



## VANDERHORSTIA OPERCULARIS, A NEW SHRIMP GOBY FROM THE NORTHERN RED SEA

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**Abstract:** The gobiid fish *Vanderhorstia opercularis* is described as a new species from two male specimens, 38.9 and 50.5 mm standard length, collected in 27-40 m off Eilat, Gulf of Aqaba, Red Sea. It lives symbiotically with burrowing alpheid shrimps. It may be distinguished from the 13 valid species of the genus by having 12 dorsal and anal soft rays, 18 to 20 pectoral rays, 40 scales in longitudinal series on the body, a long pointed caudal fin, paired fins that extend beyond the origin of the anal fin, male with a filamentous third dorsal spine, and a color pattern of four dusky bars on the body, each containing a large dark brown spot, an oblique brown bar from the nape across the operculum, with a black spot on the opercle, and numerous small orange-yellow spots over the head, body, and fins, except the pectorals.

**Key words:** Taxonomy, Gobiidae, *Vanderhorstia*, new species, Red Sea

### Introduction

Smith (1949) proposed the genus *Vanderhorstia* for the gobiid fish *Gobius delagoae* Barnard, 1937 from Mozambique. He did not provide a description, stating only that it is closely allied with *Cryptocentrus* Bleeker, but clearly differentiated from it by having the gill membranes completely free from the isthmus. Smith (1959) gave the following diagnosis for *Vanderhorstia*: "Head and body moderately compressed. 55-65 ctenoid scales, cycloid in front, nape and head naked. Teeth in bands in jaws, outer enlarge, canines. Palate edentate. Tongue truncate. Gilloopening wide. Pelvic fraenum strong. Caudal pointed, asymmetrical, exceeds head." He described a second species, *V. ornatissima*, from Mozambique and the Seychelles.

Shibukawa and Suzuki (2004) described *Vanderhorstia papilio* as a new species from the Ryukyu Islands, adding that its assignment to *Vanderhorstia* is provisional because of the present weak diagnosis of the genus. They listed 11 valid species in the genus, noting that *Cryptocentrus fasciaven-*

*tris* Smith, 1959 from Madagascar is a synonym of *V. ambanoro* (Fourmanoir, 1957), also with a type locality of Madagascar. They noted that *V. praealta* Lachner and McKinney and *V. lanceolata* Yanagisawa have a pattern of cheek papillae suggesting a closer affinity to the genus *Tomiyamichthys* Smith. In a poster presentation at the Indo-Pacific Fish Conference in Taipei in May, 2005, Shibukawa and Iwata reclassified these two species to the genus *Flabelligobius* Smith; however, Koichi Shibukawa (pers. comm.) stated that he and Iwata plan to treat *Tomiyamichthys* as the senior synonym when they publish on the genus (both genera were described by Smith, 1956 in the same paper).

There are now 13 species in the genus *Vanderhorstia*, the two most recently described, *V. bella* Greenfield and Longenecker, 2005 from Fiji and *V. nannai* Winterbottom, Iwata and Kozawa, 2005 from Palau. That more species remained to be named is clear from the books on Japanese gobies by Hayashi and Shiratori (2003) and Senou et al. (2004). The former illustrates seven species as *Vanderhorstia* sp., and the latter 10 species as undescribed in the genus (however, their

*Vanderhorstia* sp. 4 is now recognized as a species of *Tomiyamichthys*).

In 1974 the author collected two specimens of an undescribed species of shrimp-associated goby from the Gulf of Aqaba, Red Sea from 27-40 m. The species was photographed underwater with its alpheid shrimp partner at the same site in 1986, but not collected. Because the two fish seemed too deep-bodied to be placed in *Vanderhorstia*, they were labeled as *Cryptocentrus* sp. It was hoped that more specimens would be collected, but none have. Knowing that the presently recognized species of *Vanderhorstia* include ones as deep-bodied, as well as some with similar yellow-dotted color pattern, the Red Sea species is described here.

### Materials and Methods

The type specimens of the new species are deposited in the Bernice P. Bishop Museum, Honolulu (BPBM).

Lengths of specimens 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 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 from the same anterior point to the posterior end of the maxilla; cheek depth is the least depth perpendicular from the ventral edge of the suborbital to the fleshy edge of the orbit; 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; lengths of spines and rays are measured to their ex-

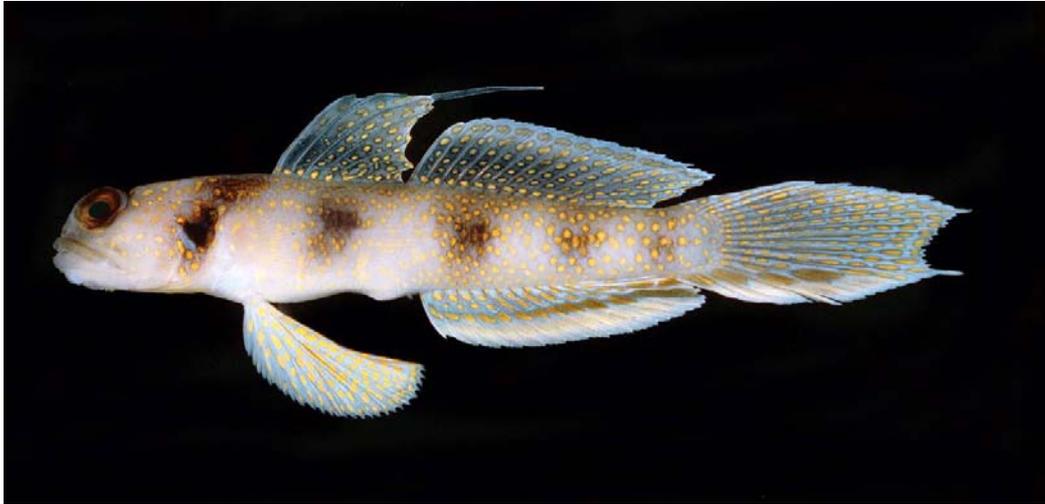
treme bases; caudal- and pectoral-fin lengths are the length of the longest ray; pelvic-fin length is measured from the base of the pelvic spine to the tip of the longest pelvic soft ray. Morphometric data presented in Table 1 are given as percentages of the standard length. Proportional measurements in the text are rounded to the nearest 0.05. Meristic and morphometric data shown in parentheses refer to the paratype when different from the holotype.

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 first gill arch, those on the upper limb listed first.

**Holotype:** BPBM 17878, male, 50.5 mm, Red Sea, Gulf of Aqaba, Israel, off the Inter-university Institute of Eilat (then the Heinz Steinitz Marine Biological Laboratory), sand patch in reef, 27 m, multiprong spear, J.E. Randall, 9 September 1974.

**Paratype:** BPBM 18097, male, 38.9 mm SL, same locality as holotype, sand patch in reef, 40 m, multiprong spear, J.E. Randall, 9 September 1974.

**Diagnosis:** Dorsal rays VI-I,12; anal rays I,12; pectoral rays 18-20; scales in longitudinal series on body 40; scales ctenoid posteriorly, cycloid anteriorly; no scales on head or prepectoral area, those posteriorly on nape embedded and difficult to count; body depth 4.85-5.5 in SL; third dorsal spine of male filamentous, 2.35-2.95 in SL; caudal fin pointed and long, 1.95 in SL (in paratype; appears to have been injured and regenerating in holotype); paired fins extending beyond origin of anal fin; body with four dusky bars, each with a large darker spot; an oblique blackish bar from nape across posterior head containing a black spot on opercle; numerous small pale spots (orange-yellow in life) on head, body, and fins except pectorals. Largest specimen, the holotype, 50.5 mm SL.

*Vanderhorstia opercularis*, n. sp.

**Figure 1.** Holotype of *Vanderhorstia opercularis*, male, BPBM 17878, 50.5 mm SL, Gulf of Aqaba, Red Sea.

**Description:** Dorsal-fin rays VI-I,12; anal-fin rays I,12; all dorsal and anal soft rays branched, the last to base (each major branch of last ray divided); pectoral rays 18-19 (19-20), the upper two and lowermost unbranched; pelvic-fin rays I,5, all soft rays branched, the fifth rays joined medially; segmented caudal-fin rays 17, 14 branched; upper unsegmented caudal rays 8; lower unsegmented caudal rays 7; longitudinal scale series 40 (anterior scales small); transverse scale rows 19; predorsal scales about 14 (embedded and difficult to count); prepelvic scales 9; circumpeduncular scales 13; gill rakers 2 + 9 (2 + 10); pseudobranch with 11 short fleshy lobes; branchiostegal rays 5; vertebrae 10 + 26; dorsal pterygiophore formula 3-22110 (Figure 1A of Birdsong et al., 1988) Body moderately deep, the depth at pelvic-fin origin 4.85 (5.5) in SL; body width at pectoral-fin origin 8.1 (7.95) in SL; head length 3.6 (3.45) in SL; head slightly compressed, the width 7.0 (7.05) in SL; snout length 4.05 (4.15) in head length; fleshy orbit

diameter 3.55 (3.5) in head length; fleshy interorbital space very narrow, the least width 14.0 (16.5) in head length; caudal-peduncle depth 2.4 (2.8) in head length; caudal-peduncle length 1.55 (1.6) in head length.

Mouth slightly oblique, forming an angle of about 15° to horizontal axis of body, the lower jaw barely projecting; mouth large, the maxilla reaching a vertical at posterior edge of orbit, the upper-jaw length 2.0 in head length; front of upper jaw with a pair of incurved canine teeth on each side (three teeth on one side of paratype), the lateral tooth largest, the symphyseal gap one-third orbit diameter; lateral canine followed by an outer row of slender incurved conical teeth along side of jaw (16 teeth in both specimens); one to two irregular rows of small conical teeth medial to canines at front of upper jaw, narrowing to one inner row along side of jaw; three pairs of nearly recumbent, incurved teeth as large as outer canines in innermost row at front of upper jaw; lower jaw with two to four strongly recurved canines in a row about one-third back from front



**Figure 2.** Probable male of *Vanderhorstia opercularis* about 70 mm TL, with *Alpheus ochrostriatus*, Gulf of Aqaba, Red Sea.



**Figure 3.** Probable female of *Vanderhorstia opercularis*, about 70 mm TL, Gulf of Aqaba, Red Sea.

**Table 1. Proportional measurements of type specimens *Vanderhorstia opercularis* as percentages of the standard length**

	Holotype	Paratype
	BPBM 17828	BPBM 18097
Standard length (mm)	50.5	38.9
Sex	male	male
Body depth (at P <sub>2</sub> origin)	20.7	18.1
Body depth (at A origin)	17.9	17.2
Body width	12.4	12.6
Head length	28.0	28.9
Head width	14.3	14.2
Snout length	6.9	7.0
Orbit diameter	7.9	8.3
Interorbital width	2.0	1.8
Cheek depth	2.6	2.8
Upper-jaw length	13.8	14.3
Caudal-peduncle depth	11.6	10.4
Caudal-peduncle length	18.1	18.3
Predorsal length	36.0	35.3
Preanal length	57.8	58.6
Prepelvic length	30.7	31.4
Base of dorsal fins	49.5	49.2
First dorsal spine	19.0	19.4
Second dorsal spine	23.1	22.6
Third dorsal spine	42.8	33.8
Spine of second dorsal fin	14.5	14.3
Longest dorsal ray	24.2	23.7
Base of anal fin	24.4	23.5
Anal spine	9.9	10.1
Longest anal ray	22.4	23.4
Caudal-fin length	damaged	51.2
Pectoral-fin length	31.4	32.1
Pelvic-spine length	10.0	11.5
Pelvic-fin length	30.7	31.4

of jaw, preceded by a band of incurved villiform teeth in two to three rows across front of jaw; side of lower jaw posterior to canines with a single row of small incurved teeth; roof of mouth with prominent well separated papillae; edge of upper lip smooth, of lower lip finely crenulate; inside of lips strongly papillose; tongue bilobed; no obvious mental flap.

Gill opening very broad, extending forward to below center of eye; gill membranes attached only anteriorly to isthmus, with no free fold across; first gill slit narrow, but

largely open; gill rakers slender, the longest about half length of longest gill filaments of first gill arch.

Posterior nostril a moderately large opening in front of center of eye at fleshy edge of orbit, with a slight rim; anterior nostril a short, collapsed, membranous tube, with no distal flap, anterorventral to posterior nostril half distance to edge of snout above upper lip. Cephalic sensory pores as illustrated for *Vandershorstia auropunctata* by Prince Akihito in Masuda et al. (1984: figure. 117), with the same nine pores of the oculoscapular canal and the three of the preopercular canal. The pattern of sensory papillae on the head is remarkably similar to that of *V. auropunctata*, with two longitudinal close-set series of papillae on cheek, one of 12 papillae commencing in line with both the ventral and posterior edges of orbit, and one of 35 papillae paralleling posterior part of upper jaw, then angling horizontally onto cheek.

Scales on body progressively smaller anteriorly; scales ctenoid posteriorly, becoming cycloid dorsally on body anterior to origin of second dorsal fin; scales ctenoid on side of body anteriorly to base of fourth dorsal spine; scales ventrally on abdomen and chest cycloid; no scales on head or prepectoral area; no scales on fins except for three rows on broad central base of fin.

Origin of first dorsal fin slightly posterior to a vertical at posterior base of pelvic fins, the predorsal length 2.8 (2.85) in SL; first dorsal spine 5.25 (5.15) in SL; second dorsal spine 4.3 (4.4) in SL; third dorsal spine filamentous and long, 2.35 (2.95) in SL; last membrane of first dorsal fin ending at origin of second dorsal fin; spine of second dorsal fin 6.9 (7.0) in SL; penultimate dorsal soft ray longest, 4.15 (4.2) in head length; origin of anal fin slightly below base of first dorsal soft ray, the preanal length 1.75 (1.7) in SL; anal spine 10.1 (9.9) in SL; penultimate anal soft ray longest, 4.45 (4.3) in head length; caudal fin of holotype apparently damaged and regenerating; caudal fin of paratype long and pointed, 1.95 in SL; tenth

pectoral ray longest, reaching to a point dorsal to base of third anal soft ray, 3.2 (3.1) in SL; prepelvic length 3.25 (3.2) in SL; fifth pelvic ray longest, reaching base of second anal soft ray, 3.25 (3.2) in SL; pelvic spine one-third length of longest pelvic ray; pelvic frenum present, the membrane reaching about halfway to tip of pelvic spine; tips of pelvic rays free, giving a slight fringe effect.

Color of holotype in alcohol: body pale yellowish with four slightly oblique dusky bars on body, the first beneath pectoral fin, and the last posteriorly on caudal peduncle, each containing a dark brown spot, the first a little larger than eye, and the last slightly smaller; scales with a small pale spot (orange-yellow in life), but distinct in preservative only dorsally on body and in dusky bars; head pale tan with an oblique blackish bar from nape across posterior operculum, containing an irregular black spot larger than pupil on opercle; fins with pale yellowish rays and translucent membranes. Color of male holotype when fresh shown in Figure 1. Color in life of a presumed male (note elongate third dorsal spine) shown in underwater photograph of Figure 2, and that of a presumed female in Figure 3.

**Etymology:** This species is named *opercularis* in reference to the prominent black spot on the opercle.

**Remarks:** Like others of the genus, *Vanderhorstia opercularis* lives symbiotically with alpheid shrimps, the two partners sharing the same burrow, which is maintained by the shrimp (generally as a pair) and guarded by the goby (Karplus, 1987). The holotype

was observed with *Alpheus bellulus*, and Figure 2 shows the goby with *Alpheus ochrostriatus*.

Two other species of the genus are known from the Red Sea, *V. delagoae* (Barnard), mentioned above as the type species of the genus (shown here as Figure 4), and *V. mertensii* Klausewitz (Figure 5). They are easily distinguished from *V. opercularis* by their color pattern and more elongate body

Of the described species of the genus, *V. opercularis* seems most similar to *V. auropunctata* Tomiyama, 1955, named in the genus *Mars* (a synonym of *Cryptocentrus*) from one specimen dredged in 58 m from Sagami Bay, Japan. The near-identical pattern of head papillae of the two species is mentioned above. *V. opercularis* differs in having 12 instead of 11 dorsal and anal soft rays, a longer and more pointed caudal fin, longer paired fins, and in color. It lacks a black spot on the dorsal fin as seen in *auropunctata*, but has a black spot on the opercle; also it is more densely spotted with orange-yellow. The filamentous third dorsal spine of males of *opercularis* would seem to be an obvious difference, if it can be shown that males of *auropunctata* lack such a prolongation. The holotype and underwater photographs of *auropunctata* in Hayashi and Shiratori (2003) and Senou et al. (2004) do not show a prolonged third dorsal spine.

*Vanderhorstia* sp. 5, illustrated by Senou et al. (2004: 365, lower figure) is the most similar in color pattern to *V. opercularis*, but it is clearly distinct in its short first dorsal and caudal fins. It was found in 30-55 m at Izu Oshima Island, Japan.

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**Figure 4.** *Vanderhorstia delagoae*, about 70 mm TL, off Jeddah, Red Sea.



**Figure 5.** *Vanderhorstia mertensi*, BPBM 21370, 50 mm SL, Gulf of Oman..

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