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Callogobius winterbottomi, a new species of goby (Teleostei: Gobiidae) from the Western Indian Ocean

NAOMI R. DELVENTHAL[1] & RANDALL D. MOOI[1,2]

[1]*Department of Biological Sciences, 212B Biological Sciences Bldg., University of Manitoba, Winnipeg MB, R3T 2N2 Canada. E-mail: naomi.delventhal@gmail.com*
[2]*The Manitoba Museum, 190 Rupert Ave., Winnipeg MB, R3B 0N2 Canada. E-mail: rmooi@manitobamuseum.ca*

Abstract

Callogobius winterbottomi new species is described from the 33.8 mm SL holotype and two paratypes (32.2 mm SL and 22.9 mm SL) from the Comoros, Western Indian Ocean. It is distinguished from all other known *Callogobius* species by the following combination of characters: sensory pores absent, 23–26 scales in lateral series, and sensory papillae preopercular row not continuous with transverse opercular row. One additional specimen of *Callogobius winterbottomi* was located from South Africa. A new standardized naming system for *Callogobius* sensory papillae rows is presented for identification and clarification of character states among *Callogobius* species. The new species is tentatively placed among what we term the "*sclateri* group", a clade including *C. sclateri* (Steindachner) and three other species that exhibit a modified female urogenital papilla with lateral distal flaps and elongate ctenii on the caudal peduncle scales. *Callogobius tutuilae* (Jordan & Seale) is removed from synonymy with *C. sclateri* because it has partially united pelvic fins (vs separate) and the preopercular sensory papillae row is continuous with the transverse opercular row (vs separate).

Key words: Gobiidae, *Callogobius winterbottomi* new species, sensory papillae rows, systematics

Introduction

The genus *Callogobius* Bleeker comprises more than 40 nominal species (Eschmeyer 2012) and is widespread in Indo-Pacific shallow marine and brackish environments, including coral reefs and coral rubble, tidepools, and mangrove streams. Because of cryptic coloration, habitat specialization, and poor condition of most museum specimens (many species have fragile skin and deciduous scales), the taxonomy is poorly known. A revision of *Callogobius* has never been completed. In the 1970s some inroads were made; Akihito & Meguro (1975, 1977) examined type material and clarified the taxa from Japan, and McKinney & Lachner (1978a) provided a summary table of selected characters obtained mostly from types. The latter authors provided a complete list of included species of *Callogobius* at the time, and formed a basis for the recognition of *Callogobius* as currently circumscribed. Unfortunately, McKinney & Lachner never completed a planned revision, although they did synonymize several species in a later publication (McKinney & Lachner 1984), but without detailed evidence. Goren (1979a) reviewed the *Callogobius* species of the Red Sea, whereas other taxonomic papers on *Callogobius* since McKinney & Lachner (1978a) consist primarily of descriptions of one or two new species (e.g., Goren 1978; Goren 1979b; McKinney & Lachner 1978b; McKinney & Lachner 1984; Chen & Shao 2000; Chen *et al*. 2006).

During a visit by the first author to the Royal Ontario Museum, three male specimens of an unknown *Callogobius* species were encountered in a single collection from the Comoros. After a thorough search, only one additional specimen of this species, a female, was located from South Africa. In this paper, we describe this species as new, briefly discuss its relationships among congeners, and suggest removal of a possible relative, *C. tutuilae* (Jordan & Seale), from synonymy with *C. sclateri* (Steindachner). We also provide a new standardized naming system for *Callogobius* sensory papillae rows for identification and clarification of character states among species of this genus.

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Material and methods

Abbreviations for institutional codes follow Fricke & Eschmeyer (2012) and/or Sabaj Pérez (2010). Comparisons to other described species are based on the holotypes of the following species and data from McKinney & Lachner (1978a): *Callogobius amikami* Goren, Miroz & Baranes, TAU P-10321; *C. andamanensis* Menon & Chatterjee, ZSI F7105/2; *C. badia* (Herre), FMNH 17373; *C. bauchotae* Goren, MNHN 1976-0184; *C. bifasciatus* (Smith), SAIAB 235; *C. bothriorrhynchus* (Herzenstein), ZIN 9684; *C. centrolepis* Weber, ZMA 111745; *C. clarki* (Goren), HUJ 10065; *C. clitellus* McKinney & Lachner, USNM 209249; *C. coelidotus* (Sauvage), MNHN 0000-2968; *C. crassus* McKinney & Lachner, USNM 220088; *C. depressus* (Ramsay & Ogilby), AMS B.9758; *C. dori* Goren, BMNH 1978.9.8.7; *C. flavobrunneus* (Smith), SAIAB 211; *C. hastatus* McKinney & Lachner, USNM 216811; *C. irrasus* (Smith), SAIAB 186; *C. kuderi* (Herre), SU 36815; *C. maculipinnis* (Fowler), ANSP 47549; *C. mucosus* (Günther), BMNH 1871.9.13.169; *C. okinawae* (Snyder), USNM 62240; *C. plumatus* (Smith), SAIAB 208; *C. santa* (Herre), FMNH 17374; *C. sclateri* (Steindachner), NMW 30901; *C. sheni* Chen, Chen & Fang, MNNB P6980; *C. shunkan* Takagi, NSMT-P 110000 (formerly TUFLFB); *C. snelliusi* Koumans, RMNH 20289; *C. snyderi* (Fowler), ANSP 72078; *C. stellatus* McKinney & Lachner, USNM 217429; *C. tanegasimae* (Snyder), USNM 62241; *C. trifasciatus* Menon & Chatterjee, ZSI F 7144/2; *C. tutuilae* (Jordan & Seale), USNM 51770; *C. vanclevei* (Herre), USNM 202513.

Meristics. Lateral series scale counts were taken from the dorsalmost extent of the opercular opening to the mid-posterior edge of the hypural plate. Scale counts were taken on both sides when possible as most *Callogobius* species have irregularly sized and unevenly spaced scales. Cyanine blue dye (following the method of Akihito *et al.* 1993) was used to identify scale pockets on specimens missing scales. Predorsal scales were counted from the origin of the first dorsal spine along the midline towards the occiput. Since these scales typically do not form a natural line, scales with at least one-third of their width crossing the midline, as well as any emarginate scales partially encircling the first dorsal-fin spine, were included. Transverse scale rows were counted diagonally from the origin of the first dorsal fin, downward and backward, to the ventral midline at or near the anal-fin base. The last segmented ray in the anal- and second dorsal fins is divided at its base and was counted as a single ray. Pectoral-fin ray counts were taken on both sides when possible. Caudal-fin rays are provided as counts of segmented rays on the upper + lower hypural plates, with the number of branched rays recorded as Arabic numerals and number of unbranched rays as lower case Roman numerals. Procurrent (unsegmented) caudal rays are provided as upper + lower counts.

Morphometrics. Measurements were taken with either dial calipers or microscope graticule and recorded to the nearest 0.1 mm (Table 1). Standard length (SL) was taken from the anterior tip of the upper jaw (snout) to the mid-posterior edge of the hypural plate (as identified by folding the caudal fin to find the hypural crease). Head length was measured from the tip of upper jaw to the upper posterior margin of the operculum. Head depth was taken vertically at the preopercular edge, which is usually the deepest point. Head width was taken at the widest point of the preopercular edge (usually a mid-lateral point). Bony interorbital width was measured by finding the narrowest interorbital distance and pinching it gently with the calipers. Predorsal length was taken from the tip of the upper jaw to the base of the first dorsal-fin spine. Preanal length was taken from the tip of the upper jaw to the base of the first anal-fin spine. Prepelvic length was taken from the tip of the upper jaw to the base of the pelvic-fin spine. Pectoral fin length was taken from the base of the uppermost ray to the tip of the longest ray. Pelvic fin length was taken from the base of the spine to the tip of the longest ray, whether the longest ray was the 4th or 5th was recorded. Caudal fin length was taken from mid-lateral edge of the hypural plate to the tip of the longest ray. Caudal peduncle depth was taken vertically, at the narrowest point, usually just anterior to the posterior edge of the hypural plate.

Sensory papillae rows. Superficial neuromasts are referred to as “sensory papillae” following common usage in goby systematics. Individual papillae rows are identified using Akihito and Meguro’s (1977) numbering system, in addition to descriptive names presented in Table 2. The descriptive names are intended to clarify states of papillae rows observed among different species within *Callogobius* (including intraspecific variation), but are not appropriate for use with other goby genera. In the species description we have commented only on papillae rows whose length and orientation are variable among *Callogobius* species and generally consistent within a given species. We report each condition along with the number of observations (taken bilaterally, if possible) in parentheses. Relative length of a given row is determined by its base; two rows are considered joined or continuous only if the base is shared; when breaks occur, the two rows are considered separate.

TABLE 1. Selected measurements of the holotype and two paratypes of *C. winterbottomi* in mm; the values in parentheses indicate the percentage of standard length (SL) or head length (HL).

	Holotype	Paratype	Paratype
Sex	M	M	M
Standard Length (SL)	33.8	32.2	22.9
Head length (HL) (% of SL)	11.5 (34.0)	11.0 (34.2)	8.3 (36.2)
Head depth (% of HL)	5.9 (50.9)	5.1 (46.4)	4.1 (49.4)
Head width (% of HL)	7.8 (67.8)	7.3 (66.4)	5.3 (63.9)
Interorbital width (% of HL)	0.78 (6.9)	0.68 (6.2)	0.63 (7.6)
Predorsal fin distance (% of SL)	13.1 (38.8)	13.2 (41.0)	9.4 (41.0)
Preanal fin distance (% of SL)	20.2 (59.8)	19.6 (60.9)	13.9 (60.7)
Prepelvic fin distance (% of SL)	11.8 (34.9)	10.6 (32.9)	7.5 (32.8)
Pectoral fin length (% of SL)	10.4 (30.8)	9.5 (29.5)	6.5 (28.4)
Pelvic fin length (% of SL)	7.5 (22.2)	7.2 (22.4)	5.4 (23.6)
Caudal fin length (% of SL)	11.1 (32.8)	10.3 (32.0)	6.7 (29.3)
Caudal peduncle depth (% of SL)	4.4 (13.0)	4.2 (13.0)	3.2 (14.0)

TABLE 2. Akihito & Meguro's (1977) numbering system for *Callogobius* sensory papillae rows, followed by our assigned descriptive names. The intermandibular row was not originally identified by Akihito & Meguro (1977), but incorporated here as Row 24. Asterisks indicate those rows that are particularly useful in describing interspecific variation in *Callogobius* and are commented on in the description of *C. winterbottomi*. Two groups of papillae rows (usually less well defined; ridges may or may not be raised) are found on the temporal and posttemporal/predorsal regions; we refer to these as the temporal and posttemporal groups, respectively. These rows are illustrated but not labelled in Figure 5.

Row 1	Internasal row
Row 2	Postnasal row*
Row 3	Interorbital row
Row 4	Oblique premaxillary row
Row 5	Preorbital row
Rows 6	Upper longitudinal premaxillary row
Rows 7	Lower longitudinal premaxillary row
Row 8	Transverse maxillary row
Row 9	Anterior suborbital row*
Row 10	Mid suborbital row*
Row 11	Posterior suborbital row(s)*
Row 12	Longitudinal cheek row*
Row 13	Transverse cheek row*
Row 14	Longitudinal maxillary row*
Row 15	Longitudinal mandibular row*
Rows 16	Transverse mandibular rows*
Row 17	Postorbital row*
Row 18	Upper cranial row
Row 19	Lower cranial row
Row 20	Preopercular row*
Row 21	Transverse opercular row*
Row 22	Oblique opercular row
Row 23	Subopercular row
Row 24	Intermandibular row

Individual sensory papillae are present in the interorbital, temporal and preopercular regions where pores would normally be found in *Callogobius* species having sensory canal pores. Because we are uncertain of their developmental origin, we are reluctant to identify them as the primary replacement neuromasts of Coombs *et al.* (1988) and Wongrat & Miller (1991). However, we suggest the term *pore replacement papillae* for these neuromasts, not to suggest a developmental connection (necessarily), but only to differentiate these individual papillae from unrelated named and numbered papillae rows in these regions.

***Callogobius winterbottomi* sp. nov.**

(Figs. 1–5, Tab. 1)

FIGURE 1. Left lateral views of type specimens of *Callogobius winterbottomi*. (a) Holotype, ROM 58914, 33.8 mm SL male. (b) Paratype, ROM 92690, 32.2 mm SL male. (c) Paratype, ROM 92690, 22.9 mm SL male. Scale bar = 5 mm.

Holotype. ROM 58914, 33.8 mm SL male. Stated locality: Indian Ocean, Comoros, Moheli Bay, on south coast about 3 nautical miles west of Nioumachoua at southwest tip of island at Drondroni River, 12°21’15” S, 43°40’00” E, rotenone, depth 9–17 m, R. Winterbottom, W. Holleman, 27 Nov. 1988.

Paratypes. ROM 92690, 2 specimens (32.2 mm SL male and 22.9 mm SL male). Collected with the holotype.

Other material. SAIAB 057357, 1 specimen (37.7 mm SL female). Stated locality: Indian Ocean, South Africa, Aliwal Shoal off Scottburgh, 30°18’01” S 30°48’58” E, 26-28 m, P.C. Heemstra, 7 Feb. 1998.

Diagnosis. *Callogobius winterbottomi* is distinguished from all other known *Callogobius* species by the following combination of characters: head pores absent, 23–26 scales in lateral series, and preopercular papillae row (Row 20) not continuous with transverse opercular papillae row (Row 21).

Description. Holotype values are indicated by an asterisk. Parentheses enclose the number of counts in the type specimens with the particular value; counts are made on both sides when applicable or possible. Dorsal fin rays VI, I,9 (3*); anal fin rays I,8(3*); pectoral fin rays 16(2*), 17(4); pelvic fin rays I,5 (6*); segmented caudal fin rays 9+7i (1*), i8 + 7i (2); procurrent rays 4 + 4 (3*); scales in lateral series 23(1), 24(3), 26(2*); predorsal scales 8(2), 9(1*); transverse scales 10(1), 11(2*). Counts for these characters in the non-type female fall within the ranges reported for the type specimens.

All scales are large and deciduous, with distinctly outlined centres without circuli (Fig. 2). Scales on the head and anterior half of the body are cycloid; cycloid scales are present in the spaces between the papillae rows on the cheeks, preoperculum and operculum, on the lateral side of the pectoral fin bases, prepelvic and predorsal regions, and on the belly. Scales on the posterior half of the body are ctenoid; ctenoid scales first appear on the mid-flank region below the 5th or 6th spine of the first dorsal fin. Ctenii are roughly triangular and pointed, and increase in number per scale towards the caudal peduncle. Slightly elongate ctenii occur on scales of the dorsal and ventral edges of the caudal peduncle (near or above the procurrent caudal fin rays) (Fig. 2).

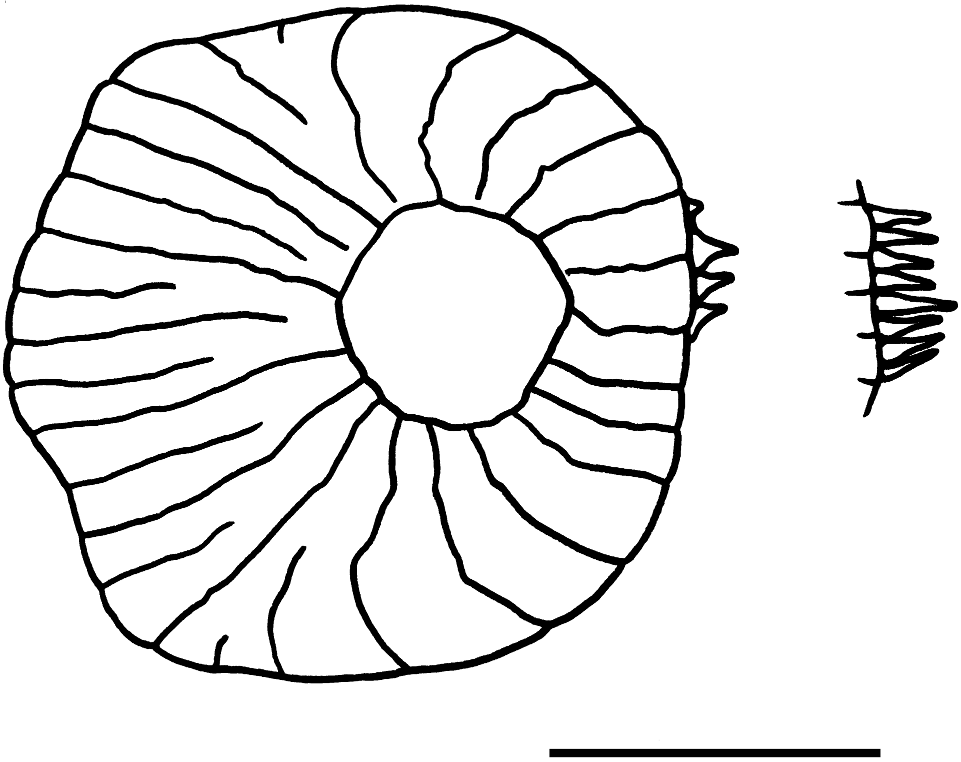

FIGURE 2. Scale morphology in *Callogobius winterbottomi*, illustrated from male paratype, ROM 92690, 32.2 mm SL. Left, entire mid-lateral scale from region below last spine of first dorsal fin showing distinctly outlined centre and single row of ctenii of normal length. Circuli are not illustrated, although note that they do not occur within the outlined centre. Right, slightly elongate ctenii of postero-dorsal caudal peduncle scale for comparison. Scale bar = 1 mm.

Teeth of upper and lower jaws (based on paratype, ROM 92690, 32.2 mm SL) are conical and slender; outer teeth larger, slightly curved and spaced at a distance of two thirds to twice the height of the tooth. There are 2–3 rows of inner teeth tightly spaced, about half the height of the outer teeth. The tongue is of medium-width with a slightly bilobed tip.

Anterior nostrils are long, slender tubes, reaching almost to the outer edge of the upper lip; the posterior nostrils are very short upright tubes.

Pelvic fins are partially united with the membrane reaching two thirds the length of the fin (Fig. 3). The fifth segmented pelvic-fin ray is about three quarters the length of the fourth ray; all segmented pelvic-fin rays are branched. The pelvic frenum is present, but somewhat weak (Fig. 3).

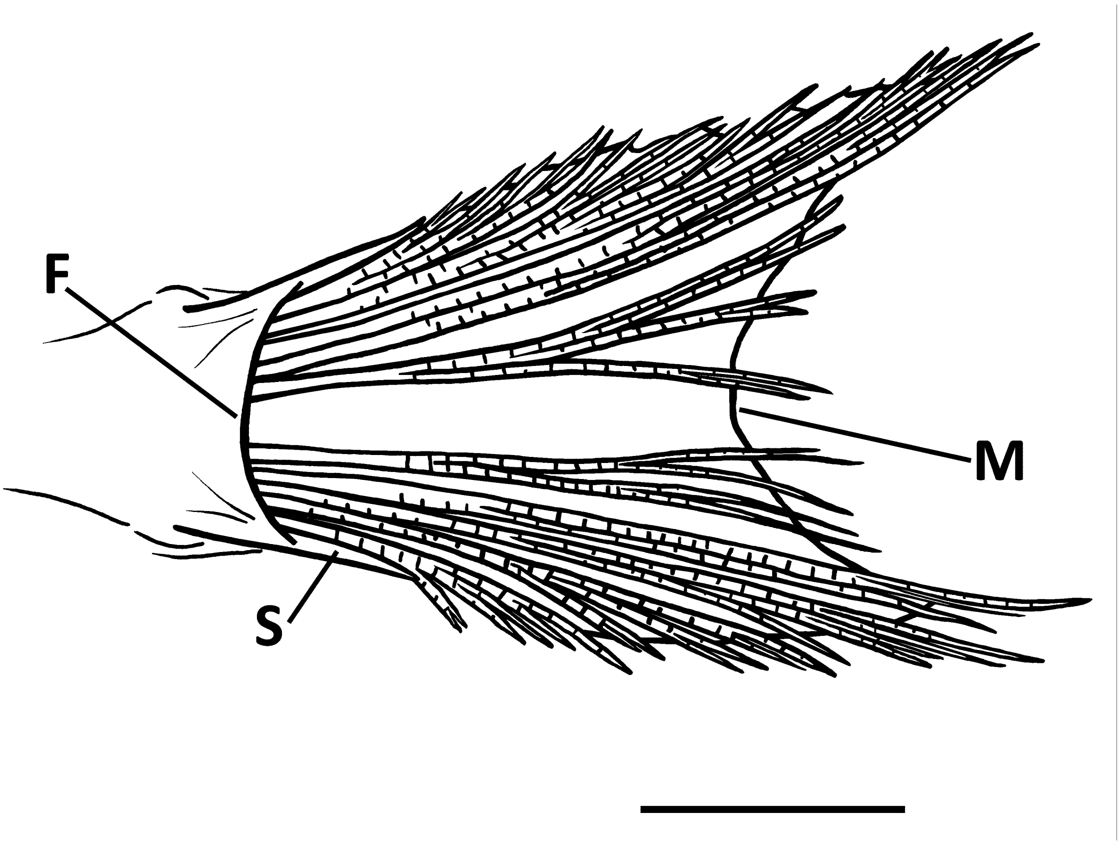

FIGURE 3. Ventral view of pelvic fins of *Callogobius winterbottomi*, illustrated from male paratype, ROM 92690, 32.2 mm SL. F—weak frenum; M—extent of membrane uniting pelvic fins, about two thirds length of fins (reconstructed, membrane damaged in all specimens available); S—pelvic spine. Scale bar = 2 mm.

FIGURE 4. Right lateral view of *Callogobius winterbottomi*, SAIAB 057357, 37.7 mm SL female. Scale bar = 5 mm.

The male urogenital papilla is very long, slender and darkly pigmented. In the female (SAIAB 057357), the papilla is broad and darkly pigmented with small, distal flaps of skin laterally (E. Heemstra & W. Holleman, pers. comm.).

Head pores are absent. Pore replacement papillae are present in the interorbital, temporal and preopercular regions where pores would normally be found in *Callogobius* species having sensory canal pores (Fig. 5).

Papillae Row Configuration (Fig. 5): The postnasal rows (Row 2) are long and joined across the midline (3*). The anterior suborbital row (Row 9) is moderately long and does not reach the eye (6*); the mid suborbital row (Row 10) reaches or nearly reaches the eye (4*) or is of moderate length (2). The posterior suborbital rows (Row 11) are short; they may be separate but touch (2*), slightly overlap (2) or be well separated (2). The longitudinal maxillary row (Row 14) is unbroken and extends posteriorly to just below (2) or usually beyond (4*) the transverse cheek row (Row 13), which is short (6*). The longitudinal mandibular row (Row 15) is unbroken (6*). There are approximately 10(1), 11(4*), or 12(1) transverse mandibular rows (Row 16) on each lower jaw. The postorbital rows (Row 17) are short (less than 2/3 the length of the distance from the dorsal mid-line to the bony edge of the cranium) (4) to medium, (more than 2/3 the length of the distance from the dorsal mid-line to the bony edge of the cranium) (2*), and may nearly reach the midline (4*). The preopercular row (Row 20) is positioned anterior to, and not continuous with, the transverse opercular row (Row 21) (6*). The non-type female specimen exhibits papillae row configurations identical to that of the holotype.

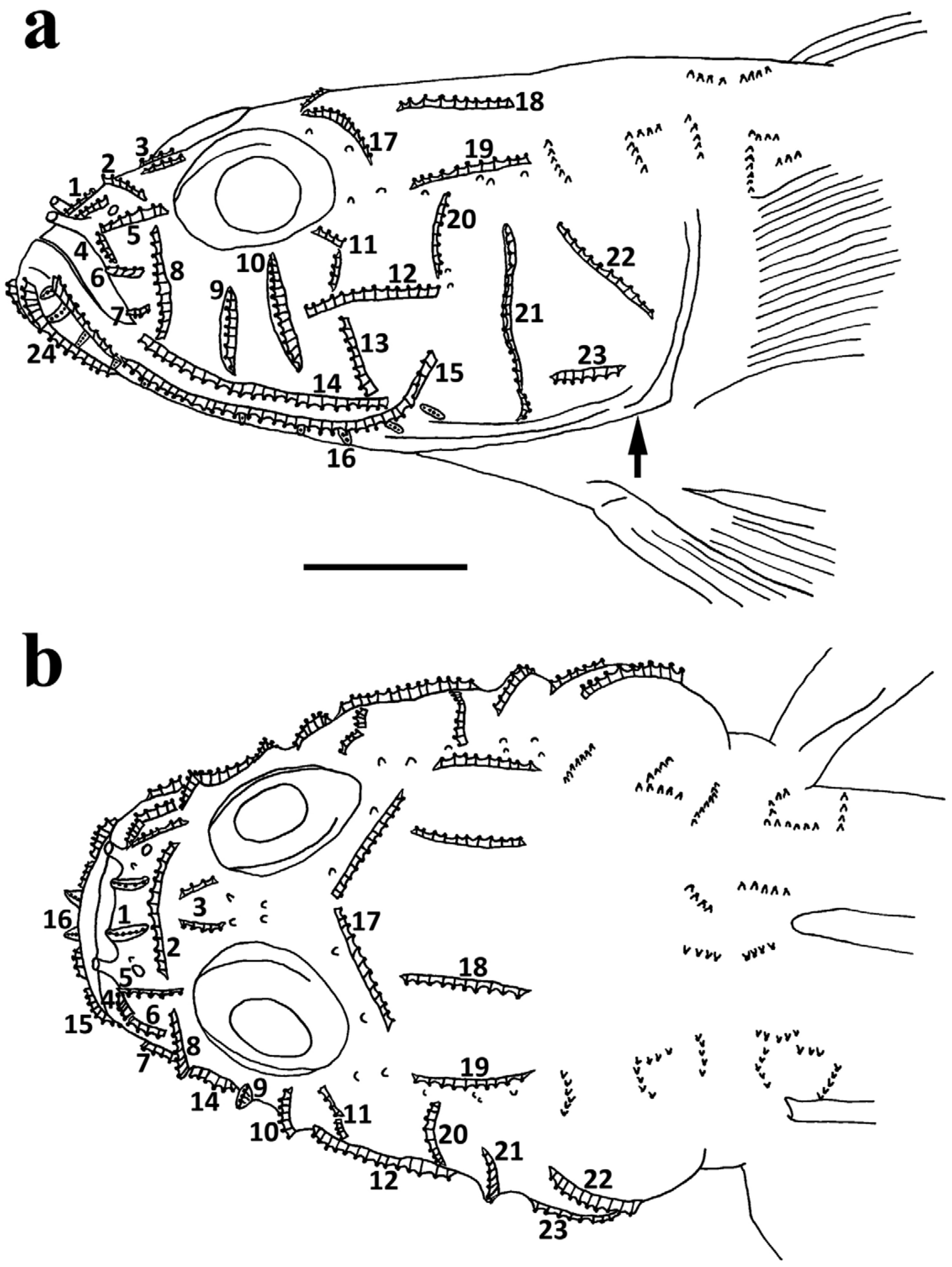

FIGURE 5. Sensory papillae pattern in *Callogobius winterbottomi* paratype, ROM 92690, 22.9 mm SL, male. (a) Lateral view. Arrow indicates anterior extent of gill opening. (b) Dorsal view. Numbers refer to Akihito & Meguro's (1977) sensory papillae system (see Table 2). Scale bar = 2 mm.

Colour in Preservative (Fig. 1): General colour pattern consists of brown dusky bars and mottling on a pale yellow-brown head and body. Head markings are poorly defined, consisting of lateral dusky blotches and a more evenly pigmented region from the snout through the post-orbital region, dorsally. The ventral region of the head is lightly pigmented. Papillae rows are more distinctly pigmented than surrounding regions. A wide dusky bar extends dorsally over the operculum and pectoral-fin base towards the first dorsal-fin spine; the ventral region of this bar may be darker than the remainder. The trunk has a wide bar extending below the first dorsal fin, reaching to, but not across, the belly. The belly is pale. A narrow, irregular, mottled bar or partial bar may be visible between the dorsal fins, particularly in the smallest specimen; this marking is more defined ventrally. A wide, slanted bar extends from the second dorsal fin to the posterior edge of the anal fin and around the anterior portion of the caudal peduncle. A wide bar encircles the posterior caudal peduncle, the edge of the hypural plate and the proximal regions of the caudal fin. The fins are pigmented with a darker brown; the first and second dorsal fins have irregular rows of pale spots and/or bands; the outermost edges are mostly pale. The pectoral fins are darkly mottled; there is greater pigment concentration medially. The pelvic and anal fins are evenly dark, except for the margins, which are pale. The caudal fin is dark, with fine, irregular and indistinct vertical bands. The urogenital papilla is dark.

Etymology. Named in honour of Rick Winterbottom who, along with Wouter Holleman, collected the type series. Rick has made substantial contributions to the systematics of gobies and other Indo-Pacific fishes, and to the development of both authors' respective careers. Suggested vernacular name: Winterbottom's flapheaded goby.

Distribution and habitat. Known only from the Comoros (3 specimens, the type series) where the field station was described as "base of vertical wall with numerous caves" at 9–17 m, and South Africa (1 specimen), collected at a depth of 26–28 m.

Comparisons. Only three other described *Callogobius* species lack all head pores: *C. hastatus*, *C. crassus* and *C. clarki*. *C. winterbottomi* can easily be distinguished from *C. hastatus* and *C. clarki* by lower lateral scale counts (23–26 vs 32–37 in *C. hastatus* and 33–41 in *C. clarki*). *C. winterbottomi* differs from *C. crassus* by higher lateral scale counts (23–26 vs 19–21) and papillae row configuration (preopercular row not continuous with transverse opercular row, longitudinal maxillary row and longitudinal mandibular row not broken in *C. winterbottomi* vs preopercular row continuous with transverse opercular row, longitudinal maxillary row and longitudinal mandibular row broken and displaced in *C. crassus*). We are aware of at least two undescribed species of *Callogobius* lacking head pores, but these both differ from *C. winterbottomi* in having the preopercular row (Row 20) continuous with the transverse opercular row (Row 21).

In the Western Indian Ocean, *C. winterbottomi* may also be confused with *C. maculipinnis*, *C. sclateri*, *C. bifasciatus*, *C. flavobrunneus* or *C. plumatus*. These species develop head pores by the time they reach 14 mm but may be more difficult to distinguish as juveniles. *C. winterbottomi* differs from small *C. maculipinnis* by having 10 or more transverse mandibular rows (vs 3–4) and the fifth segmented pelvic fin ray shorter than the fourth (vs. fifth pelvic fin ray as long or longer than the fourth); from *C. sclateri* by having a pelvic frenum and connecting membrane between the fifth segmented pelvic fin rays (vs. pelvic frenum and connecting membrane absent) and by pectoral fin darkest medially (vs. pectoral fin with dark upper edge in small *C. sclateri*); from *C. bifasciatus* and *C. flavobrunneus* by lateral scale counts (23–26 in *C. winterbottomi* vs. 37–48 in *C. bifasciatus* and 34–38 in *C. flavobrunneus*); and from *C. plumatus* by having preopercular row not continuous with transverse opercular row (vs. continuous) and by having the anterior nostril longer than the posterior nostril (vs. shorter).

Remarks. SAIAB 057357 was not assigned type status because of the difference in collection locality. Although this specimen is slightly larger and darker than the Comoros specimens (cf Figs. 1, 4), these differences are unlikely to be of taxonomic or biological significance. SAIAB 057357 is a female and all three type specimens are males, but we have not observed sexual dichromatism or dimorphism in other *Callogobius* species, except in the shape of the urogenital papilla, and do not expect them in *C. winterbottomi*.

Discussion

In *Callogobius*, the sensory papillae are on raised ridges or flaps in an arrangement that makes species in the genus easily distinguishable from all other gobies. Winterbottom (2003) hypothesized that *Callogobius* is monophyletic based on the presence of both longitudinal and transverse raised ridges. We recognize that naming systems for sensory papillae are controversial in gobies, and that similarly oriented rows have not been demonstrated to be homologous among different goby taxa (see Van Tassell *et al*. 2011 for a brief review). It is not uncommon for individual specimens of *Callogobius* to exhibit slight differences in papillae rows not normally found within a given species (e.g., in a species where the post nasal rows are usually long and overlapping slightly over the midline, occasional specimens may be found where the rows are joined at the midline). These variations generally do not hamper species identification, since in most cases other characters are used in conjunction with papillae row arrangements.

With the description of *C. winterbottomi*, there are now four described species of *Callogobius* that lack all head pores as adults; the others are *C. hastatus*, *C. crassus*, and *C. clarki*. Lack of head pores was not mentioned in the original description of *C. clarki*; we redescribe *C. clarki* in a separate paper. Two additional undescribed species of poreless *Callogobius* are currently under study by the first author and Y. Ikeda (BLIP). There is no additional evidence that poreless *Callogobius* species form a monophyletic group.

However, we hypothesize that *Callogobius winterbottomi* is a member of a monophyletic sub-group having the following external characters that are unique among *Callogobius*: modified scales on the caudal peduncle with unusually long ctenii (occasionally found in other goby genera), and female urogenital papilla with small distal flaps of skin (not previously reported in gobiids). This sub-group, with *C. winterbottomi*, includes *C. sclateri* (Steindachner), *C. bifasciatus* (Smith), *C. flavobrunneus* (Smith), and *C. clarki* (Goren). All members of this "*sclateri* group" also have the preopercular papillae row (Row 20) separate from the transverse opercular row (Row 21), lack preopercular pores, and lack elongate caudal and pectoral fins (Fig. 5). We are currently preparing a description of osteological characters that lend additional support for the monophyly of the "*sclateri* group" that will be published in an upcoming paper.

Callogobius tutuilae (Jordan & Seale 1906) has similar body and fin proportions to members of the "*sclateri* group." The only specimen, the holotype (USNM 52770), is very small and in poor condition and was synonymized with *C. sclateri* by both Koumans (1953) and McKinney and Lachner (1984). However, we recognize *C. tutuilae* as a valid species because, unlike *C. sclateri*, *C. tutuilae* has partially united pelvic fins (the pelvic fins are completely separate in even tiny juveniles of *C. sclateri*), and the preopercular papillae row (Row 20) is continuous with the transverse opercular row (Row 21) (separate in *C. sclateri*).

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References

Akihito, Iwata, A., Sakamoto, K. & Ikeda, Y. (1993) Suborder Gobioidei. *In*: Nakabo, T. (Ed.), *Fishes of Japan with Pictorial Keys to the Species*. Tokai University Press, Tokyo, Japan, pp. 997–1392. (In Japanese).

Akihito, Prince & Meguro, K. (1975) On a goby *Callogobius okinawae. Japanese Journal of Ichthyology,* 22, 112–116. (In Japanese).

Akihito, Prince & Meguro, K. (1977) Five species of the genus *Callogobius* found in Japan and their relationships. *Japanese Journal of Ichthyology,* 24, 113–127. (In Japanese).

Chen, I-S., Chen, J.-P. & Fang, L.-S. (2006) A new marine goby of genus *Callogobius* (Teleostei: Gobiidae) from Taiwan. *Ichthyological Research*, 53, 228–232.
http://dx.doi.org/10.1007/s10228-006-0338-2

Chen, J.-P. & Shao, K.-T. (2000) *Callogobius nigromarginatus*, a new species of goby (Pisces: Gobiidae) from Taiwan. *Bulletin of Marine Science*, 66, 457–466.

Coombs, S., Janssen, J. & Webb, J.F. (1988) Diversity of lateral line systems: evolutionary and functional considerations. *In*: Atema, J., Fay, R.R., Popper, A.N. & Tavolga, W.N. (Eds.), *Sensory Biology of Aquatic Animals*. Springer-Verlag, Berlin, Germany, pp. 553–593.

Eschmeyer, W.N. (Ed.) (2012) *Catalog of Fishes*, California Academy of Sciences. Available from http://research.calacademy.org/research/ichthyology/catalog/fishcatmain.asp (31 May 2012).

Fricke, R. & Eschmeyer, W.N. (2012) *Guide to Fish Collections.* Available from http://researcharchive.calacademy.org/research/Ichthyology/catalog/collections.asp (31 May 2012).

Goren, M. (1978) A new gobiid genus and seven new species from Sinai coasts (Pisces: Gobiidae). *Senckenbergiana Biologica*, 59, 191–203.

Goren, M. (1979a) *Callogobius bauchotae* new species from Marshall Island (Gobiidae, Pisces).*Cybium 3e série, Bulletin de la Société Française d'Ichtyologie* No. 7, 41–44.

Goren, M. (1979b) Red Sea fishes assigned to the genus *Callogobius* Bleeker with a description of a new species (Teleostei: Gobiidae). *Israel Journal of Zoology*, 28, 209–217.

Goren, M., Miroz, A. & Baranes, A. (1991) *Callogobius amikami*, a new species of goby (Gobiidae) from the Red Sea. *Cybium*, 15, 299–302.

Jordan, D.S. & Seale, A. (1906) The fishes of Samoa. Description of the species found in the archipelago, with a provisional check-list of the fishes of Oceania. *Bulletin of the Bureau of Fisheries*, 25, 173–455.

Koumans, F.P. (1953) Gobioidea. *In*: Weber, M. & de Beaufort, L.F. (Eds.), *The Fishes of the Indo-Australian Archipelago, Volume 10*, E.J. Brill, Leiden, The Netherlands, pp. 1–423.

McKinney, J.F. & Lachner, E.A. (1978a) Two new species of *Callogobius* from Indo-Pacific waters (Teleostei: Gobiidae). *Proceedings of the Biological Society of Washington*, 91, 203–215.

McKinney, J.F. & Lachner, E.A. (1978b) A new species of gobiid fish, *Callogobius stellatus*, from Flores Island, Indonesia (Teleostei: Gobiidae). *Proceedings of the Biological Society of Washington*, 91, 715–723.

McKinney, J.F. & Lachner, E.A. (1984) *Callogobius crassus*, a new fish from the Indo-Pacific region (Teleostei: Gobiidae). *Proceedings of the Biological Society of Washington*, 97, 627–631.

Sabaj Pérez, M.H. (Ed.) (2010) *Standard symbolic codes for institutional resource collections in herpetology and ichthyology: an online reference. Version 2.0*, American Society of Ichthyologists and Herpetologists, Washington, DC. Available from http://www.asih.org/ (8 November 2010).

Van Tassell, J.L., Tornabene, L. & Taylor, M.S. (2011) A history of gobioid morphological systematics. *In*: Patzner, R.A., Van Tassell, J.L, Kovačić, M. & Kapoor, B.G. (Eds.), *The Biology of Gobies.* CRC Press, Taylor and Francis Group, Science Publishers, Enfield, New Hampshire, pp. 3–22.
http://dx.doi.org/10.1086/666769

Winterbottom, R. (2003) *Feia ranta*, a new species of gobiid fish (Acanthopterygii; Perciformes) from Vietnam. *Aqua, Journal of Ichthyology and Aquatic Biology*, 7, 97–102.

Wongrat, P. & Miller, P.J. (1991) The innervations of head neuromast rows in eleotridine gobies (Teleostei: Gobioidei). *Journal of Zoology, London*, 225, 27–42.
http://dx.doi.org/10.1111/j.1469-7998.1991.tb03799.x