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Eviota atauroensis, a new dwarfgoby (Teleostei: Gobiidae) from Timor-Leste

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Abstract

A new species of dwarfgoby, *Eviota atauroensis* n. sp. is described from Berau Bay, Atauro Island, Timor-Leste. The new species is distinguished by having the cephalic sensory-canal pore system lacking only the IT pore (pattern 2); a dorsal/anal fin-ray formula of 9/8; 4 or 5 lower pectoral-fin rays branched; the fifth pelvic-fin ray rudimentary; two distinct dark spots on the pectoral-fin base and no additional spot ventral and anterior to the pair; 5 dark postanal ventral spots; a postocular spot; a dark spot on the caudal peduncle centered above the midline; and the male urogenital papilla cup-shaped (the shapes of urogenital papillae in *Eviota* are clarified here). The new species is currently known only from Atauro Island in Timor-Leste, where it was collected from the upper surfaces of *Porites* coral bommies situated in a shallow subtidal (0.5–2 m) surge zone.

Key words: taxonomy, ichthyology, coral-reef fishes, gobies, western Pacific Ocean, pelvic fins, *E. queenslandica*, *E. perspicilla*

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Introduction

The genus *Eviota*, found throughout most of the Indo-Pacific Ocean, is one of the most speciose coral-reef fish genera, currently represented by 130 species (Greenfield & Winterbottom 2016, Greenfield 2021), plus the species described herein. The recognition of a number of undescribed species in recent years is the result of intensive searching for cryptobenthic fishes, obtaining underwater photographs showing live coloration, and then collecting those individuals, including tissue for genetic analysis. Earlier workers studying these fishes lacked these tools, and had to make taxonomic decisions using only preserved specimens. As a result, some of the species, such as *Eviota zebrina* Lachner & Karnella, 1978, previously considered to have wide distributions, were found to be a complex of several species (Tornabene, Greenfield & Erdmann 2021). The species described here from Timor-Leste is the result of this method. In August 2012, at the request of the national government of Timor-Leste, Conservation International conducted a marine rapid biodiversity assessment (MRAP) of the northern coastline of Timor-Leste, with a particular focus on assessing the condition and biodiversity of the coral reefs of the Nino Konis Santana National Park (Erdmann & Mohan 2013). That study recorded 741 species of coral reef fish from 20 sites surveyed by author MVE and G.R. Allen; amongst those was a new species of dwarfgoby subsequently described as *Eviota santanai* Greenfield & Erdmann, 2013.

Whereas the aforementioned survey was largely focused upon the Nino Konis Santana National Park, 4 sites were also surveyed on Atauro Island, approximately 25 km north of mainland Timor-Leste, surrounded by the deep waters (>3000 m) of the Ombai Strait. The highest number of species recorded (294) recorded during the entire 2012 MRAP was obtained at Atauro at Belio Barrier Reef. Based upon this significant finding, and the general good condition of the reefs surveyed on Atauro, Conservation International recommended to the Timor-Leste government to consider potential marine protected area (MPA) development on the island. By 2016, significant progress had been made working with government and local communities to designate new MPAs, and the Timor-Leste government again requested that Conservation International provide technical assistance to conduct an MRAP biodiversity survey focused on Atauro Island.

Based on this request, Conservation International conducted a brief MRAP of 10 sites circumnavigating the island in June 2016, recording an additional 261 reef fish species not previously known from Atauro Island, and bringing the total reef-fish diversity count for Timor-Leste to 894 species (Allen & Erdmann 2016). Included amongst these was an undescribed species of dwarfgoby photographed in the shallow surge zone of Berau Bay, on the southern tip of the island. The second author returned to Berau Bay in September 2016 and collected specimens of this species, which appeared to be similar to *Eviota queenslandica* Whitley, 1932. We determined these specimens are new to science and we describe them herein.

Eviota viridis queenslandica was described briefly by Whitley (1932) from Batt Reef, part of the Great Barrier Reef off Port Douglas, Queensland, Australia. He considered it to be a subspecies of *Eviota viridis* (Waite, 1904); however, Lachner & Karnella (1980) synonymized *E. viridis* with *Eviota prasina* (Klunzinger, 1871), leaving *E. queenslandica* as a valid species. Lachner & Karnella (1980) prepared a detailed redescription of the latter species based on 320 specimens from 20 wide-ranging localities, many outside of Australia, distinguishing it from *E. prasina*. Since then, many specimens bearing a resemblance to *E. queenslandica* have been called that species in studies; we refer to these fishes as *E.* cf. *queenslandica*. Fujiwara, Suzuki & Motomura (2019) described *Eviota perspicilla* from Japan, comparing it to *Eviota japonica* Jewett & Lachner, 1983; *E. prasina*; and *E. queenslandica*, and concluded it is most similar to *E. queenslandica*. The new species described here is likely part of the species complex containing *E. queenslandica*, *E. perspicilla*, and a number of other undescribed species.

Materials and Methods

Counts and measurements, descriptions of fin morphology, and cephalic sensory-canal pore patterns follow Lachner & Karnella (1980) and Jewett & Lachner (1983), postanal ventral-midline spots follow Greenfield et al. (2022). For the cephalic cutaneous sensory papillae (free neuromasts), we follow Sanzo's (1911) terminology as applied by Winterbottom et al. (2015; Fig. 2) to the pygmygobies (*Trimma*). Cyanine Blue 5R (acid blue 113) stain and an airjet were used to make the cephalic sensory-canal pores more obvious (Akihito et al. 1993, 2002, Saruwatari et al.1997). The value of the holotype is presented first, followed by the mean for the paratypes.

Figure 1. *Eviota atauroensis*, paratype underwater, CAS-ICH 248226, Atauro Island, Timor-Leste (M.V. Erdmann).

Eviota atauroensis, n. sp.

Atauro Dwarfgoby

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Figures 1–5, 6A

Holotype. CAS-ICH 248225, 12.1 mm SL male, Timor Leste, Atauro Island, Berau Bay, -8.3198, -125.5588, 0.5 m, field number MVE-16-058, M.V. Erdmann, 22 September 2016.

Paratypes. CAS-ICH 248226, 15.5 mm SL female & 11.2 mm SL male, taken with holotype, tissue sampled.

Diagnosis. A species of *Eviota* distinguished from all congeners by a combination of a cephalic sensory-canal pore system lacking only the IT pore (pattern 2), a dorsal/anal fin-ray formula 9/8; pectoral-fin rays 16 with 4 or 5 lower pectoral-fin rays branched; fifth pelvic-fin ray rudimentary; pectoral-fin base with two distinct dark spots and no additional spot immediately ventral and anterior to pair; 5 dark postanal ventral spots; dark spot on caudal peduncle centered above midline; first postocular spot a bar of scattered melanophores, second more rounded; male urogenital papilla cup-shaped.

Description. Dorsal-fin elements VI+I,9; first dorsal fin semitriangular, no spines elongated, all second dorsal-fin rays branched except first, last ray branched to base; anal-fin elements I,8 all soft rays branched, last ray branched to base; pectoral-fin rays 16, lower 4 or 5 branched, pointed, reaching to level of first ray of second dorsal fin when adpressed; fifth pelvic-fin ray rudimentary; 5 (10) branches on fourth ray, 1 or 2 segments between consecutive branches of fourth ray; pelvic-fin membrane reduced, no basal membrane; 12 branched and 17 segmented caudal-fin rays; lateral scale rows 24; transverse scale rows 7; urogenital papilla in male cup-shaped (Fig. 2); female papilla with short finger-like projections on end; front of head rounded with an angle of about 60˚ from horizontal axis; mouth slanted obliquely upwards, forming an angle of about 55˚ to horizontal axis of body, lower jaw slightly projecting; maxilla extending posteriorly to center of pupil; anterior narial tube short, not reaching posterior margin of upper lip; gill opening extending forward to below posteroventral edge of vertical limb of preoperculum. Cephalic sensory-pore system lacks only IT pore (pattern 2); cephalic cutaneous-papillae system a reduced transverse pattern in all *Eviota* (Winterbottom & Greenfield 2020), rows of papillae as in Fig. 4.

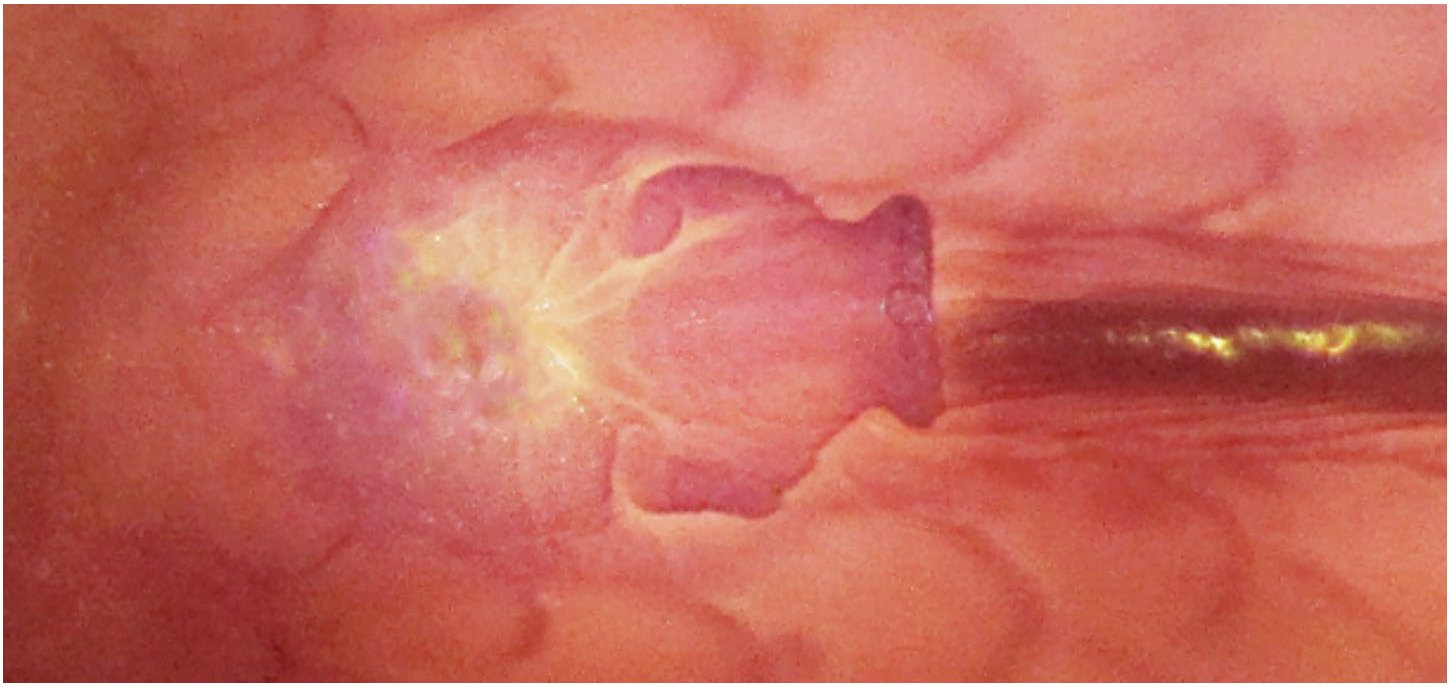

Figure 2. *Eviota atauroensis*, preserved male holotype, CAS-ICH 248225, cup-shaped urogenital papilla (D.W. Greenfield).

Measurements. Head length 26.4 (28.4); distance to origin of first dorsal fin 36.4 (36.4), origin lying behind posterior margin of pectoral-fin base; distance to origin of second dorsal fin 58.7 (55.5), well in advance of anal-fin origin; distance to origin of anal fin 59.5 (56.4); caudal-peduncle length 26.4 (22.6); caudal-peduncle depth 12.8 (14.2); body slender, its depth 24.7 (23.8); eye diameter 9.5 (8.4); snout length 4.1 (4.5); pectoral-fin length 39.7 (40.6); pelvic-fin length 33.0 (33.5), reaching urogenital papilla.

Color in life of paratype. (Fig. 1) Background color of head and body translucent gray, with bluish tinge on body; 6 internal black spots running along midline of body over silver-white vertebral column, last forming a distinct caudal-peduncle spot extending up above midline; posterior 4 spots connected to ventral postanal spots, fifth connecting to two spots; 5 dark postanal spots separated by silver-white spots. Body scales edged with red-orange; series of small red-orange spots running along dorsal-fin bases; caudal-fin base with clusters of red-orange spots over hypural plate; two red-orange spots, one dorsal and one ventral, on fleshy pectoral-fin base overlying clusters of distinctly separate, small, black melanophores. Head with red-orange spots and bars overlying small black melanophores; 3 bars on top of head, two over nape, one extending up from behind eye; area behind eyes with one spot; 3 spots extending down from eye at 4 o'clock position across cheek; another 4 forming a bar at six o'clock position extending down to below jaw; several more scattered red-orange spots on jaws, cheek, and

Figure 3. *Eviota atauroensis*, preserved paratype, CAS-ICH 248226, Atauro Island, Timor-Leste (D.W. Greenfield).

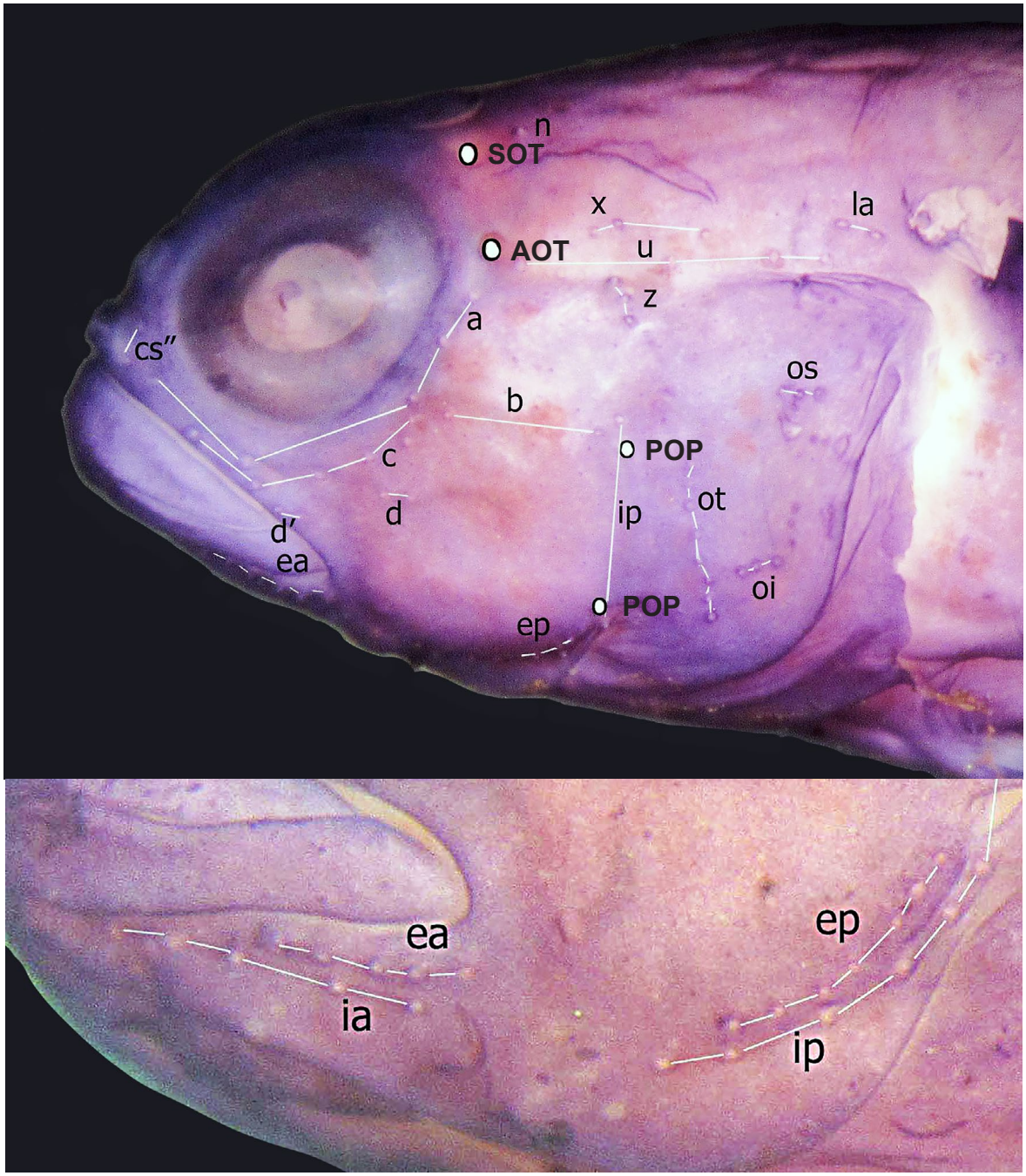

Figure 4. *Eviota atauroensis*, preserved holotype, CAS-ICH 248225, pattern of cephalic sensory papillae and papillae rows. White lines are nerve pathway, large white dots are pores (SOT, AOT and POPs illustrated; NA, AITO, PITO pores are present but not shown), lateral view (top), ventrolateral view (bottom) (D.W. Greenfield).

opercular area, as well as under head. Eye with yellow ring around pupil, iris silver crossed by narrow red spokes out from pupil. Dorsal fin crossed by a black bar about half-way up front of fin, angling down towards back of fin; area under bar clear with red-orange pigment extending up onto fin from spots along dorsal-fin base, creating several roundish areas; area above dark bar gray with distal margin darker; second dorsal-fin membrane clear, with red-orange spots on basal half of rays; caudal fin similar to second dorsal fin; basal two-thirds of anal fin black with a row of red-orange spots on membranes about one-third up from base, distal margin clear; membranes of pectoral and pelvic fins clear, rays dusky.

Color after formalin preservation of paratype. (Fig. 3) Background color of head and body light yellow; ventral side of postanal body with 5 distinct dark spots; faint dark subcutaneous bars on body above first and second spots, third and fourth spots sharing a single bar above them, fifth spot with a bar extending up to join a black

Figure 5. *Eviota atauroensis*, preserved holotype, CAS-ICH 248225, Atauro Island, Timor-Leste (D.W. Greenfield).

caudal-peduncle spot centered above body midline; two additional faint body bars under dorsal fin; a row of small clusters of melanophores running along dorsal-fin bases and a line of melanophores at caudal-fin base; two dark spots on fleshy pectoral-fin base, one dorsal and one ventral, each a cluster of distinctly separated melanophores with a few smaller melanophores between; occipital spot above top of preoperculum composed of a cluster of melanophores similar to pectoral-fin base; a small cluster of melanophores directly behind eye; top of head behind eyes with scattered melanophores; two lines of melanophores extending down from eye across cheek, from three o'clock and 5 o'clock positions; separate melanophores scattered over cheek and a greater concentration under head. First dorsal fin crossed by a bar about half way up front of fin, angling towards back of fin, area under bar clear, area above dusky with distal margin darker; second dorsal-fin membranes clear, melanophores along rays, distal margin dusky; basal two-thirds of anal fin black with a row of clear spots on membranes about one-third up from base, distal margin clear; caudal-fin membranes clear, rays dark, more concentrated basally; membranes of pectoral and pelvic fins clear, rays dusky. Body pigmentation of preserved holotype much reduced, but color of fins and caudal-peduncle spot similar (Fig. 5).

Etymology. The specific epithet is an adjective referring to the type location.

Distribution and habitat. The new species is currently known only Berau Bay, Atauro Island, Timor-Leste. Collected from the shallow (0.5–2 m) surge zone, from medium-sized *Porites* coral bommies, where the individual gobies were seen resting on the dead coral tops of bommies that are exposed at the lowest tides. The dead coral structure is subject to extensive bioerosion creating holes and cracks to shelter the gobies.

Comparisons. *Eviota atauroensis* belongs to a group of 17 species sharing the cephalic sensory-canal pore system pattern 2, a dorsal/anal fin formula of 9/8, and some branched pectoral-fin rays. All of the 17, except *Eviota hoesei* Gill & Jewett, 2004; *E. japonica*; *E. perspicilla*; and *E. queenslandica* lack the two distinct dark spots on the pectoral-fin base. The 4 exceptions can be separated from the new species as follows: *E. hoesei* lacks the prominent postocular dark spots; *E. japonica* has 6 postanal dark spots vs. 5; *E. queenslandica* (Fig. 6C) has an additional dark spot just anterior and ventral to the two spots on the pectoral-fin base (Fig. 6A), and the first dorsal fin is crossed by several oblique bars vs. a single dark bar; *E. perspicilla* (Fig. 6B) has a small dark spot on the caudal peduncle that is centered on the midline, vs. a larger spot that extends above the midline, and the nape is spotted vs. crossed by bars. Finally, *E. atauroensis* differs from all of the 17 species by having a male urogenital papilla that is cup-shaped (Fig. 2).

Four other species in the genus also have a cup-shaped male urogenital papilla: *Eviota minuta* Greenfield & Jewett, 2019 is separated by having a complete cephalic sensory-canal pore system (pattern 1) and the other three, *Eviota hinanoae* Tornabene, Ahmadia & Williams, 2013; *Eviota saipanensis* Fowler, 1945; and *Eviota erdmanni* Tornabene & Greenfield, 2016, lack the pair of dark spots on the pectoral-fin base and also differ in color pattern.

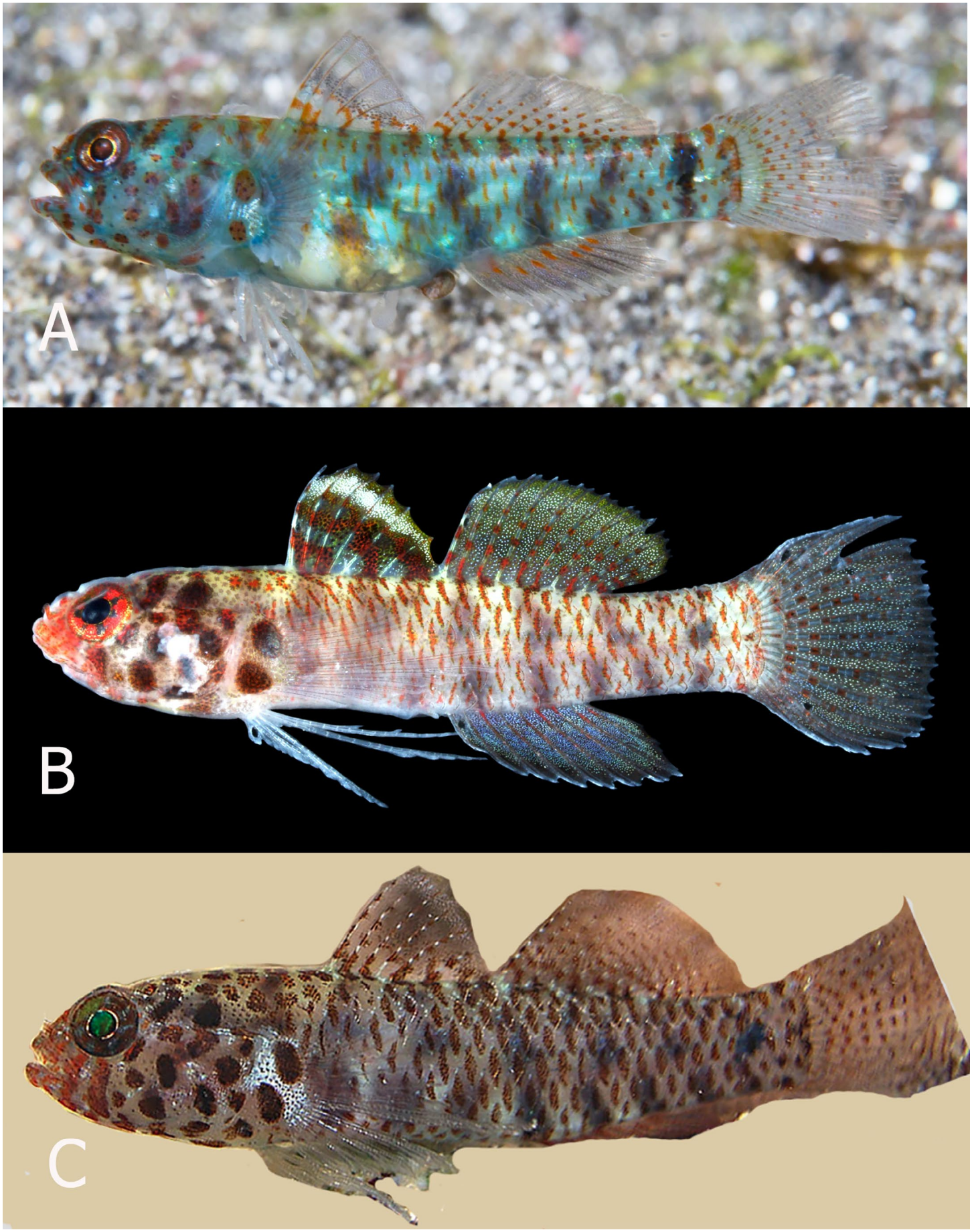

Figure 6. Comparison of live and fresh coloration: A: *Eviota atauroensis* paratype (M.V. Erdmann); B: *Eviota perspicilla* holotype (Fujiwara et al. 2019) ; C: *Eviota queenslandica*, GBR (Alonso González-Cabello).

In the key to *Eviota* species (Greenfield & Winterbottom 2016, Greenfield 2021), *E. atauroensis* would progress through the key to 69a. (*E. queenslandica*) with 5 postanal ventral spots versus 6 spots in 69b (*E. japonica*).

Remarks. The figure of urogenital papilla shapes in *Eviota* in Greenfield & Winterbottom (2016; Fig. 2, p. 37) had an error in labeling making the definition of "cup-shaped" unclear (cup-shaped and bulbous images switched). Lachner & Karnella (1980) explained that the cup-shaped male urogenital papilla of *E. saipanensis* is broad with lateral folds that can be convoluted and folded inwards, a description consistent with the papilla of *E. atauroensis* in our Fig. 2. We correct and update Greenfield & Winterbottom's (2016) figure here (Fig. 8).

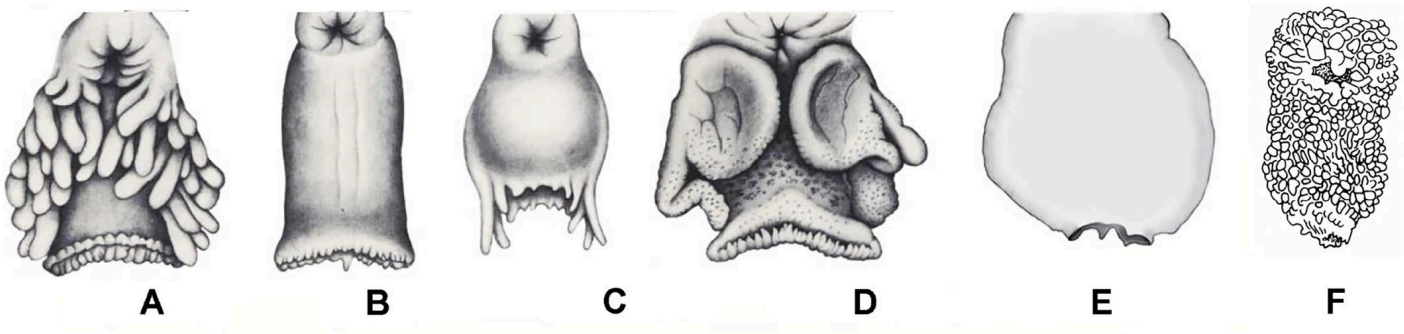

Figure 8. Examples of 6 types of urogenital papillae in mature *Eviota* (a revised version of Greenfield & Winterbottom (2016; Fig. 2, p. 37) A: fimbriate condition in male; B: nonfimbriate condition in male; C: bulbous papilla of female; D: cup-shaped papilla of male (A–D after Lachner & Kamella 1980); E: flat rounded plate of male; F: rugose (F after S.G. Mondon).

The author MVE and G.R. Allen have photographed and collected many specimens from various areas currently assigned to *E.* cf. *queenslandica*. These specimens are under study to determine the true range of *E. queenslandica*.

Other material examined:

Eviota queenslandica, CAS 43538 (13), One Tree Island, Australia.

Acknowledgments

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