratype, NSMT-P.65934, 59.1 mm SL; B) juvenile non-type, NSMT-P 65937, 26 mm SL (K. Shibukawa).

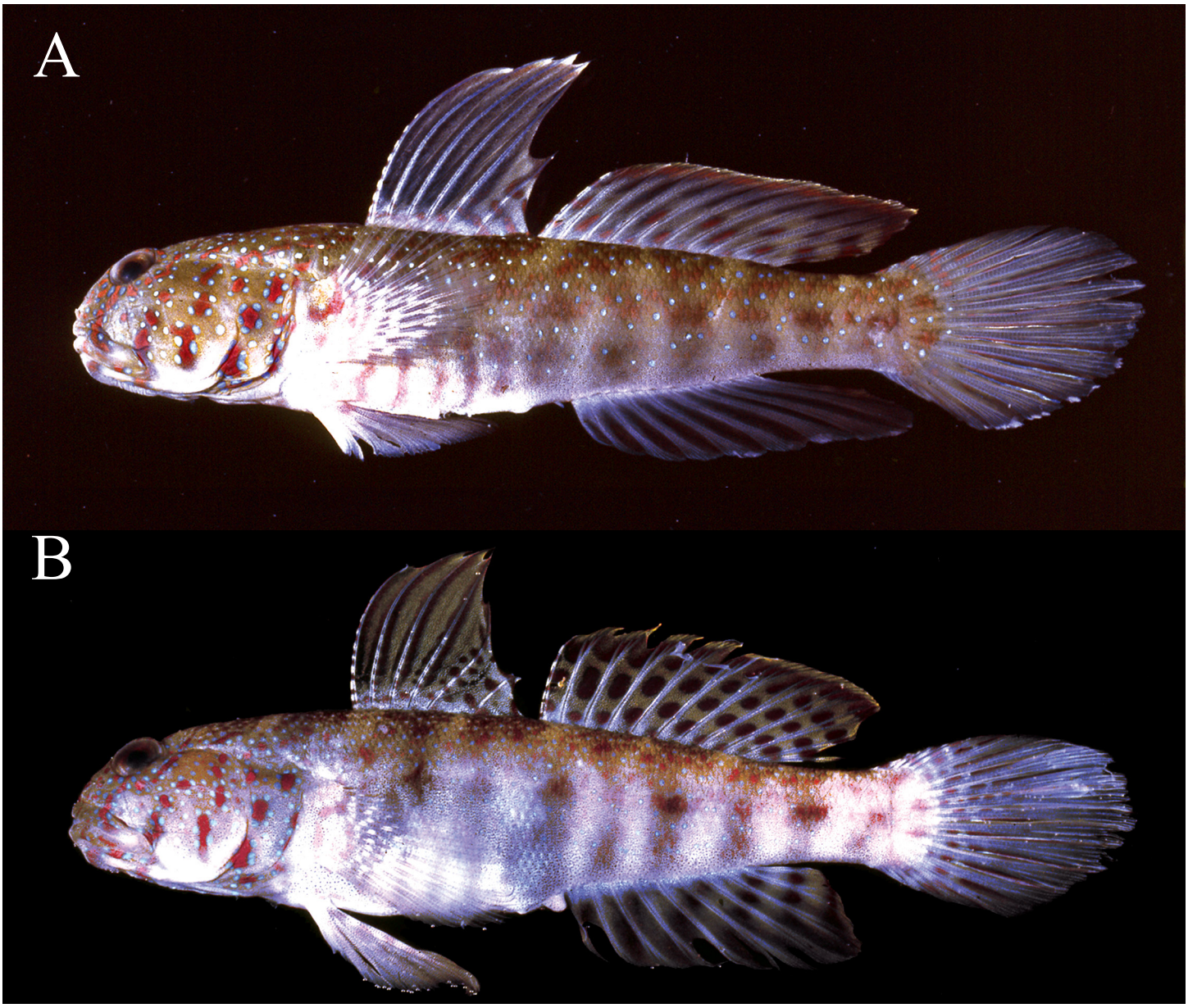

Figure 2. *Cryptocentrus altipinna*, fresh specimens, A) Sri Lanka, male paratype, 55 mm SL, BPBM 42362; B) Tanzania female paratype, 48 mm SL, AMS I.38461-001 (J.E. Randall).

Teeth conical and curved; upper jaw with outer row of teeth curved, enlarged and wide-set, teeth larger near angle of jaw, three to four rows of smaller, depressible teeth anteriorly, tapering to two to three rows posteriorly, teeth in rows pointing inward into mouth, an innermost row of enlarged backwardly directed teeth anteriorly on each side of jaw; lower jaw with teeth in outer row curved, conical, wide-set, covering anterior end of dentary only, three to four inner rows of smaller conical teeth anteriorly and two to three rows posteriorly, innermost row of teeth enlarged and larger than teeth in outer row, with teeth largest just behind bend in dentary. Tongue tip truncate to slightly emarginate. Gill rakers on outer face of first arch slender, denticulate on posterior margin, rakers shorter than filament length, longest raker near angle of arch about three-quarters filament length; rakers on inner face of first arch and other arches short and denticulate at distal tip.

Body covered with cycloid scales anteriorly and with ctenoid scales posteriorly as in Fig. 4, ctenoid in wedge to below sixth first-dorsal-fin spine, upper margin of wedge from second dorsal-fin origin and lower margin from posterior end of anal fin (except a thin line of cycloid scales at base of anal fin). Head naked, including cheeks and operculum, anterior extent of body scales from or just behind first dorsal-fin origin in line to pectoral-fin insertion. Pectoral-fin base naked or with a few minute embedded scales; midline of prepelvic area naked with scales ending on side of breast along margin of gill cover; belly fully covered with cycloid scales.

First dorsal fin very high and pointed in males, with rounded margin in females, fourth dorsal-fin spines longest, but only slightly longer than third spine, fourth spine 31.5– 36.6% SL in mature males and 26.1–28.5% SL in females and juveniles; adpressed length of first dorsal fin 32.4–37.3% SL in mature males and 27.9–30.9% SL in females, first dorsal-fin origin just behind a vertical line from pelvic fin insertion. Pectoral fin with rounded margin, reaching to above or behind pelvic-fin tip or just behind anus, length, 30.5 (26.7–29.9)% SL. Pelvic disc large, reaching to anus or slightly before, length 24.8 (23.4–23.6)% SL. Caudal fin with rounded posterior margin, central rays longest, length 35.7 (28.1–29.9)% SL.

Head pores as in Fig 3A, including posterior nasal pore median to posterior nostril by 1.5–2 nostril diameters; median anterior interorbital pore just before eyes; median posterior interorbital above posterior margin of pupil; postorbital pore behind upper margin of pupil and separated from eye by about half pupil diameter; infraorbital pore below and behind postorbital pore, behind and in line with middle of pupil; lateral canal pore above middle of preoperculum; terminal lateral canal pore above a point just before posterior preopercular margin; a short tube with pores at each end above middle of operculum; three preopercular pores, upper in line with a point just below eye; middle pore slightly closer to upper than lower pore.

Head papilla pattern transverse (Figs. 3A & 3B). Papillae not forming elevated ridges on head. Cheek with five VT lines; first from below anteroventral margin of middle of eye to posterior quarter of jaws; second incomplete and extending upward from just behind first row, not meeting eye, ending just below and before upper LT line; third interrupted by upper LT line; fourth slightly oblique, cut into two parts by upper LT line with upper part not meeting upper LT line; fifth an oblique and curved line below infraorbital pore with no vertical section ventrally below upper LT line. Upper LT reaching to near posterior preopercular margin, lower LT line ending just behind fourth VT line; an oblique line extending from anterior nostril to below posterior nostril; two short oblique lines from upper jaw to first VT line; a transverse (TT) line behind each eye, meeting or almost

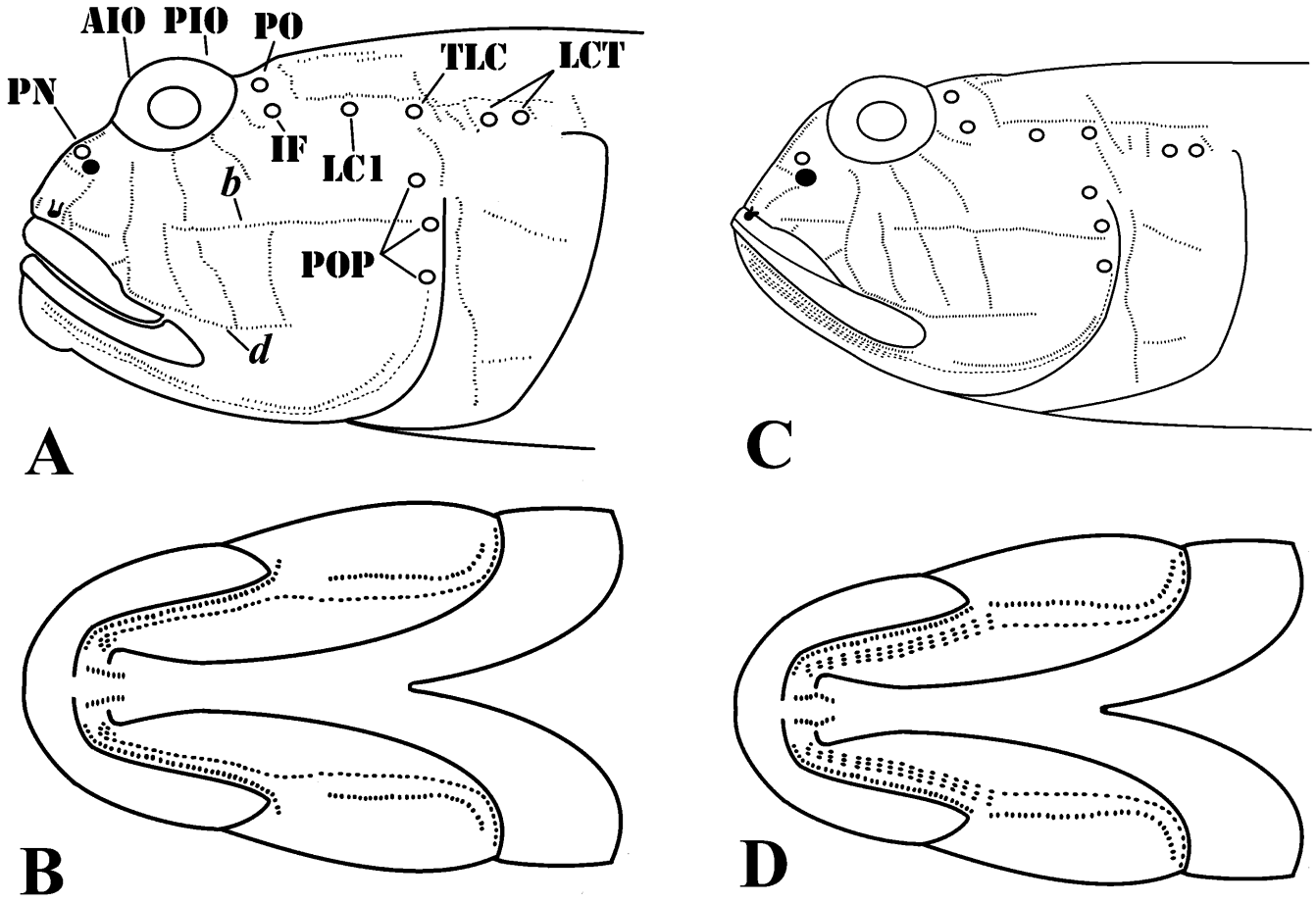

Figure 3. Position of nostrils, head pores, and papillae in *C. strigilliceps c*omplex (black circles=nostrils, open circles=head pores, oval dark spots= papillae) A) *C. altipinna*, composite, largely based on holotype, B) ventral view; C) *C. strigilliceps* composite based largely on AMS I.20793-071, 49 mm SL, D) ventral view (papilla rows *b* & *d* refer to upper and lower LT lines respectively).

Figure 4. *Cryptocentrus strigilliceps* complex, anterior limit of ctenoid scales in white, anterior limit of predorsal scales in black (double lines represent the range of variation): *C. altipinna* holotype; *C. caeruleomaculatus,* BLIH 2002079, 46 mm SL female; *C. strigilliceps*, BLIH 20040379, 37.8 mm SL male (D. F. Hoese).

meeting line on opposite side of head; preopercular-mandibular series with outer LT line interrupted just behind upper jaw, ending posteriorly well below lower preopercular pore; inner preopercular mandibular line composed of a single row of papillae, except with 2 or 3 short transverse rows near anterior tip of line, line not interrupted behind jaws, continuous to lower preopercular pore; chin papillae arranged in two posteriorly converging LT lines; preopercular-mandibular series with outer LT line interrupted just behind upper jaw, ending posteriorly well below lower preopercular pore; inner preopercular mandibular series largely uniserial, with first two elements composed of two or three papillae; outer preopercular mandibular series interrupted behind jaws. Additional papillae as shown in Fig. 3.

Color when fresh. (Figs. 1 & 2) Head and body mostly olivaceous with overlay of larger red spots and smaller blue spots; dorsal and anal fins with distinctive pattern of spots and bars as shown in fresh photographs.

Color in alcohol. (Fig. 5) Head and body brown. Sides of head with numerous small dark-brown spots, much smaller than pupil diameter, extending ventrally onto branchiostegal membranes (Fig. 5A); top of head lighter brown; lower surface of head light brown, usually without distinct cross bars, but with two or three round spots, slightly smaller than pupil diameter, on each side of head medial to lower jaw, forming a partial bar; chin dark brown in holotype. Body usually with vertical or slightly oblique bands, darker ventrally below midside; first two with irregular margins and indistinct below first dorsal fin; third band below anterior part of second dorsal fin, beginning below second dorsal-fin spine; one or two bands below middle portion of second dorsal fin, followed by a band below end of second dorsal fin, followed by a band on middle of caudal peduncle and a faint band at base of caudal fin; small, horizontally elongate, oval, spots, about equal to pupil diameter, present along midside in bands or absent, when present, anteriormost spots in line with other spots on midside and only slightly larger than other spots; numerous very small dark-brown spots, slightly smaller than head spots, with light centers. First dorsal fin with a thin stripe just above base, rest of fin gray, without distinct light and dark areas; second dorsal and anal fins dusky to dark brown (one female with dark bars posteriorly crossing anal-fin rays); pectoral fin translucent brown, with scattered brown dots basally and on pectoral-fin base; pelvic fin light to dark brown, with scattered melanophores; caudal fin light brown at base, translucent without pigment over most of fin. Urogenital papilla pale, with scattered melanophores along anterior portion.

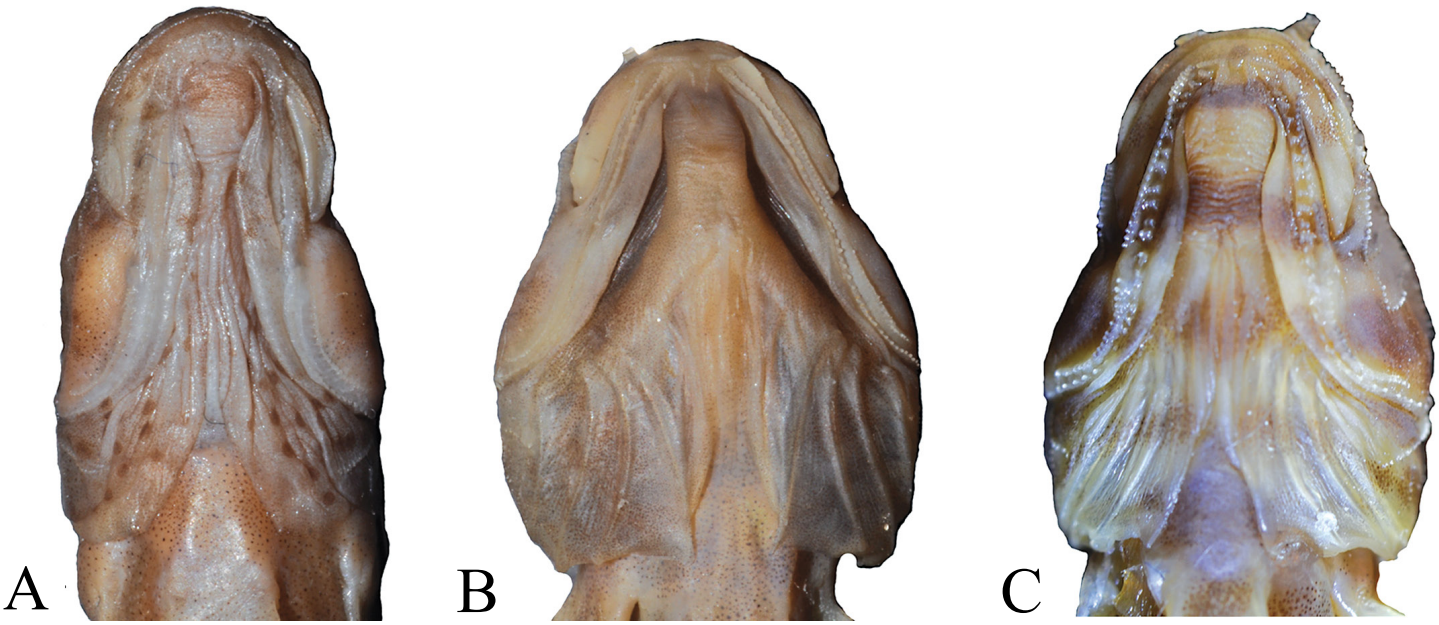

Figure 5. Ventral view of head showing coloration differences in preserved specimens: A) *C. altipinna*, AMS I.38461-001, 48 mm SL; B) *C. caeruleomaculatus*, AMS I.21933-001, 40 mm SL; C) *C. strigilliceps*, AMS I.20769-007, 37 mm SL (D. F. Hoese).

Variation. The species is sexually dimorphic in coloration as well as in the height and shape of the first dorsal fin. In males, the first dorsal fin is pointed and 1.6–2 times body depth at anal-fin origin vs. rounded and lower, 1.5–1.6 times body depth at anal-fin origin, in females. The spots on the second dorsal fin are largely black and fewer in males vs. red in females (Fig. 1). Specimens from Sri Lanka and Tanzania (Fig. 2) differ slightly in coloration from the Andaman Sea specimens, having more prominent blue spots on the body and more conspicuous ventral bands on the body.

Etymology. The specific epithet is from the Latin *altus* (high) and *pinna* (fin), it is treated as a noun in apposition.

Distribution and habitat. The species is known only from the Indian Ocean: from Tanzania, Sri Lanka, and the Andaman Sea off Thailand. Shibukawa (2005) reported the species from seagrass beds with sandy-mud bottoms.

Comparisons. The new species belongs to the *Cryptocentrus strigilliceps* complex, as described in the prior section and defined by Hoese & Larson (2004). It differs from *C. strigilliceps* in lacking the large spot below the first dorsal fin and in having largely a single of row of papillae in the preoperopercular-mandibular series. It differs from *C. caeruleomaculatus* in having a high first dorsal fin.

Preserved specimens of *Cryptocentrus leptocephalus* can easily be confused with the new species, because specimens smaller than 50 mm SL often have ctenoid scales posteriorly on the body and a high dorsal fin. However, *C. leptocephalus* differs in having an anal-fin ray count of I,10 (vs. I,9). The holotype and paratype of *C. geniornatus* also have ctenoid scales posteriorly on the body and a high dorsal fin, and the color pattern shown by Herre (1936) is identical to that of *C. leptocephalus* and they also have the anal-fin-ray count of I,10 (see Hoese *et al*. [2011]), confirming the suggestion of Randall (2005) that *C. geniornatus* is a junior synonym of *C. leptocephalus*. *Cryptocentrus leptocephalus* is more slender bodied than the *C. strigilliceps* complex and Hoese & Larson (2004) placed the species in a group of uncertain relationships.

Remarks. Two male specimens, 26 and 30 mm SL (Fig. 1C), from the type locality, have a low first dorsal fin, and are not included in the type series. Since they share the color pattern of *C. altipinna* in lacking a dark margin to the first dorsal fin and having poorly developed or no dorsal extensions of the bands above the midlateral body, they are assigned to non-type material. The low first dorsal fin suggests they are juveniles, and the larger specimen has a higher dorsal fin than the smaller, suggesting elongation of the first-dorsal-fin spines with growth.

A small male from Sri Lanka (24.7 mm SL) has a well-developed urogenital papilla and a very high first dorsal fin, indicating a mature male, therefore the specimens from Sri Lanka are included in the type series.

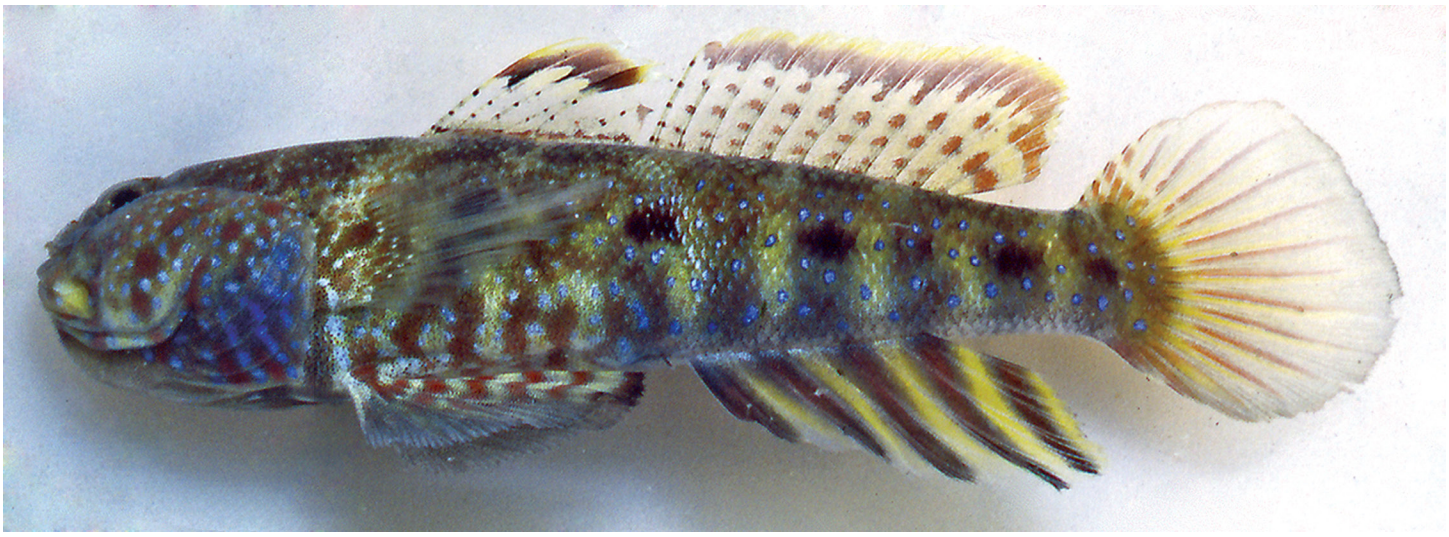

Figure 6. *Cryptocentrus caeruleomaculatus*, fresh specimen, AMS I.23499-007, 41 mm SL, Ishigaki-jima Island, Japan (D. F. Hoese).

Cryptocentrus caeruleomaculatus (Herre, 1933)

Blue-speckled Shrimpgoby

Figures 4, 5B & 6

Mars caeruleomaculatus Herre, 1933: 22 (Jolo, Sulu Province, Philippines).
Ctenogobius culionensis Herre, 1934: 84 (Culion Harbor, Calamianes, Palawan Province, Philippines)

Type material examined. CAS-SU 25502 (holotype of *Mars caeruleomaculatus*), 32 mm SL male, Philippines, Sulu Province, Jolo; CAS-SU 16959 (paratypes of *Mars caeruleomaculatus*), 5 (23.5–37 mm SL), same data as holotype; CAS-SU 26387 (holotype of *Ctenogobius culionensis*), 38.4 mm SL female, Philippines, Palawan Province, Calamianes, Culion Harbor.

Non-type material examined. (sizes as mm SL, in parentheses) **Japan**: AMS I.23492-012, 2 (32–38), Miyake-Jima; AMS I.23499-007, 1 (41) & YCM 4788, 1 (36) & BLIH 2000044, 1 (38.8), Ishigaki-jima Island; BLIH 2001286, 1 (46), Iriomote-jima; BLIH 2002079, 1 (46) & BLIH 2002359, 3 (37.8–42), Yaku-shima Island; SMBL uncatalogued 3 (32–41), Tokuno-shima Island; NSMT-P.33767, 1 (27), YCM 1518, 1 (35), Kohama-jima lsland; ZUMT 30394, 1 (38), ZUMT 32305, 1 (47), ZUMT 37303-37304, 2 (42–43), Ryukyu Islands. **Philippines**: AMS I.24425-002, 2 (16–27), Bolinao; AMS I.21897-002, 1 (30) & AMS I.21899-002, 3 (27–32), Santiago Island; AMS I.21931-001, 1 (48) & AMS I.21933-001, 3 (23–41), Cebu, Mactan Island; USNM 241817, 6 (24–38), Daco Island. **Caroline Islands**: NSMT-P.22482, 1 (32), Truk; CAS 36914, 4 (30–38), Palau; YCM unregistered (1967242), 1 (42), Guam. **Papua New Guinea**: AMS I.32492-016, 1 (32) & WAM P.29595-038, 1 (22), Madang. **Singapore**: ZRC 14726, 1 (40), ZRC 17649, 1 (43), Singapore. **Indonesia**: ZRC 49301, 3 (44–49), Sumatra. **Australia, Northern Territory**: AMS I.24676-007, 1 (25) & NTM S.11259-002, 1 (36), Darwin. **Australia, Queensland**: AMS I.11829, 1 (32), Murray Island, Torres Strait; AMS I.19467-026, 1 (48), Lizard Island; AMS I.21260-004, 4 (39–41), Daintree National Park, Noah Beach; QM I.34480, 1 (54), Sweers Island. **Australia, Western Australia**: AMS I.17060-050, 4 (47–58), Exmouth Gulf, Bundegi Reef; WAM P.25114–015, 3(31–45), Dampier Archipelago.

Diagnosis. All features of the C. *strigilliceps* complex, plus first dorsal fin low, equal to or slightly higher than second dorsal fin, and slightly less to slightly higher than body depth at anal-fin origin, with rounded margin, second to fourth spines only slightly longer than other spines, third spine longest in adult (second or third longest in juveniles), but not distinctly prolonged into filament. Mouth moderate, ending below posterior lower quarter

of eye, between posterior end of pupil to just before end of eye; jaws forming angle of 25–38° to horizontal body axis, upper margin of upper jaw in line with point about one-quarter to one-third pupil diameter below eye. Gill opening reaching to below a point just under and behind posterior preopercular margin. Head papillae minute and not on distinct ridges. Scales ctenoid posteriorly on body, becoming cycloid anteriorly on midside below sixth dorsal-fin spine to second dorsal-fin origin as illlustrated in Fig. 4. Midline of predorsal area naked, sides scaled, with scales reaching forward to a curved line from first dorsal-fin origin to between upper pectoral-fin insertion and middle of operculum. Sides of head with irregularly shaped elongate spots and numerous small bluish-white spots (black or absent in preservative); sides of body with scattered minute bluish white spots with dark blue margin; small rounded brown-to-black spots on midside with faint bands extending dorsally and ventrally from spots (darker ventrally); anteriormost spot on midside below first dorsal fin largest, about size of pupil diameter on midline of body, rarely slightly above midline, without light or dark margin. Pelvic fins fused, with a frenum, and large, reaching to or just short of anus (by no more than one pupil diameter). Longitudinal scale count=13–26 cycloid scale rows anteriorly plus 28–41 ctenoid scale rows posteriorly, total=47–59; transverse scale count (TRB) 17–25.

Description. (based on 46 specimens, 25.0–54.3 mm SL; *=holotype for counts, number of specimens in following parentheses; proportions only for specimens 30–55 mm SL) First dorsal-fin spines VI* (44); second dorsal-fin elements I,9 (1) or I,10* (43); anal -fin elements I,9* (43); pectoral-fin rays 15 (4), 16* (28), 17 (12); longitudinal scale count: anterior cycloid 13 (1), 14 (2), 15 (1), 16 (2), 17 (6), 18* (4), 19 (3), 20(4), 21 (3), 22 (6), 23 (1), 24 (2), 25 (1), 26 (1); posterior ctenoid 28 (1), 29 (1), 31* (4), 32 (2), 33 (4), 34 (5), 35 (5), 36 (6), 37 (3), 38 (5), 41 (1); total longitudinal scale count 47 (1), 48 (1), 49* (1), 50 (2), 51 (1), 52 (2), 53 (6), 54 (8), 55 (5), 56 (3), 57 (1), 58 (5), 59 (2); transverse scale count (TRB) 17 (3), 18 (5), 19* (10), 20 (9), 21 (5), 22 (3), 23 (1), 24 (2), 25 (1); gill rakers on outer face of first arch 2+1+9 (2), 3+1+9 (2), 2+1+10 (4), 3+1+10 (2), 3+1+11 (1); gill rakers on outer face of second arch 2+11 (1), 2+1+11 (1), 3+1+10 (1), 3+1+11 (3), 2+1+12 (1), 3+1+12 (3), 3+1+13 (1); segmented caudal-fin rays 9/7 (1), 9/8* (37); branched caudal-fin rays 7/6* (21), 7/7 (12), 8/7 (3), 8/8 (2), vertebrae 10+15 (1) or 10+16* (3), anterior zygapopheses prominent on vertebrae 1 to 8 or 9.

Head strongly compressed, head length 28.3–34.5% SL, head width at preopercular margin 16.1–19.9% SL. Snout rounded in dorsal view, steeply oblique (slightly convex) in side view, 6.5–9.8% SL. Eye relatively small and elevated, no groove behind eye, eye slightly less than snout length, 5.8–8.1% SL. Anterior nostril at end of short tube, just above upper margin of upper lip (by less than a nostril diameter). Posterior nostril a large pore anterior to lower part of eye, about one nostril diameter from eye and about three nostril diameters from anterior nostril. Preoperculum short, horizontal distance from end of eye to upper posterior preopercular margin 10.0–13.9% SL, subequal to distance from snout to posterior half of pupil. Postorbital long, 17.7–20.8% SL, slightly shorter than distance from tip of snout to posterior preopercular margin. Body moderately robust, depth at anal-fin origin 16.7–21.1% SL. Upper jaw relatively short, 12.2–14.4% SL, reaching to below a point between posterior margin of pupil and just in front of posterior margin of eye.

Teeth conical and curved; upper jaw with outer row of teeth curved, enlarged, and wide-set, teeth larger near angle of jaw, three to 4 rows of smaller depressible teeth anteriorly, tapering to two to three rows posteriorly, teeth in rows pointing inward into mouth, an innermost row of enlarged backwardly directed teeth anteriorly on each side of jaw; lower jaw with teeth in outer row curved, conical, wide-set, covering anterior end of dentary only, three to 4 inner rows of smaller conical teeth anteriorly and two to three rows posteriorly, innermost row enlarged and larger than teeth in outer row, largest just behind bend in dentary. Tongue tip slightly rounded to slightly emarginate. Gill rakers on outer face of first arch slender, denticulate on posterior margin, rakers shorter than filament length, longest raker near angle of arch about three-quarters filament length; rakers on inner face of first arch and other arches short and denticulate at distal tip.

Body covered with cycloid scales anteriorly and with ctenoid scales posteriorly as in Fig. 4, ctenoid in wedge to below a point between fifth first-dorsal-fin spine and second dorsal-fin origin, extending dorsally and posteriorly to below or near end of second dorsal fin and ventrally to below posterior end of anal fin or on to anterior part of caudal peduncle posteriorly on body, becoming cycloid anteriorly on midside below sixth dorsal-fin spine to second dorsal-fin origin, except a thin line of cycloid scales at base of anal fin (see Fig. 4). Head naked, including cheeks and operculum, midline of predorsal area naked, anterior extent of body scales reaching forward to a

curved line from first dorsal-fin origin to between upper pectoral-fin insertion and middle of operculum. Pectoral-fin base naked or with a few minute embedded scales; midline of prepelvic area naked with scales ending on side of breast along margin of gill cover; belly usually covered with cycloid scales, anteriormost scales minute and embedded, rarely with a small naked patch behind pelvic-fin insertion.

First dorsal fin low, with rounded margin, in both sexes, third spine usually longest, but only slightly longer than fourth spine, 17.6–30.0% SL in males and 16.3–20.3% SL in females; adpressed length of first dorsal fin reaching to just before second dorsal-fin origin up to base of second segmented dorsal-fin ray, 21.0–33.9% SL in males and 20.3–26.0% SL in females. First dorsal-fin origin just behind a vertical line from pelvic fin insertion. Pectoral fin with rounded margin, reaching to above or slightly behind pelvic-fin tip, to or just before anus, length 24.7–32.9% SL. Pelvic disc large, reaching to anus or slightly beyond in males and females below 30 mm SL, but reaching well short of anus in larger females; pelvic-fin length 22.2–27.2% SL. Caudal fin with rounded posterior margin, central rays longest, length 26.4–32.9% SL.

Head pores as described above for *C. altipinna* and illustrated in Fig. 3A. Head papillae in a tranverse pattern as in *C. altipinna* and illustrated in Figs. 3A & B.

Color when fresh. (Fig. 6) Head and body mostly olivaceous and brownish with overlay of blue spots and dorsal and anal fins with distinctive patterns of brownish spots, stripes, and bars as shown in fresh photographs.

Color in alcohol. Head and body brownish with sides and top of head with scattered faint mottling, more conspicuous on top of head; lower surface of head light to dark brown, without distinct cross bars, but with a dark region on chin resembling a short bar (Fig. 5B) and with a posteriorly sloping bar ventrally on operculum. Body with vertical or slightly oblique dark-brown bands, first two very faint with irregular margins below first dorsal fin, other bands posteriorly on body more prominent, with round spots, about equal to pupil diameter to almost as large as eye, present along midside in bands or absent; when present, anteriormost spots in line with other spots on midside and only slightly larger than other spots. Body below second dorsal fin and on caudal peduncle with very small, dark-brown spots with light centers in some specimens. First dorsal fin with a thin stripe just above base followed dorsally with 4 or 5 rows of small dark-brown-to-black spots along leading edge and sides of spines, and a submarginal brown region, with light areas extending dorsally between spines, with a light area at tip; second dorsal fin variable in coloration: spine with 4 to 6 small spots on leading edge, rest of fin translucent or with 4 or 5 rows of small, round, brown spots with light centers; anal fin with 4 or 5 dark-brown bands with anterior two, and sometimes third, usually parallel to anal-fin rays and last two or three with bands crossing rays, sloping anteriorly, posteriormost band not extending to base of fin; pectoral fin light gray; pelvic fin light to dark gray, with 3–5 bands in life very faint along central rays or absent; caudal fin light gray, without dark spots. Urogenital papilla dark brown at base and along lateral margins in males, pale brown in females.

Variation. The species does not show sexual dimorphism in height and shape of the first dorsal fin. The intensity of pigmentation varies considerably in preserved material. Some specimens, mainly from the Philippines have differences in scalation: a few have a few scales on the pectoral-fin base (usually naked); a few have the prepelvic midline scaled posteriorly (usually naked). The holotype, *Mars caeruleomaculatus,* has the typical pattern, but the holotype of *Ctenogobius culionensis* has the variant Philippines pattern. Others from the Philippines (not the same specimens) have predorsal scales reaching forward only to just above the pectoral-fin insertion and no farther; both holotypes share this variation. One specimen of 4 from one locality from Western Australia also has scales on the pectoral-fin base and prepelvic area. In two of 4 specimens from Queensland there is a small patch of scales centrally on the pectoral-fin base on one side. These scales are normally embedded and probably easily lost in preserved specimens.

Distribution and habitat. *Cryptocentrus caeruleomaculatus* is widely distributed in the western Pacific Ocean. Although reported from the Indian Ocean, specimens have only been examined from Western Australia. The species lives in association with alpheid shrimps in shallow waters to about 5 m on coastal and nearshore coral reefs.

Comparisons. *Cryptocentrus caeruleomaculatus* is most similar to *C. altipinna*, differing primarily in having a lower first dorsal fin, among other characters (discussed under *C. altipinna*). Preserved specimens of *C. caeruleomaculatus* can also be easily mistaken for C. *strigilliceps*, but can be dstinguished by the lack of scales on the predorsal midline.

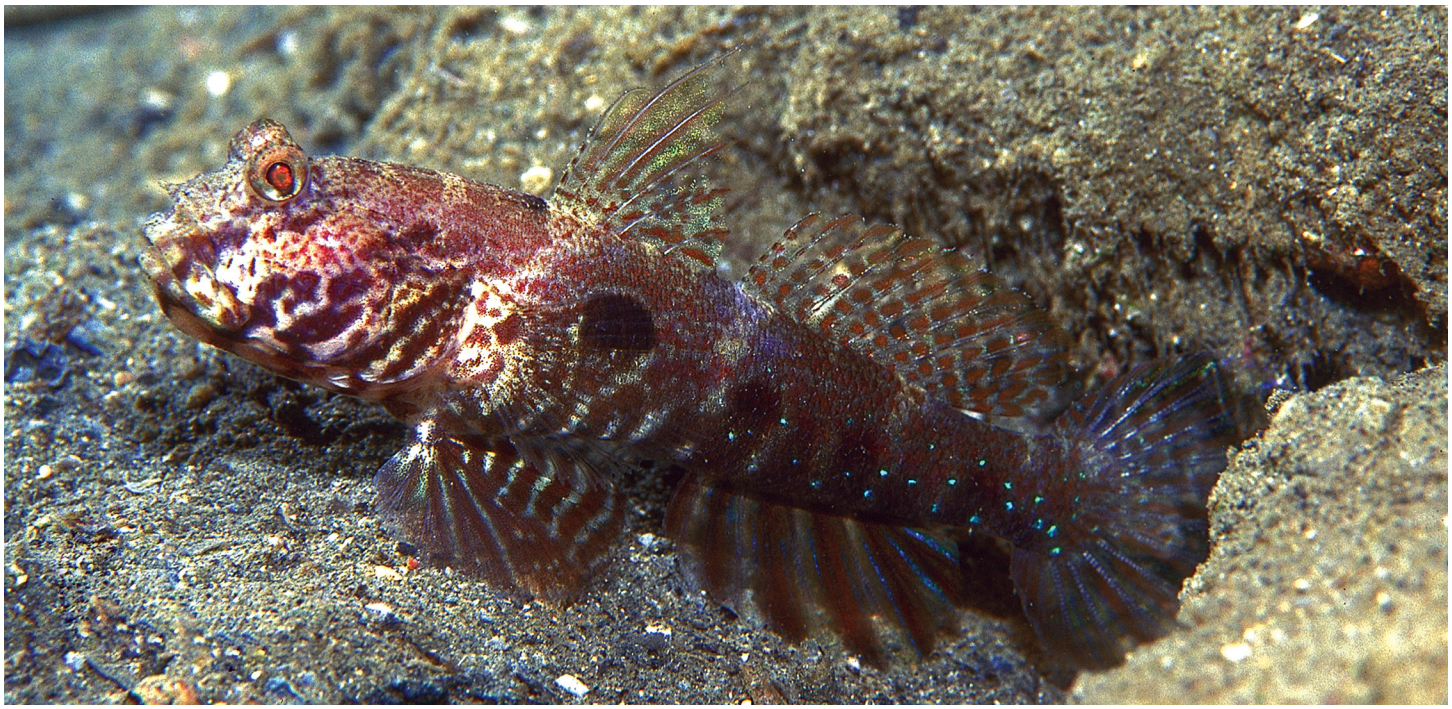

Figure 7. *Cryptocentrus strigilliceps*, fresh specimen, AMS I.23499-007, 41 mm SL, Ishigaki-jima Island, Japan (R. Steene).

Cryptocentrus strigilliceps (Jordan & Seale, 1906)

Target Shrimpgoby

Figures 3C & D, 4, 5C & 7

Mars strigilliceps Jordan & Seale, 1906: 408, fig. 95 (type locality: Apia, Samoa).
Obtortiophagus koumansi Whitley, 1933: 91, pl. 11, fig. 3 (type locality: Hayman Island, Whitsunday Group, Queensland, Australia).
Callogobius ocellatus Herre, 1935: 422 (type locality: Ovalau, Fiji); Herre 1936: 362, fig. 23 (figure of holotype).

Type material examined. USNM 51778 (holotype of *Mars strigilliceps*), 39 mm SL, female, Samoa, Apia; AMS IA.2027 (holotype of *Obtortiophagus koumansi*), 50 mm SL, female, Australia, Queensland, Whitsunday Group, Hayman Island; FMNH 17363 (holotype of *Callogobius ocellatus*), 37.5 mm SL female, Fiji, Ovalau.

Non-type material examined. (sizes as mm SL, in parentheses) **Mozambique**: SAIAB 5459, 1 (39), Wamizi Island; SAIAB 16781, 5 (28–40.5), Pinda; SAIAB 16782, 1 (39), Matemo Island. **Thailand**: AMS I.42907-001, 2 (35–37), Phuket. **Japan**: URM 4633, 1 (49), BLIH 20040176, 1 (39.2), BLIH 2003240, 1 (34), BLIH 1983103, 1 (31.9), BLIH 1983103, 2 (33.6–35), BLIH 20040379, 1 (37.8), Okinawa. **Philippines**: AMS I.21903-021, 1(48), USNM 139402, 1 (47), Luzon, Bolinao. **Papua New Guinea**: AMS I.17502-008, 1 (36), New Britain, Rabaul. **Australia, Queensland**: AMS I.20770-106, 1 (41), Sir Charles Hardy Island; AMS I.20793-071, 2 (42–56), Clack Island; AMS I.21540-013, 1 (30), Eagle Cay; AMS I.18739-104, 2 (21–33), AMS I.19108-115, 1 (22), AMS I.20993-002, 1 (36), AMS I.20994-004, 2 (35–37), AMS I.21343-028, 1 (31), AMS I.21539-083, 3 (15–31), AMS I.22216-001, 1 (36), AMS I.22217-001, 1 (34), AMS I.30057-001, 1 (35), Lizard Island; AMS I.20769-007, 2 (37–39), Halfway Island; AMS I.20772-012, 1 (22), Nymph Island; AMS I.22618-006, 1 (31), Escape Reef; AMS I.22135-005, 2 (31–40), Pandora Reef. **Solomon Islands**: AMS I/38640-001, 1 (43), Guadalcanal; USNM 365290, 1 (30), Stewart Islands. **Vanuatu**: AMS I.37936-014, 1 (45), Maewe Island. **Fiji**: AMS I.18535-018, 1 (40), Suva. **Kiribati**: AMS I.18031-012, 2 (27–33), AMS I.18039-036, 1 (43), Abaiang Atoll.

Diagnosis. All features of the C. *strigilliceps* complex, plus first dorsal fin low, subequal to or slightly higher than second dorsal fin and about 0.8–1.2 times body depth at anal-fin origin, broadly rounded margin or often with second and third dorsal-fin spines filamentous, second to fourth spines distinctly longer than other spines, second or third spine longest in both juveniles and adults, in males often prolonged as short filaments. Mouth moderate, ending below posterior margin of eye; jaws forming angle of 24°–27° with horizontal body axis; upper margin of upper jaw in line with point about one-half to equal to pupil diameter below eye. Gill opening reaching to below a point just below posterior preopercular margin. Head papillae prominent, form distinct ridges. Scales ctenoid posteriorly on body, becoming cycloid anteriorly on midside below sixth dorsal-fin spine to posterior end of first dorsal fin as illustrated in Fig. 4. Predorsal area partly scaled, with scales reaching forward along midline and sides to above posterior preopercular margin. Sides of head with irregularly shaped dark marks; ventral surface of head with distinct dark-brown-to-black transverse bars; a round, eye-sized spot below first dorsal fin above midline, margined with a thin white line, followed by a midline row of pupil-sized spots. Pelvic fins fused, with a frenum, and large,reaching to or just short of anus. Longitudinal scale count=10–20 cycloid scale rows anteriorly plus 29–40 ctenoid scale rows posteriorly, total=45–57; transverse scale count (TRB) 17–19.

Description. (based on up to 47 specimens,16–56 mm SL; *=holotype for counts, number of specimens in following parentheses; proportions only for specimens 30–55 mm SL) First dorsal-fin spines VI* (32); second dorsal-fin elements I,9 (1) or I,10* (31); anal-fin elements I,9* (32); pectoral-fin rays; 16* (9), 17 (21), 18 (2); longitudinal scale count: anterior cycloid 10 (1), 11 (2), 12 (2), 13 (1), 14* (7), 15 (4), 16 (3), 17 (4), 18 (2), 20 (2); posterior ctenoid 29 (2), 30 (1), 31 (1), 32 (4), 33 (2), 34* (5), 35 (5), 36 (3), 37 (4), 40 (1); total longitudinal scale count 45 (1), 46 (3), 47 (4), 48* (6), 49 (4), 50 (2), 51 (1), 52 (2), 53 (2), 54 (2), 57 (2); transverse scale count (TRB) 17 (6), 18* (17), 19 (9); gill rakers on outer face of first arch 1+1+10 (1), 2+1+9 (2), 3+1+9 (3), 3+1+11 (1), 3+1+13 (1), total 12 (7), 15 (1), 17 (1); gill rakers on outer face of second arch 3+12 (1), 3+1+14 (1), 4+14 (1), 5+13 (1); segmented caudal-fin rays 8/8 (2), 9/8* (27); branched caudal-fin rays 6/7 (1), 7/6* (22), 7/7*(6), 8/7*(1), vertebrae 10+16* (2), anterior zygapophyses prominent on vertebrae 1–10.

Head rounded in cross section, head length 29.3–33.7% SL; head width at preopercular margin 18.7–21.4% SL. Snout rounded in dorsal view, steeply oblique (slightly convex) in side view, 6.0–7.2% SL. Eye relatively small and elevated, no groove behind eye, eye slightly less than snout length, 5.7–7.6% SL. Anterior nostril at end of short tube, just above upper margin of upper lip, base of nasal tube more than one nostril diameter above upper lip, lower rim of tube almost in contact with upper lip; posterior nostril a large pore anterior to lower part of eye, midway between anterior nostril and eye and two nostril diameters from eye and two to three nostril diameters from anterior nostril. Preoperculum short, 8.9–9.3% SL, horizontal distance from end of eye to upper posterior preopercular margin subequal to distance from snout to middle of eye. Postorbital long 16.8–18.1% SL, slightly shorter than distance from tip of snout to posterior preopercular margin. Body moderately robust, depth at anal-fin origin 19.3–21.9% SL. Upper jaw relatively short, 13.0–14.6% SL, reaching to below a point between just before posterior margin of eye and just in front of posterior margin of eye.

Teeth conical and curved; upper jaw with outer row of teeth curved, slightly enlarged and wide-set, with a distinctly enlarged tooth on each side of jaw anteriorly; two or three rows of depressible teeth anteriorly, tapering to one or two rows posteriorly, teeth in rows pointing inward into mouth, an innermost row of enlarged backwardly directed teeth anteriorly on each side of jaw; lower jaw with teeth in outer row curved, conical, wide-set, covering anterior end of dentary only, two or three inner rows of smaller conical teeth anteriorly, tapering to a single row posteriorly, an innermost row of teeth enlarged and larger than teeth in outer row, with teeth largest just behind bend in dentary. Tongue tip slightly rounded truncate to slightly emarginate. Gill rakers on outer face of first arch slender, denticulate on posterior margin, rakers slightly shorter than filament length, longest raker near angle of arch subequal to filament length; rakers on inner face of first arch and other arches short and denticulate at distal tip.

Body covered with cycloid scales anteriorly and with ctenoid scales posteriorly, ctenoid in wedge to below fifth to sixth first-dorsal-fin spine and dorsally from second dorsal-fin origin (a few scattered cycloid scales at base of second dorsal fin in some specimens) and ventrally from posterior end of anal fin, except a thin line of cycloid scales at base of anal fin (see Fig. 4). Sides of head naked, predorsal midline and sides scaled to a point just before to just behind posterior preopercular margin. Pectoral-fin base usually with embedded scales centrally

or ventrally, rarely naked; prepelvic area usually scaled, except for a naked patch anteriorly (fully naked in juveniles). Belly fully covered with cycloid scales.

First dorsal fin low, pointed, with one or two filamentous spines in males and with a rounded margin in females, second and third dorsal-fin spines longest, second spine length 22.6–31.2% SL in males and 20.2–25.2% SL in females; adpressed length of first dorsal fin 28–34.5% SL in males, reaching to above first to fifth segmented dorsal-fin ray, and 22.4–27.9% SL in females, reaching to above a point between second-dorsal-fin spine and second segmented dorsal-fin ray, second dorsal-fin origin just behind a vertical line from pelvic-fin insertion. Pectoral fin with rounded margin, reaching to above or behind pelvic-fin tip, to or just behind anus, length, 25.1–31.2% SL. Pelvic disc large, reaching to or slightly beyond anus in male or slightly before anus in female, pelvic-fin length 24.6–30.7 SL. Caudal fin with rounded posterior margin, central rays longest, length 27.5–32.3% SL.

Head pores as described above for *C. altipinna* and illustrated in Fig. 3A. Head papillae prominent forming distinct ridges, in a tranverse pattern as illustrated in Figs. 3C & D, as in *C. altipinna* except as follows: second vertical cheek line (VT) ending just before and above upper LT line (row *b*); upper part of fourth vertical line longer almost meeting upper LT line. Two or three short oblique lines from anterior part of upper jaw to first VT line. A transverse (TT) line behind each eye, continuous with or overlapping line on opposite side of head. Inner preopercular mandibular line composed of two to three rows of papillae from chin to below end of jaws, then becoming a single row continuous to lower preopercular pore.

Color fresh and in life. (Fig. 7) Head and body mostly brownish with overlay of blue spots posteriorly and dorsal, anal, and pelvic fins with distinctive patterns of brownish spots, stripes, and bars as shown in the underwater photograph. Based on several published and unpublished photos from Africa, Japan, Enewetak, and Australia, also with a broad brown band crossing head above preoperculum and a similar band above operculum, containing a dark brown short crossbar ,or elongate spot, just before first dorsal-fin origin; interspaces light gray to white; papillae on sides not distinctive in coloration. Ventral surface of head light brown, with 4 dark-brown crossbars, last two bands extending dorsally (vertical or sloping posteriorly dorsally) onto lower operculum and preoperculum, breaking up into scattered mottling; a rounded to horizontally elongate spot (ocellated in some specimens) below anterior part of first dorsal fin on midline of body. Sides of belly with 4 or 5 thin dark-brown bands with white interspaces about equal in width to dark bands, posteriormost interspace continuous with interspace extending upward to near anterior part of first dorsal fin. First dorsal fin translucent, with brown pigment before and after spines and with scattered brown mottling posteriorly. Pelvic disc brown, with 4 to 6 dark-brown crossbars on central rays, outer rays of disc dark brown with 2 or 3 white lines along rays.

Color in alcohol. Head and body brownish with sides and top of head with scattered faint mottling. A dark-brown short crossbar just before first dorsal-fin origin, in some specimens some of papillae on sides and top of head dark brown. Ventral surface of head light brown (Fig. 5C), with 4 dark-brown crossbars: first just behind chin, second crossing from tips of jaws, third crossing below posterior preopercular margin, and fourth below operculum, bands sometimes obscure in faded juveniles. Body usually with vertical or slightly oblique bands: first from dark crossbar before first dorsal fin to above operculum; second below first dorsal fin; third a broad band, sometimes divided into three thinner bands separated by light brown bars ventrally, below second dorsal fin, beginning below second to fourth segmented ray; fourth a broad dark-brown band from beginning to middle of caudal peduncle, followed by a faint band at base of caudal fin; a large, ocellated, dark-brown spot (slightly larger than eye diameter) below first dorsal fin and above midline of side; a rounded to horizontally elongate spot below anterior part of first dorsal fin on midline of body, a similar-sized dark brown spot on midside near posterior end of second dorsal fin, followed by a third spot on midside on middle of caudal peduncle. Sides of belly with 4 to 6 narrow, white, vertical bands extending upward to just below midside. Head and body spots faded considerably in specimens in preservative for more than 30 years or stored in isopropyl alcohol. Dorsal fins translucent, with scattered melanophores; pectoral fin with faint brown wavy bars basally, becoming translucent white over most of fin; caudal fin a translucent white; anal fin with 4 or 5 dark-brown-to-black bars, each covering two rays and parallel to the rays, anteriormost faint. Pelvic disc brown, with 4 to 6 dark-brown crossbars on central rays, outer rays of disc dark brown. Urogenital papilla dark brown in larger males, pale brown in males below 30 mm SL, pale brown, often dark along anterior margin, in females.

Variation. Some juveniles below 20 mm SL lack scales before the first dorsal fin, the pectoral-fin base, and prepelvic area. The lateral canal tube above the operculum is also absent in these juveniles and the inner preopercular mandibular papilla line is composed of a single row of papillae. However, in one 21 mm SL specimen, the predorsal scales reach to above the posterior preopercular margin and the preopercular-mandibular papillae lines is composed of two rows of papillae on anterior 5 rows only. No statistical differences were noted in the sex ratio or size of males and females, with 20 females (average 39.8 mm SL) and 23 males (average 30.1 mm SL). The second and third dorsal-fin spines were filamentous in most individuals, with considerable overlap in proportions, but with the spines in some males reaching farther posteriorly. In preserved specimens, the dark spot below the first dorsal fin is often faded and lacks the light margin.

Distribution and habitat. *Cryptocentrus strigilliceps* is widely distributed from East Africa to Kiribati, Tonga, and Samoa. The species is normally found associated with alpheid shrimps over sand in a variety of coral reef habitats from 1–48 m.

Comparisons. *Cryptocentrus strigilliceps* differs from *C. altipinna* and *C. caeruleomaculatus* by having predorsal midline scales, a distinctive eye-sized dark spot above the midline below the first dorsal fin, prominent dark bands on the ventral head and pelvic fin, and the anterior nasal tube separated from the upper lip by more than one nostril diameter. In addition, the transverse rows of mandibular papillae extend the full length of the lower jaw, but are restricted to one or two anterior rows in the other two species. It should be noted that specimens preserved for long periods lose most of their markings and are best identified from the presence or absence of predorsal scales and the pattern of sensory papillae. Multiple transverse papillae rows also occur in *Cryptocentrus cryptocentrus* (Valenciennes, 1837) and *C. tentaculatus* Hoese & Larson, 2004, but they can be distinguished from the C. *strigilliceps* complex by having only cycloid scales.

Other material examined. ***Cryptocentrus cryptocentrus***: AMS I.19403-001, 2 (27–50), Mozambique, Inhaca; BPBM 18127, 4 (38–64) & BPBM 19875, 2 (55–56), Red Sea, Gulf of Aqaba; MNHN A.1166, 1 (81), syntype of *Gobius cryptocentrus*; BMNH 1908.3.23.231, holotype of *Cryptocentrus octofasciatus* Regan, 1908; ROM 37047, 1 (50.9), Chagos Archipelago, Salomon Atoll; ROM 37046, 1 (27), Chagos Archipelago, Diego Garcia Atoll. ***Cryptocentrus leptocephalus***: FMNH 17364, 39 mm SL male, holotype of *Cryptocentrus geniornatus*; CAS-SU 24465, 38 mm SL, paratype of *Cryptocentrus geniornatus*; CAS-SU 36921, 38 mm SL, Philippines.

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