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Eviota kathyae, a new dwarfgoby from the unique volcanic fjords of Tufi, Papua New Guinea (Teleostei: Gobiidae)

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Abstract

A new species of dwarfgoby, *Eviota kathyae*, is described from the volcanic fjords of Tufi, Papua New Guinea. The new species is diagnosed by the combination of unbranched pectoral-fin rays, the cephalic sensory-canal pore system lacking only the IT pore, a dorsal/anal fin-formula of 8/7, no fifth pelvic-fin ray, a vertically constricted black blotch at the caudal-fin base, a mostly unmarked caudal fin, and the iris above the pupil crossed by an unbroken red band. The species is likely endemic to this unique habitat formed by collapsed lava flows.

Key words: taxonomy, ichthyology, coral-reef fishes, gobies, new species, cryptobenthic fishes, species complexes

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Introduction

The small town of Tufi is located on the northeast coast of Papua New Guinea in Oro Province and is known for its spectacular volcanic fjords with steep walls that plunge down to over 90 m deep in some areas. The fjords were created by lava flows that collapsed, resulting in long, steep-sided inlets that now are filled with seawater, creating a complex marine environment that is highly protected from wave energy and is home to extensive, but delicate, lagoonal coral formations (see Fig. 4). This unique area has already yielded one new dwarfgoby, *Eviota vader* Greenfield, Erdmann & Ichida, 2025, collected during a reef-fish biodiversity survey of the region in March 2025. A number of potentially undescribed gobies were collected from the Tufi fjords during this expedition and the documented local ichthyofaunal list is expected to expand, some of which will likely prove to be endemic to this highly unusual habitat.

The present description increases the total number of species in the genus *Eviota* to 138. These dwarfgobies are tiny coral-reef fishes (usually <18 mm SL) occurring throughout the Indo-Pacific Ocean. They are relatively abundant on coral reefs, serving as an important link in the food chain between small invertebrates and larger fishes (Greenfield 2017), yet, because of their small size, are often not recognized or counted in surveys. A comprehensive key to the 107 species in the genus was published by Greenfield & Winterbottom (2016). Subsequently Greenfield (2017) reviewed the genus and raised the total number of species to 113. Greenfield (2021) listed, illustrated, and discussed an additional 16 species. Since 2021, a number of new species of *Eviota* have been described from various locations in the western Pacific (Greenfield & Erdmann 2021a,b; Tornabene, Greenfield & Erdmann 2021; Greenfield, Erdmann & Membrasar 2022; Erdmann, Greenfield & Tornabene 2023; Greenfield, Erdmann & Tornabene 2023; Greenfield, Erdmann & Teitelbaum 2024; Erdmann, Greenfield & Ichida 2025; Greenfield, Erdmann & Ichida 2025a,b; Greenfield, Erdmann & Putra 2025).

Most of the new discoveries involved a process that included intensive, targeted *Eviota* searches, in situ photography, specimen collection with handnets and clove oil, and preservation for eventual museum deposition. Live photography is particularly useful for recording the eye-coloration pattern, which is an important diagnostic tool for this genus (Greenfield 2017).

Materials and Methods

The holotype is deposited at the California Academy of Sciences, San Francisco, CA, USA (CAS).

Descriptions of pelvic-fin morphology and cephalic sensory-canal pores follow Greenfield (2017). Postanal ventral midline spots, along the posterior ventral midline of the body, begin at the anal-fin origin and extend to a vertical drawn two to three scale rows anterior to the ends of the hypurals; the additional smaller spot posterior to this, if present, is not counted. Dorsal/anal-fin-ray formula counts (e.g., 9/8) only include segmented rays. Measurements were made to the nearest 0.1 mm using an ocular micrometer or dial calipers (the latter only for standard length, body depth, and caudal-peduncle depth). Lengths are given as standard length (SL), measured from the median anterior point of the upper lip to the base of the caudal fin (i.e. the posterior end of the hypural plate); the origin of the first dorsal fin is measured from the median anterior point of the upper lip to the anterior base of the first dorsal-fin spine; the origin of the second dorsal fin is measured from the median anterior point of the upper lip to the anterior base of its spine; the origin of the anal fin is measured from the median anterior point of the upper lip to the anterior base of its spine; body depth is measured at the center of the first dorsal fin; head length is taken from the upper lip to the posterior end of the opercular membrane; orbit diameter is the greatest fleshy diameter; 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 the straight-line distance from the anterior tip of the premaxilla to the end of the upper margin of the dentary where the maxilla joins; caudal-peduncle depth is the least depth, and caudal-peduncle length is the horizontal distance between the verticals at the rear base of the anal fin and the caudal-fin base; pelvic-fin length is measured from the base of the pelvic-fin spine to the tip of the longest pelvic-fin soft ray. Cyanine Blue 5R (acid blue 113) stain and an airjet were used to make the cephalic sensory-canal pores, papillae, fin rays, and scales more obvious (Akihito et al. 1993, 2002, Saruwatari et al. 1997).

Figure 1. *Eviota kathyae*, fresh holotype, Tufi, Papua New Guinea (M.V. Erdmann).

Eviota kathyae, n. sp.

Fjord Dwarfgoby

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Figures 1–3 & 5A

Holotype. CAS 250336, 15.2 mm SL male, Papua New Guinea, Tufi, Don's Bommie, -9.10972°, 149.3192°, 32 m, M.V. Erdmann, W.M. Brooks & N.K. Ichida, 4 March 2025.

Paratypes. CAS 250337, 3 males, 12.5–13.0 mm SL, 3 females, 11.4–12.9 mm & immature, 9.1 mm, collected with holotype in 35–40 m depth.

Diagnosis. A species of *Eviota* distinguished from all congeners by a combination of unbranched pectoral-fin rays, a cephalic sensory-canal pore system lacking only the IT pore, a dorsal/anal-fin formula of 8/7, no fifth pelvic-fin ray, a black blotch at caudal-fin base, no prominent lines crossing caudal fin, and iris above pupil crossed by an unbroken red bar.

Description. Dorsal-fin elements VI+I,8, first dorsal fin triangular; first two spines moderately filamentous; all second dorsal-fin soft rays branched, last to base; anal-fin elements I,7, all soft rays branched, last to base; pectoral-fin rays 15, all unbranched, fin pointed, reaching to anal-fin origin; pelvic-fin elements I,4, fifth ray absent, pelvic-fin membranes between branches well developed, basal membrane reduced; 11 branched and 17 segmented caudal-fin rays; 23 or 24 lateral scales, 7 transverse scales; urogenital papilla of male holotype not tapered, fringed on end, female urogenital papilla with short finger-like projections on end; front of head rounded, with an angle of about 55˚ from horizontal axis; mouth slanted obliquely upwards, forming an angle of about 65˚ to horizontal axis, lower jaw not projecting; maxilla extending posteriorly to front of pupil; anterior naris tube extending past margin of upper lip; gill opening extending forward to below posteroventral edge of preoperculum. Cephalic sensory-canal pore system lacking only IT pore.

Measurements of holotype followed by range for all specimens and mean as percentage of SL: head length 26.3 (26.3–29.6, 28.4); origin of first dorsal fin 32.9 (32.9–36.8, 34.9) ; origin of second dorsal fin 53.9 (53.9–56.9, 55.3); origin of anal fin 58.2 (58.2–60.8, 59.6); caudal-peduncle length 27.0 (24.8,–27.6, 26.3); caudal-peduncle depth 11.2 (11.1–13.2, 12.1); body depth 20.4 (19.8–24.8, 21.6); eye diameter 8.6 (8.6–11.2, 9.7); snout length 3.2

Figure 2. *Eviota kathyae*, underwater holotype, Tufi, Papua New Guinea (M.V. Erdmann).

(3.2–5.6, 3.6); upper-jaw length 9.5 (7.0–9.6, 8.4); pectoral-fin length 38.3 (35.4–38.8, 37.1); pelvic-fin length 26.3 (26.3–34.9, 33.8).

Color in life. (Figs. 1 & 2) Background color of body translucent grey above and below midline with scattered red spots dorsally and larger red spots along dorsal-fin bases; midline of body with a dark-red stripe extending from top of head to caudal-fin base, bordered dorsally with a golden-yellow line; area above abdomen directly under midline dark red, with a white stripe extending forward to eye overlying a dark red stripe extending forward to eye, overlying a bluish-white stripe over abdomen, sometimes broken into spots; ventral postanal area of body grey with 6 red spots separated by yellow spots; caudal-fin base with a black blotch partly constricted along vertical midline, anterior portion rounded and just anterior of origin of caudal-fin rays, posterior portion a thickened vertical line at base of caudal-fin rays, bright yellow spots above and below contriction; area under head and onto breast translucent grey. Snout and jaws yellow, top of head with red and yellow stripes extending forward from body; iris above pupil crossed by a solid, unbroken, red bar overlying a narrow white line crossing above pupil, a corresponding white line below pupil, and a dark red band across lower iris.

Color in preservative. (Fig. 3) Background color of head and body light yellow, scales edged with small melanophores, along sides from pectoral-fin base to caudal peduncle; cheek, preoperculum, operculum, and pectoral-fin base peppered with small melanophores; a black blotch partly constricted along vertical midline at caudal-fin base, anterior portion rounded and just anterior to origin of caudal-fin rays, posterior portion a thickened

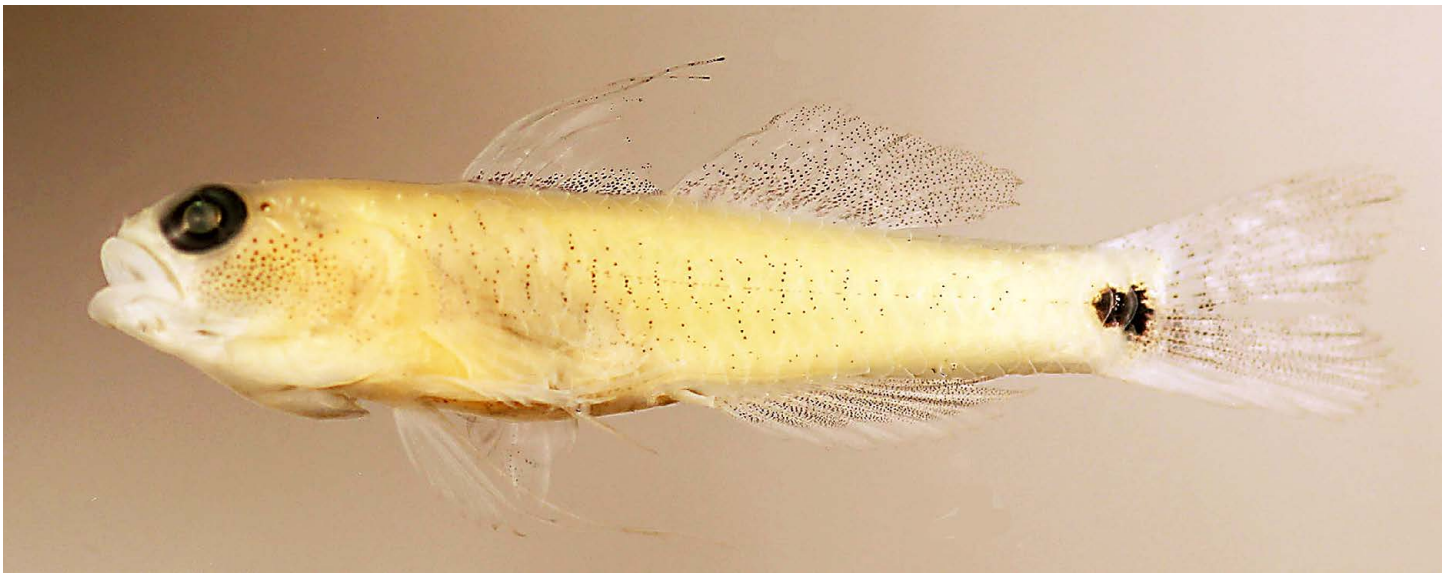

Figure 3. *Eviota kathyae*, preserved holotype, CAS 250336, 15.2 mm SL male, Tufi, Papua New Guinea (D.W. Greenfield).

Figure 4. Aerial view of the unique volcanic fjords of Tufi, Papua New Guinea (M.V. Erdmann)..

vertical line at base of caudal-fin rays; scattered melanophores just posterior to black blotch on caudal-fin rays and membranes, some extending out onto rays; a band of melanophores along first dorsal-fin base, elongated first spines with tips black; second-dorsal and anal fins peppered with melanophores; pectoral and pelvic fins with some scattered melanophores; snout, jaws, and area under eyes white.

Etymology. The specific epithet is named in honor of Kathryn (Kathy) Uhrig Kimball, the second author's life companion and an active diving member of the expedition that uncovered this beautiful new species.

Distribution and habitat. *Eviota kathyae* was observed and collected exclusively within the volcanic fjords of Tufi (Fig. 4), where it occurs at depths of 32–40 m. Individuals were typically observed perched on large foliose coral colonies or on patches of crustose coralline algae. The habitat had very little water movement and there was a significant accumulation of terrigenous sedimentation between coral colonies.

Comparisons. There are 12 species of *Eviota* that share features with *E. kathyae*, in particular the combination of unbranched pectoral-fin rays, a dorsal/anal fin-ray formula of 8/7, and the absence of only the IT cephalic-sensory pore (pattern II). *Eviota kathyae* can be distinguished from 9 of those species by the central dark blotch at the base of the caudal fin (note it is posterior to the typical caudal-peduncle spot over the preural centrum found on many other species) which is lacking on *Eviota ancora* Greenfield & Suzuki, 2011; *Eviota atriventris* Greenfield & Suzuki, 2012; *Eviota bilunula* Greenfield & Suzuki, 2016; *Eviota flebilis* Greenfield, Suzuki & Shibukawa, 2014; *Eviota nigrispina* Greenfield & Suzuki, 2010; *Eviota pellucida* Larson, 1976; *Eviota prasites* Jordan & Seale, 1906, *Eviota rubriceps* Greenfield & Jewett, 2011; and *Eviota storthynx* Rofen, 1959. The three remaining species, *Eviota marerubrum* Tornabene, Greenfield & Erdmann, 2021; *Eviota oculineata* Tornabene, Greenfield & Erdmann, 2021; and *Eviota zebrina* Lachner & Karnella, 1978 (the latter can also have 9/8) do have a similar black spot at the caudal-fin base. However, those three possess a fifth pelvic-fin ray, as do *E. atriventris*, *E. pellucida*, and *E. prasites*, vs. the absence of the fifth pelvic-fin ray in the new species. In addition, *E. marerubrum* and *E. zebrina* have three or four prominent dark, wavy, vertical lines crossing the caudal-fin which are lacking in *E. kathyae*. *Eviota oculineata* further differs from *E. kathyae* in eye and general body coloration (Fig. 5). *Eviota gunawanae* Greenfield, Tornabene & Erdmann in Greenfield, Tornabene, Erdmann & Pada, 2019 (Fig. 6) has a very similar color pattern to the new species, however it differs in morphological features, with the cephalic-sensory pore pattern lacking both the IT and NA pores and with the AITO pore positioned far forward and opening anteriorly.

Remarks. *Eviota kathyae* shares its overall general color pattern and habitat preference with *E. gunawanae* and its morphological characters with *E. oculineata*, both members of the *E. zebrina* complex (Tornabene et al .2021). Future genetic analyses will likely demonstrate that *E. kathyae* also belongs to that species complex and is closely related to *E. gunawanae*. The latter species is found in a similarly unusual environment, also highly protected from wave energy, in Sebakor Bay in Fakfak, West Papua, and was also only observed below 35 m depth (in contrast to *E. oculineata*, which is regularly found as shallow as 3 m and rarely deeper than 20 m).

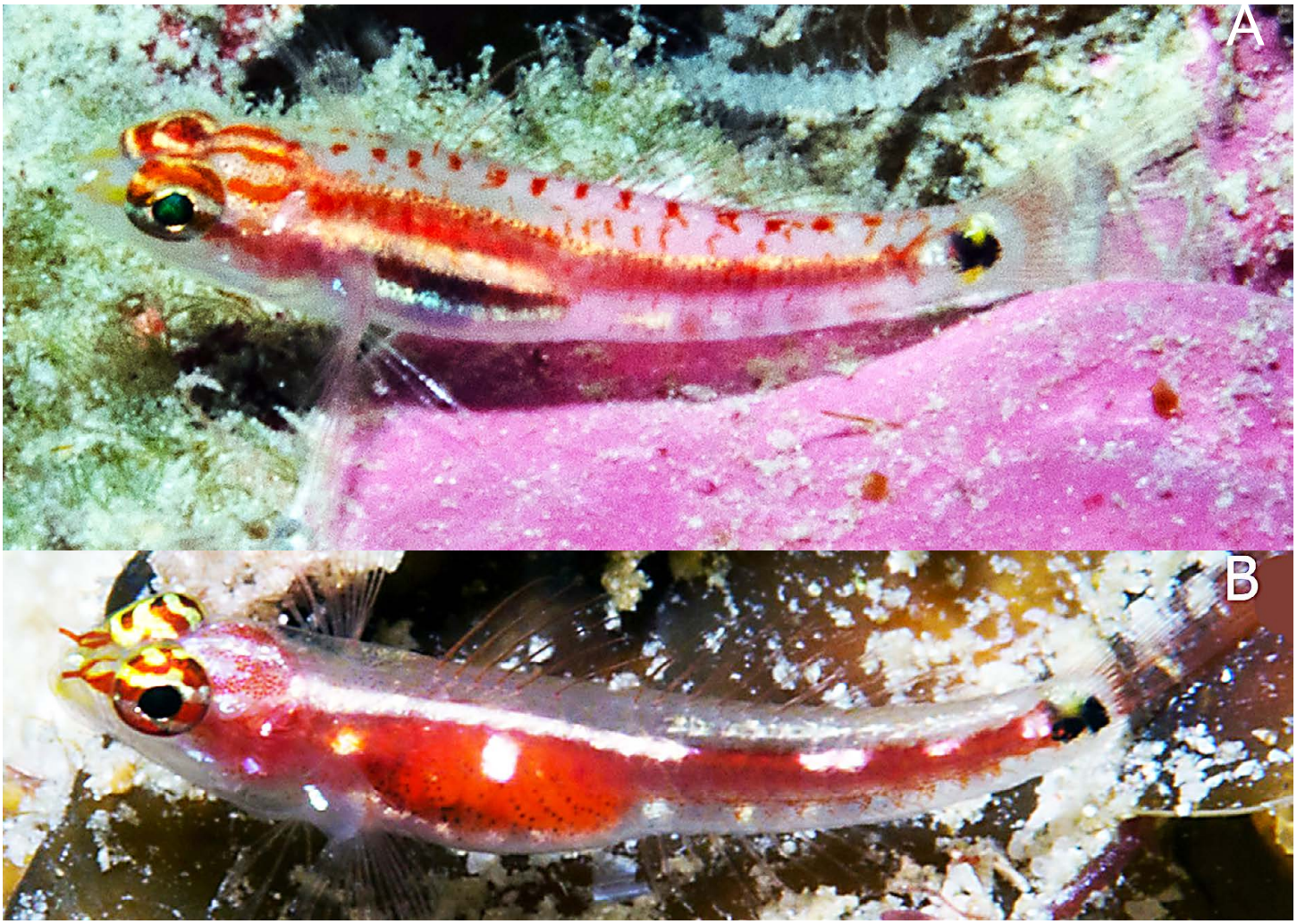

Figure 5. (A) *Eviota kathyae*, live type specimen, Tufi, Papua New Guinea (M.V. Erdmann); (B) *Eviota oculineata*, Milne Bay, Papua New Guinea, from Fig. 10 of Tornabene et al. (2021) (M.V. Erdmann).

Figure 6. *Eviota gunawanae*, underwater photograph, Fakfak, West Papua Province, Indonesia (M.V. Erdmann).

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