

# Journal of the Ocean Science Foundation

2021, Volume 38



## Redescription of the Fijian dwarfgoby *Eviota cometa* (Teleostei: Gobiidae)

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### Abstract

The holotype and paratypes of the dwarfgoby *Eviota cometa* Jewett & Lachner, 1983 were described from the Fiji Islands, but, unfortunately, non-type specimens of another closely related species from Fiji and other central and western Pacific localities were also included in the description, resulting in ongoing confusion over the identity of *E. cometa*. This second species, frequently illustrated in the literature as *E. cometa*, was recently described as *Eviota oculineata* Tornabene, Greenfield & Erdmann, 2021. *Eviota cometa* is redescribed here using only material collected from Fiji. *Eviota cometa* is distinguished from the other species by having thin, red, diagonal bars crossing the caudal fin in life; a solid dark-reddish iris; a two-part, black, basicaudal spot over the preural centrum; usually 16 or 17 pectoral-fin rays; and a dorsal/anal fin-ray formula of 9/8. The species is known only from Fiji and Tonga.

**Key words:** taxonomy, ichthyology, coral-reef fishes, gobies, Pacific Ocean, *E. oculineata*, biogeography

**Citation:** Greenfield D.W. & Erdmann, M.V. (2021) Redescription of the Fijian dwarfgoby *Eviota cometa* (Teleostei: Gobiidae). *Journal of the Ocean Science Foundation*, 38, 104–112.

**doi:** <https://doi.org/10.5281/zenodo.5706035>

**urn:** [lsid:zoobank.org/pub:C99B2A35-145A-45FC-840B-DE8768D6CAC8](https://lsid.zoobank.org/pub:C99B2A35-145A-45FC-840B-DE8768D6CAC8)

**Date of publication of this version of record:** 16 November 2021

## Introduction

The dwarfgobies (genus *Eviota* Jenkins, 1903) are a diverse group of tiny coral-reef fishes (usually <18 mm SL) found throughout most of the Indo-Pacific Ocean. They represent the second most speciose coral-reef fish genus (after *Gymnothorax*) and the fifth most speciose saltwater teleost genus (Greenfield & Winterbottom 2016, Greenfield 2021). These gobies are found throughout the Indo-Pacific Ocean, with the greatest diversity in the western Pacific in the area referred to as the ‘Coral Triangle’, which contains the world’s greatest diversity of coral-reef fishes (Allen & Erdmann 2012). Dwarfgobies are abundant on coral reefs, although their small size makes them difficult to observe (Greenfield 2017); nevertheless, tiny cryptobenthic fishes, including the dwarfgobies, can have a major effect on ecosystem functioning, providing for much of the biomass flux in the trophodynamics of the coral reef (Brandl et al. 2019).

The holotype of *Eviota cometa* was described by Jewett & Lachner (1983) from Totoya Island in the southern Lau Islands, Fiji, with paratypes from Naviti and Kadavu Islands in Fiji. Those authors also examined non-type material from various other regions in the Pacific Ocean, i.e. Ponape, Gilbert, Phoenix, and Line Islands, and included meristic data from these localities in their description. Their color description was based on a specimen from Fanning Island, the photograph of a preserved specimen from Australia, and the illustration based on a specimen from Palmyra. In their review of the *Eviota zebrina* complex, Tornabene, Greenfield & Erdmann (2021) demonstrated that the species commonly identified in photographs as *E. cometa* from other Pacific locations was different from the type specimens in Fiji, and named the new species *Eviota oculineata*. Given the potential confusion, we redescribe *Eviota cometa* herein, using more recently collected material from Fiji.

## Materials and Methods

The holotype is deposited at the United States National Museum, Washington DC, USA (USNM) and paratypes are deposited at the California Academy of Sciences, San Francisco, CA, USA (CAS); the Australian Museum, Sydney, Australia (AMS); and the Academy of Natural Sciences of Drexel University, Philadelphia, PA (ANSP).

Counts, measurements, and descriptions of fin morphology and cephalic sensory-canal-pore patterns follow Greenfield & Winterbottom (2016), as originally formulated by Lachner & Karnella (1980) and Jewett & Lachner (1983). Postanal ventral midline spots, along the posterior ventral midline of the body, begin at the anal-fin origin and extend to a vertical line two or three scale rows anterior to the ends of the hypurals; the additional smaller spot posterior to this, if present, is not counted. We follow Lachner & Karnella (1980: 4) in describing the membranes joining the first 4 pelvic-fin rays, which “...are considered to be well developed when the membranes extend beyond the bases of the first branches; they are considered to be reduced when they are slightly developed, not extending to the bases of the first branches”. 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 (posterior end of the hypural plate); 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; origin of the second dorsal-fin is measured from the median anterior point of the upper lip to the anterior base of its spine; 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 behind it; 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 was used to make pores and scale outlines more obvious (Akihito et al. 1993, 2002, Saruwatari et al. 1997).

## *Eviota cometa* Jewett & Lachner, 1983

### Comet Dwarfgoby

Figures 1–6 & 7A

**Holotype.** USNM 235817, 15.7 mm SL, Fiji Islands, Lau Archipelago, Totoya Island, -18.982°, 179.870°, 30 m, V.G. Springer, VGS 82-8A, 27 April 1983.

**Paratypes.** Fiji Islands, Great Astrolabe Reef, Kadavu Island, -18.87°, 178.52°: USNM 235832, 8 (10.3–13.7), USNM 235863, 1 (13.0), USNM 260328, 1 (16.4), CAS 52831, 2 (13.2, 14.9), ANSP 151996, 2 (11.7, 13.3). Fiji Islands, Yasawa Group, Naviti Island, approx. -17.1°, 177.2°: AMS I.24027-001, 1 (14.5).

**Non-type material.** Fiji Islands: CAS– 21980 (1), 222731 (7), 228692 (3), 228730 (1), 229085 (1), 229086 (5), 229590 (3), 229603 (1), 228685 (13), 228692 (3), 228703 (19), 228729 (1), 229055 (3), 229059 (1), 229060 (5), 229062 (5), 229143 (7), 229607 (1), 246694 (3); ROM 45234 (173).

**Diagnosis.** A species of *Eviota* distinguished from all congeners by a combination of a cephalic sensory-canal pore pattern lacking only IT pore (pattern 2), AITO pore small and opening dorsally; a dorsal/anal fin-ray formula of 9/8; 16 or 17 (usually 17) unbranched pectoral-fin rays; fifth pelvic-fin ray 5–17% of fourth ray; body depth 18–23% SL, no dark occipital spots or dark spots on pectoral-fin base; entire iris of eye dark reddish, pupil surrounded by a white ring, dorsal side of eye next to interorbital area with a short white bar not visible laterally; A two-part, black, basicaudal spot over preural centrum made up of a short, wedge-like, triangular front section



**Figure 1.** *Eviota cometa*, Yagasa Lagoon, Lau Archipelago, Fiji, approximately 140 km from the type locality on Totoya Island (M.V. Erdmann).



**Figure 2.** *Eviota cometa*, fresh specimen, CAS 222731, Budd Reef, Fiji (D.W. Greenfield).

connecting to a short, wide bar over end of hypural plate, with a yellow spot over nexus; caudal fin crossed by thin, red, diagonal bars, pale in preservative.

**Description.** Dorsal-fin elements VI+I,9, first dorsal fin triangular, second spine longest, filamentous, extending to eighth ray of second dorsal fin, all second-dorsal-fin soft 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 15 (1), 16 (7), 17 (12), unbranched, reaching at least to fifth ray of second dorsal-fin; fifth pelvic-fin ray 5–17% (10%) of fifth ray, fourth pelvic fin with 3–6 branches, 2–3 segments between consecutive branches of fourth pelvic-fin ray, pelvic-fin membrane reduced and no basal membrane, reaching well past anal-fin origin; 11–12 branched and 17 segmented caudal-fin rays; lateral-line scales 22–24; transverse scale rows 7; urogenital papilla in male smooth, wide with straight sides, and short fringes at end (Fig. 4), urogenital papilla of female bulbous, with several short finger-like projections distally; front of head rounded with an angle of about 65° from horizontal axis; mouth slanted obliquely upwards, forming an angle of about 55° to horizontal axis of body; maxilla extending posteriorly to middle of pupil; anterior narial tube short, just reaching margin of upper lip; gill opening extending forward to below posteroventral edge of preoperculum; cephalic sensory-canal-pore system missing only IT pore (pattern 2).



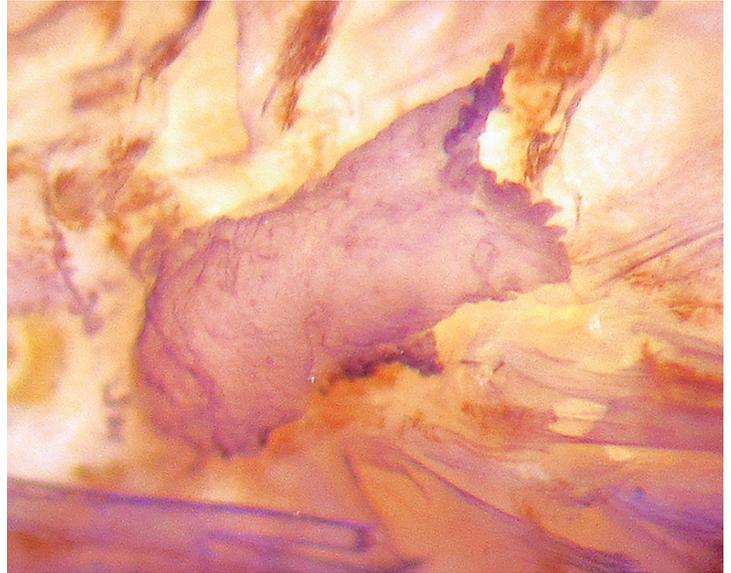
**Figure 3.** *Eviota cometa*, Samu Reef near Lautoka, Viti Levu, Fiji (J. Eyre).

Measurements (based on 10 specimens from CAS 228703, 14.1–16.8 mm SL) Head length 25.2–31.5 (26.8); origin of first dorsal fin 29.8–38.3 (33.6), lying behind posterior margin of pectoral-fin base; origin of second dorsal fin 52.8–58.4 (55.7), slightly in advance of anal-fin origin; origin of anal fin 55.3–61.1 (58.6); caudal-peduncle length 23.5–36.5 (28.4); caudal-peduncle depth 10.7–13.0 (11.5); body depth slender 17.8–22.7 (20.8); eye diameter 8.8–10.3 (9.4); snout length 3.2–4.4 (3.7); upper-jaw length for females 8.5 & 8.7, for males 8.7–11.0 (9.8), pectoral-fin length 23.9–34.9 (31.6); pelvic-fin length 27.6–40.6 (32.3), reaching anal-fin origin.

**Color in life.** (Figs. 1,3 & 7A) Background color of head and body translucent gray; 9 white spots extend along vertebral column, each separated by a dusky reddish blotch that extends dorsally and ventrally to form 8 internal body bars, ventral portions of posterior

6 form postanal spots, three over anal fin and three over caudal peduncle; 6 additional white spots dorsally on posterior portion of body; two rows of white spots on dusky reddish abdomen, one with about 8 spots extending back from top of pectoral-fin base, and second below with about 4 spots. Head with a large white spot behind upper half of eye and onto top of head with a white line crossing interorbital isthmus; side of the head dusky reddish with two small white spots; an additional white spot at lower pectoral-fin base; under eye and snout gray with a dusky reddish tinge with a white spot at end of snout, head behind eye gray below large white spot, underside of head and abdomen gray; entire iris of eye dark reddish, pupil surrounded by a white ring, and a white line dorsally not visible from a lateral view. A two-part, black, basicaudal spot over preural centrum made up of a short, wedge-like, triangular front section connecting to a short, wide bar over end of hypural plate, with a yellow spot over nexus, and sometimes a blue edging around anterior portion. Pelvic and pectoral fins gray, dorsal and anal fins with slight reddish tinge, caudal fin gray and crossed by about 4 posteriorly slanting, thin, red, diagonal bars.

**Color when fresh.** (Figs. 2 & 5) Background color of head and body translucent gray; anterior margins of scales outlined with red-orange; 8 internal red-orange bars along body: first behind pectoral-fin base, second over



**Figure 4.** *Eviota cometa*, male genital papilla, CAS 228703, 16.1 mm SL, Daveita Bay, Vanua Levu, Fiji (D.W. Greenfield).



**Figure 5.** *Eviota cometa*, fresh specimen, ROM 45234, 13.8 mm SL male, Great Astrolabe Reef, Kadavu Island, Fiji (R. Winterbottom).



**Figure 6.** *Eviota cometa*, preserved specimen, CAS 228703, 15.7 mm SL male, Daveita Bay, Vanua Levu, Fiji (D.W. Greenfield).

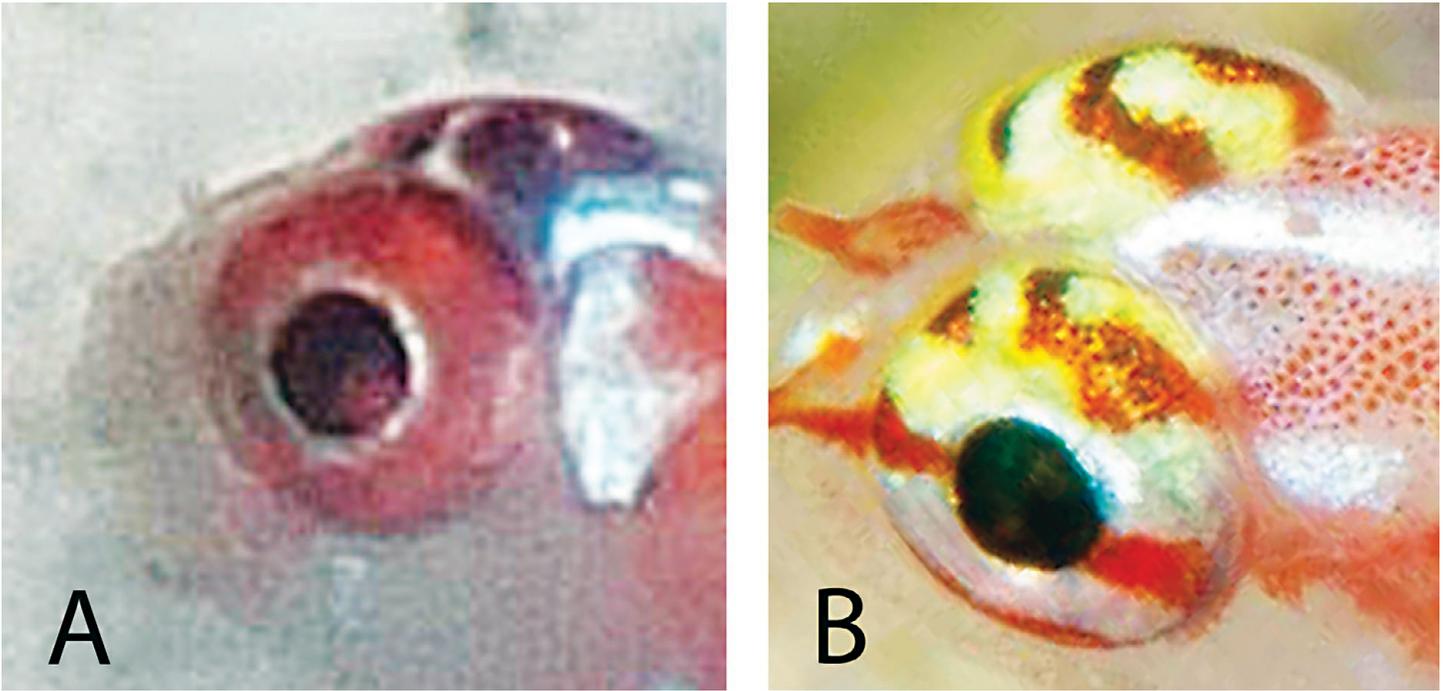
abdomen, third at level of genital papilla, fourth at anal-fin origin, fifth at center of anal fin and split ventrally with one arm at center and other at end of fin, sixth behind anal fin, seventh on caudal peduncle, and eighth at caudal-fin base at basicaudal spot, forming postanal spots (not retained in preservative); bars brighter below midline, sixth, seventh, and eighth darkest and most obvious. Head with gray operculum with pinkish tinge, color extending to pectoral-fin base and along ventral abdomen; jaws and area under eye orange-red; preoperculum, snout, and underside of head reddish pink; entire iris is dark reddish from lateral view, pupil surrounded by a white ring. A two-part, black, basicaudal spot over preural centrum made up of a short, wedge-like, triangular front section connecting to a short, wide bar over end of hypural plate, with a yellow spot over nexus, and sometimes a blue edging around anterior portion. Pelvic and pectoral fins gray, dorsal and anal fins reddish, caudal fin gray and crossed by about 4 posteriorly slanting, thin, red, diagonal bars.

**Color in preservative.** (Fig. 6) Head and body light cream, anterior margins of scales outlined with melanophores, more intense along ventral posterior portion of trunk; a distinctive black basicaudal spot consisting of two parts: a posterior narrow line centered over posterior end of hypural plate with anterior half triangular with apex connected to line, then a dusky streak extending posteriorly from narrow line over hypural plate to lower half of caudal fin, streak is crossed by two or more pale diagonal bands corresponding to red bands present in life. Side of head, snout, nape, and pectoral-fin base with scattered melanophores. First dorsal fin with a dusky stripe along its base, second dorsal and anal fins dusky; pectoral and pelvic fins pale.

**Etymology.** The specific epithet *cometa* is the Latin noun for comet, referring to the basicaudal spot and its trailing dark streak. The name is treated as a noun in apposition.

**Distribution.** Known only from Fiji and Tonga.

**Habitat.** From 1999–2003, Greenfield & Randall conducted a survey of the marine fishes of Fiji. In the field notes from that study, the habitat data (for the 19 CAS non-type material lots) included 7 associated with dead coral, 5 with coral and sand, three with sand and murky sediment, one with sand and rubble, one with rocky shore, and only two lots with live coral. The specimens from the 19 lots were taken from 0.9–22 m deep. In 1983, R. Winterbottom and ROM staff collected fishes in Fiji, mainly from Kadavu Island along the Great Astrolabe Reef, the type locality for some paratypes of *E. cometa*. The largest collection of *E. cometa* is ROM 45234, with 173 specimens, from consolidated coral growth rising 2 m off sand and silt bottom in 9–15 m depth. In addition, the author MVE photographed (Fig. 1) and collected *E. cometa* at 25 m depth from within the turbid Yagasa lagoon (in the Lau Archipelago, approximately 140 km from the type locality of Totoya Island) on a fine-sand and coral-rubble bottom.



**Figure 7.** *Eviota cometa* (A) and *Eviota oculineata* (B), live eye-color patterns (J. Eyre & R. Whitworth respectively).

**Discussion.** Since 2004, when Suzuki et al. published an underwater photograph labeled as *E. cometa*, all subsequent published photographs of putative *E. cometa* were of the same species, now known as *E. oculineata*. This is most likely because *E. oculineata*, which prefers clear-water coral areas, is far more widespread than *E. cometa*, which is found only in Fiji and Tonga. The two species are easily distinguished by the obvious live color differences of the eyes: *E. cometa* has the entire iris dark reddish and the pupil surrounded by a white ring, and a white line dorsally not visible from a lateral view, whereas in *E. oculineata* the iris has a red background with two horizontal stripes— one yellow passing through the upper margin of the pupil, and the other white and passing through the lower margin of the pupil, as well as the dorsal margin of the eye above the stripe having yellow spots or mottling (Fig. 7).

In addition, in life *E. cometa* has diagonal red bars crossing the caudal fin that are lacking in *E. oculineata*. Preserved specimens of *E. cometa* retain a pale representation of the red bars, often seen crossing the dark area of the lower caudal fin (vs. lacking in *E. oculineata*). *Eviota cometa* typically has 16 or 17 (usually 17) pectoral-fin rays whereas *E. oculineata* has 14 or 15, and a dorsal/anal fin formula of 9/8 versus 8/7. *Eviota cometa* is a member of the *Eviota zebrina* species complex, along with *E. oculineata* and *E. zebrina*, *E. pseudozebrina*, *E. longirostris*, *E. mararubrum*, *E. tetha*, and *E. gunawanae* (Tornabene, Greenfield & Erdmann 2021). The only other species in the complex with bars crossing the caudal fin are *E. zebrina*, *E. pseudozebrina*, *E. longirostris*, and *E. mararubrum*, but those bars are black, not red, and are retained in preservative, unlike the red bars of *E. cometa* that are lost.

Although *E. oculineata* was described from New Guinea and the Solomon Islands, the specimens and photographs from Fiji appear to be the same species. Greenfield & Randall (2016) included a photograph of *E. oculineata* (called *E. cometa*) by Rudy Whitworth (Fig. 8), and there are five Fijian lots of *E. oculineata* at CAS. Comparing the overall number of collections and individuals, *E. oculineata* appears to be much less common than *E. cometa* in Fiji.

The true distribution of *E. oculineata* awaits further collections and genetic studies, but photographs of dwarfgobies similar to *E. oculineata* have been taken at many areas throughout the south and western Pacific Ocean, including from Micronesia (Caroline and Hall Islands, Ponape, Chuuk, Ulithi Atoll, Ngulu Atoll); Marshall Islands (Enewetak Atoll); Kiribati (Gilbert, Phoenix, and Line Islands); the Banda Sea, Indonesia; the Great Barrier Reef, Australia; the Philippines (El Nido in Palawan); and Japan (Okinawa, Kerama).

**Comparative material.** *Eviota oculineata* Fiji: CAS 228063 (2), 228684 (2), 229061 (1), 229118 (3), 229600 (1).



Figure 8. *Eviota oculineata*, Valu-i-Ra, Fiji ( R.Whitworth).

### Acknowledgments

We would like to thank R.C. Langston, K.R. Longenecker, Captain B. Vasconcellos, T. Trnski, Semisi Meo and the crews of the *Moku Moku Hine* and *Braveheart* for assistance in the field, and to the late J. Seeto, G.R. South, and R.W. Tuxton of the University of the South Pacific, Fiji, for facilitating our collecting in Fiji, and a special thanks to R.R. Thaman, also of U.S.P., for his unending assistance; without his help this project literally would not have been possible. R. Whitworth kindly allowed us to use his photograph of *E. oculineata*, R. Winterbottom his photograph of *E. cometa*, and J. Eyre her photograph of *E. cometa*. We thank D. Catania, J. Fong, M. Hoang and L. Rocha of CAS for curatorial support. This research was supported by National Science Foundation grants INT97-29666 and DEB0-1027545, and Sea Grant Project R/FM-6PD. The manuscript was reviewed by Gerald Allen and Rick Winterbottom.

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