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Acknowledgements

TS wishes to thank K. Hatooka (OMNH), K. Okano, T. Seko (Spitz Diving Center) , H. Senou (KPM), M. Suzuki, K. Yano (Yano Diving Service) for their kind assistance for this work. ISC wishes to thank the grant support from NSC, Taipei.

TWO NEW SPECIES OF *Vanderhorstia* SMITH, 1949 (TELEOSTEI: GOBIIDAE) FROM THE RYUKYUS, JAPAN

Toshiyuki Suzuki¹ and I-Shiung Chen²

Key words: *Vanderhorstia*, new species, shrimp goby, Gobiidae, fish fauna, Japan.

ABSTRACT

Two new gobiid species of *Vanderhorstia* Smith, 1959 which have been recently collected from Japanese waters. Both new species are distributed in marine coral reef habitats off the Ryukyus, Japan. *Vanderhorstia cyanolineata* sp. nov. can be well distinguished from congeners by the following unique combination of features: (1) fin ray counts: second dorsal fin rays I/12, anal fin rays I/12; pectoral fin rays 18-19; (2) fin shape: low first dorsal fin with about equal 3rd to 5th spinous rays, caudal fin large and middle rays as sword-like projection; (3) scales: LR 50-52; TR 18; and (4) its own specific colouration mentioned below. *Vanderhorstia fulvopelvis* sp. nov. can be well distinguished from congeners by the following unique combination of features: (1) fin ray counts: second dorsal fin rays I/12, anal fin rays I/12; pectoral fin rays 17; (2) fin shape: D1 in lacking any filamentous ray; C large with larger upper lobe forming as pointed tip; (3) scales: LR 46-47; TR 16; and (4) their own specific colouration. The diagnosis, formal descriptions and color images of specimens as well as underwater photo records will be provided in this paper.

I. INTRODUCTION

The gobiid fishes in Family Gobiidae comprise the most diverse group among teleost fishes [8, 17]. Marine gobies especially in coral reef associated habitats have quite a few varieties of genera with symbiotic relationship with marine invertebrates. Among them, the Indo-Pacific gobiid genus of *Vanderhorstia*, a group of shrimp associated, marine goby symbiotic with shrimps of genus *Alpheus* with typically in-

fraorbital longitudinal papilla pattern was formally described by Smith, 1949 [5] based on the type species, *Gobius delagoae* Barnard, 1937 [5]. Smith, 1959 [24] also described another species from Indian Ocean and provided a brief diagnosis for the genus. In this genus, 25 described species are currently recognized as valid: *Vanderhorstia ambanoro* (Fourmanoir, 1957) [11], *Vanderhorstia atriclypea* (Garman, 1903) [5], *Vanderhorstia attenuata* Randall, 2007b [19], *Vanderhorstia auronotata* Randall 2007b [19], *Vanderhorstia auropunctata* (Tomiyama, 1955) [28], *Vanderhorstia bella* Greenfield and Longenecker, 2005 [14], *Vanderhorstia belloides* Randall, 2007b [19], *Vanderhorstia delagoae* (Barnard, 1937) [5], *Vanderhorstia dorsomacula* Randall, 2007b [19], *Vanderhorstia flavilineata* Allen and Munday, 1995 [3], *Vanderhorstia hiramatsui* Iwata, Shibukawa and Ohnishi, 2007 [15], *Vanderhorstia kizakura* Iwata, Shibukawa and Ohnishi, 2007 [15], *Vanderhorstia longimanus* (Weber, 1909) [28], *Vanderhorstia macropteryx* Frantz, 1910 [12], *Vanderhorstia mertensi* Klausewitz, 1974 [16], *Vanderhorstia nannai* Winterbottom, Iwata and Kozawa, 2005 [31], *Vanderhorstia nobilis* Allen and Randall, 2006 [4], *Vanderhorstia opercularis* Randall, 2007a [18], *Vanderhorstia ornatissima* Smith, 1959 [24], *Vanderhorstia phaeosticta* (Randall, Shoa and Chen, 2007) [21], *Vanderhorstia papilio* Shibukawa and Suzuki, 2004 [22], *Vanderhorstia puncticeps* (Deng and Xiong in Xu *et al.*, 1980) [31], *Vanderhorstia rapa* Iwata, Shibukawa and Ohnishi, 2007 [15], *Vanderhorstia steelei* Randall and Munday, 2008 [21] and *Vanderhorstia wayag* Allen and Erdmann, 2012 [2].

In Japan, there are 10 valid species of *Vanderhorstia* have been described or reported so far including: *Vanderhorstia ambanoro*, *V. auropunctata*, *V. hiramatsui*, *V. kizakura*, *V. macropteryx*, *V. papilio*, *V. puncticeps*, *V. rapa* and *V. wayag* as well as 4 highly possibly undescribed species ever listed by Suzuki and Shibukawa in Senou [15, 21, 25].

More recently, two unusual and rare gobiid species have been collected from Japanese waters. After the detailed taxonomic research, they are belonging to two species of *Vanderhorstia* which are new to science.

The diagnosis, full descriptions and specimen photos as well as underwater alive images of these two new species of *Vanderhorstia* from Japanese waters will be provided in this paper.

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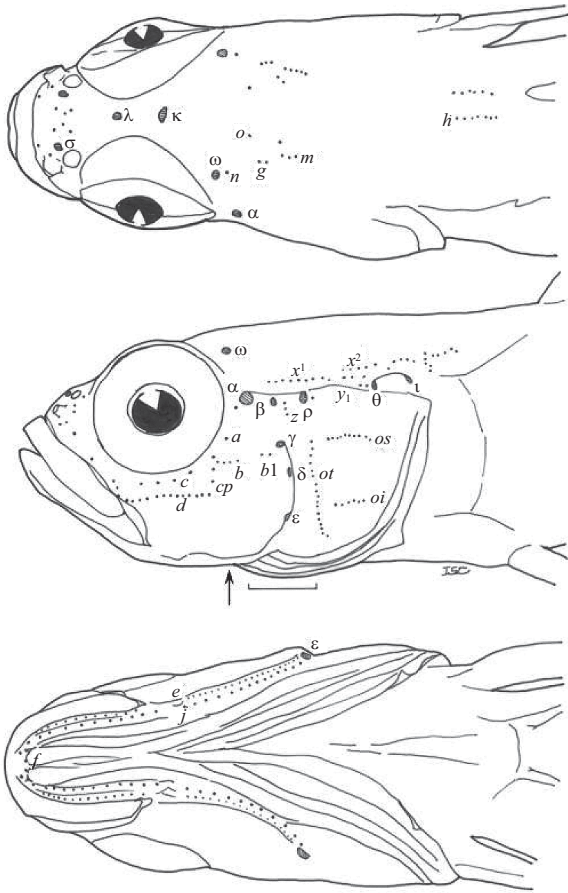


Fig. 1. Head lateral-line system of *Vanderhorstia cyanolineata*, OMNH-P 37882, holotype, 24.1 mm SL, Okinawa-jima Island, Japan. Illustration by I-S. Chen.

II. MATERIALS AND METHODS

All counts and measurements were made from the specimen preserved in 70% ethanol after 10% formalin treatment. Morphometric methods generally follow Miller [17], Suzuki *et al.* [27] and mersitic methods follow Akihito *et al.* [1], Chen and Shao [9], Chen *et al.* [10], Chen and Fang [6]. Terminology of cephalic sensory canals and free neuromast organ (sensory papillae) is from Wangrat and Miller [28], Chen *et al.* [10] and Chen and Fang [6, 7]. Descriptions of the fresh preserved and live coloration are based on color slides and the Image Database of Fishes of the Kanagawa Prefectural Museum of Natural History (KPM-NR) (<http://research.kahaku.go.jp/zoology/photoDB/>). The specimens are deposited at the Osaka Museum of Natural History, Osaka (OMNH-P), Japan.

Meristic abbreviations: A, anal fin; C, caudal fin; D1, and D2, 1st and 2nd dorsal fin respectively; LR, longitudinal scale series; P, pectoral fin; PreD, predorsal scales; SDP, scale series from origin of 1st dorsal fin to upper pectoral fin origin; TR, transverse scale series from second dorsal to anal fins; V, pelvic fin; VC, vertebral count. The fish lengths are standard length (SL).

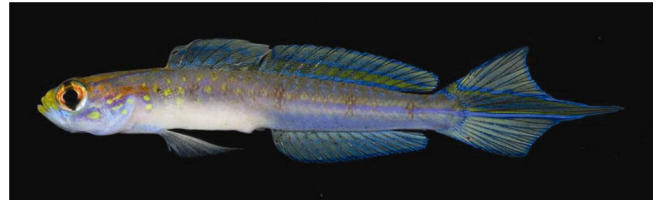


Fig. 2. *Vanderhorstia cyanolineata*, OMNH-P 37882, holotype, 24.1 mm SL, Okinawa-jima Island, Japan.



Fig. 3. *Vanderhorstia cyanolineata*, underwaterphoto, KPM-NR 44940, Okinawa-jima Island, the Ryukyu Islands, Japan, 30 m depth, 8 June 2011, photo by Toru Seko.

III. SYSTEMATICS

Family GOBIIDAE

Vanderhorstia cyanolineata sp. nov.

[New Japanese name: Aosujiyatsushi-haze]

(Figs. 1-3)

Material examined:

Holotype.- OMNH-P 37882, 24.1 mm SL, 30 m depth, Kyoda, 26°32'48.9"N 127°57'29.9"E, Nago Inlet, Okinawa-jima Island, the Ryukyu Islands, Japan, 5 July 2011.

Photograph Records from Image Database of Fishes.

KPM-NR 80594, Bali Island, Indonesia, 3 m depth, Aug. 1999, Kazuyuki Okano. KPM-NR 44940, same locality of the holotype, 8 June 2011, Toru Seko.

Diagnosis.

This species can be distinguished from other congeners by the following unique combination of features: (1) fin ray counts: second dorsal fin rays I/12, anal fin rays I/12; pectoral fin rays 18-19; (2) fin shape: low first dorsal fin with about equal 3rd to 5th spinous rays, caudal fin large and middle rays as sword-like projection; (3) scales: LR 50-52; TR 18; cheek, opercle, predorsal and prepectoral regions naked; (4) canal pores: lateral extension of anterior oculoscapular canal with turning pore α, median pore β and terminal pore ρ; posterior oculoscapular canal with two terminal pores θ and ι; and (5) specific coloration: Body with median longitudinal purplish blue stripe and four main narrow transverse pale brown bars. Anterior half of trunk with many rounded yellow spots. Head

Table 1. Morphometry of two new species of *Vanderhorstia* from Japan.

Species name	<i>V. cyanolineata</i>	<i>V. fulvopelvis</i>
Cat. No.	OMNH-P 37882	OMNH-P 35287
SL (mm)	24.1	18.2
% in SL		
Head length (HL)	23.4	28.4
Predorsal length	30.4	33.3
Snout to 2 nd dorsal origin	51.8	52.3
Snout to anus	56.2	50.5
Snout to anal fin origin	59.1	53.4
Prepelvic length	28.8	30.4
Caudal peduncle length	13.2	15.0
Caudal peduncle depth	8.8	8.9
1 st dorsal fin base	21.9	18.6
Length of longest D1 rays	19.6	12.7
2 nd dorsal fin base	36.8	32.6
Length of last D2 rays	12.4	10.6
Anal fin base	30.9	31.4
Caudal fin length	46.3	28.0
Pectoral fin length	20.0	23.6
Pelvic fin length	17.3	21.4
Body depth of pelvic fin origin	15.3	15.3
Body depth of anal fin origin	13.9	13.7
Body width of anal fin origin	7.8	7.3
Pelvic fin origin to anus	24.2	18.2
% in HL		
Snout length	12.8	18.6
Eye diameter	34.5	27.9
Postorbital length	53.8	49.0
Cheek depth	34.6	21.3
Head width in upper gill opening	40.7	32.2
Head width in maximum	56.5	41.5
Bony interorbital width	9.8	4.1
Fleshy interorbital width	28.2	14.1
Lower jaw length	49.7	36.8

with a longitudinal purplish blue line. Eye with a vertical brown band crossing the pupil. Snout and lips shiny with yellow and light blue regions. Second dorsal fin with two longitudinal rows of yellow stripes. Caudal fin with two longitudinal blue stripes. Pectoral fin base with two yellow spots.

Description.

Body slender and compressed. Head compressed. All morphometric data of the type specimen is shown in Table 1. Eye very large and high. Snout very short. Bony interorbital very narrow. Mouth large and oblique, extending to middle vertical of orbit. Both jaws with 1-2 rows of conical teeth, lower jaw

with two pairs of large canines. Gill-opening rather large, extending forward ventrally to a vertical at posterior edge of orbit. Anus located about the middle of body. VC 10 + 16 = 26.

Fins.- D1 VI, D2 I/12, A I/12, P 18-19, V I/5+I/5. D1 with long fin base but low dorsal profile with 3-5 spinous rays about equal. D1 and D2 membranes almost connected. The rear tip of D1 reaching the base of 1st branched ray when appressed. The rear tip of D2 extending to procurrent rays of caudal fin base when appressed. C large and forming a sword-like extension in middle rays, and upper and lower extreme of C rays pointed representing as two upper and lower concave profiles of distal margin. P large and elliptical. V as a sucking disc with rear tip extending to anus.

Scales.- Body with small weak ctenoid scales posteriorly; progressively smaller and becoming cycloid scales anteriorly. LR 50-52; TR 18; PreD 0; SDP 7. Predorsal middle region entirely naked. Cheek, opercle and prepectoral region naked.

Head lateral-line system.

Canals.- Nasal extension of anterior oculoscapular canal with terminal pore σ located above middle of both nostrils. Anterior interorbital groove with single pore λ . Posterior region with single pore κ . Pore ω present near posterior edge of eye. Lateral extension of anterior oculoscapular canal with turning pore α , median pore β and terminal pore ρ . Posterior oculoscapular canal with two terminal pores θ and ι . Preopercular canal with three pores γ , δ and ϵ .

Sensory papillae.- Row *a* longitudinal and short. Row *b* separated with posterior row *b1*. Row *c* longitudinal. Row *d* with densely set of papillae. A single *cp* papilla. Row *f* paired. The anterior edge of row *oi* not connected transverse row *ot*. Other papillae shown in detail as Fig. 1.

Color of holotype when freshly collected (Fig. 2).

Body generally creamy white background with median longitudinal purplish blue stripe and four main narrow transverse pale brown bars. Anterior half of trunk with many somewhat rounded yellow spots following with a longitudinal yellow stripe above the longitudinal purplish blue stripe after a vertical at anus. Belly snow white. Head creamy white with a longitudinal purplish blue line from cheek to opercle. Several orange bars behind orbit. Eye with a broad, vertical brown band crossing the pupil and other region of iris orange. Snout and upper lips with upper shiny yellow and lower bluish regions. Groove between snout and upper lip with a deep black streak.

First dorsal fin translucent with two longitudinal rows of large yellow marks against light blue background. Second dorsal fin translucent with two longitudinal rows of yellow stripes against light blue background. Anal fin uniformly creamy yellow. Caudal fin creamy yellow with two longitudinal blue stripes, one on upper lobe and the other along the

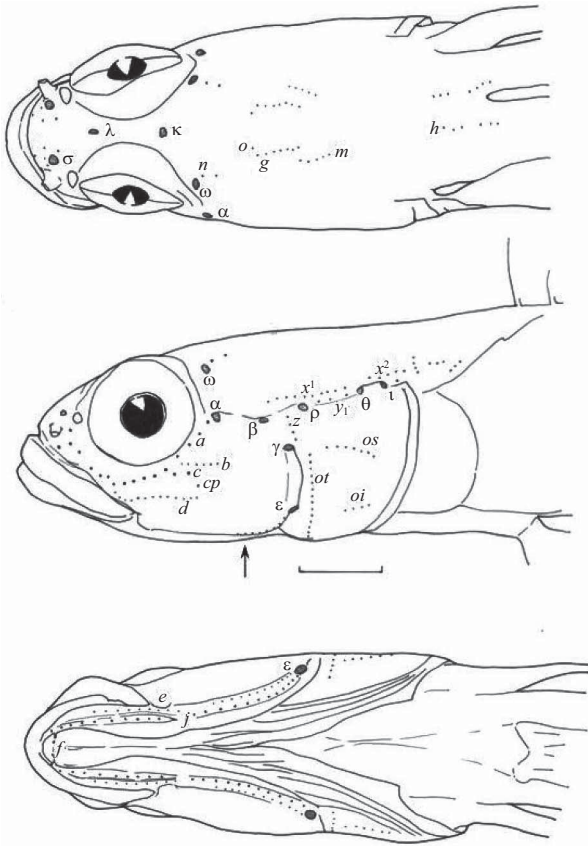


Fig. 4. Head lateral-line system of *Vanderhorstia fulvopelvis*, OMNH-P 35287, holotype, 18.2 mm SL, Okinawa-jima Island, Japan.

middle line continuously from body purplish blue stripe. Pectoral fin translucent and its base with two yellow spots. Pelvic fin pale white.

Color of holotype in alcoholic preservation.-

All bright color including yellow, orange and blue colouration faded. The pale brown cross-bars of trunk still present as pale gray. Other dark marks patterns similar to the pigmentation patterns mentioned above.

Distribution.- So far, this new species is found from Okinawa-jima Island and Iriomote-jima Island (K. Yano's personal communication), Japan. And Bali Island, Indonesia from underwater photo.

Etymology.- The specific name, "*cyanolineata*" derived from Latin "*ciano* + *lineatus*" means "blue + line" the diagnostic feature of a conspicuous longitudinal purplish blue stripe from middle body crossing through entire middle region of caudal fin.

Remarks.

This new species can be very well distinguished from other congeners by its unique alive coloration as 2 main longitudinal

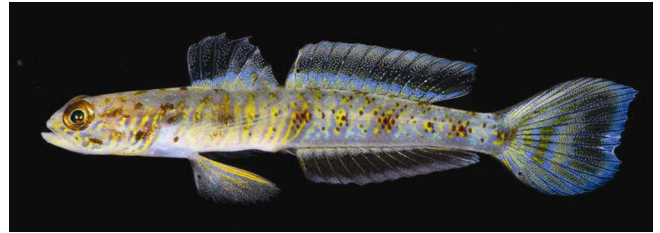


Fig. 5. *Vanderhorstia fulvopelvis*, OMNH-P 35287, holotype, 18.2 mm SL, Okinawa-jima Island, Japan.

rows of brilliant yellow rounded spots on lateral body with a very distinct sword-like caudal fin.

Vanderhorstia fulvopelvis sp. nov.

[New Japanese name: Himeyatsushi-haze]

(Figs. 4-5)

Material examined:

Holotype.- OMNH-P 35287, 18.2 mm SL, 5 m depth, Kyoda, 26°32'48.9"N 127°57'29.9"E, Nago Inlet, Okinawa-jima Island, the Ryukyu Islands, Japan, 21 Aug. 2009

Diagnosis.

This species can be distinguished from other congeners by the following unique combination of features: (1) fin ray counts: second dorsal fin rays I/12, anal fin rays I/12; pectoral fin rays 17; (2) fin shape: D1 in lacking any filamentous ray; D1 and D2 membranes very close to each other; C large with larger upper lobe forming as pointed tip; (3) scales: LR 46-47; TR 16; cheek, opercle, predorsal and prepectoral region naked; (4) canal pores: lateral extension of anterior oculoscapular canal with turning pore α , median pore β and terminal pore ρ ; posterior oculoscapular canal with two terminal pores θ and ι ; and (5) specific colouration: Trunk with four larger patches and four small patches of deep brown spots along lateral midline. Anterior half of trunk with about 12 oblique, densely-set shiny yellow stripes. Head with about 9 parallel thin yellow lines from snout to rear of opercle. Cheek with a horizontal deep brown bar. Second dorsal fin translucent with limited basal yellow marks and broader light blue bands just above. Caudal fin with two vertical light blue bands and distal light blue margin. Pelvic fin with distinct median yellow mark.

Description.

Body slender and compressed. Head compressed. All morphometric data of the type specimen is shown in Table 1. Eye very large and high. Snout short. Bony interorbital very narrow. Mouth large and oblique, extending beyond middle vertical of orbit. Both jaws with 2-3 rows of conical teeth, lower jaw with a pair of large canines. Gill-opening rather large, extending forward ventrally to a vertical midline between rear orbit and preopercle. Anus located in front of middle line of body. VC 10 + 16 = 26.

Fins.- D1 VI, D2 I/12, A I/12, P 17, V I/5+I/5. D1 with slightly longer 2nd and 3rd spinous rays, but lacking any filamentous ray. D1 and D2 membranes very close to each other. Both rear tips of D2 and A not reaching the procurvent rays when appressed. C large with larger upper lobe forming as pointed tip and smaller lower lobe as elliptical shape. P large and elliptical. V as a sucking disc with rear tip extending to anus.

Scales.- Body with weak ctenoid scales posteriorly; progressively smaller and becoming cycloid scales anteriorly. LR 46-47; TR 16; PreD 0; SDP 8. Predorsal middle region entirely naked. Cheek, opercle and prepectoral region naked.

Head lateral-line system.

Canals.- Nasal extension of anterior oculoscapular canal with terminal pore σ located above middle of both nostrils. Anterior interorbital groove with single pore λ . Posterior region with single pore κ . Pore ω present near posterior edge of eye. Lateral extension of anterior oculoscapular canal with turning pore α , median pore β and terminal pore ρ . Posterior oculoscapular canal with two terminal pores θ and ι . Preopercular canal with merely two pores γ and ϵ .

Sensory papillae.- Row *a* longitudinal and short. Row *b* short. Row *c* longitudinal. Row *d* as densely set of papillae. A single *cp* papilla. Row *f* paired. The anterior edge of row *oi* well separated to row *ot*. Other papillae shown in detail as Fig. 1.

Color of holotype when freshly collected (Fig. 5).-

Head and body generally creamy yellow background, trunk with four larger patches and four small patches of deep brown spots along lateral midline and some smaller deep brown spots scattered on upper and lower 1/3 region. Anterior half of trunk before anal fin origin with about 12 oblique, densely-set shiny yellow stripes, and posterior half of that with about 15 shorter but irregularly yellow bars. Belly snow white. Head with about 9 parallel thin yellow lines from snout to rear of opercle; 6 on snout and cheek and 3 on opercle. Cheek with a horizontal deep brown bar. Opercle with oblique deep brown bar. Nape with some irregular deep brown marks. Iris brown on upper and lower region and orange yellow on both anterior and posterior sides of middle regions.

First dorsal fin translucent with basal yellow marks and light blue marks above. Second dorsal fin translucent with limited basal yellow marks and broader light blue bands just above and its distal margin light blue. Anal fin translucent with a basal yellow band. Caudal fin somewhat yellowish with two vertical light blue bands as well as one distal light blue margin. Pelvic fin pale white with median yellow mark on its membrane.

Color of holotype in alcoholic preservation.-

All bright color including yellow and light blue colouration

faded. The deep brown patches of trunk and deep brown bar and mark on head still present as pale gray or pale brown. Other dark marks patterns similar to the pigmentation patterns mentioned above.

Distribution.- So far, this new species is only found from Okinawa-jima Island, Japan.

Etymology.- The specific name, "*fulvopelvis*" derived from Latin "*fulvus* + *pelvic*" means "yellow + pelvic fin" the diagnostic feature of the conspicuous shiny yellow mark on pelvic fin in male.

Remarks.

This new species is most similar to *V. ornatissima* Smith, 1959 than any other congeneric species. However, it can be well distinguished from *V. ornatissima* by the fin rays counts and dwarf body size and specific coloration.

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