Journal of the
Ocean Science Foundation

2019, Volume 33

Vanderhorstia dawnarnallae, a new species of shrimpgoby (Pisces: Gobiidae) from West Papua, Indonesia

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

MEITY U. MONGDONG
Conservation International Indonesia Marine Program,
Jl. Dr. Muwardi No. 17, Renon, Denpasar 80235 Indonesia
E-mail: mmongdong@conservation.org

Abstract

A new species of gobiid fish, *Vanderhorstia dawnarnallae*, is described from West Papua Province, Indonesia, on the basis of two male specimens, 39.1 and 39.2 mm SL. Diagnostic features include 13 dorsal-fin and anal-fin segmented rays, third dorsal-fin spine long and filamentous, 47–49 lateral scales, body scales mostly cycloid, posteriormost scales of caudal peduncle finely ctenoid, and scales absent on head and nape region. Color in life is pale greyish to yellowish white with 5 mid-lateral clusters of blue-margined yellow spots with one or two vertical rows of 3–5 blue-margined yellow spots between clusters. The new species is most similar to *Vanderhorstia phaeosticta* from the western Pacific Ocean, but differs most notably in lacking pronounced sexual dichromatism.

Key words: taxonomy, systematics, ichthyology, coral-reef fishes, gobies, Indo-Pacific Ocean, symbiosis, Bird's Head Seascape

Citation: Allen, G.R., Erdmann, M.V. & Mongdong, M.U. (2019) *Vanderhorstia dawnarnallae*, a new species of shrimpgoby (Pisces: Gobiidae) from West Papua, Indonesia. *Journal of the Ocean Science Foundation*, 33, 89–98.
doi: https://doi.org/10.5281/zenodo.3519384
urn:lsid:zoobank.org:pub:4D7A40BB-D0C2-4CBE-8981-A065842D08B1

Date of publication of this version of record: 25 October 2019

Introduction

The Indo-Pacific gobiid fishes of the genus *Vanderhorstia* Smith, 1949 live symbiotically with alpheid snapping shrimps. There are 25 currently recognized species (Shibukawa & Suzuki 2004, Greenfield & Longenecker 2005, Winterbottom et al. 2005, Iwata et al. 2007, Randall 2007a, 2007b, Randall & Munday 2008, Allen & Erdmann 2012, Fricke et al. 2019). The present paper describes a new species from the Kaimana coastline of West Papua Province, Indonesia (western New Guinea). The new species belongs to the *Vanderhorstia ornatissima* species group and is distinguished by its color pattern, relatively low lateral-scale count, and apparent absence of pronounced sexual dichromatism.

Materials and Methods

Type specimens are deposited at Museum Zoologicum Bogoriense, Cibinong, Java, Indonesia (MZB) and the Western Australian Museum, Perth, 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. The count of scales in longitudinal series is made from above the dorsal end of the gill opening to the base of the caudal fin; scales in transverse series 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 dawnarnallae, n. sp.

Dawn's Shrimpgoby

urn:lsid:zoobank.org:act: F4750363-5144-42F6-936E-6AC63EF92AAD

Figures 1–5 & 7A; Table 1.

Holotype. MZB 25113, male, 39.1 mm SL, Indonesia, West Papua Province, Venu Island, -4.323°, 133.500°, 10–15 m, rotenone, M.V. Erdmann, 19 April 2019.

Paratype. WAM P.34972-002, male, 39.2 mm SL, same data as holotype except collected on 25 February 2019.

Diagnosis. Dorsal-fin elements VI–I,13; anal-fin elements I,13; pectoral-fin rays 19 or 20; lateral scales 47–49; circumpeduncular scales 13 or 14; body scales mostly cycloid, including embedded scales on pectoral-fin

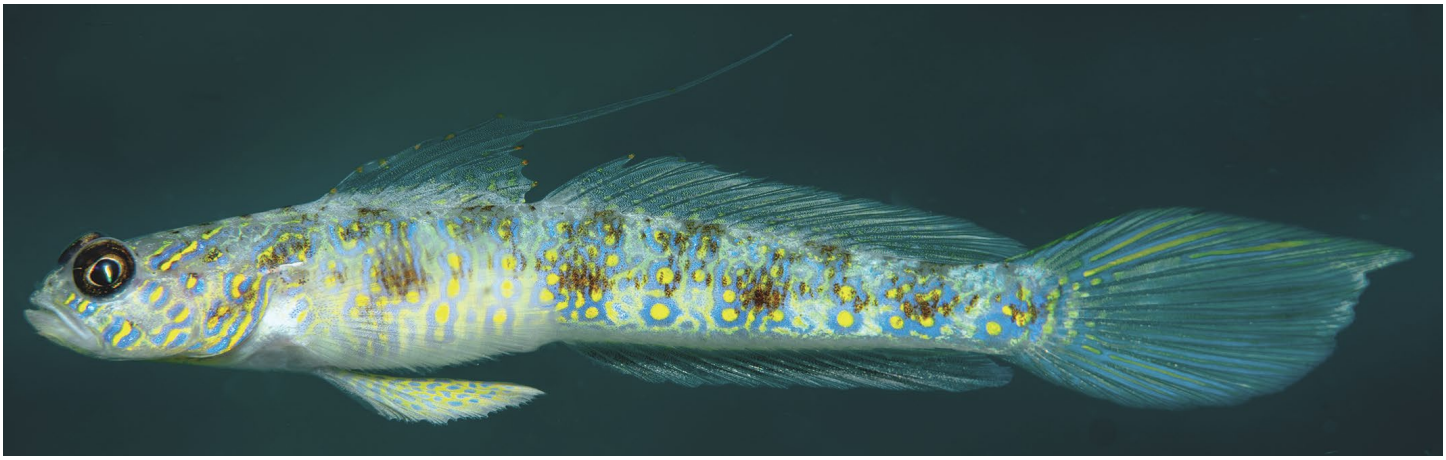

Figure 1. *Vanderhorstia dawnarnallae,* freshly collected paratype, male, 39.2 mm SL, Venu Island, West Papua Province, Indonesia. (M.V. Erdmann).

base and prepelvic region, posteriormost scales of caudal peduncle finely ctenoid, scales absent on head and nape; body elongate, depth 6.2–6.3 in SL at pelvic-fin origin; gill opening extending forward to about vertical at posterior edge of preopercle; dorsal spines progressively longer to third spine; third dorsal-fin spine elongate and filamentous, extending to base of tenth segmented dorsal-fin ray when adpressed, 2.0–2.3 in SL; caudal fin ovate with rounded margin, much longer than head, 2.5–2.6 in SL; pelvic fins joined medially, thin frenum; color in life pale greyish to yellowish white with 5 mid-lateral clusters of blue-margined yellow spots, darker in the center, with one or two vertical rows of 3–5 blue-margined yellow spots between clusters.

Description. Dorsal-fin elements VI–I,13; anal-fin elements I,13, all segmented dorsal-fin and anal-fin rays branched, (each major branch of last ray divided); pectoral rays 20 (19), all branched except upper and lowermost one or two rays; pelvic-fin elements I,5, all soft rays branched, the fifth rays joined medially with membrane, thin frenum; segmented caudal-fin rays 17; 14 (15) branched, 8 (7) upper and lower unsegmented rays; lateral scales 49 (47); transverse scales 14 (13); no scales on head or nape; median prepelvic scales 8 (9); circumpeduncular scales 13 (14); gill rakers 2+7 (2+9).

Body elongate, depth at pelvic-fin origin 6.3 (6.2) in SL, depth at anal-fin origin 7.0 (7.7) in SL; body compressed, width at pectoral-fin origin 1.6 (1.7) in body depth; head length 3.8 (4.1) in SL; head compressed, width 1.5 (1.6) in body depth; snout short, length 5.4 (4.8) in HL; orbit diameter 4.2 (3.6) in HL; interorbital space very narrow, least width 9.8 (15.6) in head width; caudal-peduncle depth 2.8 (2.9) in HL; caudal-peduncle length 1.6 (1.5) in HL.

Jaws oblique, forming an angle of about 40° to horizontal axis of body, lower jaw projecting; mouth large, maxilla reaching vertical at anterior edge of orbit, upper-jaw length 3.1 in HL; front of upper jaw with three incurved, slender, enlarged canine teeth on each side, with a row of smaller, more incurved teeth behind; side of upper jaw with a singe row of slender conical teeth; front of lower jaw with two or three rows of slender conical teeth, including three enlarged teeth on each side of median symphysis in outer row, inner row with three or four progressively larger, recurved canines about one-third back in jaw and remainder of jaw with a single row of slender conical teeth; no teeth on vomer or palatines; roof of mouth with prominent well-spaced papillae; edge of lips smooth; tongue slender with anterior truncate margin, median tip slightly produced; no distinct mental flap. Posterior nostril a large, nearly round 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 naris just above edge of upper lip.Gill opening extending forward to vertical at posterior edge of preopercle; gill membranes attached only anteriorly to isthmus, with no free fold; gill rakers relatively short, the longest about one-half to two-thirds length of longest gill filaments of first gill arch. Pattern of cephalic sensory-canal pores and papilla rows as illustrated in Fig. 2. 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 interobital space. Most papillae rows uniserial or comprising a single papilla, not forming multiple lines or aggregations except a double row between oculoscapular-canal pores H' and K'.

Scales on body progressively larger posteriorly, mostly cycloid, including embedded scales on pectoral-fin base and prepelvic region; posteriormost scales of caudal peduncle finely ctenoid; scales absent on head, including

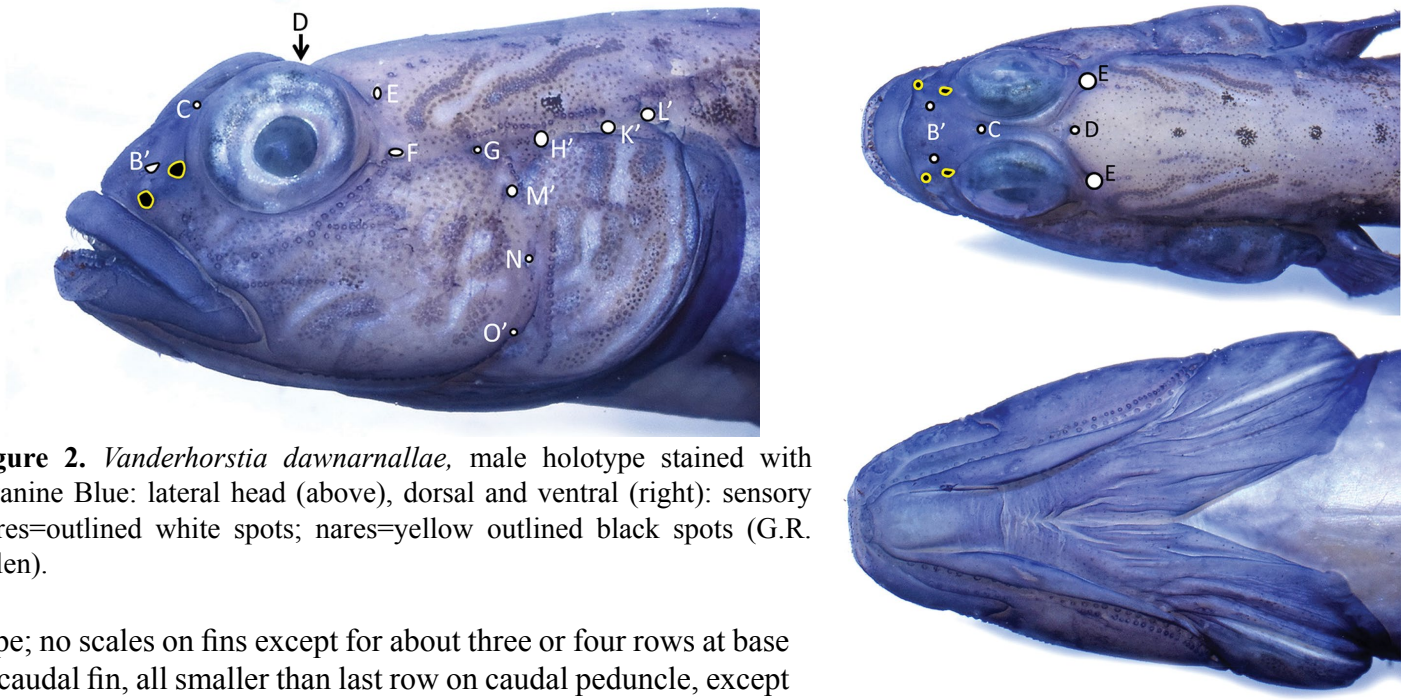

Figure 2. *Vanderhorstia dawnarnallae,* male holotype stained with Cyanine Blue: lateral head (above), dorsal and ventral (right): sensory pores=outlined white spots; nares=yellow outlined black spots (G.R. Allen).

nape; no scales on fins except for about three or four rows at base of caudal fin, all smaller than last row on caudal peduncle, except first midlateral scale.

Origin of first dorsal fin about even with level of pelvic-fin origin, predorsal length 3.5 (3.3) in SL; dorsal-fin spines slender and flexible, third filamentous and reaching to base of about tenth segmented dorsal-fin ray when adpressed; first dorsal-fin spine 1.7 in HL; third dorsal-fin spine, 2.3 (2.0) in SL; membrane of first dorsal fin ending at origin of second dorsal fin; spine of second dorsal fin 1.9 (2.1) in HL; penultimate dorsal-fin soft ray longest, 1.3 in HL; origin of anal fin below base of first or second dorsal-fin soft ray, preanal length 1.8 in SL; anal-fin spine 3.4 (3.1) in HL; penultimate anal-fin soft ray longest, 1.3 in HL; caudal fin ovate, longer than head, 2.6 (2.5) in SL; pectoral fins pointed, middle rays longest, reaching to level of first dorsal soft ray, 3.2 (3.4) in SL; prepelvic length 3.6 (3.4) in SL; pelvic fins reaching to genital papilla, 3.8 (4.1) in SL; pelvic-fin spine 3.7 (3.3) in length of longest pelvic-fin ray; pelvic fins joined by membrane medially, thin frenum reaching tip of pelvic-fin spines.

Figure 3. *Vanderhorstia dawnarnallae,* preserved male holotype (upper), 39.1 mm SL, and male paratype (lower), 39.2 mm SL, Venu Island, West Papua Province, Indonesia (G.R. Allen).

Figure 4. *Vanderhorstia dawnarnallae,* underwater photograph of adult pair, approximately 40 mm SL, Venu Island, West Papua Province, Indonesia (G.R. Allen).

Figure 5. *Vanderhorstia dawnarnallae,* underwater photograph of adult pair, approximately 40 mm SL, with symbiotic alpheid shrimp, Venu Island, West Papua Province, Indonesia (M.V. Erdmann).

Color in life. (Figs. 1 & 4, 5 & 7A) Body pale greyish to yellowish white with 5 mid-lateral clusters of blue-margined yellow spots, first below middle of first dorsal fin, second below first few rays of second dorsal fin, third below middle of second dorsal fin, fourth on anterior caudal peduncle, and fifth on caudal-fin base; a single vertical row of 3–5 blue-margined yellow spots between each of the main clusters, except two rows between first and second clusters (i.e. below posterior half of first dorsal fin); each of 5 main clusters of blue-margined yellow spots overlaid with a large reddish-brown blotch, smaller red-brown spots scattered on upper half of body including about 5 or 6 along base of dorsal fin. Head, including side of snout, cheek, opercle, and side of nape, prominently marked with blue-and-yellow bands of variable length; iris with golden to bronze-colored ring around pupil and dark brown spots or marbling on scleral surface; median fins and pectorals mainly translucent, except blue-and-yellow markings on pectoral-fin base, brown flecks on dorsal fin (including 4 or 5 along anterior edge of first dorsal fin), and caudal fin with yellow spots on basal portion and blue-and-yellow longitudinal streaks on membranes (yellow streaks most prominent on upper third of fin); pelvic fins pale yellow with blue spots.

Color in alcohol. (Fig. 3) Head and body generally greyish white with head and body markings as described in life, except white instead of yellow, and grey replacing blue; brownish markings on midlateral and upper side also as in life; fins translucent whitish with faint greyish spots on pelvic fins.

Sexual dimorphism. Unlike other members of the genus, there appears to be minimal color differences between the sexes, judging from presumably male-female pairs cohabiting burrows (Figs. 4 & 5). The only apparent difference detected was a much shorter filament on the first dorsal fin of females.

Etymology. The new species is named *dawnarnallae* in honour of Dawn Arnall, who both funded the expedition that led to the discovery of this species and has provided critical support and advice to the Bird's Head Seascape

Figure 6. *Vanderhorstia ornatissima* (A), underwater photograph, approx. 40 mm SL, southwestern Madagascar; *Vanderhorstia wayag* (B), underwater photograph, approx. 40 mm SL, Raja Ampat Islands, West Papua Province, Indonesia (G.R. Allen).

TABLE 1

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

	holotype	paratype
	MZB 25113	WAM P.34972-002
Sex	male	male
Standard length (mm)	39.1	39.2
Body depth at pelvic-fin origin	15.8	16.2
Body depth at anal-fin origin	14.3	13.0
Body width	10.2	9.8
Head length	26.1	24.4
Head width	10.5	9.9
Snout length	4.9	5.1
Orbit diameter	6.2	6.8
Interorbital width	1.1	0.6
Cheek depth	5.8	5.4
Upper-jaw length	8.5	7.8
Caudal-peduncle depth	9.2	8.5
Caudal-peduncle length	16.3	16.4
Predorsal length	29.0	30.5
Preanal length	54.7	55.6
Prepelvic length	27.7	29.6
Base of dorsal fin length	55.5	55.9
First dorsal-fin spine	15.7	14.4
Third dorsal-fin spine	43.4	50.9
Fifth dorsal-fin spine	13.5	13.8
Spine of second dorsal fin	13.6	11.4
Longest dorsal-fin ray	19.5	18.8
Base of anal-fin fin	29.9	30.3
Anal-fin spine	7.8	7.9
Longest anal-fin ray	20.3	18.9
Caudal-fin length	38.3	40.0
Pectoral-fin length	30.8	29.4
Pelvic-fin-spine length	7.1	7.4
Pelvic-fin length	26.2	24.4

marine conservation initiative that now protects the habitat of this new species. It is a pleasure and an honor to name this beautiful shrimp goby in recognition of her invaluable support.

Distribution and habitat. The species is currently known only from the type locality, about 80 km southwest of the town of Kaimana, West Papua Province, Indonesia. The habitat consists of a gently sloping bottom with clean white sand and was well-removed (more than 100 m) from reef habitat, in an area exposed to periodic strong currents, at a depth of about 10–20 m. An estimated 20 individuals were observed in an area approximately 30 m^2. They were seen mainly in pairs (Figs. 4 & 5), but occasionally solitary, although invariably associated with an unidentified snapping shrimp of the genus *Alpheus* that share the burrows (Fig. 5), a symbiotic relationship found in all *Vanderhorstia* spp.

Comparisons. The new species belongs to the *ornatissima* group of *Vanderhorstia*, which includes *Vanderhorstia ornatissima* Smith, 1959 from the western Indian Ocean (Fig. 6A), and two species from the western Pacific region: *Vanderhorstia wayag* Allen & Erdmann, 2012 (Fig. 6B) and *Vanderhorstia phaeosticta* (Randall, Shao & Shen, 2007) (Fig. 7). The members of the group possess similar color patterns and usual counts of 13 dorsal-fin and anal-fin rays. *Vanderhorstia dawnarnallae* differs from *V. ornatissima* and *V. wayag* in possessing fewer lateral scales (47–49 vs. 57–65) and also in color pattern, particularly yellow spots on the body (vs. none in the latter two species); the absence of a pair of small dark spots on the upper and lower pectoral-fin base (vs. present); and fewer dark markings (vs. more dark brown or reddish-brown spots on the side of the body) (see Fig.

Figure 7. *Vanderhorstia dawnarnallae* (A), underwater photograph, approximately 40 mm SL, Venu Island, West Papua, Province, Indonesia; *Vanderhorstia phaeosticta*, (B) male, (C) female, both Timor Leste (G.R. Allen).

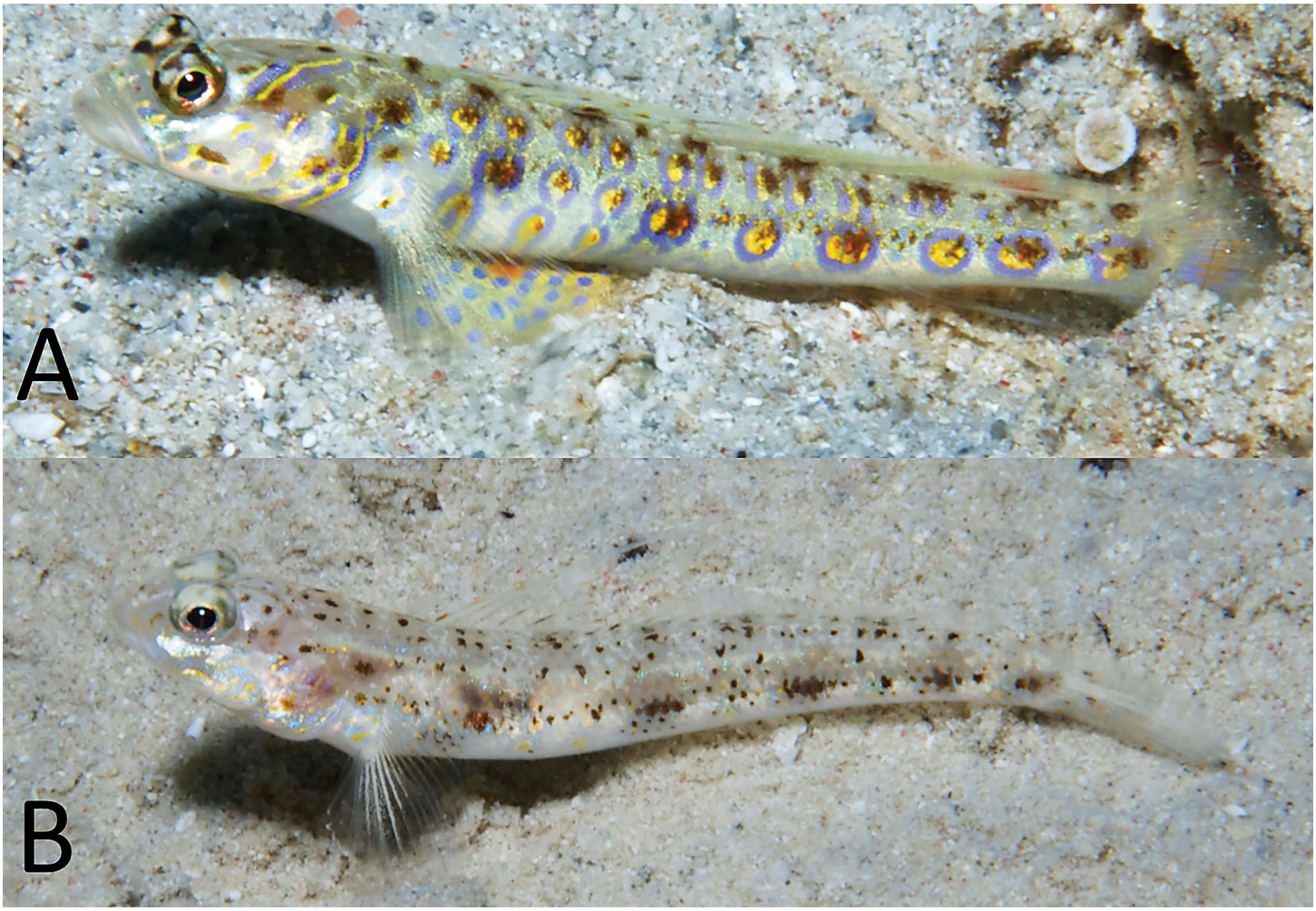

Figure 8. *Vanderhorstia* sp., underwater photographs, male (A) and female (B), approximately 35–40 mm SL, Western Samoa (M.V. Erdmann).

6). *Vanderhorstia wayag* is distinguished from the others by a red submarginal stripe on the outer pelvic fin and *V. ornatissima* by a narrow dark stripe on the basal part of the first dorsal fin.

The new species appears most similar to *V. phaeosticta*, sharing a low lateral-scale count (46–52), yellow or orange spots on the lateral body, head markings, and a blue-spotted, yellow pelvic fin. However, *V. phaeosticta* differs in having a pair of small dark spots on the upper and lower pectoral-fin base (not clearly evident in Fig. 7). In addition, *V. phaeosticta* differs markedly in being strongly sexually dichromatic (Fig. 8) in contrast to *V. dawnarnallae*, which exhibits minimal color differences between the sexes. Female *V. phaeosticta* lack yellow or orange spots on the body and have a plain translucent pelvic fin, while the male has a red submarginal pelvic-fin stripe and a more ornately marked caudal fin.

The new species is also similar to an apparent undescribed species that ranges across the southwestern Pacific including New Caledonia, Fiji, and Samoa. Although the adult male (Fig. 8A) is similar to *V. dawnarnallae*, the female pattern (Fig. 8B) differs significantly and resembles that of *V. phaeosticta*.

Acknowledgments

We are grateful to Dawn Arnall and Hayley Bailey, who invited us to join cruises to West Papua Province aboard the charter vessels *Si Datu Bua* and *Seven Seas*, respectively, in February and April 2019. We also thank Dawn, Hayley, Sarah Argyropoulos, and Nyoman for their assistance underwater and the excellent logistic assistance provided by the crews of both vessels. Mark Allen (WAM) provided x-rays and curatorial assistance and Ilham Vemandra Utama (MZB) provided the registration number for the holotype. We gratefully acknowledge the local government of Kaimana for support of Conservation International's marine conservation

initiatives in the Bird's Head region. We are also indebted to the Paine Family Trust and the Henry Foundation for their continued support of our taxonomic research. The manuscript was reviewed by two anonymous referees.

References

Akihito (1984) Suborder Gobiodei. *In*: Masuda, H., Amaoka, K., Araga, C., Uyeno, T. & Yoshino, T. (Eds.) *Fishes of the Japanese Archipelago*. Tokai University Press, Tokyo, Japan [English text], pp. 236–238.

Akihito, Sakamoto, K., Iwata, A. & Ikeda, Y. (1993) Cephalic sensory organs of the gobioid fishes. *In*: Nakabo, T. (Ed.), *Fishes of Japan with pictorial keys to the species*. Tokai University Press, Tokyo, Japan, pp. 1088–1116. [In Japanese]

Allen, G.R. & Erdmann, M.V. (2012) *Reef fishes of the East Indies.* Tropical Reef Research, Perth, Australia, 856 pp.

Fricke, R., Eschmeyer, W. N. & Van der Laan, R. (Eds.) (2019) *Eschmeyer's Catalog of Fishes: Genera, Species, References, electronic version (7 October 2019)*, San Francisco, CA, USA. Available at http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp (last accessed 8 October 2019).

Greenfield, D.W. & Longenecker, K.R. (2005) *Vanderhorstia bella*, a new goby from Fiji (Teleostei: Gobiidae). *Proceedings of the California Academy of Sciences*, 56 (2), 619–623.

Iwata, A., Shibukawa, K. & Ohnishi, N. (2007) Three new species of the shrimp-associated goby genus *Vanderhorstia* (Perciformes: Gobiidae: Gobiinae) from Japan, with re-descriptions of two related congeners. *Bulletin of the National Museum of Nature and Science (Ser. A)*, Supplement 1, 185–205.

Randall, J.E. (2007a) Descriptions of four new shrimpgobies of the genus *Vanderhorstia* from the western Pacific. *Aqua, International Journal of Ichthyology*, 12 (3), 89–100.

Randall, J.E. (2007b) *Vanderhorstia opercularis*, a new shrimp goby from the northern Red Sea. *Electronic Journal of Ichthyology, Bulletin of the European Ichthyology Society*, 3 (1), 18–25.

Randall, J.E. & Munday, P.L. (2008) *Vanderhorstia steelei*, a new shrimpgoby from the Society Islands. *Aqua, International Journal of Ichthyology*, 14 (1), 35–41.

Randall, J.E., Shao K.-T. & Chen J.-P. (2007) Two new shrimp gobies of the genus *Ctenogobiops* (Perciformes: Gobiidae), from the western Pacific. *Zoological Studies*, 46 (1), 26–34.

Saruwatari, T., Lopez, J.A. & Pietsch, T.W. (1997) Cyanine blue: a versatile and harmless stain for specimen observations. *Copeia*, 1997 (4), 840–841. https://doi.org/10.2307/1447302

Senou, H., Suzuki, T., Shibukawa, K. & Yano, K. (2004) A Photographic Guide to the Gobioid Fishes of Japan. Heibonsha, Ltd., Tokyo, Japan, 534 pp. [in Japanese]

Shibukawa, K. & Suzuki, T. (2004) *Vanderhorstia papilio*, a new shrimp-associated goby from the Ryukyu Islands, Japan (Perciformes: Gobiidae: Gobiinae), with comments on the limits of the genus. *Ichthyological Research*, 51, 113–119.

Smith, J.L.B. (1949) Forty-two fishes new to South Africa, with notes on others. *Annals and Magazine of Natural History (Series 12)*, 2 (14) , 97–111.

Winterbottom, R., Iwata, A. & Kozawa, T. (2005) *Vanderhorstia nannai*, a new species of burrow-associated goby from Palau and the Philippines (Pisces: Gobiidae). *Aqua, Journal of Ichthyology and Aquatic Biology*, 9 (3), 109–114.