PROCEEDINGS OF THE BIOLOGICAL SOCIETY OF WASHINGTON
113(2):386–396. 2000.

Description of two new blenniid fish species: *Entomacrodus lemuria* from the western Indian Ocean and *E. williamsi* from the western Pacific Ocean

Victor G. Springer and Ronald A. Fricke

(VGS) Division of Fishes, MRC-159, National Museum of Natural History, Washington, D.C. 20560-0159, U.S.A.; (RAF) Staatliches Museum für Naturkunde in Stuttgart, Rosenstein 1, D-70191, Stuttgart 1, Germany

Abstract.—*Entomacrodus lemuria* is described from specimens from Madagascar, Mauritius, and Renunion, and *E. williamsi* is described from specimens from Halmahera (Indonesia), Madang (Papua New Guinea), and Duff Islands (Santa Cruz Islands, Solomon Islands). New distribution records are provided for *E. sealei,* a widely distributed Pacific plate endemic, and *E. corneliae,* a Marquesas Islands endemic. All four species are members of the Nigricans Group of *Entomacrodus,* which group is distinguished from all other blenniids in having the lateral thirds of the ventral margin of the upper lip crenulate and the middle third entire. Within the group, these four species form a subgroup distinguished by having most of the five preopercular pore positions represented externally by pairs or multiples of pores, as opposed to rarely having more than one or two positions with pairs or multiples of pores.

Springer (1967) revised the circumtropical shorefish genus *Entomacrodus.* There have been no new species described in the genus since that publication. Springer (1972:13) provided additional information on the Indo-Pacific species, including mention of a variant color pattern in a single specimen from Madang Harbor, Papua New Guinea. He tentatively identified the variant as *Entomacrodus sealei* Bryan & Herre, 1903, which is otherwise unknown from the island of New Guinea. Springer (1982:19) reported a second specimen of the variant from Ternate, Indonesia, where typical specimens of *E. sealei* are also unknown. He believed that the distribution of the variant, from two localities near the western margin of the Pacific plate, was allopatric to that of typical *E. sealei,* a widely distributed Pacific plate endemic (Springer 1982: fig. 8). Recently, in a single collection, J. T. Williams and associates obtained five specimens of the putative variant together with a large number of typical specimens of *E. sealei.* The sympatry of the two forms convinces us that two species are involved, and we formally describe the unnamed one herein. We have also obtained numerous specimens recently collected from Mauritius, Reunion, and Madagascar of another undescribed species that also appears to be related to *E. sealei,* and we describe that species herein.

In recent years there has been much interest in documenting (inventorying) the fish faunas of many parts of the world. Concomitantly, there has been much collecting and specimens have become available from many localities previously unsampled. Since 1967, there has been an extensive accumulation of *Entomacrodus* specimens in museum collections, and the genus is in need of a new revision. We are unable to undertake that project in the forseeable future, but believe that when there is reasonable certainty that undescribed species ex-

Table 1. Frequency distributions for number of preopercular pore positions represented by pairs or multiples of pores in specimens ≥25 mm SL of the Nigricans Species Group of *Entomacrodus*. There are five pore positions.

Species	N	Number of positions with pairs or multiples of pores						
		0	1	2	3	4	5	$\bar{x}$
cadenati	84	84	-	-	-	-	-	0.00
textilis	55	54	1	-	-	-	-	0.02
caudofasciatus	149	145	4	-	-	-	-	0.03
vomerinus	113	109	3	1	-	-	-	0.04
nigricans	343	314	26	3	-	-	-	0.09
chiostictus	487	184	164	96	29	12	2	1.02
williamsi	7	-	-	1	2	1	3	3.71
lemuria	47	-	1	2	13	16	15	3.89
sealei	99	-	-	-	7	17	75	4.69
corneliae	14	-	-	-	-	-	14	5.00

ist, their descriptions are warranted without delay.

Although the species of *Entomacrodus* have not been analyzed cladistically, some of the seven species groups Springer (1967: 12–13) recognized in the genus are probably monophyletic. One of these, the Nigricans Group, was defined on the basis of the morphology of the ventral margin of the upper lip: the central third of the margin is entire and the lateral third of the margin on each side is crenulate. This morphology does not occur in any other blennioid and, thus, serves as a reasonable basis for an hypothesis of monophyly of the group. Based on this character, the two new species are both members of the Nigricans Group.

Methods

Including the two new species, there are ten species in the Nigricans Group. There are very few characters that distinguish these species, and primary among them are a few particulars of the color pattern and sensory pores. For this reason, our descriptions are brief and limited to little more than the essentials necessary to differentiate the taxa.

Unless defined herein, methods are those of Springer (1967). All counts of vertical fin-ray elements were made from radiographs. When split to the base and supported by a single pterygiophore, the posteriormost anal-fin ray was counted as 1 (Method A of Springer 1967:5).

Preopercular pore positions: There are five sensory canal foramina on the lateral surface of the preopercle (Springer 1968: fig. 7; Smith-Vaniz & Springer 1971:fig. 16). Each of these foramina is represented by (connected to) one or more pores in the skin immediately external to the foramen. We term each such representation a "preopercular pore position" or simply "position" when in context (Fig. 1). Springer (1967) recognized six pore positions, but his ventroanteriormost position does not exit from the lateral surface of the preopercle and is excluded from our definition. The pores are small and often difficult to see; however, the number of these positions with two or more pores is an important character

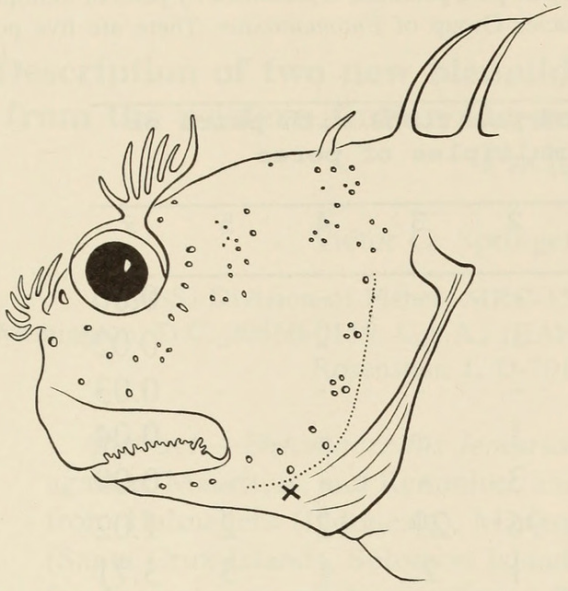

Fig. 1. Diagrammatic illustration of head pores in *Entomacrodus*. External limits of preopercle margin indicated by dotted line; x below ventralmost preopercular pore position; pore position types shown from ventralmost to dorsalmost: paired, paired, multiples, multiples, simple.

for distinguishing species of the Nigricans Group (Table 1). In specimens shorter than 24 mm SL the pore positions may consist only or mostly of single pores in all species of the Nigricans Group; however, in *E. lemuria,* all of the five specimens 18.2–22.7 mm SL, we checked for this character, had two to five positions with pairs of pores, and the smallest specimen had four positions with pairs of pores. To be on the conservative side, we restrict our characterization of pore positions to specimens 24 mm SL and longer (Table 1).

Color pattern: Many features of the color pattern in the Nigricans Group species are highly variable intraspecfically, others are reasonably consistent within and among the species. Some of the variation is the result of poor preservation, but much variation exists in well-preserved specimens. Among the most variable markings are the presence (or absence) and expression of the dusky bars on the body sides, and some of the dusky markings on the head and dorsal and anal fins. These markings, even in specimens that appear to exhibit full expression of color pattern, are of little use for diagnosing species. The more consistent banding of the caudal fin is also of no use. We have found that only aspects of the color pattern of the humeral area dorsal to the pectoral-fin axil and the upper lip are of importance. For these reasons, we restrict our color-pattern descriptions to these two features. The reader desiring more detail is referred to our illustrations and those of the Nigricans Group species in Springer (1967: pls. 18–27).

Institutional abbreviations are those listed in Eschmeyer (1998:16–22).

Materials

Unless noted otherwise, data reported are taken from specimens cited in Springer (1967, 1972).

Nigricans Species Group

Diagnosis.—Species of *Entomacrodus* with: central third of ventral margin of upper lip entire and lateral thirds crenulate; supraorbital cirri branched; nuchal cirri simple; posteriormost dorsal-fin spine reduced, not visible externally; segmented dorsal-fin rays 13–17 (rarely 13, strongly modally 14 or 15 in all but one species: modally 16 in *E. vomerinus* from the southwestern Atlantic); segmented anal-fin rays 14–18 (rarely 14 and only in *E. nigricans,* from the Caribbean; strongly modally 16 in all but *E. vomerinus,* modally 17, and 18 only in *E. vomerinus*); vertebrae 10+23–26 (strongly modally 34 in all but *E. vomerinus,* modally 35). Small species, largest specimen (always male) ranging from 53–105 mm SL, attaining more than 70 mm only in *E. lemuria* (72.1 mm) and *E. vomerinus* (105 mm).

Species Subgroups and Species Distributions

The ten species of the Nigricans Group appear to fall into three subgroups based on the number of preopercular pore positions

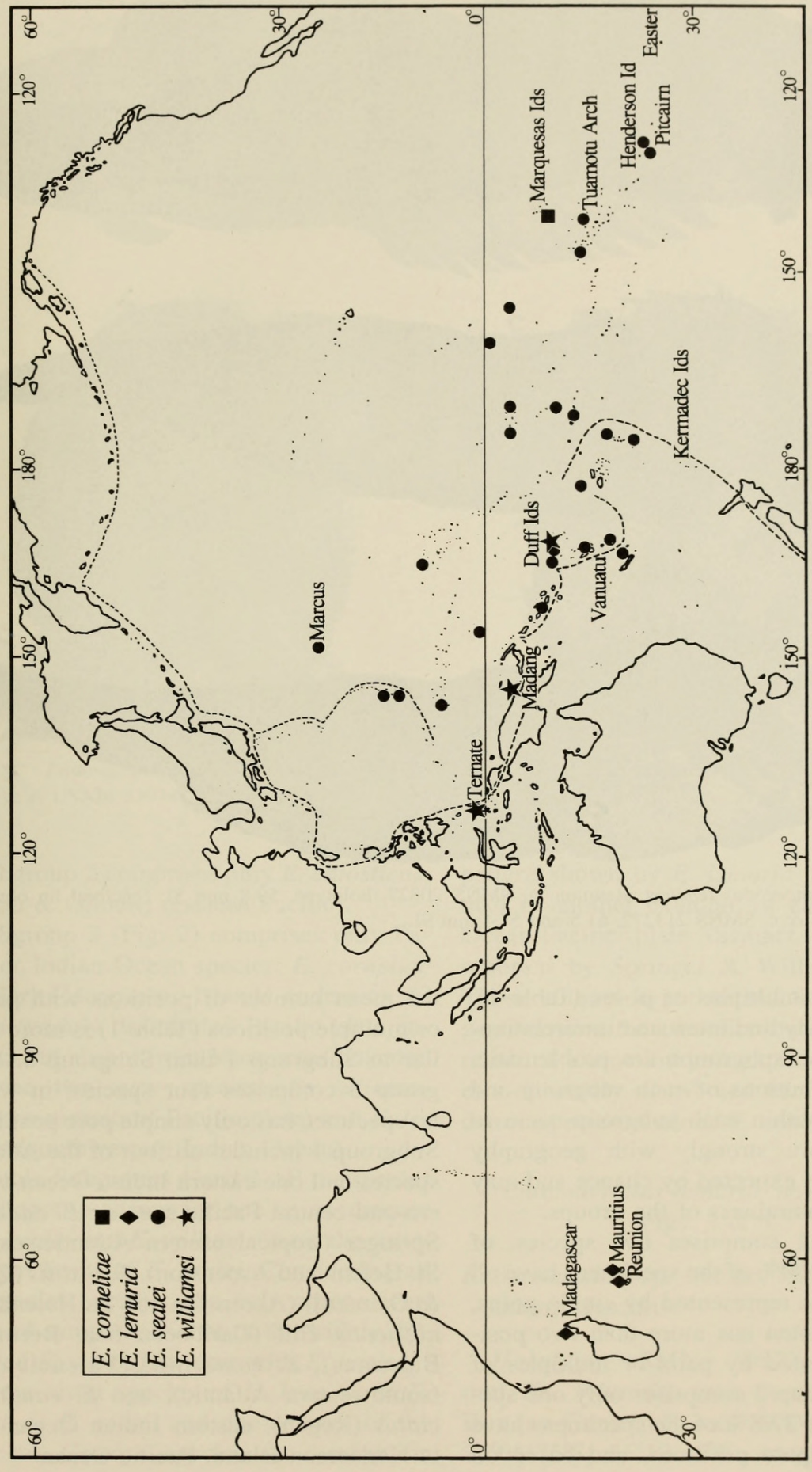

Fig. 2. Distribution of the species of Subgroup 3 of the Nigricans Species Group of *Entomacrodus*. Dashed lines indicate western margins of Pacific and Philippine lithospheric plates and eastern margin of Philippine plate, which is coincident with western margin of Pacific plate.

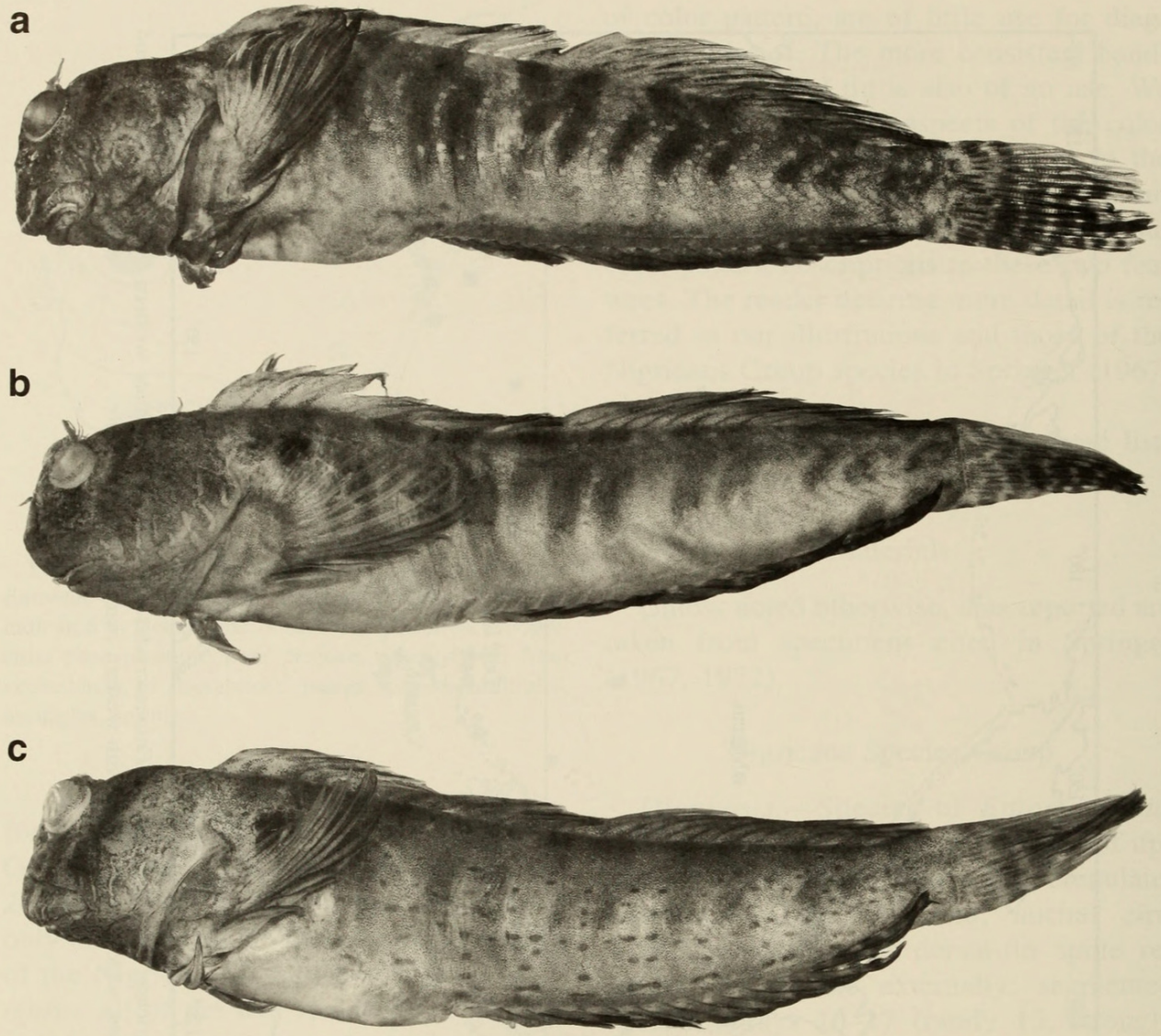

Fig. 3. *Entomacrodus lemuria,* Reunion: a, SMNS 20827, holotype, 59.8 mm SL (pectoral fin obscures humeral spot); b & c, SMNS 213272, 61.5 and 57.4 mm SL.

with pairs or multiples of pores (Table 1). The monophyly and inter- and intrarelationships of these subgroups are problematic, but the distributions of each subgroup and the species within each subgroup seem to correlate more strongly with geography than might be expected by chance and may hint at the naturalness of the groups.

Subgroup 1 comprises five species, of which 91.5–100% of the specimens have all pore positions represented by single pores, and no specimen has more than two positions represented by pairs or multiples of pores. Subgroup 2 comprises only one species, in which 37.8% of the specimens have only simple pore positions, and based on the mean number of positions with paired or multiple positions (Table 1) is more similar to Subgroup 1 than Subgroup 3. Subgroup 3 comprises four species, in which no specimen has only simple pore positions. Subgroup 1 includes all four of the Atlantic species and one eastern Indian Ocean-western-and-central Pacific species: *E. cadenati* Springer (tropical eastern Atlantic, except St. Helena and Ascension), *E. textilis* (Quoy & Gaimard) (Ascension and St. Helena), *E. nigricans* Gill (Caribbean Sea, Bermuda, Bahamas), *E. vomerinus* (Valenciennes) (southwestern Atlantic), and *E. caudofasciatus* (Regan), eastern Indian Ocean east to Henderson Island, Pacific Ocean.

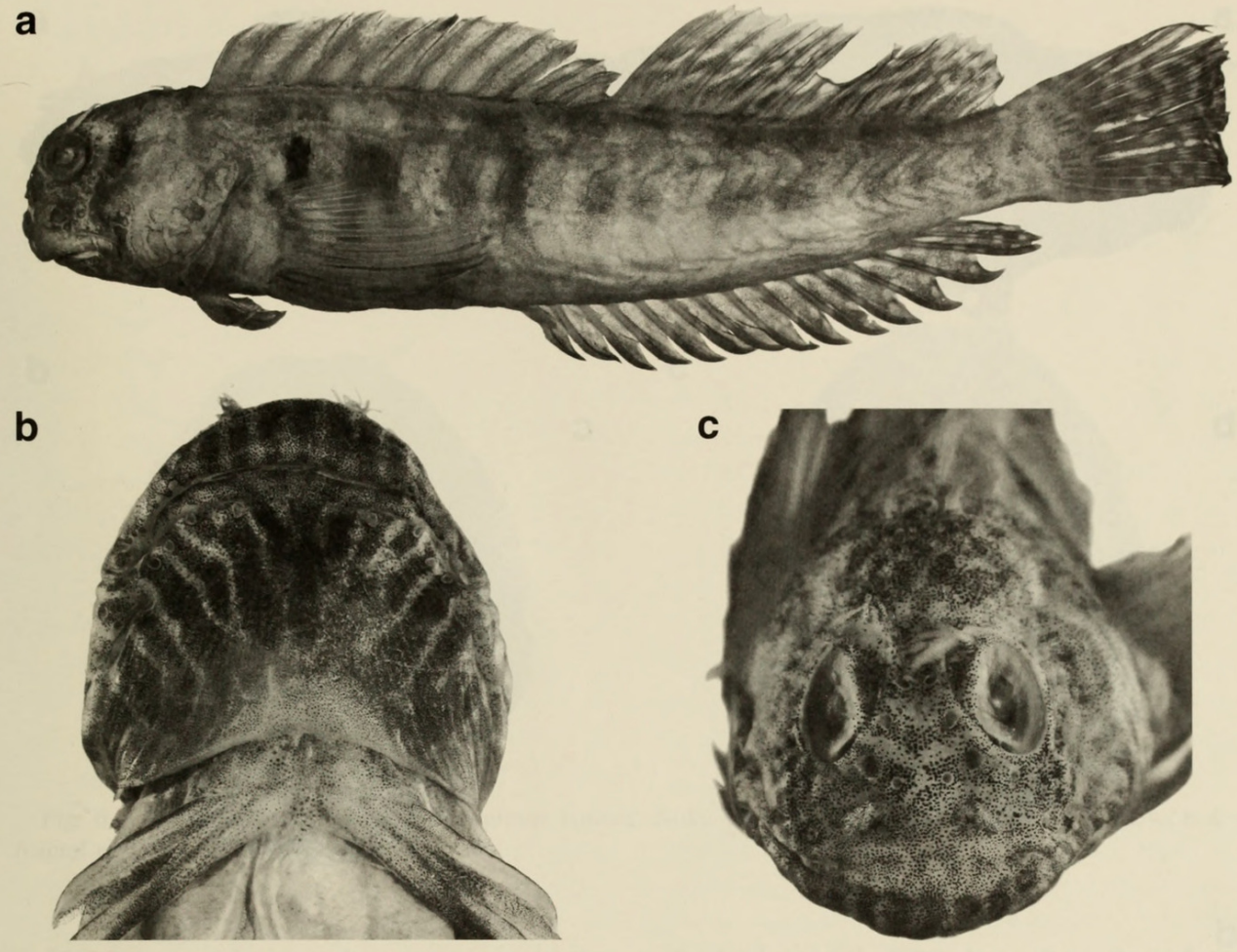

Fig. 4. *Entomacrodus lemuria,* Mauritius: a, USNM 341905, 66.3 mm SL (note damage to second dorsal fin); b & c, USNM 339747, 43.9 mm SL, ventral and anterior views of head.

Subgroup 2 comprises only *E. chiostictus* (Jordan & Gilbert) (eastern Pacific).

Subgroup 3 (Fig. 2) comprises only Pacific or Indian Ocean species: *E. corneliae* (Fowler) (Marquesas Islands endemic), *E. sealei* (widely destributed Pacific plate endemic, but absent from Marquesas Islands), and the two new species, *E. williamsi* (western margin of Pacific plate) and *E. lemuria* (southwestern Indian Ocean).

Within Subgroups 1 and 3, all the species are allopatric except for one co-occurrence of *E. sealei* and *E. williamsi* near the westernmost limits of *E. sealei.* Considering all the species together, the only other occurrence of sympatry is that of the widely distributed *E. caudofasciatus* with *E. sealei.*

If the sister species of *E. lemuria* is *E. sealei,* or *E. sealei* and one or both of the other two Group 3 species, the distribution pattern shown by *E. lemuria* and its sister taxa is another example of eastern Indian Ocean-Pacific plate disjunct distributions reported by Springer & Williams (1990). Those authors hypothesized that the broad gap between the two distributions was the result of extinction and explained the genesis of widely distributed Pacific plate endemic species, such as *E. sealei.*

Entomacrodus lemuria, new species
Figs. 3 & 4

Entomacrodus sp. Fricke, 1999:478, Réunion; Mauritius.

Holotype.—SMNS 20827, male, 59.8 mm SL, Réunion, west coast, 250 m N Boucan-Canot, 5 km WSW St. Paul, 21°01′35″S, 55°13′36″E, intertidal area of

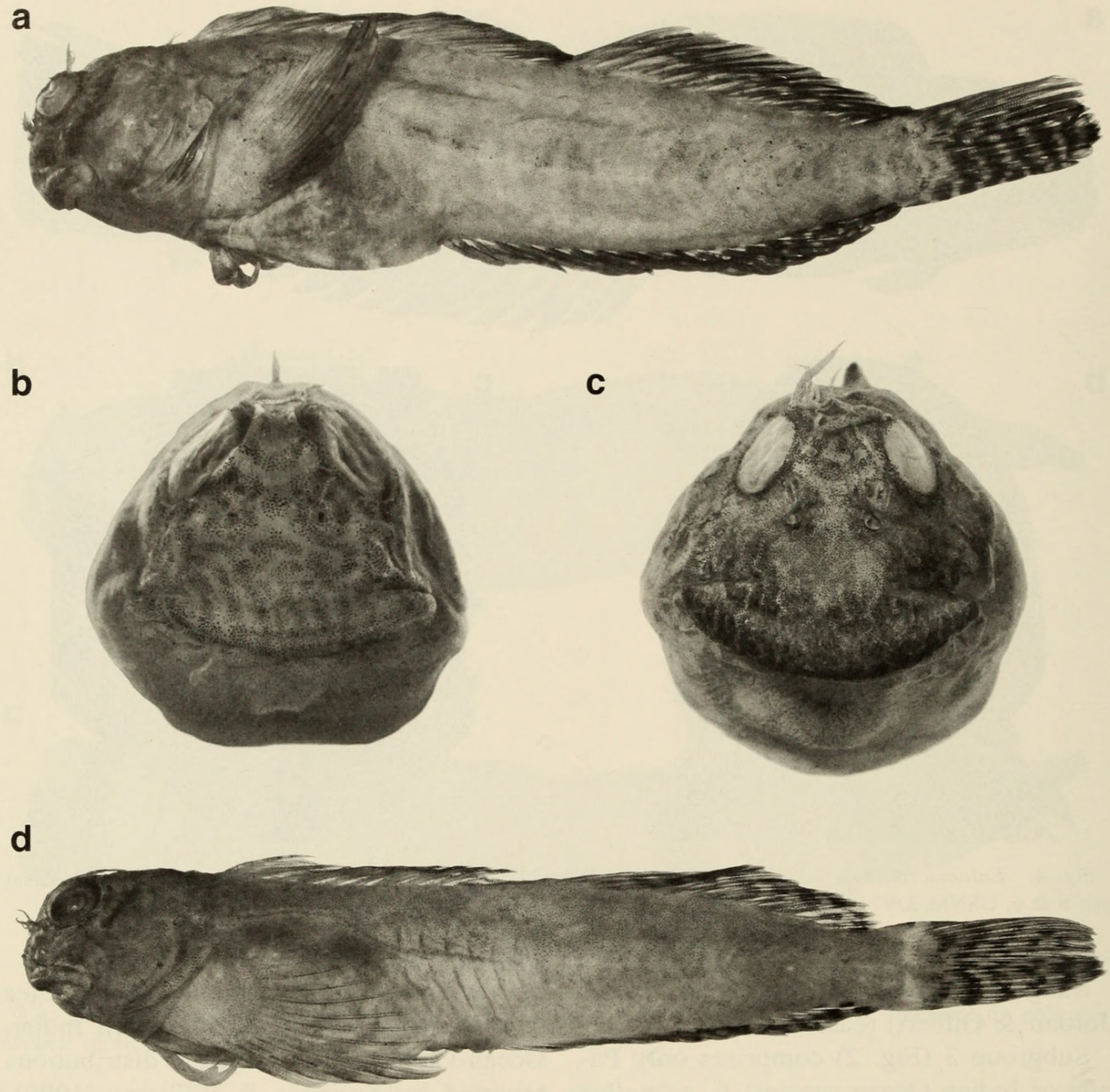

Fig. 5. *Entomacrodus williamsi,* Duff Islands, Santa Cruz Islands, Solomon Islands: a & c, USNM 356864, holotype, 59.8 mm SL lateral and frontal views of head; b & d, USNM 357792, 37.7 mm SL, frontal view of head and lateral view.

narrow fringing reef, near black rocks on shore, R. Fricke and S. Ribes, 18 Dec 1998.

Paratypes.—SMNS 21372, 4 specimens, 43.4–61.4 mm SL, collected with the holotype; AMS I.39536-001 (5:40.9–61.5 mm SL), CAS 209025 (5:25.6–60.0 mm SL), ROM 71976 (5:29.7–54.7 mm SL), RUSI 60472 (5:42.5–63.3 mm SL), USNM 339747 (57:18.1–67.9 mm SL), all Mauritius, W coast, Albion, off rocks at end of Victoria Avenue, surge zone, 0–5 m, A. C. Gill, P. C. Heemstra, M. Smale, and D. G. Smith, 15 May 1995, field no. PCH 95-M23; USNM 341905 (4:23.7–66.3 mm SL), same data as preceding, except: tide pools, between 25 April and 17 May 1995, field no. PCH 95-M9; USNM 357266 (29.5 mm SL), Madagascar, Nosy Be, near Andilama Beach Hotel, J. Paxton et al., 7 Nov 1988, *Vityaz* cruise 17, field no. JP 88-9.

Diagnosis.—Ventral margin of upper lip crenulate on lateral thirds; entire on central third; nape cirri present, simple; orbital cirri branched; 1 to 5, usually 3 to 5, preoper-

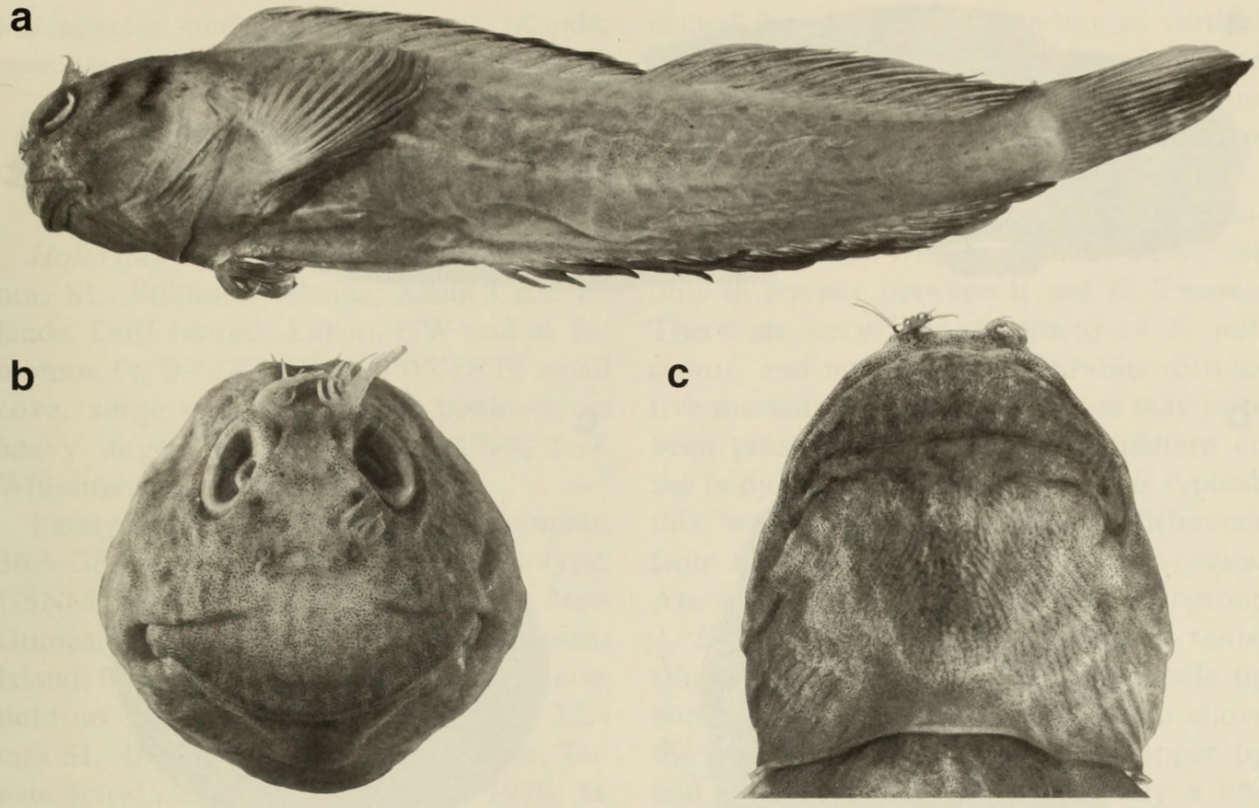

Fig. 6. *Entomacrodus corneliae,* Marquesas Islands, Nuku Hiva: AMS I.21773010, a, lateral view; b & c, frontal and ventral views of head.

cular pore positions with pairs or multiples of pores; subquadrate dark blotch present in humeral area on body (Figs. 3b, c; 4a); upper lip frequently with up to 15 alternating dark and 15 pale bands of subequal width, up to 7 of each above central, ventrally entire portion of lip (Fig. 4c, d); prominent, irregular dark mark on head just posterior to midpostorbital sensory pores (Figs. 3 & 4a).

Description (* denotes character state of holotype).—Dorsal fin XIII,14 (n = 4), XIII,15* (36), or XIV,17 (1). Anal fin II,16* (33) or II,17 (7), last ray split to base* (37) or simple (3, of which all have 17 segmented rays). Vertebrae: precaudal 10+23 (1), 24 (32), or 25* (6); pleural ribs 11* (30); epineural ribs 13* (9), 14 (6), 15 (11), 16 (0), 17 (1). Segmented pelvic-fin rays 4* (40). Pectoral-fin rays 13/14 (2), 14/14* (37), or 14/15 (1). Dorsal procurrent caudal-fin rays/ventral procurrent caudal-fin rays 7/6 (2), 7/7* (10), 8/7 (18), 8/8 (4), or 9/8 (1); segmented caudal-fin rays 13* (27), of which middle 9 are branched, dorsalmost and ventralmost 2 are simple.

Orbital cirrus branched (usually only on medial edge of stoutest cirrus), free cirrus tips 3–8, number tending to increase with size, variable bilaterally (holotype has 6/5). Nape cirri 1* on each side, rarely with 1 or 2 tiny branches. Nasal cirri palmate, 5 to 10 on each side (holotype with 8/9).

Lateral-line a continuous posteroventrally curving tube extending posteriorly to vertical from base of 9th to 13th dorsal-fin spine (10th*), continuing along body midside as series of 1 to 8 (5*) tiny, disconnected, bipored tubes extending to vertical from 11th dorsal-fin spine to 5th segmented ray (2nd segmented ray*). Preopercular pore positions (Table 1) with 1 to 5* positions with pairs or multiples of pores.

Color pattern: Highly variable ranging from almost lacking distinctive markings to being well marked. Some indication of the degree of color-pattern variation is indicated in Fig. 3, all specimens taken in the same

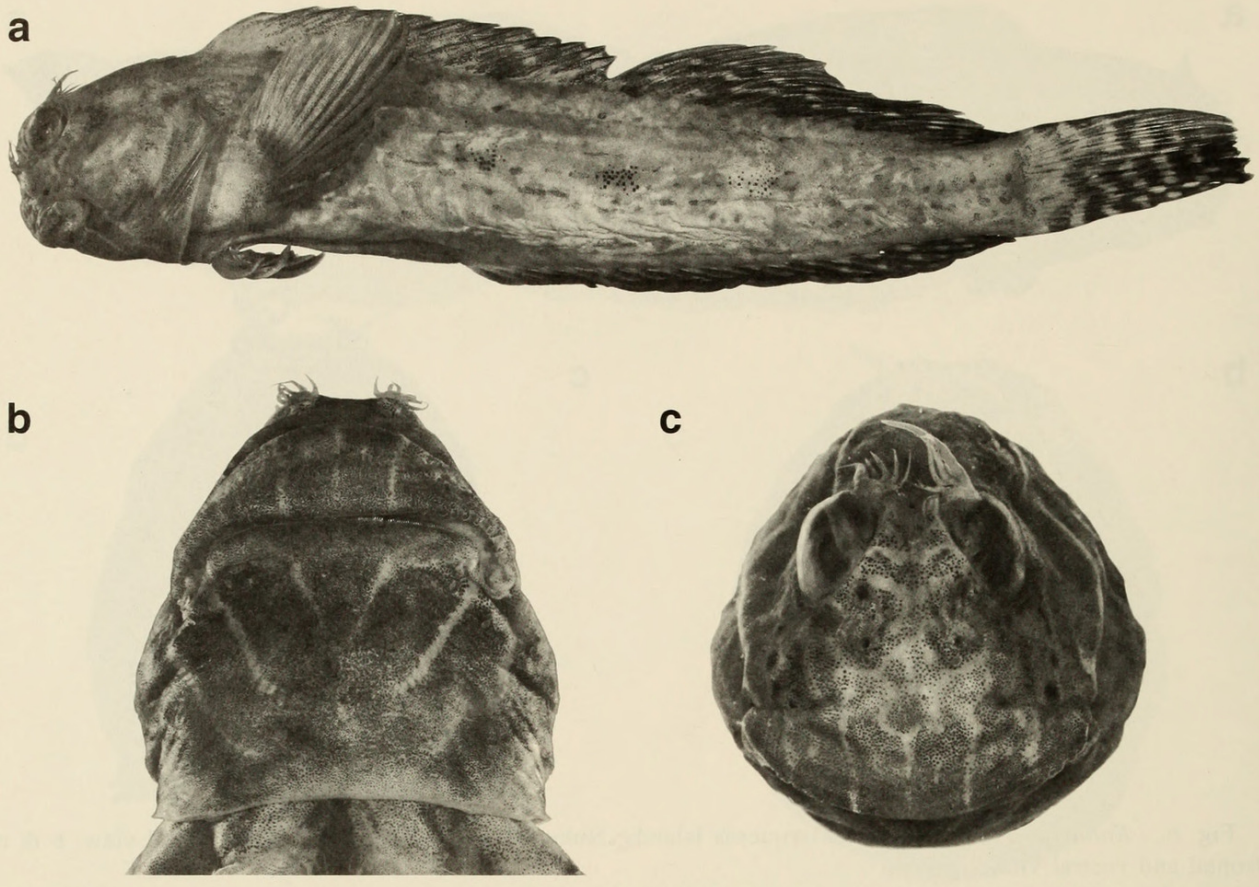

Fig. 7. *Entomacrodus sealei,* Eua, Tonga Islands: USNM 335206, 57.8 mm SL, a, lateral view; b & c ventral and frontal views of head.

collection. Most noticeable and consistent marking a diagnostic subquadrate to ovoid dark spot on body just dorsoposterior to pectoral-fin axil. Other markings may include: irregular dark spot on sensory pore series posterior to eye; snout above lip and sides of head with irregular pattern of dark and pale markings; underside of head with up to about 6 dusky chevrons separated by narrower pale bands; upper lip often with series of up to 15 dark bands alternating with up to 15 pale bands (dark lip bands, when present, 5 or 6 on central part of lip in area over noncrenulate portion of upper lip. Body with 4 or 5 pairs of dusky bands on sides, with offset dorsal portions.

Comparisons.—Entomacrodus lemuria is the only species of Subgroup 3 that has as the darkest marking on the body, a subquadrate to ovoid spot in the humeral area. *Entomacrodus sealei* occasionally has a dark slash in the humeral region, but it is much more slender than the humeral spot of *E. lemuria.* The humeral spot is essentially the only difference between *E. lemuria* and *E. williamsi.* Among the other two members of Subgroup 3, *E. lemuria* also differs from *E. sealei* (Fig. 7) in having more dark and pale lip bands, including more in the region above the noncrenulate portion of the upper lip, and in having the pale bands only a little less slender than the dark bands (versus almost consistently 7 or 8, each, dark and pale alternating bands, midlip dark bands much broader than pale bands, no more than 4 of each in area above noncrenulate portion of lip). *Entomacrodus lemuria* differs from *E. corneliae* (Fig. 6) in having only one prominent irregular dark spot on the head posterior to midpostorbital sensory pores (versus 2 such dark marks).

Etymology.—From Lemuria, a hypothetical continent, supposed to have existed in the Indian Ocean and now represented by

Madagascar and some adjacent islands; here used as a noun in apposition.

Entomacrodus williamsi, new species
Fig. 5

Holotype.—USNM 356864, male, 52.8 mm SL, Solomon Islands, Santa Cruz Islands, Duff Islands, Lakao, NW end at Temomoa Pt, 09°47′54″S, 165°05′18″E, small cove, surge channels in big boulders, in heavy surge, 0–10 m, 24 Sep 1998, J. T. Williams et al.

Paratypes: USNM 357792, 4 specimens, 36.5–38.1 mm SL, collected with holotype. USNM 206400, 37.6 mm SL, Papua New Guinea, Madang Harbour, S edge of Massas Island, 0–2.4 m, 2 Jun 1970, B. B. Collette, field no. BBC 1501. USNM 356244, 32.4 mm SL, Indonesia, Moluccas, Ternate, Ternate [city], 0.2–0.5 m, 1–2 July 1979, H. Singou, field no. HS-F610.

Description (* denotes character state of holotype).—Dorsal fin XIII,14 (n = 1) or XIII,15* (6). Anal fin II,15 (1), II,16* (5) or II,17 (1), last ray split to base* (5) or simple (2, of which 1 has 15 and 1 has 17 segmented rays). Vertebrae: precaudal 10+24* (7); pleural ribs 11* (7); epineural ribs 14* (5) or 15 (1). Segmented pelvic-fin rays 4* (7). Pectoral-fin rays 13/14 (1) or 14/14* (6). Dorsal procurrent caudal-fin rays/ventral procurrent caudal-fin rays 8/2 (1), 8/7 (2), 8/8* (2), or 9/8 (1); segmented caudal-fin rays 13* (7), of which middle 9 are branched, dorsalmost and ventralmost 2 are simple* (6, one specimen damaged).

Orbital cirrus usually branched (usually only on medial edge of stoutest cirrus), free cirrus tips 1–6 (1 or 2 probably abnormal), variable bilaterally (holotype has 5/6). Nape cirri 1* on each side (1 specimen with cirrus forked on one side). Nasal cirri palmate, 4 to 7 on each side (holotype with 6/7).

Lateral-line a continuous posteroventrally curving tube extending posteriorly to vertical from base of 9th to 12th dorsal-fin spine (11th*), continuing along body midside as series of 2 to 6 (*5) tiny, disconnected, bipored tubes extending to vertical from 13th dorsal-fin spine to 5th segmented ray (4th ray*). Preopercular pore positions (Table 1) with 2 to 5 positions with pairs or multiples of pores (5*; see Table 1).

Comparisons.—The lack of a dark humeral spot in *E. williamsi* is essentially the only difference between it and *E. lemuria.* There are very few specimens of *E. williamsi,* and none of these exhibits distinctive markings on the body, which may have been present in life. If lack of pattern on the body of preserved specimens is typical, this would constitute another difference from *E. lemuria,* and the other two species. Among the other two species of Subgroup 3, *E. williamsi* also differs from *E. sealei* (Fig. 7) in having more dark and pale lip bands, including more in the region above the noncrenulate portion of the upper lip and in having the pale bands only a litte less slender than the dark bands (versus almost consistently 7 or 8, each, dark and pale alternating bands, midlip dark bands much broader than pale bands, no more than 4 of each in area above noncrenulate portion of lip), and from *E. corneliae* (Fig. 6) in having only one prominent irregular dark spot on the head posterior to midpostorbital sensory pores (versus 2 such dark marks).

Etymology.—Named for our colleague Jeffrey T. Williams, in recognition of his outstanding efforts in collecting Indo-Pacific fishes.

Entomacrodus corneliae (Fowler, 1932)
Fig. 6

Additional material (all of the few known specimens are from the same locality): Marquesas Islands, Nuku Hiva: AMS I.21773010 (9).

Entomacrodus sealei Bryan & Herre, 1903
Fig. 7

New distribution records for *E. sealei* include: Loyalty Islands: Lifou Island, SMNS

21712 (1 specimen). Vanuatu: Tanna, USNM 344230 (13); Epi, USNM 356399 (7). Fiji: Rotuma, USNM 283060 (1). Tonga: Eua, USNM 329699 (>30), 335206 (12); Tongatapu, USNM 337428 (1); Vava'u Group, Hunga, USNM 339314 (8); Vava'u, USNM 340229 (2). Solomon Islands: Santa Cruz Islands, Duff Islands, Lakao, USNM 356857 (92); Taumako, USNM 357098 (12); Russell Islands, Mbanika (or Banika), NMNZ P.26004 (1). Tuamotu Archipelago: Rangiroa, BPBM 14007 (8). Pitcairn Islands: Henderson Island: BPBM 17091 (10).

Acknowledgments

For the loan of specimens we thank J. E. Randall (BPBM), M. McGrouther (AMS), and C. Roberts (NMNZ). Several USNM colleagues provided a variety of services: K. Darrow prepared the distribution map; K. Murphy provided technical assistance; J. Clayton, L. Palmer, and S. Raredon handled loan and accession actions. T. B. Griswold produced the photographs for Figs. 3–7. The U.S.N.M. Office of Biodiversity Programs Grant to V. G. Springer and J. T. Williams provided funds for Williams's expedition to the Santa Cruz Islands (1998), during which important material was collected. U.S.N.M. Research Opportunities Fund grant. no. 1233F57A to D.G. Smith (USNM) supported his participation in an expedition to Mauritius, during which one of the new species was collected. A draft of this manuscript was reviewed by J. T. Williams.

Literature Cited

Bryan, W. A., & A. W. C. T. Herre. 1903. Annotated list of the Marcus Island fishes.—Occasional Papers of the Bernice P. Bishop Museum 2 (1): 126–139.

Eschmeyer, W. N. 1998. Introduction. Pp. 16–22 *in* W. N. Eschmeyer, ed., Catalog of Fishes. Volume 1. California Academy of Sciences, 958 pp.

Fowler, H. W. 1932. The fishes obtained by the Pinchot South Seas Expedition of 1929, with descriptions of one new genus and three new species.—Proceedings of the United States National Museum 80 (2906):1–16.

Fricke, R. 1999. Fishes of the Mascarene Islands (Réunion, Mauritius, Rodriguez), an annotated checklist with descriptions of new species. Koeltz Scientific Books, Königstein, 759 pp.

Smith-Vaniz, W. F., & V. G. Springer. 1971. Synopsis of the tribe Salariini, with description of five new genera and three new species (Pisces: Blenniidae).—Smithsonian Contribtions to Zoology 73:1–72.

Springer, V. G. 1967. Revision of the circumtropical shorefish genus *Entomacrodus* (Blenniidae: Salariinae).—Proceedings of the United States National Museum 122 (3582):1–150, Pls. 1–30.

———. 1968. Osteology and classisfication of the fishes of the family Blenniidae.—Bulletin of the United States National Museum 284:1–85, pls. 1–11.

———. 1972. Additions to Revisions of the blenniid fish genera *Ecsenius* and *Entomacrodus,* with descriptions of three new species of *Ecsenius.*—Smithsonian Contributions to Zoology 134:1–13.

———. 1982. Pacific plate biogeography, with special reference to shorefishes.—Smithsonian Contributions to Zoology 367:1–82.

———, & J. T. Williams. 1990. Widely distributed Pacific plate endemics and lowered sea level.—Bulletin of Marine Science 47(3):631–640.