



## *Vanderhorstia vandersteene*, a new species of shrimpgoby (Pisces: Gobiidae) from Papua New Guinea

GERALD R. ALLEN

*Department of Aquatic Zoology, Western Australian Museum,  
Locked Bag 49, Welshpool DC, Perth, Western Australia 6986, Australia  
E-mail: gerry.tropicalreef@gmail.com*

MARK V. ERDMANN

*Conservation International Indonesia Marine Program,  
Jl. Dr. Muwardi No. 17, Renon, Denpasar 80235, Indonesia  
California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118, USA  
E-mail: mverdmann@gmail.com*

WILLIAM M. BROOKS

*2961 Vallejo Street, San Francisco, CA 94123, USA  
E-mail: rewmb1@aol.com*

### Abstract

A new species of gobiid fish, *Vanderhorstia vandersteene*, is described from the East Cape region of Milne Bay Province, Papua New Guinea on the basis of five specimens 17.5–32.2 mm SL. Diagnostic features include dorsal-fin elements VI-I,10–12; the fourth dorsal-fin spine filamentous, reaching the base of about the fifth to seventh segmented dorsal-fin ray when adpressed; anal-fin rays I,11; pectoral-fin rays 16–18; lateral scales 35–37; transverse scales 10; body scales mostly ctenoid, except cycloid scales anterior to the level of about the second-dorsal-fin origin, as well as on the pectoral-fin base, prepelvic region, and the lower side between the pectoral-fins and pelvic fins; scales absent on the head, including medially and anteriorly on the predorsal region; the caudal fin lanceolate with an elongate, median filament; color in life light neon blue with a wavy yellow-orange stripe from the upper operculum to the upper caudal-fin base, prominent yellow-orange bars, bands, and spots on the head and upper sides, a pair of yellow stripes on the second dorsal fin, and yellow streaks and bands on the caudal fin. We include a key to the *Vanderhorstia* species with low lateral-scale counts (less than 45).

**Key words:** taxonomy, ichthyology, coral-reef fishes, gobies, Indo-Pacific Ocean, symbiosis, Milne Bay

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## Introduction

The Indo-Pacific gobiid fishes of the genus *Vanderhorstia* Smith, 1949 live symbiotically with alpheid snapping shrimps. The diagnostic features of the genus were detailed by Shibukawa & Suzuki (2004) and Iwata et al. (2007) and include the usual presence of a well-developed pelvic frenum and connecting membrane, a relatively wide gill-opening, the branchiostegal membranes narrowly attached to the isthmus forming a free margin, no scales on the cheek and operculum, a relatively long caudal fin (longer than the head), an edentate vomer and palatine, a well-developed pattern of cephalic sensory canals and associated pores, and a longitudinal pattern of cephalic sensory papillae. There are 30 currently recognized species (Fricke et al. 2020). The genus has proliferated rapidly in recent years, with 20 species described since 2005, mostly from Indonesia, Philippines, and Japan. The most recently described species include *Vanderhorstia dawnarnallae* Allen, Erdmann & Mongdong, 2019 from the West Papua Province of Indonesia; *Vanderhorstia stegauchenia* Prokofiev, 2017 from near the Riau Archipelago in the South China Sea; *Vanderhorstia cyanolineata* Suzuki & Chen, 2014 from Nago Bay, Okinawa, Japan; *Vanderhorstia fulvopelvis* Suzuki & Chen, 2014 from the same location in Nago Bay, Okinawa; and *Vanderhorstia lepidobucca* Allen, Peristiwady & Erdmann, 2014 from the Lembah Strait, North Sulawesi, Indonesia.

We describe here a new species from the East Cape region of Milne Bay Province in Papua New Guinea that was collected by the second author (M.V. Erdmann) in September 2019. It has a striking color pattern unlike that of any known species and is further distinguished by a relatively low lateral-scale count and a filamentous fourth dorsal-fin spine. Unlike most congeners which are found in relatively shallow waters, the new species was collected at 35–60 m; three other members of the genus are known from depths below 70 m, including *V. stegauchenia* from 73 m; *Vanderhorstia puncticeps* (Deng & Xiong, 1980) from 80 m; and *Vanderhorstia longimanus* (Weber, 1909) from 118 m.

## Materials and Methods

The holotype and paratype specimens are deposited at the Western Australian Museum, Perth, Western Australia (WAM).

Lengths are given as standard length (SL), measured from the median anterior point of the upper lip to the base of the caudal fin (posterior end of the hypural plate); body depth is measured at both the origin of the pelvic fins and the origin of the anal fin, and body width at the origin of the pectoral fins; head length is taken from the upper lip to the posterior end of the opercular membrane, and head width over the posterior margin of the preopercle; orbit diameter is the greatest fleshy diameter and interorbital width the least fleshy width; snout length is measured from the median anterior point of the upper lip to the nearest fleshy edge of the orbit; upper-jaw length is from the same anterior point to the posterior end of the maxilla; cheek depth is the least distance between the ventral edge of the preoperculum and the lower edge of the eye; caudal-peduncle depth is the least depth and caudal-peduncle length the horizontal distance between verticals at the rear base of the anal fin and the caudal-fin base; caudal-fin and pectoral-fin lengths are the length of the longest ray; pelvic-fin length is measured from the base of the pelvic-fin spine to the tip of the longest pelvic-fin soft ray. Lateral scales are counted from above the dorsal end of the gill opening to the base of the caudal fin; transverse scales are counted from the origin of the anal fin anterodorsally to the base of the first dorsal fin; gill rakers are counted on the lateral margin of the first gill arch, upper limb listed first, rudiments are included in the counts. Counts and measurements for the paratypes are presented in parentheses if different from the holotype. Morphometric data presented as percentages of the standard length are in Table 1.

Terminology and abbreviations for cephalic sensory-canal pores and papilla rows follow those by Akihito (1984) and Shibukawa & Suzuki (2004). Cyanine Blue 5R (acid blue 113) stain was used to make pores, papillae, and scale outlines more obvious (Akihito et al. 1993, Saruwatari et al. 1997).

*Vanderhorstia vandersteene*, n. sp.

Electric Shrimpgoby

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Figures 1–6; Table 1

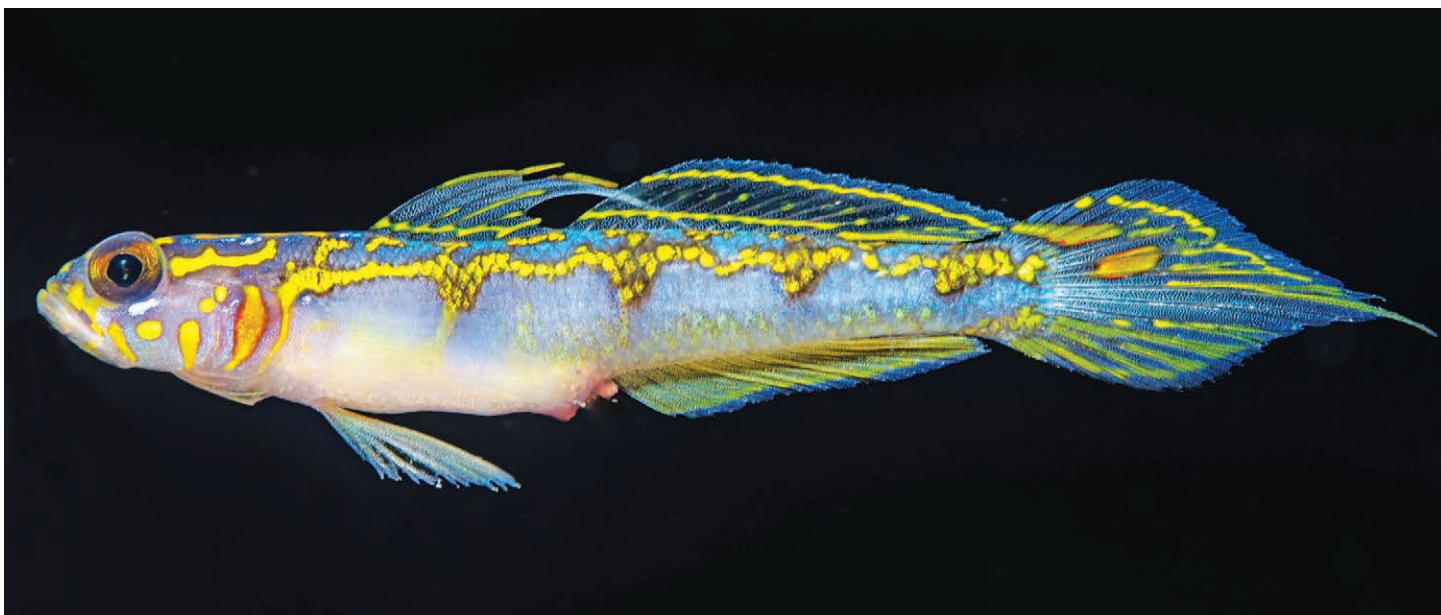
**Holotype.** WAM P. 35047-001, male, 32.2 mm SL, Papua New Guinea, Milne Bay Province, East Cape vicinity, Michelle's Reef, -10.2606°, 150.7123°, 35–60 m, clove oil and hand net, M.V. Erdmann, 21 September 2019.

**Paratypes.** WAM P. 35047-002, 4 specimens, 17.5–31.5 mm SL, collected with the holotype.

**Diagnosis.** Dorsal-fin elements VI-I,10–12, fourth dorsal-fin spine filamentous, reaching base of about fifth to seventh segmented dorsal-fin ray when adpressed; anal-fin elements I,11; pectoral-fin rays 16–18; lateral scales 35–37; transverse scales 10; body scales mostly ctenoid, except cycloid scales anterior to level of about second dorsal-fin origin, on pectoral-fin base, prepelvic region, and lower side between pectoral and pelvic fins; scales absent on head, including medially and anteriorly on predorsal region; caudal fin lanceolate with an elongate median filament; color in life light neon blue with wavy yellow-orange stripe from upper operculum to upper caudal-fin base; prominent yellow-orange bars, bands, and spots on head and upper sides; a pair of yellow stripes on second dorsal fin and yellow streaks and bands on caudal fin.

**Description.** Dorsal-fin elements VI-I,11 (one paratype with I,10 and one with I,12), fourth dorsal-fin spine filamentous, reaching base of about fifth to seventh segmented dorsal-fin ray when adpressed; anal-fin elements I,11, all segmented dorsal-fin and anal-fin rays branched, (each major branch of last ray divided); pectoral-fin rays 16 (one paratype with 17 and one with 18), all branched except uppermost and lowermost one or two rays; pelvic-fin elements I,5, all soft rays branched, the fifth rays joined medially with membrane; segmented caudal-fin rays 17; 14 (13–15) branched, 6 (5 or 6) upper and lower unsegmented rays; lateral scales 37 (35–36); transverse scales 10; no scales on head or nape; circumpeduncular scales 10 (10 or 11); gill rakers 1+9.

Body elongate, depth at pelvic-fin origin 5.7 (5.2–6.2) in SL, depth at anal-fin origin 7.1 (6.6–7.1) in SL; body compressed, width at pectoral-fin origin 1.5 (1.4–1.5) in body depth; head length 3.8 (3.4–3.9) in SL; head



**Figure 1.** *Vanderhorstia vandersteene*, freshly collected paratype, female, 27.2 mm SL, East Cape region, Milne Bay Province, Papua New Guinea (Mark V. Erdmann).

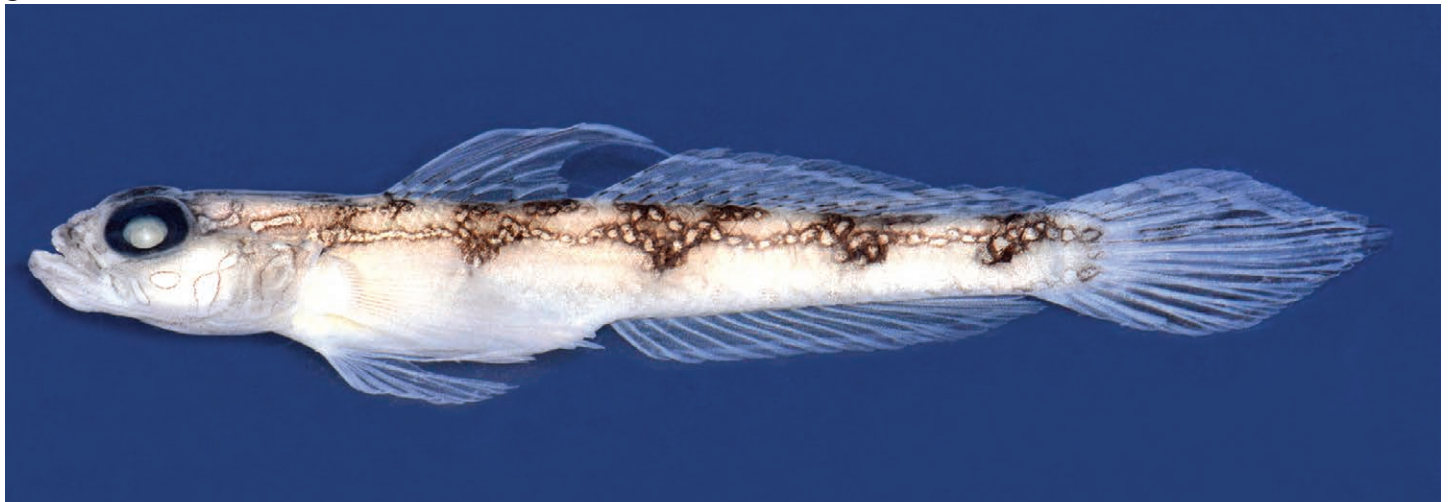


**Figure 2.** *Vanderhorstia vandersteene*, live holotype, male, 32.2 mm SL, East Cape region, Milne Bay Province, Papua New Guinea (Mark V. Erdmann).

compressed, width 1.4 (1.2–1.4) in body depth; snout short, length 5.0 (5.0–6.5) in HL; orbit diameter 2.8 (2.7–3.0) in HL; interorbital space very narrow, eyes nearly in contact; caudal-peduncle depth 2.9 (2.7–3.1) in HL; caudal-peduncle length 1.3 (1.1–1.5) in HL.

Jaws oblique, forming an angle of about 40° to horizontal axis of body, lower jaw projecting; mouth large, maxilla nearly reaching vertical at rear edge of pupil, upper-jaw length 2.5 (2.5–2.6) in HL; upper jaw with an outer row of slender, enlarged canine teeth and inner 1 or 2 rows of smaller, more incurved teeth, and a pair of relatively thick, strongly curved, enlarged canines on each side of median symphysis behind innermost row at front of jaw; lower jaw with outer row of 3 or 4 enlarged, slender canine teeth on each side of median symphysis and 2 inner rows of smaller teeth, except 2 or 3 relatively thick, large recurved canines laterally on innermost row; no teeth on vomer or palatines; edge of lips smooth; tongue broad with anterior rounded margin; no distinct mental flap.

Gill opening extending forward nearly to vertical at posterior edge of eye; gill membranes attached only anteriorly to isthmus, with no free fold; longest gill rakers about equal to length of longest gill filaments of first gill arch.



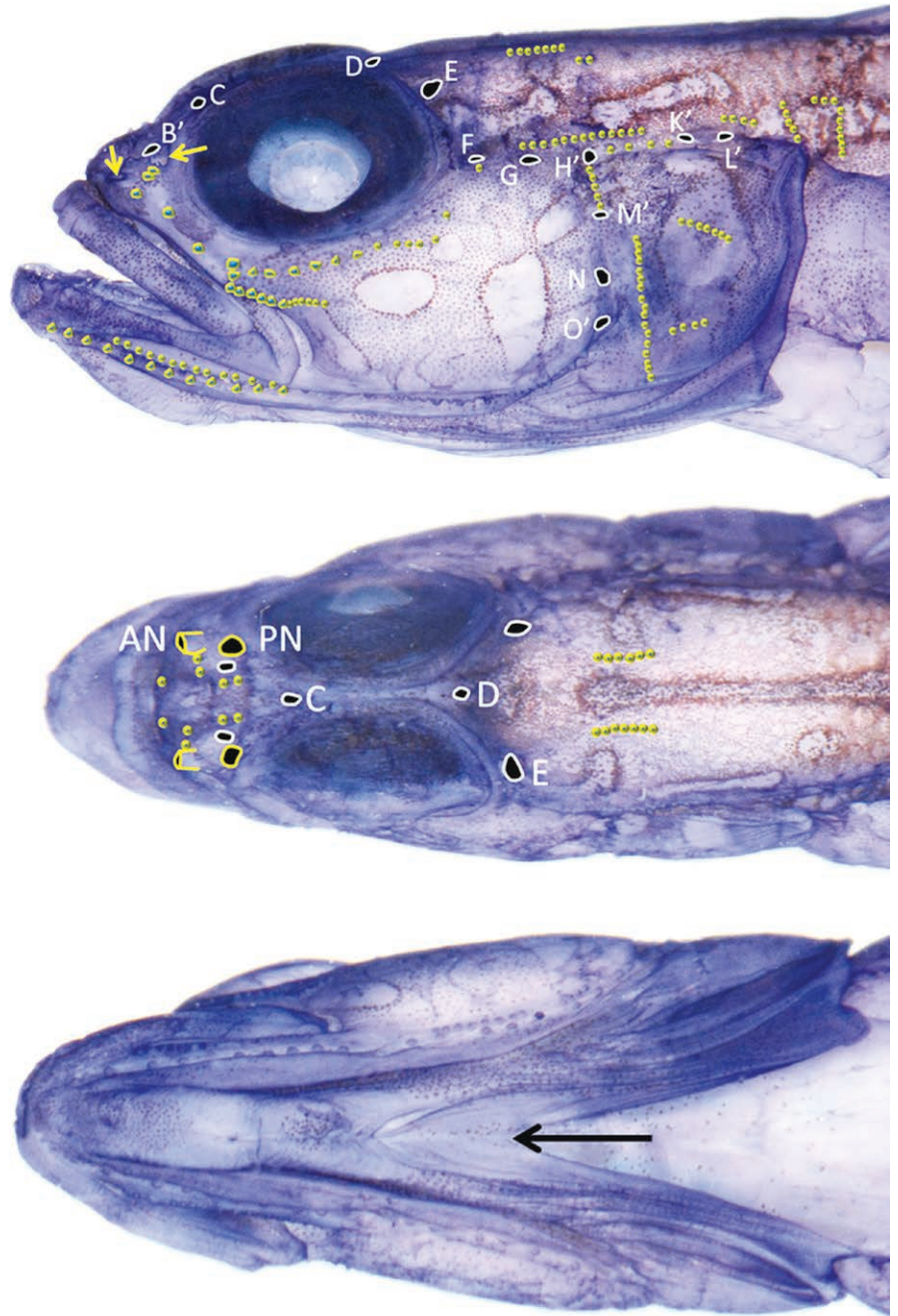
**Figure 3.** *Vanderhorstia vandersteene*, preserved holotype, male, 32.2 mm SL, East Cape region, Milne Bay Province, Papua New Guinea (Gerald R. Allen).

Posterior naris a large, ovate aperture in front of center of eye at fleshy edge of orbit, with a slightly elevated rim; anterior naris a short membranous tube, anterorventral to posterior nostril just above edge of upper lip, its aperture about one-fourth to one-third that of posterior naris.

Pattern of cephalic sensory-canal pores and papilla rows as illustrated in Fig. 4. Anterior oculoscapular-canal pores B', C (single), D (single), E, F, G, H', K', and L'; preopercular-canal pores M', N, and O'; right and left sides of anterior oculoscapular canals fused medially in interorbital space. Most cephalic sensory-papillae rows uniserial or comprising a single papilla, not forming multiple lines or aggregations except double row between oculoscapular-canal pores H' and K'.

Scales on body progressively larger posteriorly, mostly ctenoid, except cycloid scales anterior to level of about second dorsal-fin origin, on pectoral-fin base, prepelvic region, and lower side between pectoral and pelvic fins; scales absent on head, including medially and anteriorly on predorsal region; scales on side of nape extending forward to level of rear margin of opercle; no scales on fins except for about 3 or 4 rows at base of caudal fin, smaller (except first midlateral scale) than last row on caudal peduncle.

Origin of first dorsal fin behind level of pelvic-fin origin by distance equal to about pupil width, predorsal length 3.1 (2.7–3.1) in SL; dorsal-fin spines slender and flexible, fourth filamentous and reaching to base of about fifth to seventh segmented dorsal-fin ray when adpressed in adults; first dorsal-fin spine 1.6 (1.5–2.1) in HL; fourth dorsal spine 3.6 (2.8–4.6) in SL; membrane of first dorsal fin ending before origin of second dorsal fin; spine of second dorsal fin 2.2 (1.8–2.4) in HL; penultimate dorsal soft ray longest, 1.2 (1.1–1.3) in HL; origin of anal fin below base of second dorsal soft ray, preanal length 1.7 (1.7–1.8) in SL; anal spine 3.5 (3.0–3.6) in HL; penultimate anal soft ray longest, 1.4 (1.2–1.6) in HL; caudal fin lanceolate, much longer than head, 3.0 (2.1–2.5) in SL; pectoral fins pointed, middle rays longest, reaching to level of first dorsal soft ray, 3.6 (3.0–3.6) in SL; prepelvic length 3.2 (3.0–3.2) in SL; pelvic fins not reaching anal aperture, 4.6 (4.1–4.7) in SL; pelvic-fin spine 3.1 (2.5–3.0) in length of longest pelvic-fin ray; pelvic frenum weakly developed, connecting membrane reaching tip of pelvic-fin spines.



**Figure 4.** *Vanderhorstia vandersteene*, male holotype stained with Cyanine Blue. From top— lateral, dorsal, and ventral head; sensory pores=outlined white spots; papillae=yellow spots; nares=yellow arrows (at top) and yellow outlines with AN and PN labels (Gerald R. Allen).

**Color of adult in life.** (Figs. 1, 2 & 5) Generally light neon blue, grading to greyish blue dorsally on head and upper back; wavy, black-edged yellow stripe, incorporating a single zig-zagging row of scales (with dusky brown outlines) on side of body from upper pectoral-fin base to upper third of caudal-fin base, including 4, ventrally directed V-shaped deflections below rear of first dorsal fin, below anterior and posterior second dorsal fin, and a fourth (poorly-defined) below dorsal edge of caudal peduncle; also a pronounced ventral deflection at beginning of lateral stripe, forming a black-edged, yellow, oblique band to upper rear edge of opercle, narrowly continuing ventrally along rear margin of opercle; upper back with series of about 9 black-edged, irregular, yellow markings above main wavy stripe, a few sometimes connected to main stripe; poorly defined, partially merged, yellowish spots and blotches along lower side above anal fin. Head with black or brown-edged, bright yellow markings including a wavy stripe (sometimes interrupted) from rear eye to side of nape (terminating above beginning of midlateral stripe), a broad bar across middle of opercle, a pair of shorter bars on cheek interspersed with three large spots, an irregular band above maxilla, a pair of short stripes on dorsal midline of nape (predorsal region), and a large spot on posterior interorbital; light neon-blue band below eye and similar neon-blue highlights on opercle and predorsal nape. First dorsal fin translucent with black or yellow spines, narrow yellow anterior margin, wavy yellow stripe basally, and white filamentous tip on elongated fourth dorsal-fin spine; second dorsal fin translucent with black rays (occasionally interrupted with yellow spots), and a pair of wavy, bright yellow stripes, one basally and another near margin; caudal fin translucent bluish with a pair of large, black-edged, yellow polygons basally on upper lobe and a series of yellow bands/streaks overlying most rays, except central one and basal part of two adjacent rays, also a yellow submarginal band on upper lobe; anal fin pale greenish-blue with a yellow submarginal stripe and a blue margin; pelvic fins translucent with dense microscopic whitish spots; pectoral fins translucent.



**Figure 5.** *Vanderhorstia vandersteene*, live paratype, female, 27.2 mm SL, East Cape region, Milne Bay Province, Papua New Guinea (Mark V. Erdmann).

TABLE 1

Proportional measurements of type specimens of  
*Vanderhorstia vandersteene*, n. sp.  
as percentages of the standard length

	holotype		paratypes		
	WAM P.35047-001	WAM P.35047-002	WAM P.35047-002	WAM P.35047-002	WAM P.35047-002
Sex	male	male	female	female	female
Standard length (mm)	32.2	31.5	27.8	27.2	17.5
Body depth at pelvic-fin origin	17.7	16.9	16.3	17.9	19.1
Body depth at anal-fin origin	14.1	15.1	14.2	14.1	15.2
Body width	11.6	11.1	11.6	11.8	13.0
Head length	26.5	25.6	26.4	25.3	29.1
Head width	12.4	13.2	13.4	13.8	13.9
Snout length	5.2	5.1	4.7	5.1	4.5
Orbit diameter	9.3	8.7	9.3	9.0	10.8
Interorbital width	1.0	0.9	0.5	0.2	0.1
Cheek depth	7.0	7.0	6.4	7.0	8.0
Upper-jaw length	10.5	9.8	10.7	9.9	11.1
Caudal-peduncle depth	9.3	9.3	8.6	9.5	9.8
Caudal-peduncle length	19.8	22.2	18.4	22.4	19.3
Predorsal length	32.5	33.2	32.5	33.7	36.7
Preanal length	57.2	56.8	57.4	56.0	57.7
Prepelvic length	30.9	31.4	32.6	31.0	33.8
Base of dorsal fin length	48.9	49.8	50.9	52.1	52.4
First dorsal-fin spine	16.1	17.0	14.5	14.9	13.5
Fourth dorsal-fin spine	27.4	35.5	33.7	22.1	21.8
Fifth dorsal-fin spine	11.1	9.8	10.7	9.4	11.4
Spine of second dorsal fin	12.3	10.7	12.0	13.8	13.6
Longest dorsal-fin ray	21.5	22.5	21.4	22.3	23.0
Base of anal-fin fin	27.4	26.0	24.1	23.4	23.8
Anal-fin spine	7.7	7.9	7.2	8.4	8.1
Longest anal-fin ray	19.4	20.8	20.5	21.9	18.5
Caudal-fin length	33.3	44.5	39.9	48.5	39.3
Pectoral-fin length	27.9	27.4	29.2	31.2	33.4
Pelvic-fin-spine length	6.9	7.2	7.6	damaged	9.9
Pelvic-fin length	21.6	22.0	21.5	damaged	24.3



**Figure 6.** *Vanderhorstia vandersteene*, live juvenile, approx. 15 mm SL, East Cape region, Milne Bay Province, Papua New Guinea (Gerald R. Allen).

**Color of juvenile in life.** (Fig. 6) Individuals under about 20 mm SL paler than adults, with ventral deflections of main yellow stripe continuing ventrally as either yellow bar (level of first dorsal fin), black bar (below anterior part of second dorsal), or intense black spots (below rear dorsal-fin base and on caudal peduncle); upper back with 7 or 8 yellow to yellowish brown saddle-like markings, and relatively large yellow patches along lowermost side between belly and caudal-fin base.

**Color in alcohol.** (Fig. 3) Generally tan to nearly whitish with main wavy stripe and markings on upper back and head as described above, but without yellow pigmentation; fins translucent with former yellow bands and stripes faintly evident as whitish markings when viewed on a dark background.

**Sexual dimorphism.** Unlike other members of the genus, there are no apparent color differences between sexes. The elongate fourth dorsal-fin spine is evident in both sexes, but is shorter in small individuals of either sex. The female genital papilla is barrel-shaped and rectangular in ventral view and that of the male is slender and conical.

**Etymology.** The new species is named *vandersteene*, which is treated as a noun in apposition for the combined surnames of Rob Vanderloos and Roger Steene, two highly esteemed underwater photographers who have contributed greatly to our knowledge of the reef fishes of Milne Bay and who have been loyal diving companions over the course of three decades of exploration of the region. It is a pleasure to name this stunning new species in their honor.





**Figure 7.** *Vanderhorstia attenuata*, live adult, approx. 35 mm SL, Alor, Lesser Sunda Islands, Indonesia (Gerald R. Allen),

**Distribution and habitat.** The new species is currently known only from the type locality, situated on the East Cape Peninsula of Milne Bay Province, Papua New Guinea, about 28 km northeast of the town of Alotau. The habitat consists of a relatively steep outer reef slope with fish occupying burrows on black volcanic sand/rubble substrates. About 20 individuals were observed in an area that occupied about 600 m<sup>2</sup>. Solitary individuals were encountered that were invariably associated with an unidentified snapping shrimp of the genus *Alpheus* that share the burrows, a symbiotic relationship found in all *Vanderhorstia* spp.

**Comparisons.** The color pattern of the new species differs markedly from all congeners. It also possesses the unique combination of a filamentous fourth dorsal-fin spine, 11 or 12 segmented dorsal-fin and anal-fin rays, 35–37 lateral scales, no predorsal scales, ctenoid and cycloid scales on the body, and a lanceolate caudal fin with an elongated median filament. The only species occurring in the East Indian region that bears a vague resemblance is *Vanderhorstia attenuata* Randall, 2007 (Fig. 7), which also has a double row of orange/yellow markings on the upper body, similarly colored bands and spots on the head, 35–39 lateral scales, and a similar caudal-fin shape. However, it differs in lacking a filamentous dorsal-fin spine and having predorsal scales. A poorly known species from the region, *Vanderhorstia longimanus* (Weber, 1909) (see Iwata et al. 2007) described from a single specimen captured in 118 m depth near Misool, West Papua Province, Indonesia has 11 segmented dorsal-fin and anal-fin rays, 30 or 31 lateral scales, a single predorsal scale, and a lanceolate caudal-fin shape, but strongly differs in having the first three dorsal-fin spines elongate and filamentous. An additional species, *Vanderhorstia auropunctata* (Tomiyama, 1955) from Japan has 11 dorsal-fin and anal-fin rays, about 40 lateral scales, and a scaleless predorsal region, but differs in lacking filamentous dorsal-fin spines, having an ovate caudal fin, and lacking scales on the pectoral-fin base. The new species is further compared with congeners possessing fewer than 45 lateral scales in the following key.

Key to species of *Vanderhorstia* with low lateral-scale counts (less than 45)

1a.	Lateral scales 30–45 .....	2
1b.	Lateral scales 25–29 .....	10
2a.	Predorsal scales present .....	3
2b.	Predorsal scales absent .....	7
3a.	Single predorsal scale; first three dorsal-fin spines filamentous (E. Indonesia) .....	<i>V. longimanus</i>
3b.	Predorsal scales 6–18 .....	4
4a.	Pelvic fins separated with low (about 25%) connecting membrane (Japan) .....	<i>V. kizakura</i>
4b.	Pelvic fins with complete connecting membrane .....	5
5a.	Segmented dorsal-fin rays 11; dorsal-fin spines non-filamentous (Western Pacific Ocean) .....	<i>V. macropteryx</i>
5b.	Segmented dorsal-fin rays 12; third dorsal-fin spine filamentous .....	6
6a.	Third dorsal-fin spine with a short filament, barely protruding above fin profile; 5 well-developed dark bars, including one across operculum (Japan) .....	<i>V. hiramatsui</i>
6b.	Third dorsal-fin spine with an elongate filament, protruding well above fin profile; 5 dark bars weakly developed rectangular blotches (excluding opercular bar) (Red Sea) .....	<i>V. opercularis</i>
7a.	Caudal fin bifurcate due to elongated fifth and ninth branched rays; pectoral-fin rays 16–19 (Western Pacific Ocean) .....	<i>V. nannai</i>
7b.	Caudal fin rounded or lanceolate; pectoral-fin rays 16–21 .....	8
8a.	Fourth dorsal-fin spine forming long filament; pectoral-fin rays 16–18 (Papua New Guinea) .....	<i>V. vandersteene</i>
8b.	Fourth dorsal-fin spine not elongated; pectoral-fin rays 20–21 .....	9
9a.	Fourth dorsal-fin spine longest or subequal to third spine; black blotch sometimes present between fourth and sixth spines (Japan) .....	<i>V. auropunctata</i>
9b.	Third dorsal-fin spine longest; no black blotch on first dorsal fin (Japan) .....	<i>V. rapa</i>
10a.	Third dorsal-fin spine elongate and filamentous .....	11
10b.	Third dorsal-fin spine neither elongate nor filamentous .....	12

- 11a. Dorsal-fin and anal-fin segmented rays 9; predorsal scales present (S. China Sea) ..... *V. stegauchenia*
- 11b. Dorsal-fin and anal-fin segmented rays 11 or 12; predorsal scales absent (China & Japan) ..... *V. puncticeps*
- 12a. Dorsal-fin and anal-fin segmented rays usually 11; third dorsal-fin spine sometimes with short filament; caudal fin emarginate to bifurcate (Western Pacific Ocean) ..... *V. papilio*
- 12b. Dorsal-fin and anal-fin segmented rays 12; no filament on third dorsal-fin spine; caudal fin lanceolate (Fiji) .....  
 ..... *V. atriclypea*

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