Lizards of the Genus *Emoia* (Scincidae) with Observations on Their Evolution and Biogeography

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ABSTRACT The 72 recognized species of the lizard genus *Emoia* (Scincidae) are described; 13 of these are new: *E. coggeri, E. cyclops, E. digul, E. irianensis, E. jamur, E. paniai, E. brongersmai, E. montana, E. pseudopallidiceps, E. erronan, E. isolata, E. pseudocyanura,* and *E. rennellensis.* Three new subspecies—*E. arnoensis nauru, E. atrocostata australis,* and *E. physicae pupari*—are also described. A new status is recognized for eight species or subspecies: *E. atrocostata freycineti, E. bogerti, E. maxima, E. obscura, E. oribata, E. pallidiceps mehelyi, E. popei,* and *E. veracunda.*

Eight species groups are recognized on morphological grounds. Three (*baudini, cyanogaster,* and *physicae*) are known only from New Guinea and adjacent islands. Two groups (*ponapea* and *adspersa*) have limited ranges in Micronesia and Samoa. The *samoensis* Group occurs in the Samoa, Tonga, Fiji, Vanuatu, and Solomon islands. The *cyanura* Group has two areas of endemism: the Solomon Islands and islands to the west of New Guinea. The *atrocostata* Group also exhibits two areas of endemism: a primary one in Micronesia and isolated endemics in southeast Asia and on Christmas Island. Only two relatively wide-ranging species have reached Australia, in the northeastern Cape York area. Four species (or superspecies), one in the *atrocostata* Group, one in the *baudini* Group, and two in the *cyanura* Group have extensive ranges—these distributions are interpreted as the result of more opportunistic dispersal, at times probably with the aid of man.

The distribution patterns of the groups and the evidence of radiation within the currently occupied areas correlate with recent hypotheses concerning the plate tectonics of the southwest and western Pacific regions.

INTRODUCTION

The genus *Emoia* was erected by Gray (1845) as a section of *Mabouya.* Girard (1857) described *Emoa nigrita* and in his 1958 paper included Gray's species (*atrocostatus, baudini, cartereti,* and *cyanura*) ignoring the priority of *Emoia.* Boulenger (1887a) treated *Emoia* as a subgenus of *Lygosoma.* Stejneger (1899) and Cope (1900) recognized *Emoia* as a valid genus. Most authors since 1900 have accepted the generic rank of this taxon.

Gray (1845) recognized four species of *Emoia,* Boulenger (1887a) 13, and Smith (1937) 32 (24 of these are still valid). Between 1937 and 1987, 25 more species have been described or resurrected. In this study I have reexamined the validity of all species and subspecies described in the past and identified undescribed species. I presently recognize 72 species of *Emoia.* The species range from Southeast Asia through the Indo-Australian Archipelago and the Islands of the Pacific Ocean. I divide the genus into eight groups (evolutionary lineages). These are (1) *adspersa* Group, 2 species; (2) *atrocostata* Group, 6 species; (3) *baudini* Group, 22 species; (4) *cyanogaster* Group, 5 species; (5) *cyanura* Group, 12 species; (6) *physicae* Group, 11 species; (7) *samoensis* Group, 13 species; (8) *ponapea* Group, 1 species.

MATERIALS AND METHODS

Types and topotypical material were studied when available, along with collections in most European, American, and Australian museums. Two large unreported collections of *Emoia* from areas south of the central mountain range in New Guinea were examined. One derived from two expeditions into southern Irian Jaya (formerly Dutch New Guinea) made in 1939 and 1959 under the leadership of H. Boeseman and L. D. Brongersma of the Rijksmuseum van Natuurlijke Historie. The other collection, from southern Papua New Guinea, was made by Fred Parker in the 1960s and 1970s, and is deposited at the MCZ.

Most of the species are restricted in range and represented by small to moderate samples. All known collections of *Emoia* species were studied and are listed in the materials examined sections. *Emoia atrocostata, E. cyanura, E. caeruleocauda, E. jakati, E. obscura, E. pallidiceps, E. longicauda,* and *E. nigra* are widely distributed and generally abundant. Samples from numerous localities were examined, but not all examples in the large collections are included.

Measurements, unless otherwise noted, are of preserved specimens and were determined to the nearest 0.1 mm. Scale counts and measurements were standardized as follows: (1) lamellae beneath the digits were counted to include all down to the base, or to include basal ones at least two or three times the breadth of the scales on the sole; (2) dorsal scale rows were counted along the vertebral line between the parietals and the point at the tail base opposite the vent; (3) head length (HL) was measured from snout tip to the posterior edge of the ear opening; (4) eye diameter was measured by placing the needle points of the caliper within the socket and, under some pressure, determining the antero-posterior diameter, or if the eye was very small, from the anterior to the posterior corner; (5) head breadth (HB) was measured at the widest point near the jaw angles. The following abbreviations of standard measurements are used in the text: snout–vent length (SVL), head length (HL), and head breadth (HB). The minimum size at maturity of preserved specimens is an approximation based on the presence of eggs or the convoluted appearance of the oviducts for females and the large size of the testes for males.

Groups (evolutionary linages) within the genus are determined by using such characters as: (1) type of palate; (2) nasal bones distinct or fused; (3) scales keeled or smooth; (4) parietal eye present or absent; (5) interparietal present or absent; and (6) scales large or small; (7) lamellae rounded or thinned and bladelike; (8) anterior loreal long and low or short and high.

In the larger groups (*baudini, physicae, samoensis,* and *cyanura*), subgroups of similar and frequently confused species are recognized based on one unique character or a combination of shared characters. These characters include size, color pattern, rounded or thinned toe lamellae, upper labial below eye, and height of keels on scales. In evaluating species and subspecies, differences include (1) minor color-pattern differences, (2) size, (3) number of midbody scale rows, (4) number of dorsal scale rows, (5) number of fourth toe lamellae, (6) presence or absence and size and shape of interparietal, (7) size and shape of anterior loreal, (8) number of upper labial below eye, and (9) in some instances proportional measurements. Characters involving scale counts may show no, moderate, or extensive overlap in observed ranges for species in the same complex or when compared with species in other complexes. The mean ($\bar{x}$) and standard deviation (SD) were determined for counts of lamellae, midbody scale rows, and dorsal scale rows for those species where the sample size (n) was greater than five. In comparing species or subspecies, where overlap in ranges of counts for these characters occurred, Student's t-test of significance for differences between means was used. When the difference between the means is significant, the "t" value, degrees of freedom (df), and probability (P) are given in the comparisons.

Repositories for specimens studied are indicated in the text by the following abbreviations: American Museum of Natural History, New York (AMNH); Australian Museum, Sydney

(AMS); British Museum (Natural History), London (BMNH); California Academy of Sciences, San Francisco (CAS or CAS-SU); Carnegie Museum, Pittsburgh (CM); Field Museum of Natural History, Chicago (FMNH); Fiji Museum, Nadi (FM); Florida State Museum, Gainesville (UF); Naturhistorisches Muséum, Basel (NMBA); Muséum National d'Histoire Naturelle, Paris (MNHN); Museum of Comparative Zoology, Harvard, Cambridge (MCZ); Museum of Vertebrate Zoology, University of California, Berkeley (MVZ); Museum Zoologicum Bogoriense, Bogor (MZB); Natur-Museum and Forschungs-Institute, Senckenberg (SMF); Rijksmuseum van Natuurlijke Historie, Leiden (RMNH); United States National Museum of Natural History, Washington, D.C. (USNM); Zoologisches Museum, Hamburg (ZMH); Museo Civico di Storia Naturale, Genova (MSNG); Zoological Museum, Amsterdam (ZMA); Zoologisk Museum, Copenhagen (ZMUC); University of Papua New Guinea, Waigani (UPNG); Brigham Young University, Provo (BYU); University of Puget Sound, Tacoma (CPS); South Australian Museum, Adelaide (SAMA); Queensland Museum, Brisbane (QM); National Museum of Victoria, Melbourne (NMV); Bishop Museum, Honolulu (BPBM); University of the South Pacific, Fiji (USP); University of Guam, Mangilao (UGM); University of Kansas Museum of Natural History, Lawrence (KU); Naturhistorisches Museum, Wien (NMW); Rijksuniversitair Centrum Antwerpen (RUCA); Institut Royal des Sciences Naturales Belgique, Brussels (IRSNB); University of Michigan, Museum of Zoology, Ann Arbor (UMMZ); Universität Humboldt Museum für Naturkunde, Berlin (ZMB).

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Systematic Section

Emoia Gray

Eusoma Fitzinger, 1843:22 (not *Eusoma* Garmar, 1817) Type species *Eumeces lessoni* (=*Scincus cyanurus* Lesson, 1826) Duméril and Bibron 1839.

Emoia Gray, 1845:95. Type species *Mabouya* (*Emoia*) *atrocostatus* Gray (=*Scincus atrocostatus* Lesson), designated by Stejneger 1899:807; Boulenger 1887a: 209.

Emoa Girard, 1857:197. Type species *Emoa nigrita* (=*Emoia nigra* Jacquinot and Guichenot, 1853); Boulenger 1887a:211 (listed as subgenus of *Lygosoma* and credited to Gray).

Diagnosis.—Skinks with the following combination of characters: supranasals present; window in movable lower eyelid; frontoparietals fused; limbs well developed, pentadactyl.

These four characters are shared by all species of the genus. However, one or both of the derived characters (window in moveable lower eyelid and frontoparietals fused) also characterize some species of *Lipinia* and *Leiolopisma,* lygasomine genera lacking supranasals. Greer (1974:200) suggests that *Emoia* may be derived from a *Eugongylus* stock or a pre-*Leiolopisma spenceri*-like stock.

Several additional characters are common to all species of *Emoia,* but they are not diagnostic because they are also found in most species of several other genera of skinks. These include: (1) rostral broader than high; (2) frontal as long as or longer than broad and in contact with two anterior supraoculars; (3) four large supraoculars; (4) parietals large and in contact; (5) ear prominent, usually with small lobules anteriorly, but always much smaller than eye; (6) rank of adpressed toes from the shortest to the longest: first, second or fifth, third, fourth; (7) tail slender and much longer than body.

The present range of the genus extends from Christmas Island, Java, Malaya, Vietnam, and Taiwan at its western boundary, through the islands of the Indo-Australian Archipelago, Philippines, New Guinea, Cape York Peninsula, and eastward throughout the islands of the Pacific Basin as far as Clipperton Island in the north but not Easter Island in the south (Fig. 31). The Pacific Basin is here defined as including those islands east of the Philippines in the north, and the Solomons and New Caledonia in the south; the western limit of the basin is demarcated by the Pacific-Basin line (Fig. 31). This is a zoogeographic, not a geological boundary, although close to that of the Pacific Plate.

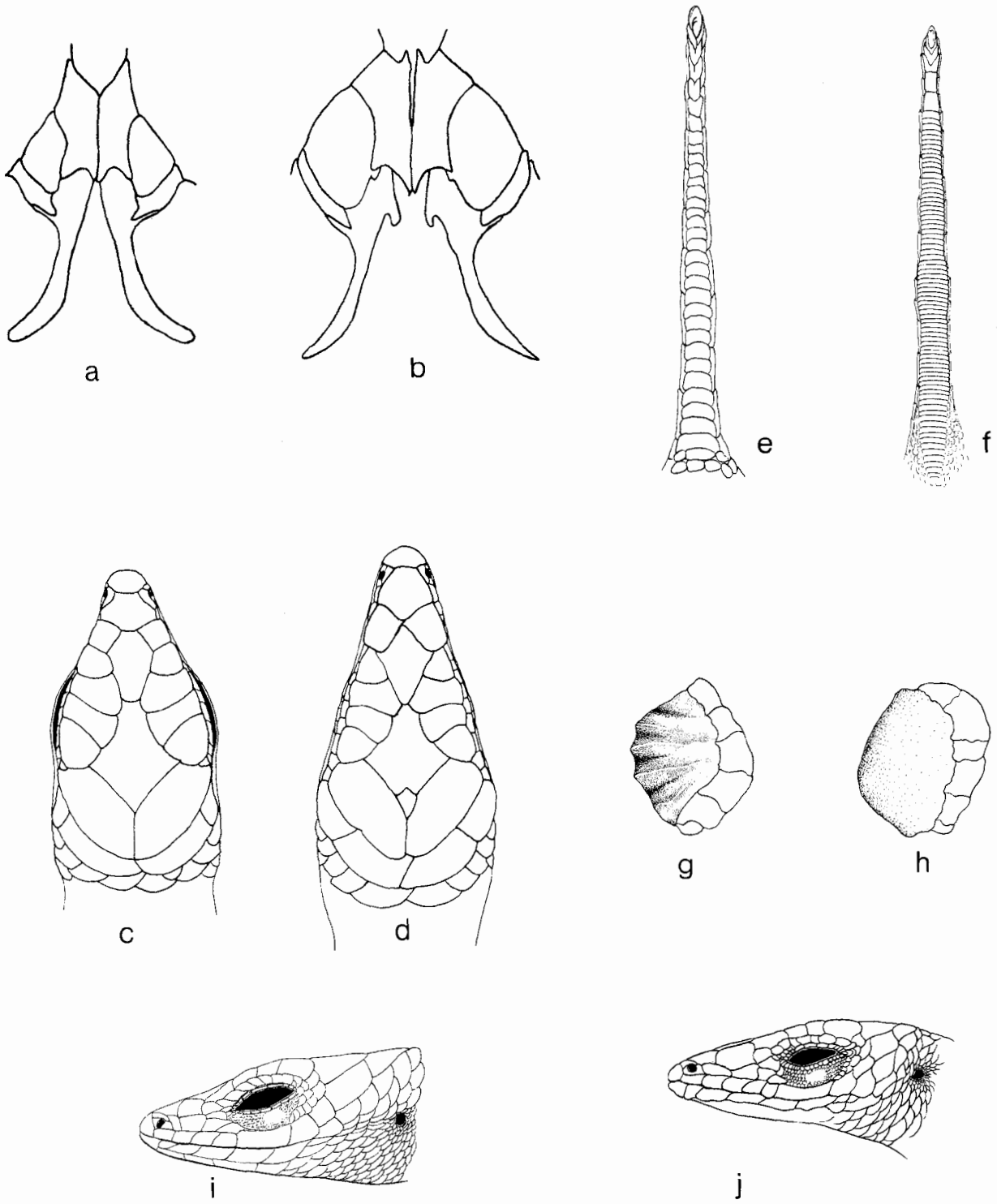


FIGURE 1. (a) Alpha-type palate, *Emoia samoensis* (after Greer); (b) beta-type palate, *Emoia cyanura* (after Webster); (c) interparietal fused with frontoparietals, *Emoia caeruleocauda*; (d) interparietal distinct, *Emoia parkeri*; (e) broad, rounded lamellae, *Emoia loveridgei*; (f) thin, bladelike lamellae, *Emoia cyanogaster*; (g) keeled scale, *Emoia physicae*; (h) smooth scale, *Emoia cyanogaster*; (i) anterior loreal shorter and higher than posterior, *Emoia caeruleocauda*; (j) anterior loreal long and narrow, about as high as posterior, *Emoia cyanogaster*.

The genus includes eight species groups. In earlier papers (Brown 1953, 1954; Brown and Marshall 1953) I based these groups on external morphological characters. Alan Greer (AMS), while working on the generic relationships of *Leiolopisma* (Scincidae), called my attention to cranial characters he was using to diagnose some scincid genera. These have proved useful in diagnosing species groups in *Emoia*.

KEY TO SPECIES GROUPS OF *EMOIA*

1a. Premaxillary teeth 13; palate intermediate between alpha- and beta-types; nasal bones not fused; color brownish, without stripes or metallic blues or greens (Fig. 4h); (known only from Ponape in eastern Carolines) ..... *ponapea* Group

1b. Premaxillary teeth 11; palate either alpha- or beta-type 2

2a. Dorsal scale rows between parietals and base of tail 93–114; midbody scale rows 48–66 ..... *adspersa* Group

2b. Dorsal scale rows between parietals and base of tail 39–87; midbody scale rows 22–44 3

3a. Parietal eye absent 4

3b. Parietal eye present 5

4a. Weak to strong keels on dorsal scales in juveniles and adults (Fig. 1g) (*E. pseudopallidiceps* and some *E. physicina* have weak keels posteriorly on body); usually sixth upper labial enlarged and under eye (except in *E. montana, E. physicina,* and *E. pseudopallidiceps*) ..... *physicae* Group

4b. Adults with smooth dorsal scales (Fig. 1h) (occasional juveniles with weak keels); usually fifth upper labial enlarged and below eye (except in *E. klossi,* seventh, and the *aenea* complex, sixth) ..... *baudini* Group

5a. Anterior loreal as long as or nearly as long as posterior loreal and not or little higher (Fig. 1j) 6

5b. Anterior loreal distinctly shorter and higher (Fig. 1i) 7

6a. Nasal bones not fused; subdigital lamellae rounded to moderately thinned, fewer than 60 under fourth toe (except for *E. murphyi* and *E. sanfordi*) ..... *samoensis* Group

6b. Nasal bones fused; fourth toe lamellae thin and bladelike (Fig. 1f) 60–95 (in *E. sorex* more rounded and 41–48) ..... *cyanogaster* Group

7a. Nasal bones not fused; palate beta-type (Fig. 1b); a pale narrow vertebral stripe beginning at tip of snout for most species, but if not, subdigital lamellae thin, bladelike (Fig. 1f) ..... *cyanura* Group

7b. Nasal bones fused; palate alpha-type (Fig. 1a); a pale narrow vertebral stripe never present; subdigital lamellae rounded, not bladelike (Fig. 1e) ..... *atrocostata* Group

Some of the groups include clusters of species that overlap in scale counts and appear similar in color (especially in preservative), notably the *baudini, physicae, cyanura,* and *samoensis* groups. As a consequence, most species were previously assumed to be highly variable, particularly when field observations were not available and only small samples were examined. Recent field work and larger samples for such species as *E. samoensis, E. baudini,* and *E. physicae,* for example, have made it possible to distinguish several previously confused species and subspecies. Seven species (superspecies)—*E. atrocostata, E. caeruleocauda, E. cyanura, E. jakati, E. nigra*—with wide ranges throughout the islands, and *E. obscura* and *E. pallidiceps* with wide ranges in New Guinea, are still among those exhibiting extensive variability. In this study I am able to distinguish three subspecies of *E. atrocostata* and two of *E. pallidiceps.* Additional field studies and/or genetic studies of these and other superspecies may identify other populations that represent distinct taxa. Benoit Mys at the Laboratorium Algemene Dierkunde, RUCA, is currently studying populations of *E. pallidiceps* and *E. jakati.*

adspersa Group

DIAGNOSIS.—SVL at maturity 63–106 mm; scales smooth; midbody scale rows 48–66; dorsal scale rows 93–114; fourth toe lamellae 23–34; interparietal not fused with frontoparietals; anterior loreal shorter and higher than posterior; nasal bones fused; parietal eye present; palate alpha type; dorsal ground color grayish green, greenish, tan, or brown with vague or sharp dark spots on dorsum; upper lateral surface with or without dark band.

The species of this group differ from those of the *atrocostata* group primarily in two derived characters—the smaller scales resulting in a greater number of midbody and dorsal rows, and the relatively shorter limbs. Schwaner and Brown (1984) reviewed the species of this group.

KEY TO THE SPECIES OF THE *ADSPERSA* GROUP

1a. SVL at maturity 63.0–85.0 mm; fourth toe lamellae 23–31; a dark brown to black lateral band (4–10 scales wide), complete between ear and forelimb, but sometimes broken into a series of irregular blotches between forelimbs and hindlimbs; (Samoa and some nearby island groups) ..... *E. adspersa*

1b. SVL at maturity 77–106 mm; fourth toe lamellae 27–34; a dark lateral band not present; (Samoa and some nearby island groups) ..... *E. lawesi*

Emoia adspersa (Steindacher)

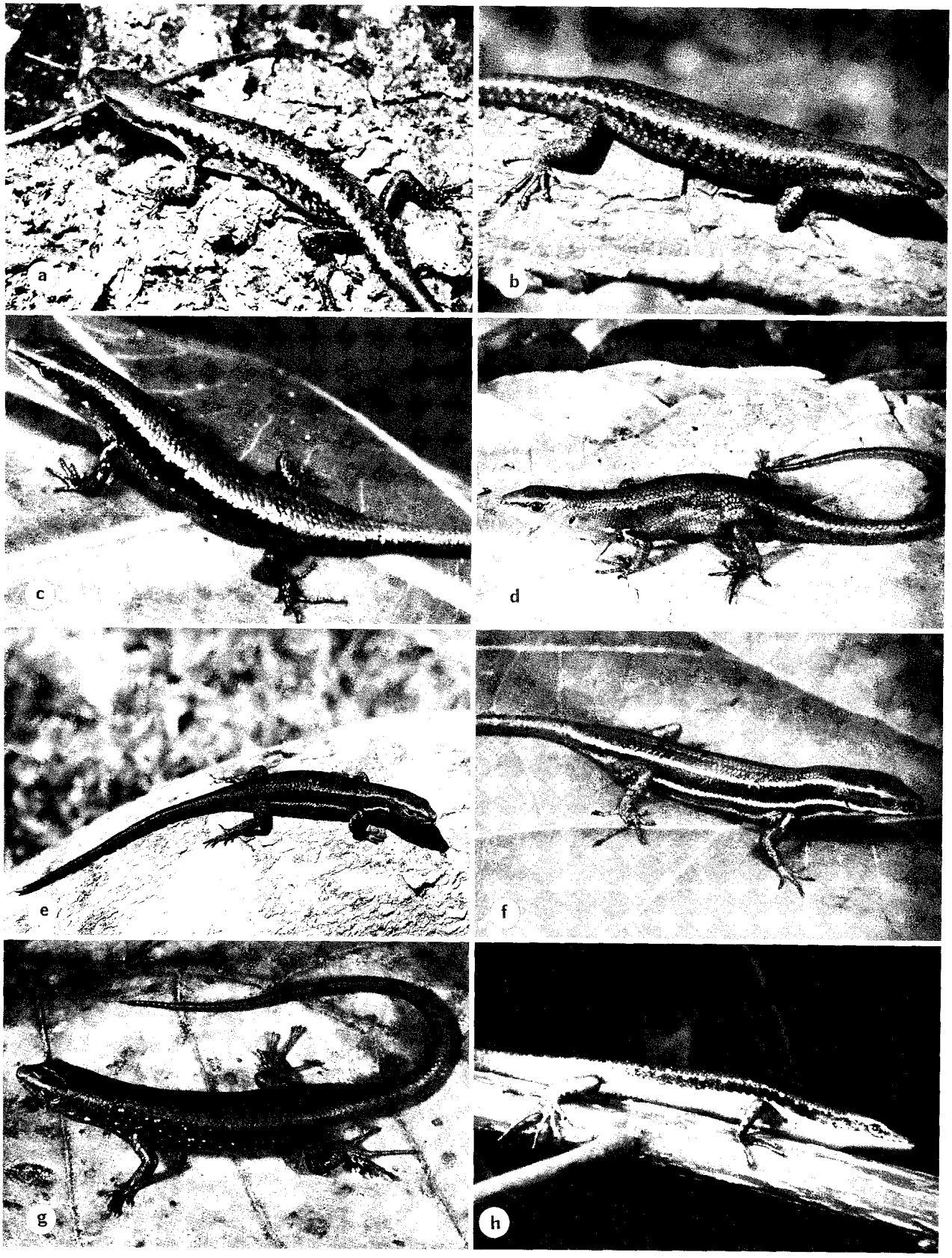
(Figure 2a)

Emoa atrocostata: Girard 1858:264.

Eumeces (*Mabuya*) *adspersus* Steindacher, 1870:340 (type loc.: Samoa; holotype in NMW).

→

FIGURE 2. (a) Color pattern of adult *Emoia adspersa.* Photo courtesy of H. G. Cogger. (b) Color pattern of *Emoia a. atrocostata.* Photo courtesy of H. G. Cogger. (c) Color pattern of *Emoia obscura.* Photo courtesy of H. G. Cogger. (d) *Emoia popei,* showing prominent pale spot on side of neck. Photo courtesy of M. McCoy. (e) *Emoia p. pallidiceps,* showing pale lateral line extending anteriorly to ear. Photo courtesy of R. G. Zweifel. (f) *Emoia jakati,* showing pale lateral line extending anteriorly to end of snout. Photo courtesy of H. G. Cogger. (g) Color pattern of *Emoia p. physicae.* Photo courtesy of M. McCoy. (h) Color pattern of *Emoia cyanogaster.* Photo courtesy of H. G. Cogger.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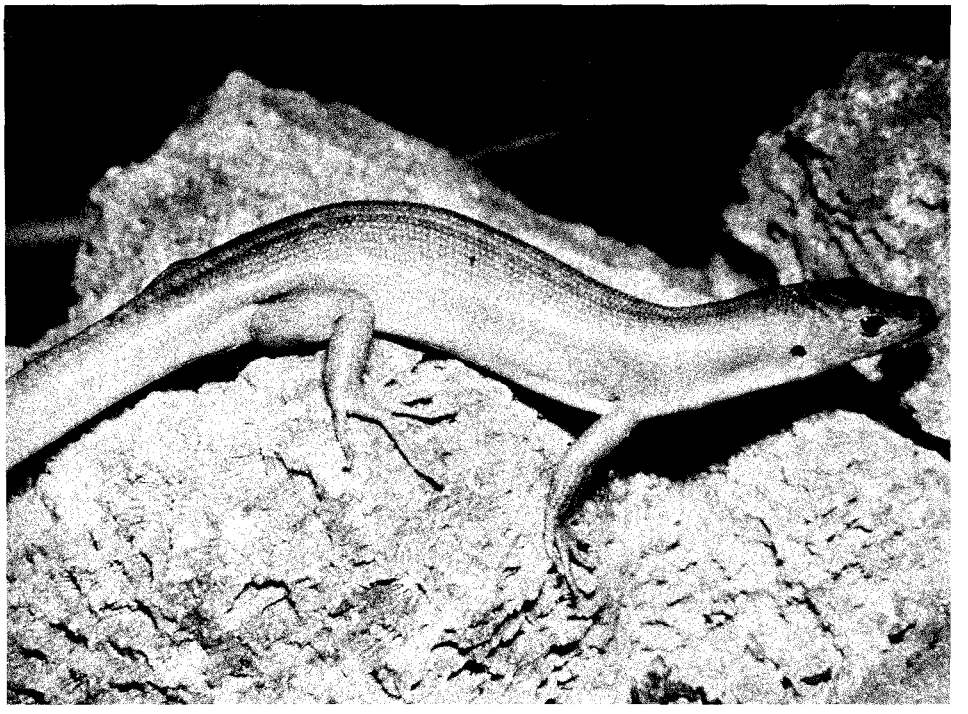

FIGURE 3. *Emoia lawesi*, showing absence of dark band on upper lateral surface, Niue Island. Photo courtesy of H. G. Cogger.

Euprepes (*Mabuia*) *parvisquameus* Peters, 1874:160 (type loc.: Savaii Island, Samoa; type presumed lost [Günther Peters, pers. comm.]).
Eumeces microlepis Fischer, 1886:58 (type loc.: Upolu I., Samoa; type destroyed, fide Obst 1977).
Lygosoma adspersum: (part) Boulenger 1887a:298.
Lygosoma (*Emoia*) *adspersum*: Sternfeld 1920:416.
Emoia adspersa: (part) Burt and Burt 1932:518; (part) Higgins 1943:59; (part) Brown 1956:1487; Mittleman 1952:21; Greer 1970:171; (part) Whitaker 1970: 357; Schwaner 1980:15; Schwaner and Brown 1984:161.

DESCRIPTION.—SVL 63.0–81.0 mm for 24 females and 64.0–85.0 mm for 22 males; snout bluntly rounded, its length 37–44% of HL and 53–64% of HB; HB 64–75% of HL and 13–17% of SVL; eye 70–78% of snout length and 37–45% of HB; rostral truncate dorsally, in broad contact with frontonasal; supranasals triangular, not in contact with anterior loreal; prefrontals separated; interparietal moderately large, longer than broad; one pair of nuchals; anterior loreal shorter and higher than posterior; seven or eight upper labials, usually sixth enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 50–60 ($\bar{x}$ = 54.8; SD = 2.45; n = 26); dorsal rows 93–114 ($\bar{x}$ = 102.8; SD = 4.708; n = 25); length of extended hindlimb 76–92% of axilla–groin distance and 36–45% of SVL; rounded lamellae under fourth toe 23–31 ($\bar{x}$ = 27.4; SD = 1.414; n = 25).

COLOR (in preservative).—Dorsal ground color olive-green to olive-brown, usually with scattered dark blotches covering one to three scales; dark brown to blackish band present on upper lateral surface, from four to 10 scales in breadth, but with uneven edge between ear and forelimb, continuing as more or less solid band from forelimb to groin or broken into irregular series of dark blotches (Fig. 2a), dark band often bordered dorsally by series of light (bluish white or grayish) faint or sharp dashes, one or two scales in breadth and two to four or five scales in length; dorsal surface of tail and limbs have scattered dark spots; lower lateral surfaces and undersurface of head and throat bluish gray; venter dirty ivory diffused with bluish gray.

COMPARISONS.—As pointed out by Schwaner and Brown (1984), the two species (*adspersa* and *lawesi*) differ primarily in features of the color pattern, SVL, size of eye (see ratios in descriptions), and means for number of subdigital lamellae (t = 7.492; df = 71; P = <0.001).

REPRODUCTION.—Clutch size normally two eggs (rarely one).

HABITAT.—Ground dweller in littoral forest areas. Schwaner (1980) observed these lizards emerge from holes in the coral-sand substrate at the base of breadfruit trees. Isopods are a principal food item.

RANGE.—Savaii and Upolu, Western Samoa; Swains and Nukunonu in Tokelau group, Puka Puka in Danger group, Funafuti Island in Ellis Islands. The population reported from Futuna west of Samoa and northeast of Fiji probably also belongs to this species.

MATERIAL EXAMINED.—**Samoa:** NWM 16623 (holotype, examined by Terry Schwaner), BMNH 94.10.5.6; Savai I.: FMNH 39206, AMNH 29012; Upolu I.: BMNH 1926.3.20.1; AMS R110122. **Ellice Islands:** Funafuti I.: MCZ 10261–62, AMS R2084–88, R2469–70, R4096–97; R109859–60. **Tokelau Group:** Nukunona I.: BMNH 90.11.14.5–6; FMNH 83919; Swains I.: USNM 108551, 163584–89, 196923 (two specimens), 21519–30; Danger I., Puka Puka: AMNH 29208.

Emoia lawesi (Günther)

(Figure 3)

Mabouia lawesii Günther, 1874:297 (type loc.: Savage (=Niue) Island; syntypes in BMNH).
Lygosoma adspersum: (part) Boulenger 1887a:298.
Lygosoma (*Emoia*) *lawesii*: Sternfeld 1920:417.
Emoia adspersa: (part) Burt and Burt 1932:518.
Emoia lawesi: Schwaner 1980:14; Schwaner and Brown 1984:162.

TABLE 1. Standard scale counts and measurements for species of the *Emoia atrocostata* group.

Species	Adult SVL (mm)	*n*	Labial below eye 5th	Labial below eye 6th	Midbody scale rows	Scale rows parietals to tail	Fourth toe lamellae
E. arnoensis arnoensis	73.0–85.3	23	2	15	36–40	66–75	35–42
E. arnoensis nauru	69.8–91.0	13	6	5	36–40	82–87	37–41
E. atrocostata atrocostata	57.1–97.5	127	58	56	34–43	61–76	30–42
E. atrocostata freycineti	59.0–78.4	40	17	18	35–43	62–76	32–41
E. atrocostata australis	59.0–80.0	20	19	1	32–37	63–70	29–35
E. boettgeri	59.9–76.9	38	6	22	36–42	60–72	42–52
E. laobaoense	63.3–74.0	2	1	1	38–40	65–67	30–32
E. nativitatis	58.5–75.7	22	12	6	30–34	66–73	30–34
E. slevini	63.1–84.0	22	6	8	34–38	62–74	30–37

DESCRIPTION.—SVL 77-106 mm for 26 males, 78–105 mm for 38 females (Schwaner 1980); snout tapered, rounded at tip, its length 37–46% of HL, 56–68% of HB; HB 62–75% of HL, 13–16% of SVL; eye 55–68% of snout length, 32–40% of HB; rostral truncate or shallowly convex dorsally, in broad contact with frontonasal; supranasals in contact with anterior loreal; prefrontals separated; interparietal large; one pair of nuchals; anterior loreal much shorter and higher than posterior; seven or eight upper labials, sixth enlarged and beneath eye; seven or eight lower labials; dorsal scales smooth; midbody scale rows 48–62 ($\bar{x}$ = 53.625; SD = 2.726; n = 48); dorsal rows 99–112 ($\bar{x}$ = 104.792; SD = 2.858; n = 48); 17 or 18 rows across the nape between ear openings; length of extended hindlimb 68–88% of axilla–groin distance and 35–44% of SVL; rounded lamellae under fourth toe 27–34 ($\bar{x}$ = 30.604; SD = 1.876; n = 48).

COLOR (in preservative).—Dorsal ground color grayish green, olive, green, greenish light brown, or dark olive-brown for melanistic specimens; back and upper lateral surfaces with diffuse or occasionally sharply outlined dark blotches covering few to several scales, usually oriented transversely; dark band on upper lateral surface absent (Fig. 3); some specimens with scattered white scales on dorsum; venter grayish white, yellowish, or ivory on head, throat, and belly.

COMPARISONS.—See description of *E. adspersa*.

REPRODUCTION.—Clutch size normally two eggs. A few females had only one egg (Schwaner 1980).

HABITAT.—Ground-dwelling species, most frequently observed in areas of coral rubble and along paths in littoral forests; also seen in a freshwater marsh area. Isopods are the primary food item (Schwaner 1980).

RANGE.—Au'nuu, Ta'u and Olosega Islands in American Samoa, Niue (=Savage) Island, which is south of Samoa and east of Tonga, and Tongatabu Island, Tonga group.

MATERIAL EXAMINED.—**Niue I:** BMNH 1946.8.3.74–75 (syntypes), 1969.617–19, AMNH 46367, MCZ 33545, USNM 28200–01, AMS R109959, R110075–76. **Samoa:** Au'nuu I.: KU 185302–07, 185341–44; Olosega I.: AMNH 29228, 29237, KU 185308–12, USNM 215031–35, CAS 151250–51; Ta'u I.: USNM 215036–51, KU 185313–40, 185345. Tonga: **Tongatabu I.:** BMNH 90.11.14.4.

atrocostata Group

DIAGNOSIS.—SVL at maturity 60–90 mm; scales smooth; midbody scale rows 30–43; dorsal scale rows 60–87; subdigital lamellae rounded, 28–52 under fourth toe; interparietal not fused with frontoparietals, usually relatively long and narrow; anterior loreal shorter and higher than posterior (in one subspecies composed of two superimposed scales); nasal bones fused; parietal eye present; palate alpha type; dorsal ground color grayish, grayish tan, brown, or solid black, lighter colors with various darker markings.

KEY TO SPECIES OF THE *ATROCOSTATA* GROUP

1a. Color uniformly black (only slightly lighter on venter) fading to brown or slate for older preserved specimens; (eastern Micronesia and Nauru I.) ..... *E. arnoensis*

1b. Dorsal and lateral surfaces grayish, olive-gray, or tan to brownish, often with darker and lighter spots and flecks, sometimes with black upper lateral band; venter ivory, grayish, or tannish 2

2a. Lamellae on fourth toe 42–52; dorsal ground color olive-green to brown; blackish (dark in preservative) lateral band absent ..... *E. boettgeri*

2b. Lamellae on fourth toe 28–42 (not more than 40 except for a few populations of *E. atrocostata*) 3

3a. Dorsal ground color grayish green to grayish tan or tan; blackish (dark in preservative) lateral band present; (found in mangrove and beach habitats) ..... *E. atrocostata*

3b. Dorsal ground color tan to brown, usually marked by scattered, pale and dark scales; blackish lateral band absent (not in mangrove or beach habitats) 4

4a. Dorsal and lateral surfaces light brown, but with three or four rows of scales on upper lateral surface somewhat darker; 38–40 midbody scale rows; (Laobao area in mountains of Vietnam) ..... *E. laobaoense*

4b. Dorsal and upper lateral surfaces tan to brown, usually with scattered pale (yellowish in life) and dark flecks or small spots; 30–34 midbody scale rows; (Christmas Island, Indian Ocean) ..... *E. nativitatis*

4c. Dorsal and upper lateral surfaces light brown to brown usually with some pale and dark flecks; 34–38 midbody scale rows; (Mariana Archipelago) ..... *E. slevini*

Emoia arnoensis Brown and Marshall

Emoia arnoensis was described from Arno Atoll in the Marshall Islands. It has since been recorded from the Carolines and from Nauru Island (=Pleasant Island), an isolated island to the

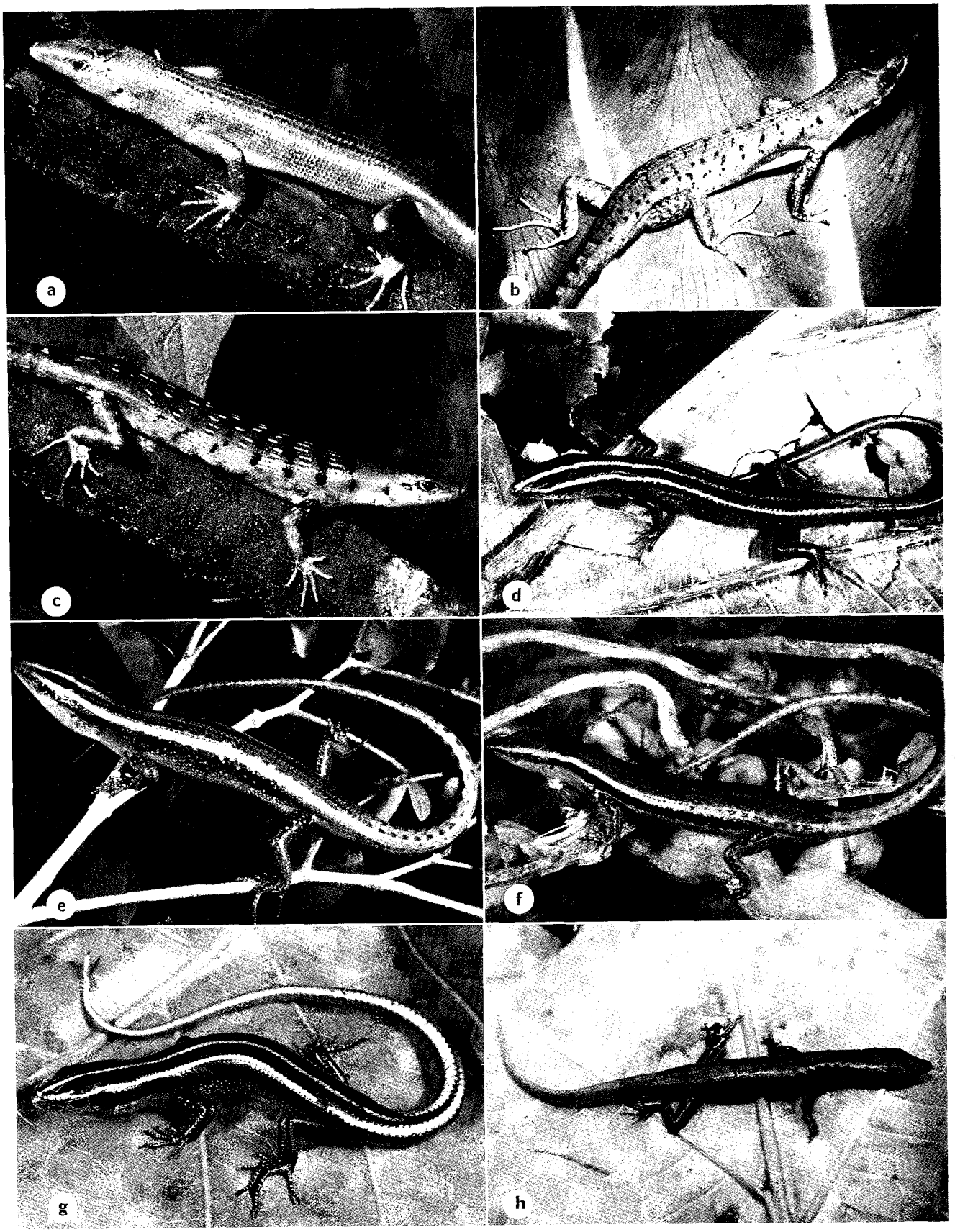
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TABLE 2. Frequency distribution of midbody scale rows for populations of *Emoia atrocostata*.

	32	33	34	35	36	37	38	39	40	41	42	43
E. a. atrocostata (Marianas, Palaus, and Carolines)	—	—	—	—	—	—	—	4	8	3	2	1
E. a. atrocostata (Philippine Is.)	—	—	—	1	3	6	12	4	5	1	—	—
E. a. atrocostata (Bismarck and Admiralty Is.)	—	—	—	—	1	—	1	1	2	—	—	—
E. a. atrocostata (New Guinea and satellite islands)	—	—	1	2	15	3	9	1	1	—	—	—
E. a. atrocostata (Moluccas and Celebes)	—	—	—	—	—	—	1	1	—	—	—	—
E. a. atrocostata (Borneo)	—	—	—	—	2	1	—	1	—	—	—	—
E. a. atrocostata (Christmas I.)	—	—	—	—	—	—	2	2	6	2	—	—
E. a. atrocostata (Singapore and Malay Pen.)	—	—	1	1	2	1	1	—	1	—	—	—
E. a. atrocostata (Taiwan and Ryukyu Is.)	—	—	1	1	3	2	3	1	3	—	—	—
E. a. freycineti (Solomon Is. and Vanuatu)	—	—	—	1	5	6	7	7	11	2	2	1
E. a. australis (Cape York, Australia)	1	2	6	3	6	2	—	—	—	—	—	—

south. This population on Nauru Island is treated as a distinct subspecies. The following key serves to distinguish the two.

1a. Dorsal scale rows between parietals and base of tail 66–75 ..... *E. a. arnoensis*

1b. Dorsal scale rows between parietals and base of tail 82–87 ..... *E. arnoensis nauru*

Emoia arnoensis arnoensis Brown and Marshall

Emoia nigra: Fisher 1948:69.

Emoia arnoensis Brown and Marshall, 1953:201 (type loc. Arno Atoll, Marshall Islands; holotype in USNM); Brown 1956:1487; Brown and Falanruw 1972: 105.

DESCRIPTION.—SVL 73.0–85.3 mm for 10 males and 73.9–82.6 mm for six females; snout moderately tapered, bluntly pointed, its length 36–40% of HL and 56–64% of HB; HB 58–64% HL and 13–15% of SVL; eye 58–68% of snout length and 36–43% of HB; rostral forming a somewhat rounded suture with frontonasal; supranasals triangular, in contact with anterior loreal; prefrontals not in contact; interparietal longer than broad, one pair of nuchals; anterior loreal longer than high, shorter than to nearly as long as posterior; seven or eight upper labials, sixth (rarely fifth) enlarged and below eye; usually seven or eight lower labials; dorsal scales smooth; midbody scale rows 36–40 ($\bar{x}$ = 38.739; SD = 1.214; n = 23); dorsal rows 66–75 ($\bar{x}$ = 70.8; SD = 2.536; n = 20); length of extended hindlimb 90–104% of axilla–groin distance and 43–50% of SVL; round lamellae under fourth toe 35–42 ($\bar{x}$ = 38.714; SD = 0.90; n = 21); under first toe 12–14.

COLOR (in life).—Uniformly glossy black on dorsal and lateral surfaces; only slightly lighter on the ventral surface. (Microscopic examination shows the ligher shade to be due to a few scattered light flecks and the narrow lighter areas edging the ventral scales posteriorly.)

COLOR (in preservative).—Color of dorsum fades to slate.

COMPARISONS.—*Emoia arnoensis* and *E. boettgeri* have sometimes been confused, but they differ in color, number of fourth toe lamellae, length of limbs, and number of dorsal scale rows (means differ significantly, t = 5.225; df = 43; $P < 0.001$). They apparently compete to such an extent on small islands in some of the Marshall atolls that they cannot coexist on the same island (Brown and Marshall 1953), but on large islands with more varied habitats, such as Kusaie in the Carolines, both species occur. *Emoia arnoensis* has been confused with *E. nigra* of the *samoensis* group because of a superficial resemblance in color. Actually they differ subtly in color (more black-brown dorsally and a lighter venter for *E. nigra*), and in size at maturity (Tables 1 and 7).

HABITAT.—On the ground in open spaces in forest, in rocky areas at edge of vegetation, under shrubs and around breadfruit trees, coconut husks, and houses.

RANGE.—Marshall and Caroline islands.

MATERIAL EXAMINED.—**Marshall Islands:** Chitakinmatoroen I., Arno Atoll: USNM 132131 (holotype); Arno Atoll: USNM 132133–36, CAS-SU 13487, MCZ 52116 (paratypes), MCZ 121932–40. **Caroline Islands:** Rug I.: CAS-SU 7541; Lae Atoll: USNM 132258; Kusaie I.: USNM 123919–20, 28223, AMS R95938–39.

Emoia arnoensis nauru n. subsp.

(Figure 5)

Lygosoma atrocostatum: Waite 1903:2.

HOLOTYPE.—AMS R109771, an adult female, collected by H. G. Cogger, 1983, on Nauru I.

PARATYPES.—AMS R3201, R69794–95, R69797–98, R7104–06, R109755, R102762, R109772, R8528, and CAS 158267 (same locality as holotype).

This population from the isolated volcanic island of Nauru is very similar to *E. a. arnoensis* from the Caroline and Marshall islands in most characters.

DIAGNOSIS.—Color nearly uniform black; number of fourth toe lamellae 37–41 ($\bar{x}$ = 38.778; SD = 1.394; n = 9); midbody scale rows 36–40 ($\bar{x}$ = 38.0; SD = 1.0; n = 9); number of dorsal scale rows between parietals and base of tail 82–87 ($\bar{x}$ = 84.4; SD = 1.578; n = 10). There is no overlap with the nominal subspecies in the number of dorsal scale rows (Table 1).

DESCRIPTION OF HOLOTYPE.—An adult female; SVL 79.5 mm;

←

FIGURE 4. (a) *Emoia concolor*, showing relatively uniform greenish-tan pattern. Photo courtesy of H. G. Cogger. (b) *Emoia samoensis*, showing typical blackish markings that tend to form transverse bands. Photo courtesy of H. G. Cogger. (c) *Emoia trossula*, showing typical color pattern. Photo courtesy of H. G. Cogger. (d) *Emoia cyanura*, showing dark color phase with prominent pale middorsal stripe. Photo courtesy of M. McCoy. (e) *Emoia pseudocyanura*, showing typical color pattern for population on Guadalcanal Island. Photo courtesy of M. McCoy. (f) *Emoia maculata*, showing typical color pattern. Photo courtesy of M. McCoy. (g) *Emoia caeruleocauda*, showing dark color phase with prominent pale middorsal stripe. Photo courtesy of M. McCoy. (h) *Emoia ponapea*, showing typical color pattern. Photo courtesy of J. V. Vindum.

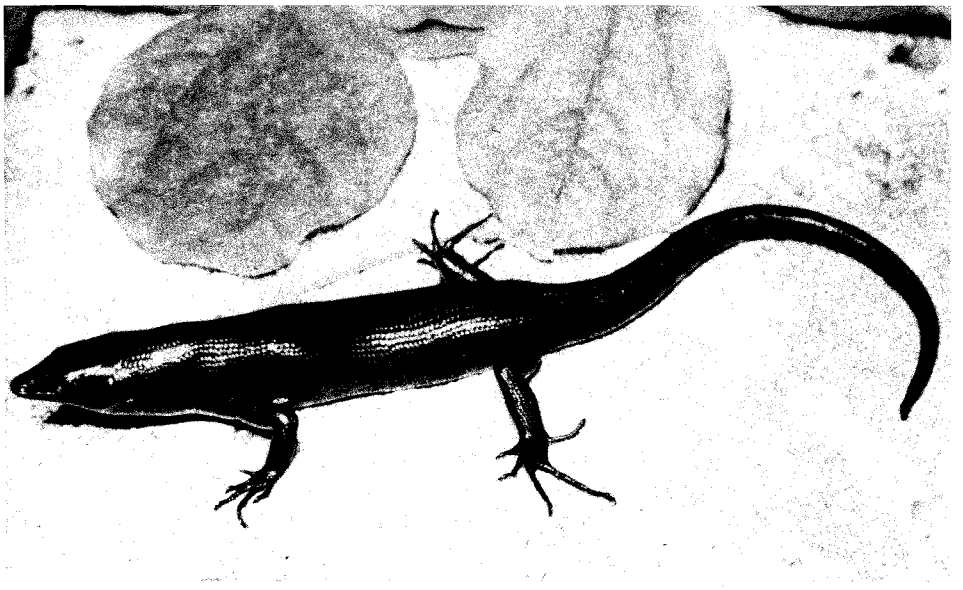

FIGURE 5. *Emoia arnoensis nauru,* showing uniform blackish color, Nauru Island. Photo courtesy of H. G. Cogger.

midbody scale rows 40; dorsal scale rows 86; fourth toe lamellae 37; dorsal color in recently preserved specimens uniformly dark slate to black; only slightly lighter on venter; older specimens, slate-brown.

ETYMOLOGY.—From Nauru Island, the only known locality.

REPRODUCTION.—A gravid female (CAS 158267) has two large oviducal eggs.

HABITAT.—Cogger (AMS, in litt., Aug. 1986) stated that the only population of *E. arnoensis nauru* he found was in a small forest of mature *Ficus* trees and in dense shrubbery along its border. Most specimens occupied the aerial roots of the trees.

RANGE.—Nauru Island in the Central Pacific.

Superspecies **Emoia atrocostata** (Lesson)

Scincus atrocostatus was one of three species of *Emoia* that Lesson (1830) described from Pacific islands. The others were *Scincus cyanurus* and *Scincus cyanogaster.* The plates in the Atlas accompanying the Zoologie text by Lesson, which appeared in Duperrey's "Voyage Autour du Monde" (1830), were actually published four years earlier (1826). Since the beautiful illustration (pl. 4, fig. 4) readily identifies the species (specifically the nominal subspecies) and bears the name *Scincus astrocostatus* Lesson, the name must be recognized as having been published in 1826, as is also true for *E. cyanura* and *E. cyanogaster.*

Lesson (1830:50) stated that the species inhabits the island of Oualan (=Kusaie?) in the Carolines. The holotype has been lost. Recent collections from the island of Kusaie in the Carolines have not verified the occurrence of this species on that island. I have, therefore, not designated a neotype at this time pending further efforts to find a population on Kusaie Island.

Although several populations from various islands have been described as distinct species (see the following synonymy), at the present time, I recognize only those populations in Cape York and in the Solomons archipelago and Vanuatu as subspecies.

Lygosoma buergersi, as described by Vogt, agrees with samples of the New Guinea populations of *E. atrocostata* except for the statement that the number of midbody scale rows is 28. This possibly is an error for 38.

KEY TO SUBSPECIES OF *EMOIA ATROCOSTATA*

1a. Anterior loreal usually divided horizontally into two scales; fifth (rarely sixth) upper labial enlarged and below eye; midbody scale rows 32–37 (rarely more than 36, Table 2); color pattern on dorsum grayish to grayish brown, darker on head; upper lateral surfaces blackish or dark brown with scattered pale spots in two or three regular rows; (Cape York, Australia) ..... *E. atrocostata australis*

1b. Anterior loreal rarely divided; midbody scale rows 34–43 (rarely less than 36); fifth or sixth upper labial enlarged and below eye; color pattern not as above 2

2a. Color pattern on dorsum usually one of distinct, narrow, irregular, transverse, black and pale bands; (Vanuatu and Solomon Islands) ..... *E. atrocostata freycineti*

2b. Color pattern on dorsum usually without distinct, transverse, light and dark bands; (localities other than Australia, Vanautu and Solomons) ..... *E. a. atrocostata*

Emoia atrocostata atrocostata (Lesson)

(Figure 2b)

Scincus atrocostatus Lesson, 1826, pl. 4, fig. 4 (type loc.: Oualan [=Kusaie?] Island, Carolines; syntypes not found, Guibé 1954); Lesson 1830:50; Brygoo 1985:7. (This locality is in doubt because the occurrence of a population on Kusaie Island has not been verified.)

Mocoa cumingi Gray, 1845:81 (type loc.: Philippines, type in BMNH).

Mabouya atrocostatus: Gray 1845:95.

Euprepes bitaeniata Peters, 1864:53 (type loc.: Luzon and Shamar islands, Phillippines; type possibly in ZMB).

Euprepes (Mabuya) cumingi: Peters 1867:20.

Mabouya jerdoniana Stolioska, 1870:172 (type loc.: Penang Island; type disposition unknown).

Eumeces (Mabouya) singaporensis Steindachner, 1870:341 (type loc.: Singapore; type disposition unknown).

Euprepes (*Mabouya*) *parietalis* Peters, 1871:572 (type loc.: Sarawak, Borneo; type possibly in ZMB).
Euprepes (*Mabuia*) *microstictus* Peters, 1874:373 (type loc.: Palau Islands; type possibly in ZMB).
Euprepes (*Mabouya*) *atrocostatus*: Doria 1875:350; Peters and Doria 1878:358.
Euprepes marmorata Macleay, 1877:65 (type loc.: Long Island, Torres Strait; type in AMS).
Euprepes irrorata Macleay, 1877:66 (type loc.: Hall Sound, Central Province, Papua New Guinea; type in AMS).
Eumeces serratus Fischer, 1886:56 (type loc.: Murray Island, Torres Strait; type destroyed, fide Obst 1977).
Lygosoma atrocostatum: Boulenger 1887a:295, 1895a:31, 1900:52; Boettger 1893: 106; Müller 1894:835; Roux 1911:218, 1913:115; de Rooij 1915:259; Taylor 1922:226; Schuz 1929:11; Sternfeld 1920:415; Thompson 1912:4.
Emoia atrocostata: Stejneger 1899:897; Van Denburgh 1912:234; Schmidt 1932: 185; Smith 1937:227; Brongersma 1942:155; Tanner 1951a:7; Mittleman 1952: 22; Brown 1956:1487; Mertens 1957:92; Brown and Alcala 1961:631, 1964:599, 1980:69; Greer 1970:171; Heatwole 1975:7; Brown 1983:324; (part) Cogger, Cameron, and Cogger 1983:162.
Emoia atrocostatum: Barbour 1912:94; Hediger 1934:468.
Lygosoma sinus Smith, 1929:294 (type loc.: Christmas Island, type in BMNH); Gibson-Hill 1947:84.
Lygosoma buergersi (?) Vogt, 1932:292 (type loc.: Sepik River area, Papua New Guinea; type possibly in ZMB).
Emoia atrocostata irrorata: Loveridge 1948:372; Zweifel 1980:415.

Guibé (1954) stated that the syntypes of *Scincus atrocostatus* are lost. A search during my visit at the Muséum National d'Histoire Naturelle in 1983 confirmed their absence.

DESCRIPTION.—SVL 60.9–97.5 mm for 38 males and 57.1–92.2 mm for 40 females; snout tapered, bluntly rounded; its length 37–45% of HL and 54–67% of HB; HB 60–71% of HL and 14–18% of SVL; eye 58–68% of snout length and 34–48% of HB; rostral forming long, truncate or slightly convex suture with frontonasal; supranasals narrow, elongate; prefrontals narrowly in contact to moderately separated; interparietal narrow, usually elongate; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or only second upper labials; six to eight upper labials, fifth or sixth (some populations fifth, some sixth, and some about equally fifth or sixth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 34–43 ($\bar{x}$ = 38.048; SD = 1.876; n = 126); dorsal scale rows 61–76 ($\bar{x}$ = 67.852; SD = 3.117; n = 122); preanals scarcely enlarged; length of extended hindlimb 94–115% of axilla–groin distance and 45–54% of SVL; rounded lamellae under fourth toe 30–42 ($\bar{x}$ = 34.674; SD = 2.473; n = 127); under first toe 10–14.

COLOR (in preservative).—Dorsal ground color highly variable, bluish gray to grayish olive-green, grayish tan, or light brown, with dark brown or blackish flecks, or two distinct rows of dark spots or smaller dark marks (rarely in several rows); upper lateral surface usually with dark brown to black band with irregular margins, varying in width from two to several scale rows, begins at eye (rarely the ear) and usually continues along flanks, marked by scattered pale scales; lower lateral surfaces bluish gray to grayish tan marked by some dark flecks and spots; venter bluish or grayish white to ivory, usually darker under head and throat; labials with variable dark blemishes.

COMPARISONS.—*Emoia a. atrocostata, E. atrocostata freycineti,* and *Emoia atrocostata australis* have grayish-green to tan dorsal ground color and a more or less complete blackish band along the upper lateral surface, which distinguishes them from other species with more uniform color (brownish or black) on the dorsal and upper lateral surfaces. These subspecies also inhabit beach and mangrove margins, in contrast to other species of this group, which prefer more inland habitats.

Emoia a. atrocostata differs from *E. atrocostata freycineti* primarily in color pattern and in the means for number of fourth toe lamellae (t = 4.193; df = 163; $P < 0.001$). *Emoia atrocostata australis* differs from the nominal subspecies and *E. atrocostata freycineti* in several characters. These include: (1) significant differences between the means for both midbody scale rows (t = 7.305; df = 144; $P < 0.001$, when compared with *E. a. atrocostata,* and t = 8.218; df = 60; $P < 0.001$, when compared with *E. atrocostata freycineti*) and fourth toe lamellae (t = 2.705; df = 145; P = 0.008, when compared with *E. a. atrocostata,* and t = 6.129; df = 55; $P < 0.001$, when compared with *E. atrocostata freycineti*); (2) the double anterior loreal, in contrast to a single anterior loreal; and (3) some features of the color pattern.

When scattered island populations presently referred to *E. a. atrocostata* are compared, differences in scale counts are not great. The number of midbody scale rows is somewhat higher for populations in the Marianas, western Carolines, Palaus, and Christmas Island, Indian Ocean (Table 2). The SVL at maturity is slightly less for populations in Taiwan and the Ryukyu Islands. Additional data are needed to determine whether other subspecies or closely related sibling species may exist among these populations.

REPRODUCTION.—Normally lays two eggs. Alcala and Brown (1967) observed egg-laying sites for Philippine populations in holes of mangrove trees above the level of the highest tides. Other probable sites were rocky banks at the back of beaches. Breeding and egg-laying is apparently year around; incubation ranged from 56 to 71 days. Hatchlings were 33–39 mm in SVL.

HABITAT.—Shoreline areas. In the Philippines, Brown and Alcala (1980) found populations in mangrove swamps or rocky banks behind beaches, with individuals foraging over mud and sand beaches during low tides. They observed one population living in the banks of an abandoned fish pond behind a beach near Dumaguete City, Negros Island. McCoy (1980:33) found populations of the subspecies *E. atrocostata freycineti* in the Solomons in rocky foreshores but not in mangroves; individuals there enter tidepools in search of food, remaining under water for several minutes.

RANGE.—Island chains such as Marianas, western Carolines, Palaus, and Bismarcks along the boundary of the Pacific and Australian plates westward through New Guinea, the islands of Torres Strait, the East Indies, Christmas Island, Malay Peninsula, Indochina, Borneo, Philippines, Taiwan, and Miyakoshima Island in the Ryukyus.

MATERIAL EXAMINED.—**Caroline Islands:** USNM 121590, 122557; MCZ 39382, 121004, UGM (uncatalogued) 6 specimens, CAS-SU 21758–59. **Marianas Islands:** USNM 216333, CAS 139828, FMNH 188740. **Palau Islands:** CAS-SU 7523–25, CAS 122586; CAS 122599–602, 122608–09, CAS 122605–07, 122451–52, MCZ 159062, USNM 122577. **Admiralty Islands:** MCZ 7180. **Bismarck Islands:** MVZ 40825–26, ZMC R47654, AMS R41233, MCZ 80471, QM J32812. **Islands of Torres Strait:** BMNH 95.4.26.43, AMS R48561, R56063, R61586–88, R61651–61, R61823, R61889–93, R61973, R62654, QM J25423–26, J25786, J25800; Long Island: AMS R31582 (holotype of *Mabouia marmorata*). **New Guinea and small surrounding islands: Irian Jaya;** Japen I.: CAS 5474, MCZ 7696, 7700; Dunan I.: AMS R48561; Waigeo I.: MCZ 7699; Sorong: AMS R6830, RMNH 8857, MCZ 7689–99; Doromena: FMNH 43185, CAS-SU 11248: **Papua New Guinea:** East Sepik Province: Wewak: MCZ 152808. Madang Province: Manam I.: AMS R31246; Madang area: FMNH 13948, 13950–53, AMNH 105230–34, MCZ 132786–87, 152802, CAS 103634; Morobe Province: Finschhafen: AMNH

95676–82. Milne Bay Province: AMNH 76756; Misima I., Louisiade Archipelago: AMNH 76835–36, 76838, 76480–41, 76844–46, 76848–49, 76852. Central Province: Port Moresby area: AMS R69466, MCZ 64313, 150802–04, 150844; St. Joseph River area: AMS R31862 (syntype of *Mabouia irrorata*); Hall Sound: AMS R31851 (syntype of *irrorata*). Western Province: AMNH 56550, 57901, 111420–26, 115043–36, 117750; MCZ 123679, 136069–70; Daru I.: AMNH 57578–79, 57582–85; MCZ 124031, 137591; Mawatta: MCZ 140672, 142050–80, AMS R73725–27; NMV D54436; Fly River area: BMNH 85.6.30.4; New Guinea: MNHN 2905 (syntype of *Eumeces freycineti*). **Molucca Islands:** Wotap I.: RMNH 18657; Halmahera I.: MCZ 7697; Amboina I.: ZMUC 771. **Celebes and surrounding islands:** Celebes: FMNH 14241–45, MCZ 19588, BMNH 96.12.9.34–35, RMNH 18660; Karakelong I.: RMNH 18659; Soela I.: RMNH 18661–66. **Mentawai Islands:** BMNH 1926.3.18.13. Siberut I. (off Sumatra): CAS-SU 7542. **Christmas Island** (Indian Ocean): BMNH 1946.8.10.94 (type of *Emoia sinus*), 1946.8.10.99, CAS 16865, AMS R82959, R82980, R83142, R83148–53, R85180, R85197, R90254, QM J37874, MCZ 39382. **Singapore and Malay Area:** Singapore: BMNH 1928.5.11.7, 1928.5.11.9–11a; Malaya, Malacca: BMNH 1956.1.2.355. **Taiwan Island:** Koshun: CAS 18707–15, FMNH 127757–61. **Ryukyu Islands:** Miyako Shima I.: CAS 21714–18. **Borneo and surrounding islands:** North Borneo; Sandakan: FMNH 63694–95; Sarawak: MCZ 9042; Samunsam: MCZ 157180; Bako National Park: MCZ 157165–66; Nyabau Forest Reserve: FMNH 150766–68, 150770–810, 158725–26, AMNH 111903; Maratea I.: MCZ 22950. **Philippine Islands:** BMNH 1946.8.6.86 (holotype of *Mocoa cumingi*); Balabac I.: ZMUC R47460–53; Dinagat I.: BMNH 77.10.9.21–24; Colotcot I.: CAS 60567; Bantayan I.: CAS 124714–20, 124501; Basilan I.: CAS 60355–58, 60441–43; Busuanga I.: CAS-SU 11540; Bancoran I.: CAS 60001; Caluya I.: CAS 127638–39; Gigante South I.: CAS 125040; Greater Govenen I.: CAS 60585–86; Imampulugan I.: CAS-SU 27970; Lapinig Chico I.: CAS-SU 27389; Pan de Azucar I.: CAS 124229–32, 124620–24; Polilio I.: CAS 62292–96; Ponson I.: CAS 124706; Poro I.: CAS 124721–24; Bongas I.: MCZ 26471; Tablas I.: MCZ 26461; Negros I.: CAS-SU 20670–84, 24341–44, CAS 133021–22, 131923, 133028–31, 146542–51, 156008, BMNH 1963-919, MCZ 79695; Mindanao I.: MCZ 26472–81, CAS 124876–77, FMNH 52535–57; Luzon I.: CAS 15432; Mindoro I.: MCZ 26470; Samar I.: CAS-SU 13587–88, FMNH 96454–69, 96288–89; Panay I.: CAS-SU 13585; Guimaris I.: CAS 125335; Palawan I.: CAS-SU 28604, 28569–78, CAS 157299, 157354, FMNH 202748–52; Cebu I.: CAS-SU 20685–86, 20726–39, 20744–45, CAS 140224, 145681–85, FMNH 77826.

Emoia atrocostata australis n. subsp.

Lygosoma atrocostatum: (part) de Rooij 1915:259.
Emoia atrocostata irrorata: (part) Ingram 1979:433.

Cogger (1975:291) referred populations from Cape York, Australia, to *Emoia atrocostata,* and Ingram (1979:433) used the name *Emoia atrocostata irrorata,* following Loveridge (1948). Macleay's type of *irrorata* was from Hall Sound, Central Province, Papua New Guinea.

The specimens of *E. atrocostata* I examined from Cape York were sufficiently distinct in the double anterior loreal, the slightly smaller size, some features of the color pattern, and the lower number of midbody scale rows and fourth toe lamellae from other populations of *E. atrocostata,* including those from the nearby islands of Torres Strait and the southern coast of New Guinea, that I herein treat them as a distinct subspecies. Since the type series for Macleay's *E. marmorata* (from Long Island in Torres Strait) and *E. irrorata* (from Papua New Guinea) do not include specimens from the Australian mainland, it appears that no earlier name is available for this Australian form.

HOLOTYPE.—AMS R56160, a female, collected at Somerset, Queensland, Australia by Harold Cogger, 11 July 1976.

PARATYPES.—AMS R56051–54, R56056, R56158–59, R56161–63, R56218–23, R56277, R58285, QM J24732 (same locality as holotype). AMS R9600 from western Cape York is tentatively included. This specimen is not designated as a paratype.

DIAGNOSIS.—Distinguished by the following combination of characters: midbody scale rows 32–37 ($\bar{x}$ = 34.850; SD = 1.387; n = 20); dorsal scale rows 63–70 ($\bar{x}$ = 66.278; SD = 1.742; n = 18); fourth toe lamellae 29–35 ($\bar{x}$ = 33.1; SD = 1.714; n = 20); SVL of mature specimens 59–80 mm; anterior loreal divided horizontally into two scales; dorsum grayish brown with scattered darker spots on body, head darker, lateral surfaces dark brown to black, marked by smaller white spots or scales, especially dorsally.

DESCRIPTION OF HOLOTYPE.—SVL 67.2 mm; anterior loreal composed of two scales; midbody scale rows 36; dorsal scale rows 68; fourth toe lamellae 33; dorsal ground color dark grayish brown with some darker spots on body; top of head somewhat darker; lateral surfaces dark brown to black, especially on flanks, with two or three irregular rows of scattered light (whitish) small spots or scales along dorsolateral area (sometimes projecting as narrow lines onto the back); similar spots occur on ventrolateral margin; some light spots on limbs and in transverse rows on tail.

ETYMOLOGY.—After the only known locality.

COMPARISONS.—See description of *Emoia a. atrocostata.*

HABITAT.—Ingram (1979) stated: "At Somerset and Naru Point they were common on the rocky shores even in the splash zone, where they often hid in holes among oysters. At all localities individuals when hard pressed would jump into the water, then swim strongly with their robust tails." Cogger (1975) listed the habitat as mangrove swamps, lowland forest, coastal scrub, and beach areas.

RANGE.—Cape York area, Queensland, Australia.

Emoia atrocostata freycineti (Duméril and Bibron), NEW STATUS

(Figure 6)

Gongylus (Eumeces) freycineti Duméril and Bibron, 1839:648 (type loc.: Vanikoro Island, Santa Cruz group, Solomons; syntypes in MNHN); Brygoo 1985:44.
Emoia nigra: (part) Barbour 1921:103.
Emoia atrocostata: Schmidt 1932:185; McCoy 1980:32; (part) Cogger, Cameron, and Cogger 1983:162.
Emoia manni Brown, 1948:159 (type loc.: San Cristobal Island, Solomons; holotype in MCZ).

Brown (1948) described *E. manni* from specimens reported by Barbour (1921) as *E. nigra.* I herein treat these Solomons populations of *E. atrocostata* as a distinct subspecies, for which an earlier name *freycineti* is available. They differ from others of the *E. atrocostata* complex primarily in their general dorsal pattern of narrow, transverse, pale and blackish bands (Fig. 6). This pattern is rare or absent in other populations. The SVL at maturity may also be slightly less than for populations in New Guinea and surrounding islands (see Table 1), and the mean for the fourth toe lamellae is higher.

LECTOTYPE (new designation).—MNHN 2906, Vanikoro Island, Santa Cruz Group, Solomons.

DESCRIPTION OF LECTOTYPE.—SVL 74.6 mm; midbody scale rows 37; scale rows 72; lamellae beneath fourth toe 32; a darker band evident along upper lateral surface and irregular, more or less transverse rows of blackish spots evident on the dorsum (this color pattern is variety "A" of Duméril and Bibron 1839).

DIAGNOSIS.—SVL of mature specimens 59.0–75.2 mm for 10 males and 61.5–79.4 mm for six females; midbody scale rows 35–43 ($\bar{x}$ = 38.69; SD = 1.854; n = 42); dorsal scale rows 62–76 ($\bar{x}$ = 68.65; SD = 3.945; n = 40); rounded lamellae under fourth toe 32–41 ($\bar{x}$ = 36.541; SD = 2.168; n = 37); lamellae under first toe 11–41; dorsal ground color grayish blue, tan, or brown; scattered darker scales in more or less transverse bands

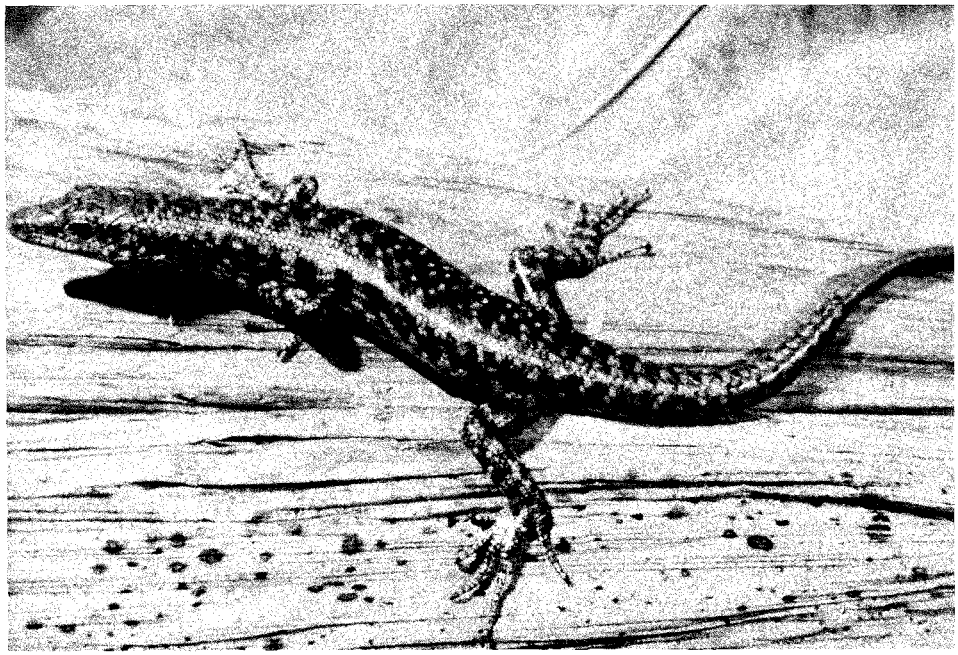

FIGURE 6. *Emoia atrocostata freycineti,* showing dark transverse bands on dorsum, Erate Island, Vanuatu. Photo courtesy of H. G. Cogger.

about two or three scale rows wide; broad, uneven margin, dark brown or black lateral band, occasionally broken into large blotches by rows of paler scales; tail with narrow light and dark bands or light bands reduced to transverse rows of separate pale spots; limbs with narrow, irregular cross bands of pale scales.

COMPARISONS.—See description of *Emoia a. atrocostata.*

REPRODUCTION.—McCoy (1980:33) stated that the clutch of eggs (normally two) is deposited in beach debris, under driftwood or in hollows in limestone rock.

HABITAT.—McCoy (1980:33) stated: "This is a common species with a specialized habitat; in the Solomons it only occurs on rocky foreshores bordering the sea where large populations may occur. It is an active, agile lizard and readily enters tidal pools to escape potential predators; it can stay submerged in saltwater for several minutes at a time. I have also seen it active where waves are breaking, clinging to the rock while the wave passes over it. Most of its feeding (primarily small invertebrates) is done in the intertidal zone."

RANGE.—Solomon Islands and Vanuatu.

MATERIAL EXAMINED.—**Solomon Islands:** Vanikoro I.: MNHN 2906–2907 (syntypes of *freycineti*); San Cristobal I.: MCZ 15078 (holotype of *E. manni*), 15073–77, 15079–83; Guadalcanal I.: MVZ 44203, 44230, FMNH 44508 (paratypes of *manni*), AMS R40833, FMNH 44514–15, VNM D54175–79, MCZ 104593, 111141–43; Tulagi I.: BMNH 1915.12.4.1; Russell I.: AMNH 42257; New Georgia I.: MVZ 44964, MCZ 111144–51, 118132; Maliata I.: AMS R91004–8, R87432–33, MCZ 110747–50, 110751–797, 111114–40, 118125–31; Ola Malu I.: AMS R69570, R69574; Nuguria I.: MCZ 156530–31, AMS R80864; Malaupaina I.: CAS 153236–41; Arnovon I.: AMNH 41825; Gizo I.: AMNH 41891; Florida I.: AMNH 43923; Tunibuli I.: FMNH 13792; Bougainville I.: MCZ 93831–33; Shortland Is.: MCZ 89685, 93834–36; Rennell Is., Bellona: CAS 72204. **Vanuatu:** AMS R3559; Mola I.: BMNH 1973.1537.

Emoia boettgeri (Sternfeld)

Lygosoma (Emoia) boettgeri Sternfeld, 1920:406 (type loc.: Ponape Island, Caroline Islands; holotype in SMF).

Emoia atrocostata: (part) Loveridge 1948:373.

Emoia boettgeri: Mittleman 1952:23; Greer 1970:171; Kiester 1982:9.

Emoia boettgeri boettgeri: Brown and Marshall 1953:201; Brown 1956:1487; Brown and Falanruw 1972:105.

Emoia boettgeri orientalis Brown and Marshall, 1953:204 (type loc.: Arno Atoll, Marshall Islands; holotype in USNM); Brown and Falanruw 1972:108.

Brown and Marshall (1953) recognized two subspecies of *E. boettgeri,* the nominal one from the Caroline Islands and *E. b. orientalis* from Arno Atoll in the Marshalls, based primarily on the number of lamellae. Larger samples from more widely distributed populations have shown that this apparent difference is not true. Therefore, the concept of a distinct subspecies in the Arno Atoll must be abandoned.

DESCRIPTION.—SVL 59.9–76.8 mm for 25 mature males and 62.1–76.9 mm for 11 mature females; snout tapered, round-pointed, its length 35–39% of HL and 59–66% of HB; HB 57–63% of HL and 13–15% of SVL; eye 58–70% of snout length and 36–44% of HB; rostral forming moderate suture from frontonasal; supranasals triangular, in contact with anterior loreal; frontals moderately separated; frontal strongly tapered; interparietal distinct; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or second labials; six or seven upper labials, fifth or sixth enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 36–42 ($\bar{x}$ = 38.704; SD = 1.489; n = 27); dorsal scale rows 60–72 ($\bar{x}$ = 66.4; SD = 2.449; n = 25); preanals not much enlarged; length of extended hindlimb 100–120% of axilla–groin distance and 49–56% of SVL; rounded lamellae under fourth toe 42–52 ($\bar{x}$ = 45.613; SD = 2.333; n = 31); under first toe 13–16.

COLOR (in preservative).—Dorsal ground color from dark olive-green through light brown to dark brown; nearly uniform, or with numerous vague, darker spots about scale size or larger; some paler olive-green specimens with prominent blackish spots, covering one or a string of three or four scales; others with scattered, small, light spots on the dorsolateral areas; limbs sim-

ilarly spotted; venter bluish gray, usually with lighter areas in limb regions and on tip of chin.

COMPARISONS.—See description of *E. arnoensis*. *Emoia boettgeri* and *E. slevini* are similar in color, but *E. boettgeri* is smaller, has fewer fourth toe lamellae (Table 1), shorter limbs (see ratios in descriptions), and a significant mean difference in midbody scale counts ($t = 5.84$; df = 47; $P < 0.001$).

REPRODUCTION.—A gravid female (CAS 159831) has two oviducal eggs.

HABITAT.—Brown and Marshall (1953) reported that on Arno Atoll the species is most frequently found in open (brush-free) areas in the interior of the islands, but also around houses and piles of coconut husks. Jens Vindum (CAS, pers. comm.) found the species on Ponape Island in open areas between the mangroves and the secondary forest.

RANGE.—Numerous islands in the Caroline and Marshall groups.

MATERIAL EXAMINED.—**Caroline Islands:** Ponape I.: SMF 15347 (holotype of *E. boettgeri*), MCZ 121013–24, 22073–75, CAS 159703–04, 159710–11, 159747–48, 159750–54, 159794, 159823, 159831–33, BMNH 98.5.27.9–10, USNM 139300–01, 138984, 139016, AMS R57495–96; Truk Is.: USNM 123911, MCZ 121005–12; Kusaie I.: USNM 123921–22; Koshae I.: AMS R95940–41, MVC 175474–531; Oruluk Atoll: USNM 139295–96. **Marshall Islands:** Jaluit Atoll: USNM 139026–33; Arno Atoll: USNM 132132 (holotype of *E. b. orientalis*), 132137–40, MCZ 52177, CAS-SU 13488, FMNH 69474 (paratypes of *E. b. orientalis*), MCZ 131031, 121028–30, AMNH 72544; Majuro Atoll: MCZ 159061, 121025–27.

Emoia laobaoense Bourret

Emoia laobaoense Bourret, 1937:16 (type loc.: Lao-bao, Indochina; syntypes in MNHN); Guibé 1954:101; Brygoo 1985:54.

Bourret (1937:16) described *E. laobaoense* from two specimens collected at an elevation of about 250 m in rugged mountains about 75 km inland from Da Nang. Bourret considered this species close to *E. atrocostata*, differing primarily in its large nostril located posteriorly on the nasal and the presence of a supplementary shield above the postnasal.

I have examined the syntypes of *E. laobaoense*, as well as small samples of *E. atrocostata* from Borneo, Malay, and Singapore, and consider *laobaoense* a valid species.

DESCRIPTION (based on two specimens).—SVL 74 mm in one male, 63.3 mm in one female; snout rounded, its length 53–59% of HB, 38–39% of HL; HB 65–74% of HL, 16–17% of SVL; eye 69–74% of snout length, 39–41% of HB; rostral forming nearly straight suture with frontonasal; prefrontals narrowly separated or in contact anteriorly; interparietal longer than broad; one pair of nuchals; anterior loreal shorter and slightly higher than posterior, in contact with first and second upper labials and with supranasal (on one side); postnasal present; six or seven upper labials, fifth or sixth enlarged and below eye; 7 lower labials; scales smooth; midbody scale rows 38–40; dorsal rows 65–67; length of extended hindlimb 99–112% of axilla–groin distance and 49–51% of SVL; rounded lamellae under fourth toe 30–32; under first toe 9–11.

COLOR (in preservative).—Ground color of dorsum and most of lateral surfaces brownish (somewhat faded), marked by somewhat darker band (three to four scale rows wide) along upper lateral surface; venter medium brown.

COMPARISONS.—In midbody scale rows, paravertebral rows between the parietals and base of tail, and some features of the color pattern, *E. laobaoense* falls within the range of *E. atrocostata* from Malay, Singapore, and Borneo. In the number of fourth toe lamellae, *E. laobaoense* is lower (30–32) compared to the above-mentioned populations of *E. atrocostata* (35–42), although the lamellar count for populations of *E. atrocostata* in some Pacific island areas is as low as 32 or rarely 30. The diameter of the eye relative to snout length is also slightly greater for *E. laobaoense* (see ratios in descriptions). Another difference seems to be ecological—*E. atrocostata* is an inhabitant of coastal mangroves and rocky shorelines, whereas *E. laobaoense* is an inland species.

HABITAT.—Wooded, mountainous area about 75 km inland from coast.

RANGE.—Lao-bao area, Vietnam.

MATERIAL EXAMINED.—Lao-bao (16°36′N, 106°38′E), Indochina (=Vietnam), MNHN 1948:58–59 (syntypes). Brygoo (1985:54) designated MNHN 1948:58 as the lectotype.

Emoia nativitatis (Boulenger)

(Figure 7)

Lygosoma nativitatis Boulenger, 1887b:516 (type loc.: Christmas Island; holotype in BMNH), 1888a:536.
Lygosoma atrocostatum: Smith 1929:294; Gibson-Hill 1947:81.
Emoia nativitatis: (new combination) Cogger, Sadlier, and Cameron 1983:43.

Boulenger (1887b) described *E. nativitatis* from Christmas Island. He did not compare it with any other species, but stated that the specimen had 34 midbody scale rows, 32 lamellae under the fourth toe, and lacked a dark lateral band (usual in *E. atrocostata*). Smith (1929), studying skinks from Christmas Island, concluded that *E. nativitatis* should be regarded as a synonym of *E. atrocostata* because variation in number of midbody scale rows was much greater than formerly thought. At the same time he described *E. sinus* based on a population of *E. atrocostata* on Christmas Island, stating that *E. sinus* had 44 midbody scale rows, 38 fourth toe lamellae, and a blackish lateral band. Gibson-Hill (1947:84) followed Smith in placing *nativitatis* in the synonymy of *atrocostata*.

Cogger et al. (1983) resurrected *E. nativitatis*, noting differences from sympatric *E. atrocostata* in number of midbody scale rows (31–34 compared with 34–44, rarely less than 36 in *E. atrocostata*), in color pattern, and in habitat.

DESCRIPTION.—SVL 58.5–75.7 for 10 males and 65.6–71.3 for six females; snout tapered, rounded at tip, its length 48–58% of HB and 35–39% of HL; HB 62–71% of HL and 13–16% of SVL; eye 60–80% of snout length and 37–47% of HB; rostral forming long, nearly straight suture with frontonasal; supranasals narrow, elongate; prefrontals narrowly to moderately separated; interparietal moderately long; one pair of nuchals; anterior loreal shorter and slightly higher than posterior, in contact with first and second, or second and third upper labials and with supranasal; six or seven upper labials, fifth or sixth enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 30–34 ($\bar{x} = 32.067$; SD = 1.163; $n = 15$); dorsal scale rows 66–73 ($\bar{x} = 68.857$; SD = 2.214; $n = 14$); preanals only slightly enlarged; length of extended hindlimb 85–98% of axilla–groin distance and 45–50% of SVL; rounded lamellae under fourth toe 30–34 ($\bar{x} = 31.923$; SD = 1.115; $n = 13$); under first toe 10–13.

COLOR (in life).—Cogger et al. (1983:43) gave the following

FIGURE 7. *Emoia nativitatis,* showing grayish tan color, Christmas Island. Photo courtesy of H. G. Cogger.

description: "Ground colour rich metallic brown, paler on sides, with numerous irregularly-scattered paler and darker scales, pale ones yellowish, darker ones almost black; sides of head and neck suffused with grey, venter rich yellowish-brown, much paler than dorsum; no indication of dark dorsolateral stripe."

COLOR (in preservative).—Light brown to tan on dorsum and upper lateral surface, more grayish on the lower lateral surface; usually some small, pale and darker spots, particularly on sides.

COMPARISONS.—*Emoia nativitatis* differs in number of midbody scale rows (30–34) from the sympatric population of *E. atrocostata* on Christmas Island (midbody scale rows 37–44 for sample of 12) and in the means for the number of fourth toe lamellae ($t = 4.627$; df = 23; $P < 0.001$). The snout is also slightly shorter relative to HB.

REPRODUCTION.—Gravid females have two large oviducal eggs.

HABITAT.—Cogger et al. (1983) stated that this species is found in forest clearings, usually in the floor litter but occasionally on low vegetation or tree buttresses. It is abundant wherever sunlight penetrates the canopy.

RANGE.—Christmas Island.

MATERIAL EXAMINED.—**Christmas Island** (Indian Ocean): BMNH 1946.8.10.59 (holotype), 98.9.19.6–13, 1934.10.3.12–20, 88.6.20.58, CAS 16866, MCZ 29255, AMS R82897–98, R82913, R82937, R83018, R83084, R83124, MNHN 00–446–47.

Emoia slevini Brown and Falanruw

(Figure 8)

Emoia slevini Brown and Falanruw, 1972:107 (type loc.: Cocos Island, Mariana Islands; holotype in USNM).

DESCRIPTION.—SVL 63.1–75.0 mm for six females and 69.0–84.0 mm for 12 males; snout round-pointed, its length 59–67% of HL and 36–44% of HB; HB 59–72% of HL and 13–16% of SVL; eye 61–66% of snout length and 35–39% of HB; rostral forming relatively long, straight suture with frontonasal; supranasals triangular, in contact with anterior loreal; prefrontals not in contact; interparietal small; one pair of large nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or only second upper labial; six or seven upper labials, fifth or sixth (more frequently the latter) enlarged and below eye; seven or eight lower labials; dorsal scales smooth; midbody scale rows 34–38 ($\bar{x} = 36.5$; SD = 1.058; $n = 22$); dorsal scale rows 62–74 ($\bar{x} = 65.696$; SD = 3.096; $n = 23$); length of extended hindlimb 88–98% of axilla–groin distance and 48–49% of SVL; rounded lamellae under fourth toe 30–37 ($\bar{x} = 33.286$; SD = 1.488; $n = 21$); under first toe 10–12.

COLOR (in life).—Dorsal ground color iridescent medium brown to dark brown with some darker flecks and occasional pale flecks; limbs often lighter with numerous dark flecks; venter whitish to gray or cream anteriorly, more yellow posteriorly and sometimes orange about vent.

COLOR (in preservative).—Dorsal ground color brown or somewhat reddish brown with scattered darker markings, sometimes forming a vague pattern of narrow, broken transverse bands.

COMPARISONS.—See description of *Emoia boettgeri.*

HABITAT.—Specimens from Cocos Island were in forested areas (mostly *Casuarina* trees), and were generally active on the forest floor or under debris. Two individuals were observed on the lower part of the trunk of large trees.

RANGE.—Mariana Islands.

MATERIAL EXAMINED.—**Mariana Islands:** Cocos I.: USNM 192781 (holotype), CAS 129138–43, 145570, UGM 547–52, 1305–06, 1394–95, 1448, 1450–51, MCZ 128164, FMNH 171832, BMNH 1971.1027, USNM 216333; Rota I.: USNM 122645–46; Guam I.: USNM 122470; Tinian I.: USNM 128028.

baudini Group

DIAGNOSIS: SVL at maturity 30–65 mm for 19 species (exceptions, *E. aenea* and *E. guttata* (51–73 mm) and *E. klossi*

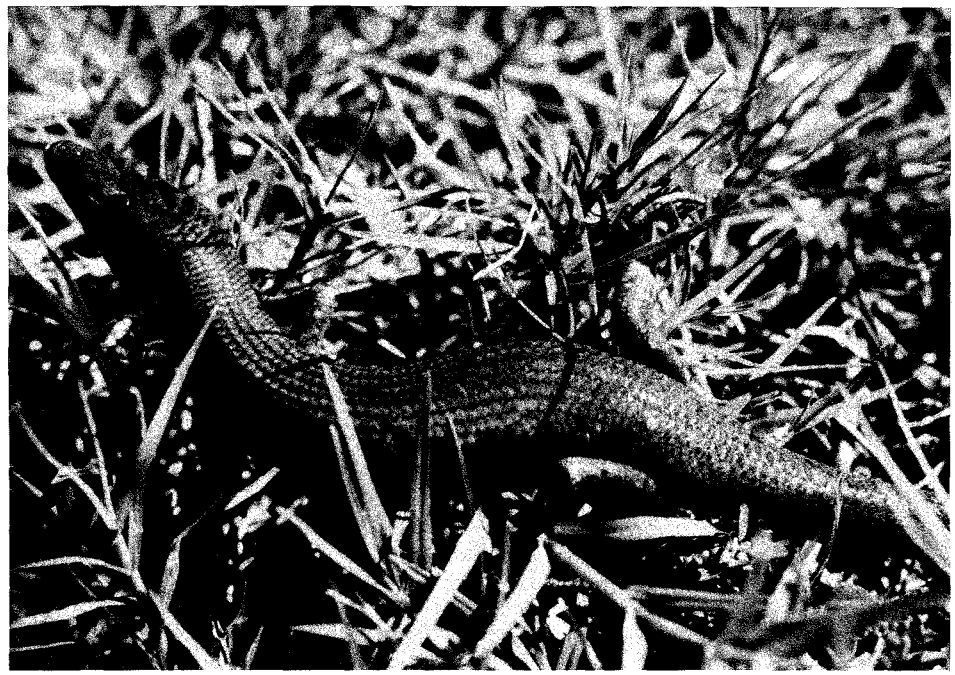

FIGURE 8. *Emoia slevini*, showing relatively uniform light-brown color, Cocos Island, Marianas. Photo courtesy of M. V. C. Falanruw.

(77–90 mm); head and snout moderately tapered and depressed; dorsal scales smooth except for juveniles of a few species; midbody scale rows 26–42; dorsal scale rows 42–68; subdigital lamellae rounded, 23–48 under fourth toe; interparietal fused with frontoparietal (rarely separated); anterior loreal shorter and higher than posterior; most species with fifth (a few with sixth) upper labial enlarged and beneath eye; nasal bones fused; parietal eye absent; palate alpha type; dorsal ground color iridescent greenish, tan, or brown with or without darker markings; lateral surfaces usually with darker band; some species with pale lateral line or spots (Fig. 2b).

This group includes 22 species, most of which are limited to New Guinea and adjacent islands (except for *E. jakati*), a distribution similar to that of the closely related *physicae* group. A further similarity lies in the very restricted ranges of certain species, sometimes a single drainage system or isolated moun-

TABLE 3. Standard scale counts and measurements for species of the *Emoia baudini* group.

Species	Adult SVL (mm)	*n*	Labial below eye				Midbody scale rows	Scale rows parietals to tail	Fourth toe lamellae
			4th	5th	6th	7th			
E. aenea	53.5–71.0	27	–	3	20	–	31–36	49–54	39–46
E. aurulenta	37.0–49.5	28	–	14	1	–	26–32	45–52	39–48
E. baudini	30.1–46.4	17	–	12	–	–	30–36	45–50	27–32
E. bismarckensis	52.3–64.0	14	–	2	6	–	37–42	49–56	33–42
E. bogerti	43.9–54.0	78	2	48	4	–	29–36	54–65	27–38
E. coggeri	37.5–49.8	22	–	17	1	–	34–39	44–51	33–39
E. cyclops	47.3–57.1	12	–	9	3	–	34–39	51–56	38–42
E. digul	43.0–56.8	20	–	19	1	–	32–37	53–60	30–35
E. guttata	51.0–73.0	29	–	2	23	–	33–38	49–58	35–42
E. irianensis	41.5–63.6	36	–	33	–	–	33–41	58–69	30–38
E. jakati	36.9–53.3	80	–	48	5	–	29–39	44–58	30–42
E. jamur	43.4–51.3	21	–	4	16	–	32–38	45–53	35–43
E. klossi	77.0–90.5	8	–	–	2	6	30–34	54–60	42–46
E. loveridgei	33.5–46.0	35	–	30	3	–	30–37	45–58	23–33
E. maxima	41.5–47.0	26	–	12	1	–	38–42	48–58	36–44
E. mivarti	41.5–56.5	40	–	11	10	–	32–40	48–58	38–46
E. obscura	43.9–63.5	127	–	78	6	–	30–39	42–58	30–42
E. pallidiceps	36.5–61.5	285	–	55	17	–	30–38	44–59	28–44
E. paniai	48.6–50.4	3	1	2	–	–	25–26	54–60	26–28
E. popei	44.9–65.0	44	–	6	37	–	34–42	45–52	36–46
E. submetallica	44.4–64.0	36	–	32	3	–	34–41	54–61	30–37
E. veracunda	34.9–52.7	86	–	35	2	–	30–36	39–52	29–40

tain area. The *baudini* group includes four wide-ranging species: *E. jakati, E. obscura, E. pallidiceps,* and *E. veracunda.*

Two samples from populations on Halmahera Island and Japen Island do not readily fit definitions of known species at this time and may prove to be distinct. One of the specimens (BMNH 1946.8.10.54, a syntype of *E. kuekenthali*) is an example of a much smaller species and belongs in the *baudini* group rather than the *physicae* group. It appears to be most similar to *E. maxima.* Three specimens (BMNH 1984.991–993) from Mt. Bauduri, Japen Island, have the sixth labial enlarged and below the eye, a condition which characterizes *E. aenea, E. bismarckensis, E. guttata, E. jamur,* and *E. popei*; but other characters of these specimens do not agree with any of the above species.

Key to the Species of the *baudini* Group

1a. Midbody scale rows 25–32 (rarely more than 30) 2
1b. Midbody scale rows 29–42 (rarely less than 32) 3
2a. Fourth toe lamellae 39–48; dorsal scale rows between parietals and base of tail 45–52 ..... *E. aurulenta*
2b. Fourth toe lamellae 26–28; dorsal scale rows between parietals and base of tail 54–60 ..... *E. paniai*
3a. Sixth or seventh (rarely fifth) upper labial enlarged and below eye 4
3b. Fifth (rarely sixth) upper labial enlarged and under eye 8
4a. SVL at maturity about 75–90 mm; seventh (rarely sixth) upper labial enlarged and below eye ..... *E. klossi*
4b. SVL at maturity less than 75 mm; usually sixth (rarely fifth) upper labial enlarged and below eye 5
5a. Midbody scale rows 31–38 (rarely more than 36) 6
5b. Midbody scale rows 35–42 (rarely less than 36) 7
6a. SVL at maturity 53–71 mm; snout length 54–62% of HB; distinct pale (whitish) spot, line, or blotches on side of neck lacking; (Western Province and south of central mountain range in southern Irian Jaya) ..... *E. aenea*
6b. SVL at maturity 51–73 mm; snout length 43–50% of HB; side of neck mottled with dark and pale patches; (Wau area in Bulolo drainage, Morobe Province) ..... *E. guttata*
6c. SVL at maturity 43–51 mm; snout length 47–54% of HB; side of neck marked by two pale scales or two patches of pale scales; (western end of central mountains, Irian Jaya) ..... *E. jamur*
7a. SVL at maturity 52–64 mm; fourth toe lamellae 33–42; side of neck marked by a dark band, bordered dorsally by a few pale spots and ventrally by a pale band; (New Britain and New Ireland in the Bismarcks) ..... *E. bismarckensis*
7b. SVL at maturity 45–65 mm; fourth toe lamellae 36–46 (rarely less than 39); side of neck lacking dark band but with a distinct pale (whitish) spot near forelimb; row of pale scales on flanks lacking; (Northern, Morobe, Madang, and East Sepik provinces north of central mountain ranges) ..... *E. popei*
7c. SVL at maturity 43–51 mm; fourth toe lamellae 35–43 (rarely more than 40); side of neck marked by two whitish scales or two clusters of pale scales; flanks with an irregular row or small clusters of white scales at limb level; (western end of the central mountains, Irian Jaya) ..... *E. jamur*
8a. Narrow, pale lateral line extending anterior to ear and along upper labials to tip of snout 9
8b. Narrow, pale lateral line present or absent, if present not extending anterior to angle of jaw or ear 10
9a. Fourth toe lamellae 38–46 (rarely less than 40); dorsal ground color greenish tan to olive-green with scattered dark spots laterally; (Admiralty Islands) ..... *E. mivarti*
9b. Fourth toe lamellae 30–42 (rarely more than 38); color pattern marked by five relatively narrow, light stripes; (New Guinea and islands of western Pacific) ..... *E. jakati*
9c. Fourth toe lamellae 33–39 (rarely more than 38); dorsal ground color greenish to tan with scattered dark flecks or spots; (northern Huon Peninsula, Papua New Guinea) ..... *E. coggeri*
10a. Distinct, narrow, pale lateral line or row of pale dots on lateral surface between ear and hindlimb and fore- and hindlimbs 11
10b. Scattered pale dots or blotches but not narrow line or row of dots between ear and hindlimb 13
11a. Midbody scale rows 36–42 (rarely less than 38); narrow, pale lateral line between ear and hindlimb, sometimes with faint extension to angle of jaw; (northern Irian Jaya and western Papua) ..... *E. maxima*
11b. Midbody scale rows 30–39 (rarely more than 37) 12
12a. Fourth toe lamellae 23–32 (rarely more than 30); usually very narrow lateral line between fore- and hindlimbs ..... *E. loveridgei*
12b. Fourth toe lamellae 28–44 (rarely less than 32); dorsal scale rows between parietals and base of tail 44–59 (rarely more than 56); a moderately narrow, whitish lateral line (in one population, a row of dashes) between ear or lower jaw and hindlimbs; (Papua New Guinea) ..... *E. pallidiceps*
12c. Fourth toe lamellae 30–35 (rarely more than 33); dorsal scale rows between parietals and base of tail 51–60 (rarely less than 53); two or three whitish dashes between ear and forelimb and scattered whitish scales on flanks; (Digul drainage in southern Irian Jaya) ..... *E. digul*
13a. Dorsal scale rows between parietals and base of tail 54–69 (rarely less than 55) 14
13b. Dorsal scale rows between parietals and base of tail 39–58 (rarely more than 55) 15
14a. Midbody scale rows 34–41 (rarely less than 35); upper lateral surface brown, darker than dorsum; usually with row of pale scales between fore- and hindlimbs and cluster of pale scales on side of neck near forelimb; (mountains in Central and Morobe provinces) ..... *E. submetallica*
14b. Midbody scale rows 29–36 (rarely more than 34); upper lateral surfaces brown to blackish brown, sometimes with light blotches; sides of neck marked by light blotches or slanted light and dark lines; (Vogelkop Peninsula to southern Irian Jaya) ..... *E. bogerti*
14c. Midbody scale rows 33–41 (rarely less than 35); dorsal half of lateral surfaces brown to dark brown with scattered pale scales or flecks, not in rows; (Baliem drainage and Pesnoake Mountains, western Irian Jaya) ..... *E. irianensis*

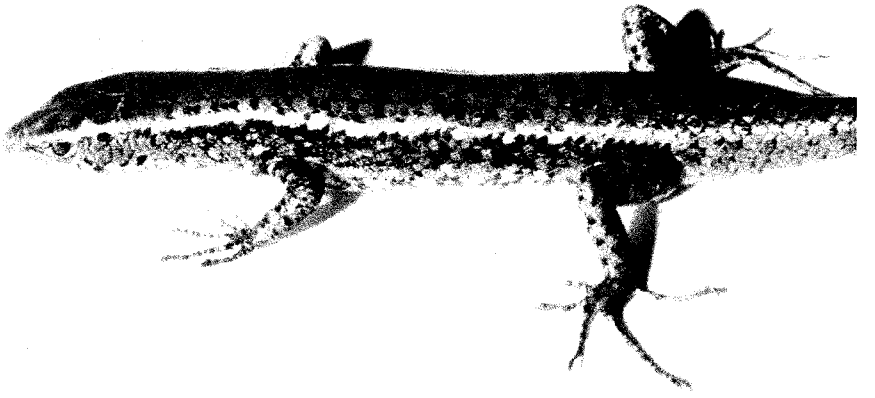

FIGURE 9. *Emoia aurulenta,* showing vague checker-board pattern, Papua New Guinea. Photo courtesy of F. Parker.

15a. Vertebral scale rows 39–52 (rarely more than 48, except 44–52 for populations of *E. veracunda* from Japen and Waige islands) 16

15b. Dorsal scale rows between parietals and base of tail 42–60 (rarely less than 48 except 42–49 for Karkar Island population of *E. obscura*) 17

16a. Fourth toe lamellae 27–32 (mean 29.6); lateral surfaces dark brown to blackish with numerous small (usually about size of scale) pale spots on neck and flanks; (Vogelkop Peninsula, Irian Jaya) ..... *E. baudini*

16b. Fourth toe lamellae 29–40 (mean 34.5), not less than 34 for populations from northern and western Irian Jaya; lateral surfaces dark brown to blackish with few to numerous, scattered pale scales ..... *E. veracunda*

17a. Entire lateral surfaces of neck and body, and margin of venter dark brown to blackish, with a few scattered pale scales or small clusters of such scales along the dorsolateral and ventrolateral margins; (Cyclops Mountains, Irian Jaya) ..... *E. cyclops*

17b. Upper lateral surfaces (two to six scale rows) dark brown to blackish, with some pale blotches or vague pale band on flanks; rarely with scattered pale scales; lower lateral surface grayish; (north of central mountains throughout New Guinea and Central Province in southeastern Papua New Guinea) ..... *E. obscura*

aurulenta Subgroup

This subgroup of relatively small, slender species of the *E. baudini* group differ from other species primarily in the lower number of midbody scale rows, 26–32 (usually less than 30). Occasional examples of a few other species have midbody scale counts as low as 30, but their means range from about 34 to 40. The two included species, *E. aurulenta* and *E. paniai,* are recorded from south of, and at the west end of, the central mountain ranges in Irian Jaya and in Papua New Guinea in the Fly River drainage.

Emoia aurulenta Brown and Parker

(Figure 9)

Emoia aurulenta Brown and Parker, 1985:2 (type loc.: Migalsimbip, Western Province, Papua New Guinea; holotype in MCZ).

This small, colorful species was collected by Fred Parker at several locations in the Bamu and Fly River drainages, Western Province, Papua New Guinea.

DESCRIPTION.—SVL 41.3–49.5 mm for 16 males and 37.4–47.5 mm for eight females; snout tapered, bluntly rounded, its length 35–40% of HL and 52–60% of HB; HB 64–69% of HL and 15–18% of SVL; eye 75–85% of snout length and 40–45% of HB; rostral forming long, nearly straight suture with frontonasal; supranasals triangular and narrowly in contact with anterior loreal; prefrontals moderately to widely separated; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or only second upper labials; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 26–32 ($\bar{x}$ = 28.966; SD = 1.295; n = 29); dorsal scale rows 45–52 ($\bar{x}$ = 48.267; SD = 1.741; n = 30); preanals somewhat enlarged; length of extended hindlimb 90–110% of axilla–groin distance and 47–54% of SVL; rounded lamellae under fourth toe 39–48 ($\bar{x}$ = 42.174; SD = 2.253; n = 29); lamellae under first toe 10–14.

COLOR (in preservative).—Dorsum light greenish brown to brown, always marked by lighter and darker blotches usually involving all dorsal scale rows, or occasionally not including the paravertebral rows; light and dark blotches on alternate scales or involving two or more scales (Parker's field notes describe the appearance as a checker-board pattern); upper lateral surfaces dark brown, bordered dorsally by a row of scattered light

scales; scattered light scales between and on limbs; neck marked by light blotches, and posterior labials by dark bars; venter dirty white to grayish, lightest on the chin and limb regions.

COLOR (in life).—Top of head bronze with lighter line from above eye to nuchals or, for a few specimens, extending onto neck; dorsum gray or brown with alternate black scales or black spots in checkered pattern; upper flanks black or mottled black and brown; lower flanks and occasionally side of neck marked by golden-yellow spots; venter yellowish to cream.

COMPARISONS.—See description of *E. paniai.*

REPRODUCTION.—Gravid females have two large oviducal eggs.

HABITAT.—Forest floor under unbroken canopy, from sea level to about 1200 m.

RANGE.—Bamu and Fly River drainages, Western Province and Lorentz drainage, southern Irian Jaya.

MATERIAL EXAMINED.—**Papua New Guinea:** Western Province: Migalsimbip: MCZ 142327 (holotype), MCZ 142322–26, 142328–30, 152268–71, 152273–75, CAS 154186, AMNH 111718, AMS R40778, SAM R11637, UPNG 6477–78, 6480, 6483; Derongo: MCZ 131895–900, AMNH 103961; Menemsorae: MCZ 131901; Emeti: MCZ 152265–67, 152291, AMNH 111715; Tingkem: MCZ 131894 (paratypes). **Irian Jaya:** Lorentz River drainage, Kloof Bivak: ZMA 11861A–B.

Emoia paniai n. sp.

HOLOTYPE.—RMNH 21159, Paniai, Wissel Lakes, Irian Jaya, 27 August 1939, collected by members of the Royal Netherland Geographical Expedition.

PARATYPES.—Irian Jaya, Lake Paniai area: RMNH 21146, Enarotali area: BPBM 6519.

DIAGNOSIS.—Distinguished from other species of the *baudini* group by the following combination of scutellation and color pattern: midbody scale rows 25–26; dorsal scale rows 54–60; fourth toe lamellae 26–28; SVL at maturity about 50 mm; fourth or fifth upper labial enlarged and below eye; prominent, small and large pale blotches on side of neck and lower lateral surface.

DESCRIPTION OF HOLOTYPE.—Adult female; SVL 48.6 mm; midbody scale rows 26; dorsal scale rows 60; fourth toe lamellae 27.

DESCRIPTION.—SVL 48.8–50.4 mm for two adult females; snout tapered, bluntly rounded, its length 49–52% of HB and 33–34% of HL; HB 63–68% of HL and 13–14% of SVL; eye 67–68% of snout length and 32–35% of HB; rostral forming nearly straight suture with frontonasal; supranasals relatively large, broadest anteriorly; prefrontals widely separated; seven supraciliaries; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with second or first and second upper labials; five or six upper labials, fourth or fifth enlarged and under eye; seven lower labials; dorsal scales smooth; midbody scale rows 25–26; dorsal scale rows 54–60; preanals slightly enlarged; length of extended hindlimb 89–90% of axilla–groin distance and 45–48% of SVL; lamellae under fourth toe 26–28; lamellae under first toe 9–10.

COLOR (in preservative).—Dorsal ground color (four scale rows) tannish to light brown with irregularly edged dark brown line bordering narrow, ivory dorsolateral stripe, which begins on supraciliaries; dorsum marked by additional dark brown spots and blemishes; upper lateral surfaces (three to four scale rows) dark brown; sides of neck and lower lateral surfaces marked by numerous, large and small, pale blotches; labials with few small, dark spots; venter bluish gray with yellowish tinge.

ETYMOLOGY.—The name is based on the type locality, the Paniai Lake area.

COMPARISONS.—*Emoia paniai* is more like *E. aurulenta* than any other species in the *E. baudini* group. It differs from *E. aurulenta* in the higher number of paravertebral scale rows between parietals and base of tail, the much lower number of subdigital lamellae (Table 3), snout shorter relative to HB, eye smaller compared to snout length or HB (see ratios in descriptions).

REPRODUCTION.—One paratype (RMNH 21146) is a gravid female with two large oviducal eggs.

RANGE.—Wissel Lakes and Enarotali areas at the west end of the central mountains, Irian Jaya.

baudini Subgroup

The *baudini* subgroup includes 12 species divisible into three complexes (*aenea* complex, *baudini* complex, and *submetallica* complex). The five species of the *aenea* complex (*E. aenea, E. bismarckensis, E. guttata, E. jamur,* and *E. popei*) normally have the sixth labial enlarged and below the eye. The species of the other two complexes usually have the fifth upper labial enlarged and below the eye. The four species of the *baudini* complex (*E. baudini, E. cyclops, E. obscura,* and *E. veracunda*) have 43–58 dorsal scale rows between the parietals and base of the tail (rarely more than 54 except for *E. cyclops* and some populations of *E. obscura* in northern Irian Jaya). The three species of the *submetallica* complex (*E. bogerti, E. irianensis,* and *E. submetallica*) have 54–67 dorsal scale rows between the parietals and the base of the tail (rarely less than 56).

aenea complex

Emoia aenea Brown and Parker

Lygosoma baudini: (part) Boulenger 1914:259.

Emoia aenea Brown and Parker, 1985:5 (type loc.: Menemsorae, Western Province, Papua New Guinea; holotype in MCZ).

DESCRIPTION.—SVL 53.5–71.0 mm for 13 males and 57.2–69.5 mm for eight females; snout tapered, bluntly rounded, its length 54–62% of HB and 34–39% of HL; HB 58–69% (rarely less than 60%) of HL and 14–17% of SVL; eye 67–90% of snout length and 36–50% of HB; rostral forming long, nearly straight suture with frontonasal; supranasals narrow, elongate, in contact with anterior loreal; prefrontals moderately to widely separated; seven or eight supraciliaries; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second, second, or second and third upper labials; usually six to eight upper labials, sixth (occasionally fifth) enlarged and below eye; seven or eight lower labials; dorsal scales smooth; midbody scale rows 31–36 ($\bar{x}$ = 33.0; SD = 1.170; n = 20); dorsal scale rows 49–54 ($\bar{x}$ = 50.9; SD = 1.518; n = 20); preanals not or slightly enlarged; length of extended hindlimb 91–120% of axilla–groin distance and 45–54% of SVL; rounded lamellae under fourth toe 39–46 ($\bar{x}$ = 42.652; SD = 1.892; n = 19); lamellae under first toe 10–13.

COLOR (in preservative).—Dorsal ground color tan to vague grayish brown or light brown; nearly uniform, marked by longitudinal row of dark brown blotches, or sometimes dark brown, narrow, marginal lines on scale rows lying lateral to paravertebral rows; top of head relatively uniform; upper lateral surface with narrow, dark brown or blackish band varying from one to four scale rows in breadth, narrowing or vague on side of neck

and head and scarcely evident on snout; sometimes bordered by scattered, pale scales along its dorsal margin; some pale scales on lower lateral surfaces, but dark band itself usually unmarked; upper part of upper labials dusky, some dark marks on lower labials; venter uniform whitish ivory; undersurface of tail with scattered, small, blackish or grayish spots.

COLOR (in life).—Head and neck bronzy; belly white.

COMPARISONS.—*Emoia aenea* and *E. jamur* are sympatric. They differ in color pattern and in means for counts of midbody scale rows ($t = 7.021$; df = 40; $P < 0.001$), dorsal scale rows ($t = 2.946$; df = 41; $P = 0.005$), and fourth toe lamellae ($t = 7.940$; df = 44; $P < 0.001$). Two other sympatric species of the *baudini* group, *E. bogerti* and *E. irianensis,* differ in several characters: (1) number of dorsal scale rows (Table 3); (2) number of fourth toe lamellae (Table 3), and (3) fifth rather than sixth upper labial below the eye.

Three eastern New Guinea species have also been confused with *E. aenea. Emoia submetallica* differs in the mean for number of midbody scale rows ($t = 9.076$; df = 54; $P < 0.001$); *E. popei* in the means for midbody scale rows ($t = 11.390$; df = 62; $P < 0.001$) and dorsal scale rows ($t = 7.351$; df = 61; $P < 0.001$); and *E. guttata* in the means for all three scale counts—midbody scale rows ($t = 6.662$; df = 43; $P < 0.001$), dorsal scale rows ($t = 3.623$; df = 45; $P = 0.001$), and fourth toe lamellae ($t = 8.641$; df = 43; $P < 0.001$).

REPRODUCTION.—Gravid females have two large oviducal eggs.

HABITAT.—Parker's specimens were found in primary forest in areas of high rainfall. All his localities are at low elevation between sea level and 100 meters.

RANGE.—Western Province, Papua New Guinea, and from the Mimika River, Digul River, and Jamur Lake areas in southern and western Irian Jaya.

MATERIALS EXAMINED.—**Papua New Guinea:** Western Province: Menemsorae: MCZ 131949 (holotype); Matkomrae: MCZ 144393; Emeti: MCZ 144386; Kiunga: MCZ 131948. **Irian Jaya:** Mimika River area: BMNH 1913.11.1.81–82, 1913.10.31.164F; Gariau, Jamoer Lake area: RMHN 21278; lower Digul River, Tanah Merah: RMHN 21180–85, 21273–74, 21276–77, 21279; Tanah Ringgih: RMHN 21275, 21280–82; Kouh: RMHN 21186–89, CAS 156680; Mariang: RMHN 21190–94; Kawakit: CAS 156681 (paratypes); Lorentz River drainage: ZMA 15659–61, 15764a–b, 15752.

Emoia bismarckensis Brown

Emoia bismarckensis Brown, 1983:317 (type loc.: New Britain Island, Bismarcks; holotype in MCZ).

Brown (1983) stated that *E. bismarckensis* was probably closely related to *E. submetallica* or *E. flavigularis.* The fused nasal bones confirm that it is properly assigned to the *Emoia baudini* group and is related to *E. submetallica.*

DESCRIPTION.—SVL of four mature males 54.2–64.0 mm, of four mature females 52.3–63.8 mm; snout bluntly rounded to almost truncate, its length 38–39% of HL and 52–56% of HB; HB 68–75% of HL and 16–19% of SVL; eye 61–75% of snout length and 35–52% of HB; rostral forming long, nearly straight suture with frontonasal; supranasals narrow, in contact with anterior loreal; prefrontals widely separated; one pair of nuchals; anterior loreal shorter and slightly higher than posterior, in contact with first and second upper labials; six or seven upper labials, sixth (rarely fifth) enlarged and below eye; five or six lower labials; dorsal scales smooth; midbody scale rows 37–42 ($\bar{x} = 39.167$; SD = 1.403; $n = 12$); dorsal scale rows 49–56 ($\bar{x} = 53.154$; SD = 2.267; $n = 13$); two enlarged preanals; length of extended hindlimb 105–128% of axilla–groin distance and 51–55% of SVL; rounded lamellae under fourth toe 33–42 ($\bar{x} = 38.0$; SD = 2.641; $n = 13$); under first toe 10–11.

COLOR (in preservative).—Dorsal ground color light brown to greenish olive-brown, with few to several scattered, irregularly shaped, dark brown to black spots and blotches; lateral surfaces of body fading gradually to bluish gray; a wide dark brown to black band on side of head and neck, extending to just behind the forelimbs, bordered below by bluish white to white band, and above by few to several light spots; venter dirty ivory to light gray.

COMPARISONS.—*Emoia bismarckensis* is in the same species complex as *E. popei* and *E. guttata* from eastern Papua New Guinea. It differs from *E. guttata* not only in color pattern but also in the higher number of midbody scale rows, which barely overlap (Table 3), and the longer snout relative to the HB (see ratios in descriptions). From *E. popei* it differs in color pattern and significantly in the means for dorsal scale rows ($t = 9.955$; df = 54; $P < 0.001$) and fourth toe lamellae ($t = 4.903$; df = 58; $P < 0.001$). *Emoia bismarckensis* also differs significantly in dorsal scale rows ($t = 5.174$; df = 42; $P < 0.001$) and lamellar counts ($t = 6.387$; df = 47; $P < 0.001$) from *E. submetallica,* the other species from eastern Papua New Guinea to which it is similar in size and color.

REPRODUCTION.—Gravid females have two large oviducal eggs.

RANGE.—Southeastern New Britain and New Ireland.

MATERIAL EXAMINED.—**New Britain I.:** Gazelle Peninsula, Cape Lambert area: MCZ 156183 (holotype), MCZ 135358, 156181–82, BMNH 1978.1208, ZMUC R7735–38, CAS 148072 (paratypes), SAM 11854; Aru area: RUCA (one spec.); Vasilau: RUCA (one spec.). **New Ireland:** Kait River area: BPBM 2573; Langkamen on Lelet Plateau: RUCA (four spec.).

Emoia guttata Brown and Allison

(Figure 10)

Emoia submetallica: Allison 1982:810.

Emoia guttata Brown and Allison, 1986:47 (type loc.: Mt. Kaindi [1300 m] Wau area, Bulolo River drainage, Morobe Province, Papua New Guinea; holotype in BPBM).

DESCRIPTION.—SVL 51.0–73.0 mm for 407 males and 51.0–69.0 mm for 339 females; snout tapered, bluntly rounded, its length 43–50% of HB and 28–32% of HL; HB 63–73% of HL and 15–17% of SVL; eye 58–74% of snout length and 25–36% of HB; rostral forming long, nearly truncate suture with frontonasal; supranasals narrowly triangular, in contact with anterior loreal; prefrontals moderately to widely separated; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second, second, or rarely second and third upper labials; six or seven upper labials, sixth (rarely fifth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 33–38 ($\bar{x} = 35.4$; SD = 1.225; $n = 25$); dorsal scale rows 49–58 ($\bar{x} = 53.222$; SD = 2.547; $n = 27$); preanals slightly enlarged; length of extended hindlimb 95–117% (rarely less than 100%) of axilla–groin distance and 46–54% of SVL; rounded lamellae under fourth toe 35–42 ($\bar{x} = 38.038$; SD = 1.661; $n = 26$); lamellae under first toe 9–11.

COLOR (in preservative).—Dorsal ground color of freshly preserved specimens greenish brown to light olive-brown; head and anterior part of neck are relatively unmarked except for a few blackish-brown spots on supraoculars for some specimens; body

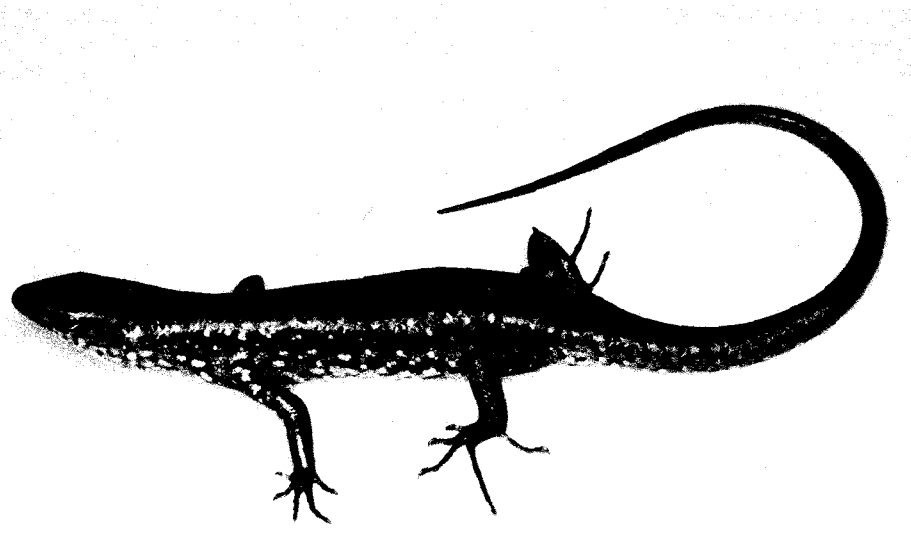

FIGURE 10. *Emoia guttata,* showing pale blotches on lateral surface of neck, Papua New Guinea. Photo courtesy of A. Allison.

and tail marked by scattered blackish blotches involving one to several scales, and scattered pale to whitish scales, especially dorsolaterally; upper lateral surface marked by uneven blackish band, three to four scale rows in breadth (in long-preserved specimens dark brown), extending anteriorly as narrow band through eye and along snout; narrower, lighter band below this broken by scattered, dark, transverse lines and bordered ventrally by narrow, irregular blackish band or series of blotches; lateral surfaces marked by numerous, scattered, pale to whitish scales; sides of neck with light and dark blotches; venter whitish suffused with greenish blue to light slate; venter grayish to slate.

COMPARISONS.—*Emoia guttata* differs from sympatric *E. popei* in color pattern, the smaller eye relative to snout length or HB, and a significant difference in the means for: (1) midbody scale rows ($t = 6.199$; df = 67; $P < 0.001$), (2) dorsal scale rows ($t = 10.976$; df = 68; $P < 0.001$), and (3) fourth toe lamellae ($t = 7.017$; df = 71; $P < 0.001$). *Emoia guttata* differs from *E. submetallica* in the higher count for fourth toe lamellae, barely overlapping (Table 3), in the means for midbody scale rows ($t = 4.434$; df = 59; $P < 0.001$), and for dorsal scale rows ($t = 5.634$; df = 56; $P < 0.001$). For comparison with *E. bismarckensis* and *E. aenea,* see descriptions of those species. The other species of this complex, *E. jamur,* differs significantly in the mean for dorsal scale rows ($t = 6.008$; df = 48; $P < 0.001$).

REPRODUCTION.—Reproduction year around. Clutch size two eggs. Eggs deposited in shallow holes in the soil; hatch in 95–115 days; SVL of hatchlings 25–27 mm.

HABITAT.—Terrestrial, occurring in successional forest and disturbed areas, but the species is almost completely absent from dense, original forest. Individuals bask in early morning in open areas; they forage (usually for a few hours) in leaf litter.

RANGE.—Upper Bulolo River drainage, Morobe Province, Papua New Guinea.

MATERIAL EXAMINED.—**Papua New Guinea:** Morobe Province: Wau: BPBM 8345 (holotype), BPBM 8337, 8346–47, 8811–14, 8816, 8818–19, 8822, 8824–25, 8827, 8829, 8833, 8837, 8839, 8843, 8845, 8847-48, 8851, 8856, 8865, 8867, 8870–72, 8874, 8876–77, 8881, 8883, 8886–87, 8889, 8895–96, 8913, 8915–16, 8921–22, 8924, 8926–30, 8932–33, 8938, 8943–44, 8946–49; 9226, 9228–29, 9231–33, 9235–36, 9238, 9241, 9247–48, 9255–56, 9258–60, 9265, 9268, 9275–80, 9282, 9284, 9286–87, 9290–303, 9305, 9325, 9335, 9970, 9974, 9989–90, 9992, 9999–10000, 10002, 10013–14, 10017–19, 10021, 10027–28, 10031, 10045, 10047, 10049, 10051–56, 10058, 10060–61, 10063, 10070, 10076, 10079, 10081–90, 10092–104, 10106–115, 10117, 10119–21, 10123–32, 10137, 10143–46, 10149–55, 10172, 10190, 10194, 10203, 10212, 10215–17, 10226–31, 10243, 10246, 10259, 10261–62, 10266–67, 10270–71, 10280–83, 10294–95, 10314, 10330–31, 10335, 10349, 10362, 10380, 10410, 10422, 10430, 10441, 10449, 10452, 10456, 10458, 10466, 10474, 10481–83, 10499–507, 10512–19, 10521, 10525, 10527, 10532, 10539, 10541, MCZ 142638–39, CAS 155986–95; AMNH 126687–96 (paratypes).

Emoia jamur n. sp.

HOLOTYPE.—RMNH 21346 collected in Gariau area, Jamur Lake, on neck of land south of Geelvink Bay, Irian Jaya, by Brongersma and Boesman, December 1954.

PARATYPES.—RMNH 21344–45, 21347–68, 21161–63, 21166–70, CAS 156738–39, same locality as holotype; Lorenz River drainage, Sabang: ZMA 15765c. Three specimens (RMNH 5510 and BMNH 1905.11.29.7–8, Vogelkop Peninsula) are tentatively assigned to this species but are not designated as paratypes.

DIAGNOSIS.—Distinguished from other species of *aenea* complex by following combination of characters: relatively smaller size, 43–51 mm SVL at maturity; 32–38 midbody scale rows; 45–53 dorsal scale rows; 35–43 rounded lamellae under fourth toe; two or three small white spots on side of neck and usually a series of prominent white spots on flanks at limb level.

DESCRIPTION OF HOLOTYPE.—An adult male; SVL 47.0 mm; midbody scale rows 36; dorsal scale rows 51; fourth toe lamellae 39.

DESCRIPTION.—SVL 43.4–48.0 mm for 10 mature males and 44.0–51.3 mm for 10 females; snout tapered, bluntly rounded, its length 47–54% of HB and 31–35% of HL; HB 60–70% of HL and 15–18% of SVL; eye 72–82% of snout length and 35–43% of HB; rostral forming long, relatively straight suture with frontonasal; supranasals narrowly triangular, in contact with anterior loreal; prefrontals narrowly to moderately separated;

usually seven supraciliaries; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second (rarely only second) upper labials; six or seven upper labials, sixth (rarely fifth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 32–38 ($\bar{x}$ = 35.636; SD = 1.255; n = 22); dorsal scale rows 45–53 ($\bar{x}$ = 49.304; SD = 1.964; n = 20); length of extended hindlimb 100–123% of axilla–groin distance and 47–54% of SVL; rounded lamellae under fourth toe 35–43 ($\bar{x}$ = 37.889; SD = 2.063; n = 27); under first toe 9–11.

COLOR (in preservative).—Dorsal ground color grayish tan or grayish olive to very light brown, on head, anterior neck, and paravertebral scale rows; scale row on either side of paravertebral rows marked by dark brown along margins of some scales, resulting in overall pattern of three light and two dark (often broken) longitudinal stripes extending from anterior of forelimbs to base of tail; lateral surface uniformly brown or brown only on dorsal three or four scale rows, narrowing on neck to a line on snout and rostral; at lower edge of this band, at level of limbs, an irregular row of white scales or small clusters of scales, sometimes more or less fused into irregular line; side of neck, marked by two whitish scales or small clusters of scales; prominent whitish slash on upper forelimb; labials almost uniform golden brown or marked with dark bands; venter bluish to grayish white.

ETYMOLOGY.—Jamur Lake area, the type locality.

COMPARISONS.—For comparison with *E. aenea* and *E. guttata,* see descriptions of those species. *Emoia jamur* differs significantly from *E. popei* in means for midbody scale rows (t = 5.291; df = 64; $P < 0.001$) and for fourth toe lamellae (t = 7.016; df = 72; $P < 0.001$). *Emoia jamur* also differs from these three species in some aspects of color pattern. *Emoia jamur* differs from the sympatric species, *E. bogerti* and *E. irianensis,* not only in having the sixth rather than the fifth labial below the eye, but also in color pattern and in the greater number of midbody scale rows and fourth toe lamellae (Table 3).

REPRODUCTION.—Gravid females have two large oviducal eggs.

RANGE.—Jamur Lake area and the Fak Fak area, Vogelkop Peninsula. The latter record is based on three specimens tentatively assigned to this species.

Emoia popei Brown, NEW STATUS

(Figure 2d)

Emoia submetallica popei Brown, 1953:25 (type loc.: Marienberg, East Sepik Province, Papua New Guinea; holotype in FMNH); Room, 1974:433; (part) Zweifel, 1980:434.

Brown (1953) described *E. submetallica popei* from 16 specimens (15 from the Marienberg area on the lower Sepik River, East Sepik Province, and one from Cape Endaradare, Northern Province, Papua New Guinea). It is now evident that *E. popei* is more closely related to those species in the *aenea* complex than in the *submetallica* complex and should be treated as a distinct species. Populations of *E. popei* and *E. submetallica* are sympatric in the Garaina area, Morobe Province, without evidence of intergradation.

DESCRIPTION.—SVL 44.9–65.0 mm for 15 mature males and 48.5–63.7 mm for 15 females; snout tapered and bluntly rounded, its length 31–35% of HL and 46–51% of HB; HB 66-71% of HL and 16–18% of SVL; eye 72–86% of snout length and 34–41% of HB; rostral forming relatively straight suture with frontonasal; supranasals narrowly to rather widely separated; one pair of nuchals, anterior loreal shorter and higher than posterior, usually in contact with first and second upper labials; six or seven upper labials, sixth (rarely fifth), enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 34–42 ($\bar{x}$ = 37.818; SD = 1.715; n = 44); dorsal scale rows 45–52 ($\bar{x}$ = 48.093; SD = 1.36; n = 43); length of extended hindlimb 94–110% (rarely less than 100%) of axilla–groin distance and 46–54% of SVL; rounded lamellae under fourth toe 36–46 ($\bar{x}$ = 44.766; SD = 2.407; n = 47); lamellae under first toe 10–12.

COLOR (in preservative).—Eight dorsal scale rows light to medium brown with a few scattered darker markings on body; top of head relatively uniform brown; lateral surfaces darker brown, nearly uniform or with vague to distinct whitish spot on neck (near forelimb); few scattered, small pale scales on flanks of type series; distinct whitish patch on neck, especially on specimens from Morobe and Milne Bay provinces; some examples marked by almost complete pale line (about two scale rows wide) on side between limbs; dorsolateral margin even or interrupted by some pale scales; upper labials dusky except for ventral margins that are ivory; lower labials uniformly light or with some dark markings; venter grayish white to grayish ivory, lighter on chin and limb regions.

COMPARISONS.—For comparisons with other members of the *aenea* complex, see descriptions of *E. aenea, E. bismarckensis, E. guttata,* and *E. jamur. Emoia popei* differs from *E. submetallica,* with which it has sometimes been confused, in the lower number of dorsal scale rows and fourth toe lamellae, barely overlapping (Table 3). From sympatric populations of *E. obscura,* it differs in color pattern, the greater number of midbody scale rows and fourth toe lamellae, and in usually having the sixth rather than fifth upper labial enlarged and below eye.

REPRODUCTION.—Gravid females have two large oviducal eggs.

HABITAT.—Reportedly found only on the forest floor.

RANGE.—Northern to East Sepik provinces, north and east of central mountain range in Papua New Guinea.

MATERIAL EXAMINED.—**Papua New Guinea:** East Sepik Province: Marienberg: *FMNH 65316 (holotype),* 14127, 14129, 65306–11, 65313–315, 65317–318, AMNH 72998 (paratypes), MCZ 156515; East Sepik Province: AMNH 99583 (paratype). Northern Province: Cape Endaradere: CPS 4323 (paratype); Kokoda: AMNH 95367–68, 95370. Morobe Province: Masba Creek: AMNH 95781; Garaina area: AMNH 103414–15, 103419–22; 105469–70; coast, 60 km south of Lae: BMNH 1980.486–87; Wau area: BPBM 8362, 8364–65, 8368, 8371, plus 8 uncatalogued. Madang Province: Madang area: AMS R24459; Tung (west of Bogia): RUCA (10 specimems); Soran (West of Bogia): RUCA (5 specimens); Malala: RUCA (4 specimens); Maibang (eastern edge of Finisterre Mts.): RUCA (4 specimens).

baudini complex

The four species of this complex (*E. baudini, E. cyclops, E. obscura,* and *E. veracunda*) have the fifth upper labial enlarged and below the eye and have a lower average count for fourth toe lamellae than do species of the *aenea* complex. Three species (*baudini, veracunda,* and *cyclops*) typically exhibit scattered small pale spots on the lateral surfaces. This character is also seen in a few populations of *E. obscura* in Central Province.

Emoia baudini (Duméril and Bibron)

(Figure 11)

Gongylus (Eumeces) baudini Duméril and Bibron, 1939:653 (type loc.: New Guinea; lectotype in MNHN); Brygoo 1985:10.

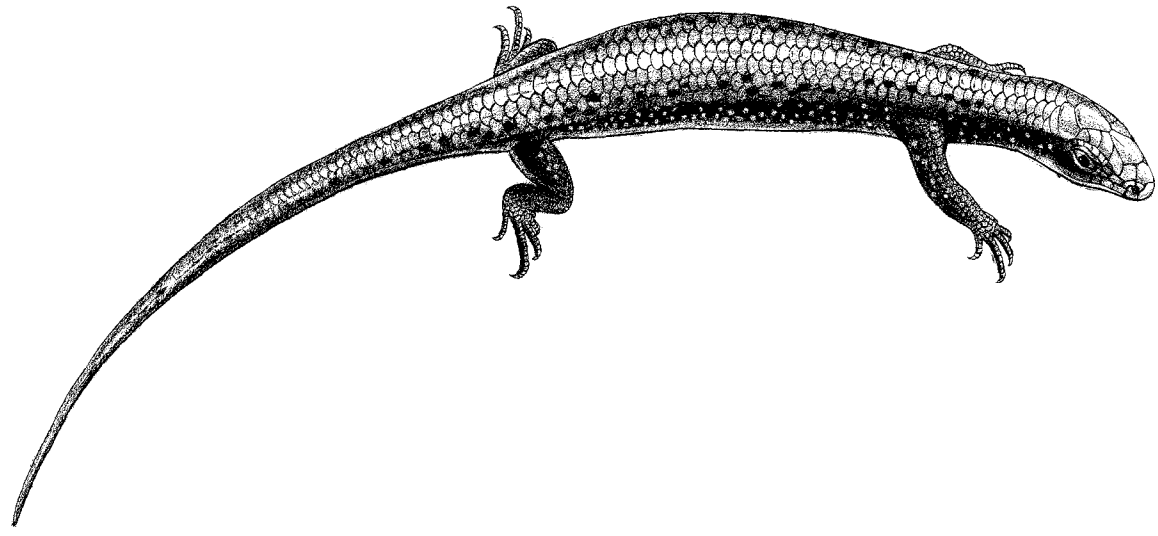

FIGURE 11. *Emoia baudini,* showing small, scattered, pale spots on lateral surface, Irian Jaya. Drawing by M. Bradbury.

Emoia baudini: Gray 1845:95; Girard 1858:263; Barbour 1912:94; (part) Smith 1937:227; Mittleman 1952:22.
Eumeces beccari Sauvage 1878:53.
Euprepes (Tiliqua) baudini: (part) Peters and Doria 1878:353.
Lygosoma baudini: (part) Boulenger 1887a:296; (part) de Rooij 1951:257.
Emoia b. baudini: (part) Loveridge 1948:369; Brown 1953:2.

Emoia baudini was the first species of the *E. baudini* group to be described. I have examined the syntypes in MNHN. Although they are labeled simply "New Guinea," they are in close agreement with samples from a population or populations in the Vogelkop (=Gendlawasih) Peninsula, Irian Jaya. The type locality is therefore restricted to the Vogelkop Peninsula.

The type specimens of *E. baudini* were most probably collected by the naturalists on the voyage of Durmont d'Urville (1826–29), because they were not included among the species collected during the voyage of Duperrey (1922–26) and described by Lesson (1830).

Peters and Doria (1878) placed *E. physicae* in the synonymy of *E. baudini* based on similarities in cephalic squamation, scale counts, general features of color pattern and the assumption that the keeled-scale character was highly variable. Boulenger (1887a), using keys based primarily on a number of midbody scale rows and fourth toe lamellae, followed Peters and Doria in maintaining *physicae* in synonymy. In 1915 de Rooij did the same. Their descriptions were sufficiently general to include both smooth-scaled and keel-scaled specimens. However, the SVL (38 mm) given by Boulenger is within the range of adults of *E. baudini,* a small species; whereas that given by de Rooij (68 mm) is typical of *E. physicae.*

Loveridge (1948) not only retained *physicae* but also placed *jakati* and *mivarti obscura* in the synonymy of *E. b. baudini* or *E. baudini pallidiceps.* Brown (1953) used more characters to show that *E. physicae* and *E. baudini* were distinct species and representative of two different, though related, species groups. He also returned *E. pallidiceps* to species rank and removed *E. mivarti* and *E. obscura* from the synonymy.

LECTOTYPE (new designation).—MNHN 5006a, New Guinea.

DESCRIPTION OF LECTOTYPE.—A male, with smooth scales, SVL 46.4 mm; midbody scale rows 32; dorsal scale rows 46; fourth toe lamellae 30.

DESCRIPTION.—SVL of three mature males 32.9–41.9 mm, of three mature females 30.1–37.6 mm (unknown sex 46.4 mm); snout tapered and slightly depressed, bluntly rounded, its length 35–37% of HL and 53–55% of HB; HB 65–71% of HL and 16–17% of SVL; eye 75–79% of snout length and 39–44% of HB; rostral forming long, straight suture with frontonasal; supranasals widely separated, fairly long and narrow, in contact with anterior loreal; prefrontals widely separated; usually seven supraciliaries; one pair of nuchals; anterior loreal higher and shorter than posterior, in contact with first and second upper labials and with supranasal; six or seven upper labials, fifth enlarged and below eye; five or six lower labials, dorsal scales smooth; midbody scale rows 30–36 ($\bar{x}$ = 33.0; SD = 1.813; n = 15); dorsal scale rows 45–50 ($\bar{x}$ = 47.733; SD = 1.668; n = 15); preanals not or slightly enlarged; length of extended hindlimb 72–95% of axilla–groin distance and 36–41% of SVL; rounded lamellae under fourth toe 27–32 ($\bar{x}$ = 29.684; SD = 1.493; n = 19); lamellae under first toe 7–10.

COLOR (in preservative).—Dorsal ground color metallic green to olive-brown usually with series of blackish spots or dashes along dorsolateral margin from region of forelimbs onto base of tail; lateral surfaces of neck and body black or brown with scattered, prominent bluish or white spots about the size of single scale; venter bluish or grayish white. The color of some specimens, including the syntypes, is sufficiently dark (perhaps the result of preservation) that the small pale (whitish) spots are faint.

COMPARISONS.—*Emoia baudini* is sympatric with, or in close proximity in Irian Jaya to, two other species of the *baudini* complex (*E. obscura* and *E. veracunda*). However, *E. baudini* is slightly smaller, differs in some features of the color pattern, and relatively shorter limbs (see ratios in descriptions). *Emoia baudini* also differs significantly from *E. veracunda* in the means for the number of fourth toe lamellae (t = 7.277; df = 109; P < 0.001), and the hindlimbs are relatively shorter. *Emoia baudini* differs significantly from *E. cyclops* in the means for midbody (t = 6.049; df = 26; P < 0.001) and dorsal scale rows (t = 9.28; df = 23; P < 0.001). *Emoia baudini* differs significantly from *E. obscura* in the much lower number of fourth toe lamellae

(Table 3), and in the means for midbody ($t = 4.451$; df = 44; $P < 0.001$) and dorsal scale counts ($t = 7.452$; df = 42; $P < 0.001$).

REPRODUCTION.—A gravid female (FMNH 15507) has two oviducal eggs.

RANGE.—Vogelkop Peninsula, Irian Jaya.

MATERIAL EXAMINED.—**New Guinea:** specific locality unknown: MNHN 5006b–c (syntypes); Irian Jaya: Vogelkop Peninsula: Manokwari area: MCZ 7695a–b, AMS R6812, RMNH 5620, 8861a–b, FMNH 15506–11; Manikion: RMNH 5240a–d, ZMA 1575a; Manokuan: ZMUC R47866–68.

Emoia cyclops n. sp.

HOLOTYPE.—BMNH 1938.6.8.43, collected in the Cyclops Mountains in Irian Jaya at an elevation of 1100 to 1200 m by L. E. Cheesman in 1938.

PARATYPES.—Irian Jaya: Cyclops Mountains: BMNH 1938.6.8.42, 1938.6.8.45–53; MCZ 112247–48; CAS 157630.

DIAGNOSIS.—Distinguished from others of the *Emoia baudini* complex by following combination of characters: SVL of adults 47–57 mm; midbody scale rows 34–39; dorsal scale rows 51–56; rounded lamellae under fourth toe 38–42; some features of color pattern: dark brown band on lateral surface wide, extending onto margins of the venter, and labials with prominent, dark bars.

DESCRIPTION OF HOLOTYPE.—An adult male; SVL 53.8 mm; midbody scale rows 36; dorsal scale rows 55; fourth toe lamellae 39.

DESCRIPTION.—SVL 47.3–56.8 mm for four mature males; 57.1 mm for one mature female; snout tapered, bluntly rounded, its length 42–52% of HB and 32–33% of HL; HB 73–76% of HL and 15–17% of SVL; eye 68–80% of snout length and 31–40% of HB; rostral forming nearly straight suture with frontonasal; supranasals triangular, in contact with anterior loreal; prefrontals narrowly to moderately separated (rarely in contact); usually six supraciliaries; one pair of nuchals; anterior loreal shorter and higher than posterior; and in contact with second or first and second upper labials; six or seven upper labials, fifth (occasionally sixth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 34–39 ($\bar{x} = 36.769$; SD = 1.423; $n = 13$); dorsal scale rows 51–56 ($\bar{x} = 54.0$; SD = 1.633; $n = 10$); limbs well developed, length of extended hindlimb 98–104% of axilla–groin distance and 47–52% of SVL; rounded lamellae under fourth toe 38–42 ($\bar{x} = 39.667$; SD = 1.231; $n = 12$); under first toe 10–12.

COLOR (in preservative).—Dorsal ground color (six plus scale rows) grayish olive-tan to light brown, scales usually with some fine, radiating, darker brown lines and often scattered, small, dark-brown spots; top of head nearly uniform or with dark brown spot near posterior border of each parietal, and sometimes posterior edges of supraoculars are dark; lateral surfaces to margin of venter dark brown, usually with few scattered pale scales or occasionally short vertical clusters of such scales along dorsolateral line and near ventrolateral margin; lips usually dark barred; venter dusky ivory to grayish.

ETYMOLOGY.—Cyclops Mountains to which the species appears to be restricted.

COMPARISONS.—The dark lateral band that extends ventrally onto the margins of the venter is broader than that in other species of this complex. For comparison with *E. baudini,* see description of that species. *Emoia cyclops* differs from *E. veracunda* in the higher number of midbody and dorsal scale rows, which barely overlap (Table 3). It differs from populations of *E. obscura* in northern Irian Jaya not only in color pattern but also in the means for the number of fourth toe lamellae ($t = 3.146$; df = 41; $P = 0.003$).

RANGE.—Cyclops Mountains, a small coastal range in northern Irian Jaya.

Superspecies **Emoia obscura** (de Jong), NEW STATUS

(Figure 2c)

Lygosoma baudini (?): Ogilby 1890b:95; (part) de Rooij 1915:257; (?) Vogt 1932: 292; Boulenger 1898:8.
Lygosoma pallidiceps: (part) de Rooij 1915:257.
Lygosoma mivarti obscurum de Jong, 1927:317 (syntypes: Pioneer Bivak, on the Memberamo River, Irian Jaya; lectotype in ZMA); Daan and Hillenius 1966: 133.
Emoia baudini pallidiceps: (part) Loveridge 1948:370.
Emoia obscura: Mittleman 1952:28.
Emoia submetallica submetallica: (part) Brown 1953:12.
Emoia submetallica obscura: Brown 1953:16.
Emoia loveridgei: (part) Zweifel 1980:416.

De Jong (1927) described *Emoia mivarti obscura* from the Mamberamo drainage system in Irian Jaya. Brown (1953) proposed a close relationship of this population with *E. submetallica* and made it a subspecies. He assigned other specimens from the Lorentz River drainage, south of the central mountains, to another subspecies, *bogerti,* and a population from Madang Province to the subspecies *popei.* Populations of *E. obscura* from Central, Milne Bay, and Morobe provinces in Papua New Guinea were erroneously assigned to *E. s. submetallica* by Brown. Later authors accepted Brown's subspecies and ranges.

More extensive samples of populations from numerous localities in New Guinea indicate that *E. obscura, E. bogerti,* and *E. submetallica,* like *E. popei,* are best treated as full species. *Emoia obscura* is now known to be sympatric with *E. submetallica* in Central and Morobe provinces and with *E. popei* in Morobe and Madang provinces.

The description of *Lygosoma pallidiceps* by de Rooij (1915: 259) does not fit that species, but does fit *E. obscura,* since the pale lateral line is said to begin at the forelimb (not the ear). A vague, pale line between the fore- and hindlimbs is exhibited by some *E. obscura.* Boulenger's (1898) listing of *E. baudini* from Central and Milne Bay provinces in eastern Papua is most probably based on examples of this species.

LECTOTYPE (new designation).—ZMA 11445, Irian Jaya, Pioneer Bivak on Mamberamo River, collected by W. C. van Heurn, 1920.

DESCRIPTION OF LECTOTYPE.—An adult female, SVL 55.8 mm; midbody scale rows 38; dorsal scale rows 57; fourth toe lamellae 38.

DESCRIPTION.—SVL 43.9–63.5 mm (rarely greater than 60) for 18 males and 46.0–61.0 for 20 females; snout tapered, its length 35–39% of HL and 51–60% of HB; HB 64–69% of HL and 15–18% of SVL; eye 60–82% of snout length and 40–46% of HB; rostral forming long, relatively straight suture with frontonasal; supranasals narrowly triangular, in contact with anterior loreal; prefrontals narrowly to moderately separated; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or second upper labials; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale

TABLE 4. Frequency distribution of scale counts for populations of *Emoia obscura*.

	Midbody scale rows									
	30	31	32	33	34	35	36	37	38	39
E. obscura (Central Prov.)	—	—	4	4	12	11	18	4	2	—
E. obscura (Milne Bay, Northern, Morobe, and Madang provs.)	—	—	4	5	13	5	5	—	—	—
E. obscura (Karkar Island)	2	3	10	5	4	1	1	—	—	—
E. obscura (Irian Jaya)	—	—	1	2	7	6	7	2	3	3

	Scale rows parietals to tail																
	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58
E. obscura (Central Prov.)	—	—	—	—	—	1	5	6	8	10	12	7	3	1	—	—	—
E. obscura (Milne Bay, Northern, Morobe, and Madang provs.)	—	—	—	—	3	3	8	8	5	2	2	—	—	—	—	—	—
E. obscura (Karkar Island)	1	2	4	5	5	4	4	1	—	—	—	—	—	—	—	—	—
E. obscura (Irian Jaya)	—	—	—	—	—	—	1	2	1	3	4	7	3	2	3	2	1

	Fourth toe lamellae												
	30	31	32	33	34	35	36	37	38	39	40	41	42
E. obscura (Central Prov.)	1	1	2	7	8	11	9	9	4	1	2	1	—
E. obscura (Milne Bay, Northern, Morobe, and Madang provs.)	1	1	3	5	5	6	8	2	2	—	—	—	—
E. obscura (Karkar Island)	—	—	—	—	1	2	4	4	7	2	2	1	—
E. obscura (Irian Jaya)	—	1	3	1	3	4	3	2	3	4	3	3	1

rows 30–39 ($\bar{x}$ = 34.529; SD = 1.391; n = 138); dorsal scale rows 42–58 ($\bar{x}$ = 50.059; SD = 3.09; n = 135), usually more than 47, except for population on Karkar Island, and rarely more than 54, except for population from Star Mountains in Irian Jaya (Table 4); limbs well developed, length of extended hindlimb 90–117% of axilla–groin distance and 46–52% of SVL; rounded lamellae under fourth toe 30–42, rarely more than 40 ($\bar{x}$ = 35.787; SD = 2.537; n = 136); under first toe 9–11.

COLOR (in preservative).—Dorsal ground color tannish olive-green to medium brown, relatively uniform or with few, small darker spots; dorsolateral margin marked by narrow (one-half to one scale row in breadth) vague to fairly distinct lighter line; dark brown band, variable in breadth, on upper lateral surface; beginning at eye or nostril relatively uniform with a fairly even dorsal margin, ventrally merging into gray of the lower lateral surface; some specimens with scattered pale scales or a somewhat vague pale line (usually somewhat wider than for *E. pallidiceps*) between limbs (never distinct pale line from forelimb to ear); venter dirty ivory to grayish or slate, slightly lighter along edge of lower jaw and limb regions.

COMPARISONS.—Populations of *Emoia obscura* are sympatric with other species of the *baudini* Group in various parts of northern New Guinea and in Central Province in the southeast. These include *E. submetallica, E. popei, E. guttata, E. veracunda, E. cyclops, E. jakati, E. pallidiceps,* and *E. loveridgei. Emoia obscura* is seldom confused with the last three because of the distinctive color patterns of those species. For comparison with *E. baudini, E. cyclops, E. guttata,* and *E. popei,* see descriptions of those species.

Emoia obscura has frequently been confused with *E. veracunda* and *E. submetallica.* It differs from *E. submetallica* in minor differences in color pattern and significant differences in the means for all three scale counts: (1) midbody scale rows (t = 8.015; df = 110; $P < 0.001$), (2) dorsal scale rows (t = 14.320; df = 104; $P < 0.001$), and (3) fourth toe lamellae (t = 3.623; df = 110; $P < 0.001$). Similar differences in the means for these counts are also true when *E. veracunda* and *E. obscura* are compared: (1) midbody scale rows (t = 6.55; df = 223; $P < 0.001$), (2) dorsal scale rows (t = 9.838; df = 234; $P < 0.001$), and (3) fourth toe lamellae (t = 3.57; df = 226; $P < 0.001$). Actually, only the Karkar Island population of *E. obscura* accounts for examples of that species which strongly overlap with *E. vercunda* in counts of dorsal scale rows. The range for mainland populations of *E. obscura* is 46–58 and of *E. veracunda* 39–50.

Some of the disjunct populations of *E. obscura* show differences in frequency distributions for scale counts (Table 4). The population from the type locality on the Mamberamo, and those from other areas in Irian Jaya, have a somewhat higher count for dorsal scale rows, and more frequently, the sixth rather than the fifth upper labial than do those from Papua New Guinea. A unique specimen from Mt. Wilhelm in Papua also fits in with these populations. The population on Karkar Island, off the coast of Madang, exhibits a lower count for midbody and dorsal scale rows than do any of the other populations (Table 4).

The populations of Irian Jaya, based on presently available samples, are well isolated from those in Papua New Guinea. Except for the population in the May River area on the north slope of the Star Mountains, *E. obscura* is not known from East or West Sepik provinces. Also it appears not to be widely distributed in Madang Province, where it is recorded only from Wanuma in the Adelbert Range and Karkar Island. Numerous populations, however, have been recorded from Central, Milne Bay, Northern, and Morobe provinces. Some of these disjunct populations may prove to be geographic races or even closely related sibling species, but such treatment is held in abeyance pending much needed additional field and perhaps genetic studies.

REPRODUCTION.—Three hatchlings measured 20.5–23 mm SVL. Gravid females have two large oviducal eggs.

HABITAT.—Normally on ground and in leaf litter in rain forest, swampy forest areas, also some grassland areas. Individuals

were sometimes seen on low branches or tree trunks one or two feet from the ground. This species has been recorded from sea level to 1800 meters in Papua New Guinea.

RANGE.—Milne Bay, Madang, Central, and Morobe provinces, Papua New Guinea; the north slope of Star Mountains in Western Sepik Province, north of the central mountains, Irian Jaya; and Waigeo Island and Batanta Islands.

MATERIAL EXAMINED.—**Irian Jaya:** MCZ 19608; Pioneer Bivak on the Mamberamo River: ZMA 11445–46 (syntypes), 14570c–d, 15755a–b; Mafor: BMNH 86.11.29.1; Toem: RMNH 8864; Idenberg River: AMNH 62434–37, 62452–54, RMNH 10497; Doorman Peak: ZMA 12099A–B ("B" with some reservations); Itoda: BPBM 3719; north slope of Star Mountains: SAMA R6231, R6250, R6248a–c, R6252, R6260a–c, R6266 (with some reservations); Mt. Bantjiet: AMNH 94341. **Papua New Guinea:** Madang Province: Karkar I.: AMS R24708, R24713–14; R24716–17, R24755, R24935–41, AMS R25408, R25429–40, R25538, R25675–76, R25724, R26726, R25106–07, R25109–10, R25112–14, R25197–99, R25200, R25210, R25594–95, R25600, R25644, R25759, R26023, R28861–62, R28874; Wanuma: BPBM 5763–64, 5766–70, 5772, 5774–78. Morobe Province: Yagepa: BPBM 10611, 10614; Selimbeng area: AMNH 95339; Garaina area: AMNH 103416–18, 105475. Milne Bay Province: Baiana: AMNH 74007, 74024, 74106; Cape Vogel: AMNH 74030, 74060, 74154, 74160, 74172, 74183, 74196, 74207, 74252, 74316; Kwagira River: AMNH 74225, 74271, 74274, 74366, 74369, 74374, 74391–93; Mt. Dayman: AMNH 74196. Central Province: Aroma: BMNH 97.12.10.68–69; Mafulu: AMNH 59002, 59004, 59006–07, 59011, 59015, 59017, 59020–22, 59025–29, 59032–33, 59189–90, 59193, 59195–96; CAS-SU 13485; Kubuna: AMNH 59165–66, 59168–71, 59173–177, 59179–80, 59182; Yule I.: AMNH 59151, Port Moresby area: AMNH 82609–15, 117747–49; Brown River: AMNH 103423–25, MCZ 152920–28, AMS R80867, QM J30048–50, J30055, J30059, J32804, J32882, J32855; Sogeri: AMNH 102234, QM R32972, AMS 80867, CAS 118105–09, 118761–68, AMNH 102234, AMS J32972, SAMA R10992; Loloki River: AMS R14604, R14618–22, R14629; Mt. Diamond: AMS J30059, J32548. One specimen (BPBM 2660) from Mt. Wilhelm on the border between Madang and Eastern Highlands provinces is also tentatively assigned to *E. obscura*. Three specimens from **Waigeo I.,** ZMA 15651, BMNH 1984.910–11, and one from **Batanta I.,** AMNH 94312, are tentatively assigned to this species.

Emoia veracunda Brown, NEW STATUS

Emoia baudini veracunda Brown, 1953:6 (holotype: Marienberg, East Sepik Province, Papua New Guinea; holotype in FMNH); Zweifel 1980:415.
Emoia baudini: Scott, Parker, and Menzies 1977:11.

Populations in sufficiently close agreement with the type series of *E. baudini* to be referred to that species are known only from the Vogelkop Peninsula in Irian Jaya. One population from Manikion (Vogelkop Peninsula) and others throughout northern New Guinea east of the Vogelkop, Waigeo, and Japen islands, and the Otakwa and Mimika drainages south of the central mountains resemble *E. baudini* in general color pattern and number of midbody scale rows. However, they differ in the larger size at maturity and/or in higher number of subdigital lamellae (Table 3). Brown (1953) described these populations as *E. baudini veracunda,* but it is now treated as a full species.

DESCRIPTION.—SVL 34.9–46.8 mm for 20 mature males and 40.9–52.7 mm for 20 females; snout tapered, bluntly rounded, its length 52–58% of HB and 37–41% of HL; HB 68–73% of HL and 16–20% of SVL; eye 68–82% of snout length and 39–45% of HB; rostral forming long, nearly straight suture with frontonasal; supranasals triangular, in contact with anterior loreal; prefrontals moderately separated; one pair of nuchals; anterior loreal shorter and much higher than posterior, in contact with first and second or second upper labials; six or seven upper labials, fifth (rarely fourth or sixth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 30–36 ($\bar{x}$ = 33.0; SD = 1.642; n = 87); dorsal scale rows 39–52, rarely more than 48 ($\bar{x}$ = 46.089; SD = 3.037; n = 101); preanals not or only slightly enlarged; length of extended hindlimb 93–105% of axilla–groin distance and 41–58% of SVL; rounded lamellae under fourth toe 29–40 ($\bar{x}$ = 34.511; SD = 2.803; n = 92), number of lamellae usually 30–37 for populations from the Sepik Drainage eastward through northern Papua New Guinea, in the Otakwa and Mimika drainages, and in south-western Irian Jaya, and 34 to 41 for populations in northern Irian Jaya, Japen, and Waigeo Islands; lamellae under first toe 8–12.

COLOR (in preservative).—Dorsal ground color grayish green to light medium brown or occasionally greenish brown, nearly uniform or with vague to sharp darker markings outside paravertebral rows; scattered, pale or whitish scales on lateral surfaces of neck and body (rarely absent); dorsal margin of dark lateral band usually broken by some grayish or whitish scales; venter uniform ivory to grayish or heavily flecked with brownish gray; labials dusky or barred. Benoit Mys (RUCA, pers. comm.) noted that in life some examples from the Toricelli Mountains have reddish orange on the posterior venter and on the side of the neck and head.

COMPARISONS.—For comparison with other species in the *baudini* complex, *E. baudini, E. cyclops,* and *E. obscura,* see their descriptions. The one population of *E. veracunda* from the Otakwa and Mimika drainages, southern Irian Jaya, is sympatric with or contiguous to populations of *E. bogerti, E. irianensis,* and *E. jamur.* From the first two it differs in the much lower counts for dorsal scale rows (Table 3). When compared with *E. jamur* there are significant differences in the means for all three scale counts: (1) midbody scale rows (t = 7.019; df = 109; P < 0.001), dorsal scale rows (t = 4.844; df = 122; P < 0.001), and fourth toe lamellae (t = 5.810; df = 117; P < 0.001).

Populations from various parts of the range of *E. veracunda* show differences in scale counts. The populations in northern Irian Jaya differ significantly from more eastern Papuan populations in the means for dorsal scale counts and fourth toe lamellae. The mean of dorsal scale rows for northern Papuan populations is 44.122 (n = 49) and for northern Irian Jayan populations 47.891 (n = 46); and the "t" value is 7.62 with 93 degrees of freedom, and the probability < 0.001. For fourth toe lamellae, the mean of northern Papuan populations is 32.417 (n = 36) and of northern Irian Jayan populations 36.419 (n = 43); and the "t" value is 8.594 with 77 degrees of freedom, and the probability < 0.001. The small samples from the Mimika and Otakwa drainages in southern Irian Jaya are in close agreement with northern Irian Jayan populations in terms of dorsal scale rows ($\bar{x}$ = 47.857, n = 7); and close to northern Papuan populations in terms of fourth toe lamelllae ($\bar{x}$ = 34.0, n = 13).

REPRODUCTION.—Gravid females have two large oviducal eggs.

HABITAT.—This small brownish terrestrial species is found in litter of the forest floor.

RANGE.—Waigeo and Japen islands, Manikion area on the Vogelkop Peninsula (where it is sympatric with *E. baudini*), north of central mountain range near Hollandia in Irian Jaya, eastward to Northern Province in northern Papua New Guinea, and Western Highlands Province in southern Papua New Guinea. Two populations in the Otakwa and Mimika drainages in southern Irian Jaya are also tentatively assigned to this species.

MATERIAL EXAMINED.—**Papua New Guinea:** East Sepik Province: Marienberg: FMNH 65302 (holotype), 65303–05 (paratypes), FMNH 15501, 15531 (6 specimens); Maprik: MCZ 152809; Kanganamon: FMNH 14006 (paratype); Lumi:

AMNH 100290; Milion: AMNH 100291–92; Nuku: AMNH 100296–97 (paratypes); Mirlingi: RUCA (three specimens); Wallis I.: RUCA (six specimens). West Sepik Province: Pes: RUCA (nine specimens). Morobe Province: Huon Peninsula: AMNH 95317, 95319, 95337–38, 95683–84; Lae: AMNH 66705; Wau: AMS R60541, R59409, R60463. Western Highlands Province: Baiyer River area: AMNH 103298–308. Madang Province: Adelbert Mts.: AMNH 105236–38; Ikunden: RUCA (six specimens); Soran: RUCA (six specimens). **Irian Jaya** (without specific locality): CAS-SU 11614–15; Hollandia area: FMNH 36619, 43170, 43172, 43184, BMNH 1938.6.8.40, AMNH 61960 (paratypes), AMNH 61982; Japen I.: MCZ 7694 (paratype), SAMA R2800, RMNH 5238a–c, 8866c, BMNH 1984.946–989; Waigeo I.: BMNH 1984.912–945; Vogelkop Peninsula, Manikion area: ZMA 15758b. Samples from the Otakwa and Mimika drainages, BMNH 1913.10.31.155–164a, are also tentatively assigned to this species.

submetallica complex

Emoia bogerti Brown, NEW STATUS

Emoia submetallica bogerti Brown, 1953:18 (type loc.: Baliem River, Irian Jaya: holotype in AMNH).
Emoia pallidiceps: Brongersma 1931b:28.

Brown (1953) treated this population as a subspecies of *E. submetallica,* based on some similarities in size and color for the small samples available. Larger samples from many areas indicate that *E. s. bogerti,* like *E. popei* and *E. obscura,* is best treated as a distinct species rather than a subspecies of *E. submetallica.*

Brongersma (1931b:28) refers three specimens from Angi-gita on the Vogelkop Peninsula to *Lygosoma* (=*Emoia*) *pallidiceps.* Since *pallidiceps* is not known from that far west, and the given scale counts agree with those of *E. bogerti* rather than *E. maxima,* a western relative of *E. pallidiceps,* these specimens are referred to *E. bogerti.* Benoit Mys (RUCA, pers. comm. 1986) re-examined two of these (IRSNB 119a–b) and verified the scale counts.

DESCRIPTION.—SVL 43.9–58.8 mm for 29 males and 46.9–54.0 mm for 20 females; snout tapered and bluntly rounded, its length 51–58% of HB and 36–41% of HL; HB 65–74% of HL and 15–18% of SVL; eye 64–76% of snout length and 33–43% of HB; rostral forming long, straight or slightly convex suture with frontonasal; supranasals narrowly triangular, in contact with anterior loreal; prefrontals usually widely separated; usually seven supraciliaries; one pair of nuchals; anterior loreal shorter and somewhat higher than posterior, in contact with first and second or only second upper labial; six or seven upper labials, fifth (rarely fourth or sixth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 29–36 ($\bar{x}$ = 32.170; SD = 1.464; n = 100); dorsal scale rows 54–65 ($\bar{x}$ = 59.274; SD = 2.32; n = 106); length of extended hindlimb 88–107% of axilla–groin distance and 45–51% of SVL; rounded lamellae under fourth toe 27–38, rarely greater than 34 ($\bar{x}$ = 31.449; SD = 2.091; n = 98); under first toe 8–11.

COLOR (in preservative).—Dorsal ground color light brown with margins of rows other than along vertebral line dark brown (giving the impression of very narrow, dark brown longitudinal lines); two or three scale rows on upper laterals brown to blackish brown, straight-edged dorsally, and sometimes with paler dorsolateral line, especially anteriorly; sides of neck marked by narrow light and dark lines or blotches; continuous light stripe below upper dark band or rather elongate dark and light dashes and patches on sides between limbs; venter grayish ivory to slate; limbs brown, sometimes with distinct darker blotches.

COMPARISONS.—*Emoia bogerti* is sympatric with populations of *E. irianensis,* also in the *submetallica* complex, and both are widely separated from populations of *E. submetallica. Emoia bogerti* barely overlaps with *E. submetallica* in number of midbody scale rows (Table 3). It also differs significantly in the means for dorsal scale rows (t = 6.551; df = 135; $P < 0.001$) and fourth toe lamellae (t = 5.832; df = 132; $P < 0.001$). *Emoia bogerti* differs from *E. irianensis* in the slightly smaller eye (see ratios in descriptions) and significantly in the means for: (1) midbody scale rows (t = 16.111; df = 145; P = <0.001); (2) dorsal scale rows (t = 8.94; df = 149; $P < 0.001$); and (3) fourth toe lamellae (t = 5.646; df = 131; $P < 0.001$). *Emoia bogerti* and *E. irianensis* further differ in the following details of color pattern. *Emoia bogerti* has a narrow, dark brown, lateral band (one or two scale rows in breadth) below the pale dorsolateral line, while most of the lateral surface is more golden-brown with scattered dark brown spots or short golden and dark brown slanting lines. *Emoia irianensis* has the upper lateral surface (five to seven scale rows) rather dark brown with scattered, small pale spots usually less than scale-size. For comparisons with *E. aenea, E. guttata, E. jamur,* and *E. popei,* see descriptions of those species.

The population of *E. bogerti* in the Angi-gita Lake area has lower counts for midbody and dorsal scale rows than do other populations. For midbody scale rows the means are 30.826 (n = 23) for Angi-gita and 32.571 (n = 77) for Wissel Lakes and Baliem areas, and the t value = 5.782 (df = 98; $P < 0.001$). For dorsal scale rows the means are 57.591 (n = 22) for Angi-gita and 59.605 (n = 86) for Wissel Lakes and Baliem areas, and the t value = 3.929 (df = 106; $P < 0.001$).

REPRODUCTION.—Gravid females have two large oviducal eggs.

RANGE.—Baliem, lower Digul, and Eipomek drainage systems, Wissel Lakes area at the western end of the central mountains in Irian Jaya, and Angi-gita area, Vogelkop Peninsula.

MATERIAL EXAMINED.—**Irian Jaya:** Baliem River Camp, Baliem River: AMNH 61911 (holotype), 61902–10, 61912–21, 61926–51, CAS-SU 13486 (paratypes), AMNH 91553–62, RMNH 10478a–b; Kuranelala, Eipomek Valley: RMNH 18203; Nuggona: RMNH 18203; Tanah Merah on the Digul River: RMNH 21144–45; Wissel Lakes area: RMNH 21147, 21148–56, 21271–73, 21283–86, 21288–90, 21369–76, 21378–83, 21302–29, CAS 156744–45; Angi-gita Lake area, Vogelkop Peninsula: BPBM 6880–95, 6897–916, 6918, 6921–22, 6924–25, ZMA 11862.

Emoia irianensis n. sp.

HOLOTYPE.—RMNH 21239, a mature female, collected at Tussen Tage on Paniai Lake at western end of central mountains, Irian Jaya, 3 Jan. 1955, by L. D. Brongersma, M. Boesman, and party.

PARATYPES.—**Southern and western Irian Jaya:** Dimija, Wissel Lakes: RMNH 21233–38, 21240, 21301; Araboe, Wissel Lakes area: RMNH 21231–32, 21330–43, CAS 156746–49; Missie Tage on Tage Lake: RMNH 21287, BPBM 2561, 5108–09, 3900; Enarotali, Wissel Lakes area: RMNH 21157–58, 21160, 21293–94, 21298, 21300, BPBM 6521–27; Hitalipa: MZB 1087–94; Kumopa: MZB 1079–86; Beoga: MZB 1055–56; Usaciga: MZB 1078; Moanemani: BPBM 3720–21, 2415; Wagete: BPBM 3408–09; Urapuna: BPBM 3753, 3755. Other specimens tentatively assigned to this species, Irian Jaya, Hellwig Mts.: ZMA 15753a–c, Okaitadi: BPBM 2399–2400.

DIAGNOSIS.—Distinguished by the following combination of characters: SVL of 24 mature specimens 41 to about 63 mm; number of midbody scale rows 33–41; dorsal scale rows 58–69; fourth toe lamellae 30–38; fifth (rarely sixth) upper labial enlarged and beneath eye; head and snout not strongly depressed or elongated; dorsal ground color grayish olive-green to light brown with few dark spots or vague darker, transverse bands;

lateral surfaces dark brown with small scattered light flecks or spots.

DESCRIPTION OF HOLOTYPE.—An adult female, SVL 53.9 mm; midbody scale rows 38; dorsal scale rows 65; fourth toe lamellae 36.

DESCRIPTION.—SVL 41.5–58.6 mm for 13 males and 49.7–63.6 mm for 11 females (two females measuring 46 and 47 mm do not appear fully mature); snout tapered, bluntly rounded at tip, its length 34–38% of HL and 49–59% of HB; HB 63–68% of HL and 14–17% of SVL; eye 74–91% of snout length and 40–48% of HB; rostral forming nearly straight or slightly convex suture with frontonasal; supranasals triangular, moderately to widely separated anteriorly, in contact with anterior loreal; prefrontals usually widely separated; six or seven supraciliaries; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or second supralabials; six or seven supralabials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; scales smooth for adults, occasionally dorsals with very weak keels for some juveniles; midbody scale rows 33–41 ($\bar{x}$ = 36.617; SD = 1.751; n = 47); dorsal scale rows 58–69 ($\bar{x}$ = 63.047; SD = 2.636; n = 43); length of extended hindlimb 84–110% of axilla–groin distance and 44–54% of SVL; rounded lamellae under fourth toe 30–38 ($\bar{x}$ = 33.8; SD = 2.18; n = 35); under first toe 9–11.

COLOR (in preservative).—Dorsal ground color usually grayish olive-green, but ranging from this to light brown; dorsum usually marked by vague, darker brown spots or rarely ladderlike longitudinal bands (about one scale row wide) on either side of vertebral rows (ladder pattern result of confinement of dark brown to lateral and posterior margins of scales); lateral surfaces (at least upper half) dark medium brown with scattered light flecks or scales; frequently scattered pale scales dorsolaterally along margin of dark lateral band; band more narrow and sometimes broken as it extends through upper eye and loreals, but rarely encroaches on rostral; lower labials usually with some dark transverse bars; upper labials, though more dusky, often with vague, dark bars; venter dirty white to ivory, slightly more grayish under head and throat.

ETYMOLOGY.—Based on the locality, the mountains in western Irian Jaya.

COMPARISONS.—*Emoia irianensis* is sympatric or contiguous with populations of *E. bogerti, E. veracunda, E. jamur,* and *E. aenea* in southern Irian Jaya. For comparisons, see descriptions of those species. Similarly, for comparisons with *E. guttata* and *E. popei* from eastern Papua New Guinea, see under those species. When compared with *E. submetallica,* it differs in the means for dorsal scale rows (t = 12.188; df = 72; $P < 0.001$) and in the color pattern. The populations of *E. irianensis* in the Baliem River and the Beoga areas (Rouffaer River drainage) differ somewhat in the number of midbody and dorsal scale rows.

REPRODUCTION.—Gravid females have two large oviducal eggs.

HABITAT.—Forested mountains at elevations above 1200 m.

RANGE.—Pegmoake mountains at the western end of the Central Divide in Irian Jaya between Wissel Lakes and Beoga, in drainages both to the north, west, and south.

Emoia submetallica (Macleay)

Euprepes submetallicus Macleay, 1877:69 (type loc.: Hall Sound, Papua New Guinea; lectotype in AMS).

Euprepes metallicus: Boulenger 1887a:209 (listed by name only).

Emoia pallidiceps: (part?) De Vis 1890:497.

Emoia submetallica submetallica: (part) Brown 1953:12.

Emoia baudini pallidiceps: (part) Goldman et al. 1969:482 (based on Loveridge's key).

Emoia submetallica: Scott, Parker, and Menzies 1977:11; Cogger 1979:193.

Emoia submetallicus: Ingram 1979:413.

Macleay (1877) refers to only one specimen of *E. submetallica* from Hall Sound area, Central Province, Papua New Guinea. However, there are three specimens in the type series in the Australian Museum. Only two of these fit the description of *E. submetallica,* the third specimen is an example of the New Guinea population of *E. atrocostata,* as noted by Cogger (1979).

Both AMS R31861 and R31863 agree with Macleay's brief description in all but overall length, stated to be about seven inches. The two specimens are actually five to six inches. Although both are badly faded, AMS R31861 is closest to Macleay's description in length and squamation and was designated as the lectotype by Cogger (1979). The only reference in the literature to this species, prior to resurrection by Brown (1953), was a listing by Boulenger (1887a:209) of *Euprepes metallicus* Macleay (apparently a reference to *submetallicus*).

More than 50 specimens from Central Province, Papua New Guinea (the general type locality of *E. submetallica*), are generally similar in color pattern. The pattern lacks the narrow, pale stripe between ear and forelimb, which characterizes *E. pallidiceps,* although most have a distinct, pale, short bar on the side of the neck. This series of 50, however, exhibits bimodal curves in size at maturity and the number of paravertebral rows between the parietals and the base of the tail. Twenty-two specimens are in close agreement with the types of *E. submetallica*; the remaining specimens best fit *E. obscura.*

DESCRIPTION.—SVL 46.0–59.0 mm for 15 mature males and 44.4–64.0 mm for 17 mature females; snout tapered, its length 38–41% of HL and 51–59% of HB: HB 67–75% of HL and 15–18% of SVL; eye diameter 69–78% of snout length, 38–45% of HB; rostral forming long, relatively straight suture with frontonasal; supranasals triangular, in contact with anterior loreal; prefrontals narrowly to moderately separated; normally seven supraciliaries; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second (rarely second or second and third) upper labials; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 34–41 ($\bar{x}$ = 37.361; SD = 1.959; n = 30); dorsal scale rows 54–61 ($\bar{x}$ = 56.742; SD = 3.055; n = 31); length of extended hindlimb 95–114% of axilla–groin distance and 49–52% of SVL; rounded lamellae under fourth toe 30–37 ($\bar{x}$ = 33.75; SD = 1.826; n = 36); under first toe 9–11.

COLOR (in preservative).—Dorsal ground color grayish olive-green to light brown or grayish brown; longitudinal band of darker spots and dashes (one to two scale rows in breadth) on either side of paravertebral rows; usually some scattered dark brown spots on supraoculars and sometimes on parietals; lateral surface marked by a broad, dark brownish band usually six to eight scale rows in breadth all along the flank, fairly evenly margined dorsally; usually marked at level of limbs by broken series of scattered, whitish scales or nearly continuous light line; dark lateral band narrows and extends through eye and along snout onto rostral, where it often persists as a dark line on ventral edge of rostral; small cluster (two to six scales) or short line of

pale (whitish) scales on neck close to forelimb (never forming line all the way from ear to forelimb); upper labials dusky; lower labials uniformly light to dusky, especially on the posterior labials; venter grayish white to grayish slate, only slightly lighter along border of lower labials and forelimb region.

COLOR (in life).—Fred Parker (pers. comm.) notes that in life the venter is more grayish, and the lips and chin do not show the yellow pigment typical of *E. obscura.*

COMPARISONS.—See descriptions of *E. aenea, E. bismarckensis, E. bogerti, E. guttata, E. irianensis, E. obscura,* and *E. popei.*

HABITAT.—Primarily in forest, rarely in open areas, in the Garaina region, Morobe Province, Papua New Guinea. This species does not bask in the sunlight.

RANGE.—Yule Island and mountain areas of Central Province, Garaina and upper Waria River areas in Morobe Province, Papua New Guinea.

MATERIAL EXAMINED.—**Papua New Guinea:** Central Province: AMS R31863 (holotype, by designation of Cogger 1979), AMS R31861 (paratype); Woitape: AMS R23606–09, R23611–17; Rigo: SAMA R7710, R7719–20; Efogi: UPNG 5512, 6910–13; Yule I.: BMNH 86.11.29.2–3. Morobe Province: Garaina-Saurere area: AMNH 95895, 103395–402, 103418, 105371–74, 105476–82; MCZ 149810–15, 149828, 149833; Waria River area (1700 m): BPBM 10625, 10627, 10630.

Emoia klossi (Boulenger)

Lygosoma klossi Boulenger, 1914:259 (type loc.: Utakwa River area, Irian Jaya; lectotype in BMNH); de Rooij 1915:259.
Emoia klossi: Mittleman 1952:25; Brown 1953:20; Scott, Parker, and Menzies 1977:11.

Boulenger (1914) stated that the dorsal scales have five to seven weak keels, which would place *Emoia klossi* in the *E. physicae* group. Actually, the scales in adults are smooth. Boulenger's error was doubtless due to the fact that the scales are usually marked by narrow light and dark longitudinal lines, which in reflected light gives the impression of weak keels.

In addition to the syntypes, four specimens from the Cyclops Mountains on the north coast near Hollandia, one from Mt. Nibo, Eastern Sepik Province, Papua New Guinea, and three from Waigeo Island are assigned to this species. They are in close agreement in scale counts and color pattern. Larger samples are necessary before possible differences between these populations can be determined.

LECTOTYPE (new designation).—BMNH 1946.8.7.2 (from the syntype series) collected in the Utakwa River Valley, south of the central divide in Irian Jaya by the Wollaston Expedition.

DESCRIPTION OF LECTOTYPE.—A female, with smooth scales showing radiating pale and dark lines; SVL 90.5 mm; midbody scale rows 30; dorsal scale rows 57; fourth toe lamellae 42.

DESCRIPTION.—SVL 77.0–90.5 mm for four mature specimens (one specimen measuring 61.5 mm appears to be immature); snout tapered, rounded at tip, its length 30–39% of HL and 49–62% of HB; HB 59–69% of HL and 15–18% of SVL; eye 65–78% of snout length and 32–45% of HB; rostral forming long suture with frontonasal; prefrontals separated; one pair of nuchals; anterior loreal shorter and slightly higher than posterior, in contact with second or second and third labials; eight or nine upper labials, usually seventh enlarged and below the eye; seven or eight lower labials; dorsal scales smooth except for small juvenile (37.5 mm), which has faint keels, as do juveniles of some other species; midbody scale rows 30–34 ($\bar{x}$ = 31.375; SD = 1.408; n = 8); dorsal scale rows 54–60 ($\bar{x}$ = 56.875; SD = 1.959; n = 8); length of extended hindlimb 116–131% of axilla–groin distance and 54–59% of SVL; rounded lamellae under fourth toe 42–46 ($\bar{x}$ = 43.375; SD = 1.506; n = 8); lamellae under first toe 14–16.

COLOR (in preservative).—Dorsal ground color greenish brown with some scattered dark spots or sometimes narrow, irregular, transverse bands; an uneven-margined dark band from eye to forelimb region, continuous with series of dark blotches or bars on upper lateral surface of body; venter dirty ivory, usually marked by small brown or blackish blotches.

COMPARISONS.—*E. klossi* is larger and has relatively longer limbs (see ratios in descriptions) than any other species in the *E. baudini* group, closer in size to *E. longicauda* and *E. atrocostata* in the *E. cyanogaster* group. Also, *E. klossi* has the seventh, not fifth or sixth, upper labial enlarged and below the eye. There is no obvious closely related species.

REPRODUCTION.—One specimen from Waigeo Island measuring 37.5 mm snout–vent may be close to size at hatching.

RANGE.—Utakwa River area south of the central divide, Cyclops Mountains, and Waigeo Island in northern Irian Jaya, and Mt. Nibo in Papua New Guinea.

MATERIAL EXAMINED.—**Irian Jaya:** Utakwa River Valley (800 m elevation): 1948.8.4.1–2 (syntypes); Cyclops Mountains: BMNH 1936.6.8.56–58, MCZ 112252; Waigeo I.: BMNH 1984.907–909. **Papua New Guinea:** Mt. Nibo in Eastern Sepik Prov.: AMNH 100274.

pallidiceps Subgroup

Several species of the *E. baudini* group typically exhibit a narrow, pale lateral line between the ear and the groin, the angle of the mouth and the groin, or the tip of the snout and the groin. *Emoia digul* has a row of pale dashes or spots in place of the line along the flanks, as occasionally do some populations of *E. pallidiceps.* This subgroup includes two complexes.

pallidiceps complex

Four species (*E. pallidiceps, E. loveridgei, E. maxima,* and *E. digul*) have the pale lateral line extending anteriorly only to the ear or the angle of the jaw.

Emoia loveridgei Brown

(Figure 12)

Emoia baudini pallidiceps: (part) Loveridge 1948:370.
Emoia loveridgei Brown, 1953:10 (type loc.: Toem, Irian Jaya; holotype in MCZ); Zweifel 1980:416; Greer 1970:171; Scott, Parker, and Menzies 1977:11.

DESCRIPTION.—SVL 33.5–46.0 for 21 males and 34.9–40.2 mm for 21 females; snout tapered, broadly rounded at tip, its length 26–33% of HL and 42–46% of HB; HB 60–68% of HL and 13–15% of SVL; eye 52–69% of snout length and 23–30% of HB; rostral forming relatively long, straight or slightly concave suture with frontonasal; supranasals widest anteriorly, in contact with anterior loreal; prefrontals separates; one pair of nuchals; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; anterior loreal shorter and somewhat higher than posterior; in contact with second or occasionally first and second upper labials; dorsal scales smooth; midbody scale rows 30–37 ($\bar{x}$ = 33.224; SD = 1.649; n = 49); dorsal scale rows 45–58 ($\bar{x}$ = 49.267; SD = 2.016; n = 45), rarely above 51, except for populations in Southern and Western High-

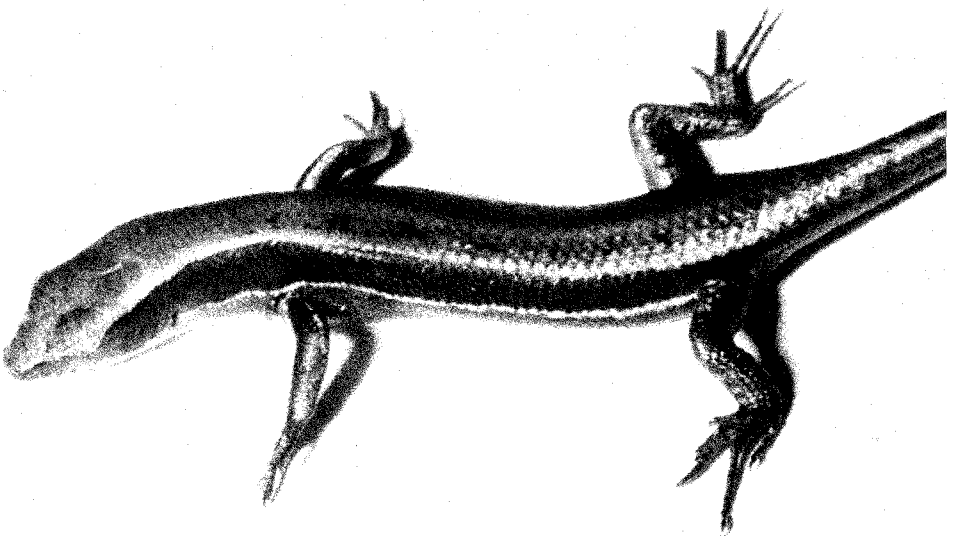

FIGURE 12. *Emoia loveridgei,* showing narrow, pale lateral line, Papua New Guinea. Photo courtesy of F. Parker.

land provinces, which have a count of 51–58; preanals somewhat enlarged; length of extended hindlimb 91–107% of axilla-groin distance and 43–50% of SVL; lamellae under fourth toe 23–33, rarely more than 31 ($\bar{x}$ = 27.547; SD = 2.777; n = 64); lamellae under first toe 7–9.

COLOR (in preservative).—Dorsal ground color grayish olive to greenish brown or dark brown, somewhat darker on head and tail regions; scales of the second row on either side of vertebral line usually edged with darker brown; lateral surfaces to lower level of limbs brown to blackish brown from snout almost to tip of tail; lower lateral surface and the venter gray-brown to slate; faint, sometimes irregular, narrow light line from axilla to groin usually present; lips and chin heavily barred with blackish brown.

COMPARISONS.—This species has been confused with *E. pallidiceps,* but the whitish line on the flanks tends to be more ventral as well as narrower and may or may not continue anteriorly between the forelimb and the ear, or occasionally may be entirely absent. Also the number of fourth toe lamellae 23–33 (rarely more than 31) is lower than for *E. pallidiceps,* 28–44 (rarely less than 31). The snout is shorter relative to HB or length, and the eye smaller (see descriptions).

The population assigned to *E. loveridgei* in Southern and Western Highlands provinces south of the central mountains differs in number of dorsal scale rows (51–58 with a mean of 54.071) from those populations in northern Papua (45–54 with a mean of 49.267). The difference is significant (t = 7.721; df = 57; $P < 0.001$).

REPRODUCTION.—Gravid females have two oviducal eggs.

HABITAT.—In the litter of the forest floor from near sea level to 2000 m.

RANGE.—Toem area on northern coast of Irian Jaya, southern Madang Province, numerous localities on the Huon Peninsula, from Wau somewhat southward in Morobe Province, and tentatively from the mountains in Southern Highlands, Western Highlands, and Western provinces, Papua New Guinea.

MATERIAL EXAMINED.—**Irian Jaya:** Toem: MCZ 49318 (holotype), MCZ 49320–25, FMNH 67264, BMNH *1969.1540* (paratypes). **Papua New Guinea:** Sepik Province: Ilam River: AMS R62480. Madang Province: Maibang: RUCA (7 specimens); Tauta, north end of Finishterre Mts.: RUCA (8 specimens). Morobe Province: Gusika: AMNH *66685–86* (paratypes); Lae: AMS R59408, R66187; Bulolo: AMS R80865–66; Huon Peninsula: AMNH 95312–16, 95318, 95320–27, 95693–725, 109522–23, 120601–06; Wau area: MCZ 44192–94 (paratypes), MCZ 142564, MCZ 145994–95, AMS R64542, BPBM 8752, 8756, 8802, 8807, 8836, 8857, 9082, 9087, 9224, 9239–40, 9242, 9283, 9341; Boana: MCZ 97312–13, 131927–35. The following are also tentatively assigned to this species. Southern Highlands Province: Ialibu: AMNH 103405, 103407–13; Mendi: CAS 107754–60, VNM D49951: Western Highlands Province: Koge: SAMA R8348B, R8350D, Tambul: AMNH 105465–66: Western Province: *Gigabip:* MCZ 141318–19.

Emoia digul n. sp.

HOLOTYPE.—RMNH 21220, collected at about 1250 m in the Sibil drainage, tributary to the Digul River, south side of the central mountain range in eastern Irian Jaya by L. D. Brongersma and party in 1959.

PARATYPES.—**Irian Jaya:** Digul drainage, Sibil area: RMNH 21199–21219, 21221–21222; Ok Bon: CAS 156740–41, RMNH 21178–79, 21420; Nimdol in Bon drainage: RMNH 21223–30.

DIAGNOSIS.—Distinguished from other species in *E. pallidiceps* complex by following combination of characters: midbody scale rows 32–37; dorsal scale rows 53–60 (rarely more than 56); fourth toe lamellae 30–35; SVL at maturity 43–57 mm; lateral surfaces dark brown, marked by irregular row of scattered white scales or clusters of scales on flanks at level of limbs and few white scales or cluster of such scales on side of neck.

DESCRIPTION OF HOLOTYPE.—Adult male, measuring 55.1 mm SVL; midbody scale rows 32; dorsal scale rows 54; fourth toe lamellae 31; color of dorsum medium brown with scattered dark spots.

DESCRIPTION.—SVL 43.2–55.1 mm for nine mature males

and 49.5–56.8 mm for nine females; snout tapered, bluntly rounded, its length 46–52% of HB and 32–36% of HL; HB 65–71% of HL and 15–17% of SVL; eye 73–86% of snout length and 36–41% of HB; rostral forming long, relatively straight suture with frontonasal; supranasals triangular; prefrontals narrowly to rather widely separated; usually seven supraciliaries; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or only second upper labial; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 32–37 ($\bar{x}$ = 33.909; SD = 1.477; n = 22); dorsal scale rows 53–60 ($\bar{x}$ = 55.059; SD = 2.904; n = 17); length of extended hindlimb 95–107% of axilla–groin distance and 36–41% of SVL; rounded lamellae under fourth toe 30–35 ($\bar{x}$ = 32.05; SD = 1.468; n = 20); under first toe 8–11.

COLOR (in preservative).—Dorsal ground color light to medium brown with scattered, dark brown spots, smaller than individual scales; bordered by pale dorsolateral line at least anteriorly; lateral surfaces (six to eight scale rows) dark brown or ventral part somewhat mottled brown and grayish; flanks at level of limbs usually marked by row of scattered pale scales; usually two or three whitish scales or dashes between ear and forelimb; labials are dark barred; usually some dark brown marks on parietals and supraoculars; venter slate-gray to grayish ivory.

ETYMOLOGY.—Based on locality.

COMPARISONS.—*Emoia digul* is similar in color pattern to some populations of *E. pallidiceps,* but the pale lateral line is always broken into spots or segments. The head is broader relative to its length (see ratios in descriptions). Also, *E. digul* differs from adjacent populations of *E. pallidiceps* in southern Papua New Guinea in the significantly greater means of dorsal scale rows (t = 3.071, df = 6, P = 0.003).

REPRODUCTION.—Gravid females have two large oviducal eggs.

HABITAT.—Specific information is not available for this species, but the Sibil and Bon valleys are generally forested and are about 1100–1500 m elevation.

RANGE.—Sibil and Bon tributaries of Digul (1200–1500 m, elevation) drainage in southern Irian Jaya.

Emoia maxima Brown, NEW STATUS

Emoia pallidiceps maxima Brown, 1953:10 (type loc.: Hollandia, Irian Jaya; holotype in FMNH), Zweifel 1980:417.

Brown (1953) described *Emoia pallidiceps maxima* from Irian Jaya based on relatively small samples from a few scattered populations of *E. pallidiceps.* More recently, samples from many more populations, especially in Papua New Guinea, have provided much more information on the variability exhibited by *E. pallidiceps.* Two Papuan subspecies are now recognized, and it is possible that others exist. However, the distinctly greater number of midbody scale rows exhibited by populations in northern Irian Jaya, without evidence of intergradation with *E. pallidiceps* from eastern New Guinea, indicates that *E. maxima* is best treated as a valid species.

DESCRIPTION.—SVL 41.5–47.0 mm for eight mature specimens; snout tapered, bluntly rounded at tip, its length 46–55% of HB and 32–37% of HL; HB 65–72% of HL and 15–18% of SVL; eye 64–84% of snout length and 30–42% of HB; rostral forming long, nearly straight suture with frontonasal; supranasals triangular, usually in contact with anterior loreal; prefrontals moderately separated; usually seven supraciliaries; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or only second upper labials; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 38–42 ($\bar{x}$ = 40.05; SD = 1.276; n = 20); dorsal scale rows 48–58 ($\bar{x}$ = 54.2; SD = 3.364; n = 15); length of extended hindlimb 88–112% of axilla–groin distance and 44–54% of SVL; rounded lamellae under fourth toe 36–44 ($\bar{x}$ = 39.933; SD = 2.438; n = 15); lamellae under first toe 10–12.

COLOR (in preservative).—Dorsal ground color grayish green to almost tan; paravertebral rows relatively free of darker markings, but two rows of scales lateral to paravertebrals with scattered, dark brown spots or blotches; upper lateral surfaces (five or six scale rows) uniform dark brown, bordered below by narrow, pale (whitish) line from ear, above forelimb to groin, and sometimes slanting faintly from ear to lower jaw; lips dark barred; venter dirty ivory.

COMPARISONS.—*Emoia maxima* is most similar in color pattern to *E. pallidiceps mehelyi* in that some examples exhibit a faint, narrow, slanting pale line between the ear and the angle of the jaw. *Emoia maxima* differs from *E. pallidiceps* in the number of midbody scale rows (Table 3). They also differ significantly in the means for dorsal scale rows (t = 8.536; df = 117; $P < 0.001$) and fourth toe lamellae (t = 4.958; df = 127; $P < 0.001$).

REPRODUCTION.—Gravid females have two large oviducal eggs.

HABITAT.—CAS-SU 11595 is recorded as found on the floor of the rain forest.

RANGE.—Hollandia, Lake Sentani, and Aitape areas in Northern Irian Jaya, and also northern Vogelkop Peninsula, based on three specimens tentatively assigned to this species.

MATERIAL EXAMINED.—**Irian Jaya:** CAS-SU 11595; Hollandia area: FMNH 43143 (holotype); FMNH 43144–47, 43165–69, 43173, AMNH 61957, CAS-SU 11591–94. **Papua New Guinea:** Aitape: MCZ 48604 (paratypes); Hollandia: BMNH 1938.6.8.65–67; Lake Sentani area: BMNH 1938.6.8.41, 1938.6.8.62–63, RMNH 5238a, CAS-SU 11974–75, 11977. Two specimens from Skroe (RMNH 7287a–b) and one (RMNH 5580) from the Jakati River area, both on Vogelkop Peninsula, Irian Jaya, are also assigned to this species with some reservations.

Superspecies **Emoia pallidiceps** (de Vis)

Emoia pallidiceps (de Vis, 1890) was described from the St. Joseph River area, Central Province, Papua New Guinea. The type specimens are not in the Queensland Museum and are presumed lost (Covacevich 1971, and pers. comm.). According to Covacevich (1971), de Vis "never published register numbers for his frogs and reptiles, rarely stated how many were used for his descriptions or where they were lodged, and must be held responsible for the apparent loss of many of his type specimens."

De Vis's description is brief and his counts of midbody and lamellar scales fit any of three species (*E. pallidiceps, E. obscura, E. submetallica*), all of which occur in the Central Province. Two features of the color pattern, however, agree closest to *E. pallidiceps*: "sides black, this color sharply defined above, and especially on the neck from the ground color of the upper surface; on the flanks interrupted by a pale streak from the axilla to the groin."

The primary color feature to be added to de Vis's description is that a pale narrow line is also present between ear opening

and forelimb for most specimens having a distinct line from axilla to groin.

In keeping with Article 75 of the International Code of Zoological Nomenclature (1985), it is appropriate to designate a neotype because: (1) no type specimen has been found, though several searches have been conducted in the past two decades; (2) several species have been confused under this name; (3) this species is highly variable and two subspecies are currently recognized.

A series of nine American Museum specimens from the Mafulu and Port Moresby areas and eight Bishop Museum specimens from the Kororo area exhibit the color pattern of the species and are readily separated from samples of other species of *Emoia* from the Central Province. The neotype is chosen from the AMNH series.

The name *pallidiceps* was resurrected by de Rooij (1915), his description is that of *E. obscura*; by Sternfeld (1920), his description is that of *E. jakati*; and by Brongersma (1931b) for a population on the Vogelkop Peninsula that fits *E. bogerti*. Loveridge (1948) considered *E. pallidiceps* as a subspecies of *E. baudini*. His series included only two or three examples of *pallidiceps* (none from the Central Province), and his definition was so broad that he included examples of *E. jakati* and *E. obscura*. He also identified other examples of *pallidiceps* as *E. b. baudini*.

Emoia pallidiceps is widely distributed on both sides of the central mountain divide in eastern Papua. The scattered populations show considerable variation, which forces me to regard the taxon as a superspecies. Further field and laboratory work is necessary to determine relationships among the variants. At this time I recognize only two subspecies (*E. p. pallidiceps* and *E. p. mehelyi*).

Key to Subspecies of *Emoia pallidiceps*

1a. Pale lateral line not extending anterior to ear, or only faintly indicated at anterior edge of ear; midbody scale rows 30–37, rarely more than 35 (mean 33.423); (Finisterre Mountains, Madang Province, to SE Papua) ..... *E. pallidiceps pallidiceps*

1b. Pale lateral line (faint or strong) often extended between ear and angle of lower jaw (prominent in some populations); midbody scale rows 32–38, rarely less than 34 (mean 35.171); (Madang and East Sepik provinces) ..... *E. pallidiceps mehelyi*

Emoia pallidiceps pallidiceps de Vis, 1890

(Figure 2e)

Emoia pallidiceps (part) de Vis, 1890:497 (type loc.: St. Joseph River area, Central Province, Papua New Guinea; syntypes lost); Mittleman 1952:28; Scott, Parker, and Menzies 1977:11.
Lygosoma mivarti: (part) Mehelyi 1898:167.
Lygosoma mehelyi: (part) de Rooij 1915:256; (part) Vogt 1932:292.
Emoia baudini pallidiceps: (part) Loveridge 1948:370.
Emoia pallidiceps pallidiceps: (part) Brown 1953:7; Zweifel 1980:417; Greer 1970: 171; Room 1974:443.

Neotype.—AMNH 59187, from Mafulu, Central Province, Papua New Guinea (here designated).

Description of Neotype.—Adult male, 46.2 mm in SVL; midbody scale rows 34; dorsal scale rows 48; fourth toe lamellae 36; lateral surfaces dark brown (after long preservation) with narrow whitish line along neck from ear and on flanks at limb level.

Description.—SVL 36.5–53.5 mm for 15 mature males and 40.0–61.5 mm for 15 mature females; snout tapered, bluntly rounded at tip, its length 48–57% of HB and 32–39% of HL; HB 53–60% of HL and 15–18% of SVL; eye 68–89% of snout length and 34–39% of HB; rostral forming long, relatively straight suture with frontonasal; supranasals triangular, in contact with anterior loreal; prefrontals narrowly to moderately separated; usually seven supraciliaries; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or only second upper labials; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 30–37 ($\bar{x}$ = 33.423; SD = 1.348; n = 52): dorsal scale rows 44–59 ($\bar{x}$ = 52.961; SD = 2.271; n = 51), rarely more than 54 (except for populations in Chimbu, Highlands and West Sepik provinces); length of extended hindlimb 95.0–119% of axilla–groin distance and 46–57% of SVL; rounded lamellae under fourth toe 28–44, rarely more than 40 or less than 30 ($\bar{x}$ = 33.480; SD = 2.279; n = 50); under first toe 9–12.

Color (in preservative).—Dorsal ground color grayish green to olive-green or tan, marked with two broad, usually broken bands or rows of brownish spots on either side of paravertebral rows; upper lateral surfaces black (fading to dark brown in preservative), marked by continuous narrow pale line (occasionally broken into separate spots or dashes) and a continuous (rarely broken) line along neck to ear; one or two pale slashes on upper arm; venter grayish to slate, slightly lighter in the limb region; lips dark barred or more or less uniformly dusky.

Comparisons.—For comparison with *E. loveridgei, E. digul,* and *E. maxima,* see descriptions of those species. Populations of *E. pallidiceps* in Papua New Guinea exhibit some differences in scale counts and color pattern. The number of dorsal scale rows between the parietals and base of tail is somewhat greater for the populations from the Telefomin area just to the northeast of the Star Mountains in the interior of West Sepik Province. Also, for most populations there is a relatively solid, narrow, pale lateral line, but for some this line is more variable, frequently broken into a series of spots on the flanks. This pattern is most evident in populations in the Wau area, Morobe Province, and to some extent in Chimbu, Eastern, and Western Highland provinces. However, only the populations from Madang and East Sepik provinces are presently recognized as a valid geographic race.

Reproduction.—Fred Parker (pers. comm.) informs me that one hatchling measured 27 mm in SVL. Gravid females have two large eggs in the oviducts.

Habitat.—Fred Parker (pers. comm.) states that this species occupies a variety of habitats, from dense forests, clearings, grassland, and gardens in southern Papua New Guinea. It ranges from near sea level to about 1700 or 1800 m. It is a terrestrial basking species.

Range.—Recorded from Central, Gulf, Southern Highlands, Western Highlands, Enga, Chimbu, Eastern Highlands, Morobe, Northern, Milne Bay, and extreme southern Madang provinces, Papua New Guinea. A population from Telefomin, West Sepik Province, is also tentatively assigned to this taxon.

Material Examined.—**Papua New Guinea:** Central Province: Mafulu: AMNH 59009–10, 59023–24, 59034, 59184, 59187 (neotype), 59198; Port Moresby: AMNH

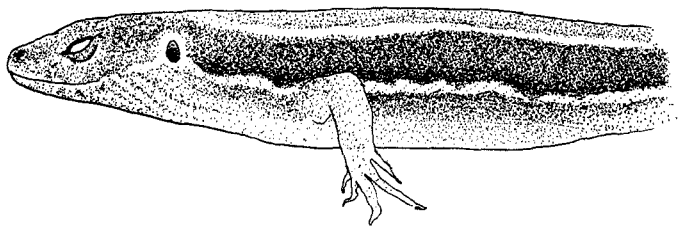

FIGURE 13. *Emoia pallidiceps mehelyi,* showing slanting pale line from ear to angle of jaw, Papua New Guinea. Drawing by J. Moorhouse.

82616–18. Northern Province: Popondetta: MCZ 154601; Embi Lake: MCZ 153822; Kokoda: MCZ 42154; Mt. Wilhelm: MCZ 47098–99; Sangari: MCZ 140673. Milne Bay Province: Goodenough I.: MCZ 152276–79; Barabara: BMNH 97.12.10.56–57; Fergusson I.: BMNH 95.4.26.41–42; Mt. Victoria: BMNH 96.10.31.15–17. Morobe Province: Wagau: AMNH 95331–33, 95335; Ramu River: MCZ 99183–84; Wau: BPBM 8331, 8366–67, 8369–70; Zangaren: AMNH 95758–60, 95762; Gusiko: AMNH 88206; Kotkin: AMNH 95768–69; Selimbing area: AMNH 95340; between Selimberg and Tumnang: AMNH 95341; Mt. Rawlinson: AMNH 95342, 95763–67; Tumnang: AMNH 95340, MCZ 54250. Madang Province: Tauta at north end of Finisterre Mts.: RUCA (19 specimens); Karonk Valley: AMS R23024–27, 23029–35, 23242, UPNG 947–48, 3399–403, 4995–99. Eastern Highlands Province: Gorko: AMS R24581, R24591–92, R24599, R64760; Lufa: CAS 100697, MCZ 83554–60; Watabung: MCZ 79845–63, AMNH 98574–80, SAMA R3558a–b, CAS 96300-04; Masul: MCZ 84790–91, VNM 11127–28; Bena Bena: AMS R64725–35; Wonenara: AMNH 98581, MCZ 83484–86, CAS 100702; Nivi: AMNH 97596, MCZ 83526–29, CAS 100688; Barabuna: AMNH 98599–604, CAS 100698–701, MCZ 83539–53; Nonderi: AMNH 98613, MCZ 90826–30; Mai: MCZ 109828; Orumba: MCZ 83530–38, AMNH 95345; Lafoiyufa: AMNH 98591–95, MCZ 83522–25; Dunantina Valley: MCZ 109610–18; Kainantu: MCZ 153512–14, 153259–74; Elmagale: AMNH 98612, MCZ 91995–97; Kotuni: AMNH 92516–26, MCZ 84367–68; Okapa: MCZ 109619–24; Koko: AMNH 95364–65; Purosa: MCZ 90753–811, 99186–91; Awande: MCZ 96171–75. Chimbu Province: Kunidawa: AMNH 98571, 98582–87, VNM 13433, 13428–29, MCZ 83487–507, 109591–762, 109779–810, BMNH 1970.1221–36, CAS 100691–96, SAMA R5788a–c, 9529a–b, 9530, AMS R24615–16; Emai; MCZ 90433–73, 90475, 90854–95, AMS R24636–38; Kerowae: AMS R60454–56; Koge: SAMA R8348a–b, 8350a–d, VNM 11129–35, MCZ 90831–52, 90896–918, 90924–76, AMS R24642–49; Duman: SAMA R5785a–b, CAS 100703–06; Mintima: MCZ 109518–20, 109605–08; Agakamatasa: MCZ 90751–52; Oruge: MCZ 90476–77; Ninmuo: MCZ 109829–31, 84801–03, 90426–32; Ubamigiawa: MCZ 84800, 90505–21; Pari: MCZ 109609; Kerowagi: MCZ 109811–27; Chuave: MCZ 84774–82, 84786–87; Igindi, AMNH 98572–73, 98619–23, MCZ 84783–85, 90502–04, 90605–707; Wahgi River area: MCZ 84783–85, 90522–64, 90710–47, BMNH 1965.282–96. Gulf Province: Koni: CAS 117725, 117728, MCZ 109527–28, 109530–35; Uraru: MCZ 109570, 109576; Oroi: MCZ 109832, 109834–36, 109524–26. Western Highlands Province: Minj: MCZ 84788–89; Nondugl: SAMA R41112–18; Baiyer River: MCZ 98185, AMNH 103403. Enga Province: Yaramanda: AMS R13833–35. Western Province: Emeti: AMNH 111716–17. Southern Highlands Province: Ialibu: AMNH 103432, 103434. Western Sepik Province: Telefomin: CAS 127213–27 and BPBM 3460.

Emoia pallidiceps mehelyi (Werner), NEW STATUS

(Figure 13)

Emoia mivarti: (part) Mehely 1898:169.

Lygosoma mehelyi Werner, 1899:371 (type loc.: Stephansort (=Bogadjim), Madang District, Papua New Guinea; type not designated); (part) de Rooij 1915: 256; Vogt 1911a:417, 1932:292.

Emoia p. pallidiceps: (part) Brown 1953:7.

Mehely (1898) referred 24 specimens (3 females, 21 males) from Stephansort on Astrolabe Bay, Madang Province, and the nearby Oertzen Mountains to *E. mivarti.* His counts for midbody scale rows ranged 32–37, and the 4th toe lamellae 33–44. These counts overlap *E. pallidiceps, E. obscura,* and *E. jakati* (see Table 3), and all three share some general color features that he mentioned. However, he noted that the sample of females has the narrow pale lateral line extending anteriorly from the ear along the upper labials to the end of the snout, but for the males only indistinctly to the angle of the mouth. Based on these color descriptions, Mehely evidently had examples of two species in his series, *E. jakati* and *E. pallidiceps.*

Werner (1899) examined specimens from Madang Province and the Bismarcks. He stated that the males referred to as *E. mivarti* by Mehely probably represented an undescribed species, although he apparently had not examined Mehely's specimens. He proposed the name *E. mehelyi* for this species but did not give a detailed diagnosis. De Rooij (1915) recognized Werner's *L. mehelyi,* but did not list specimens or compare it with any other species.

The pale lateral line that extends anteriorly from the ear to the angle of the jaws, a feature described by Mehely and also noted by de Rooij, distinguishes some, but not all, individuals in Mehely's series, for which Werner (1899) proposed the name *E. mehelyi.* Many examples from Madang and East Sepik provinces and some areas in Irian Jaya show this character in varying degree.

Recent collections from the Adelbert Mountains and other areas of Madang Province confirm that the presence of this line from the ear to the angle of the jaw is usually evident, though often faint. This condition is most sharply defined in examples from the Bogia area and the Adelbert Mountains in Madang Province and for a part of the sample from the Marienberg area in East Sepik Province. It is strikingly different from the pattern in *E. p. pallidiceps* in Morobe and more southerly provinces, and also in provinces south of the central mountains. Southern Madang Province, at the north end of the Finisterre Range, may be an area of intergradation. The subspecies *mehelyi* is distinguished from the nominal subspecies by the following combination of characters.

DIAGNOSIS.—SVL at maturity 38.9–51.7 mm for 30 males and females; midbody scale rows 32–38 ($\bar{x}$ = 35.171; SD = 1.192; n = 123), rarely less than 34 (Table 5); dorsal scale rows 45–55 ($\bar{x}$ = 49.106; SD = 1.94; n = 104), rarely greater than 52 (Table 5); fourth toe lamellae rounded, 31–44 ($\bar{x}$ = 36.382; SD = 2.404; n = 110), rarely greater than 41; dorsal ground color grayish green to grayish tan or tan, varying from nearly uniform with only scattered dark brown marks on lateral edges of some scales to most scales dark bordered; lateral surfaces dark brown (in preservative) with narrow, pale, usually whitish stripe (usually covering parts of two scale rows) between ear and jaw.

COMPARISONS.—*Emoia pallidiceps mehelyi* differs from the nominal subspecies in the means for midbody scale rows (t = 5.493; df = 155; $P < 0.001$) and fourth toe lamellae (t = 5.288; df = 148; $P < 0.001$), and in the extension of the pale lateral line from the ear anteriorly to the angle of the jaw for most examples.

REPRODUCTION.—Gravid females have two oviducal eggs.

HABITAT.—Benoit Mys (RUCA, pers. comm.) stated that he collected this subspecies from forested areas along the coast and in the mountains in Madang Province.

RANGE.—Adelbert Mountains, Karkar and Manam islands, Madang Province; Marienberg, East Sepik Province in Papua New Guinea; the Idenberg drainage in Irian Jaya; and Tolokiwa and Umboi islands in the Bismarcks.

MATERIAL EXAMINED.—**Papua New Guinea:** Madang Province: Bogia: AMNH 105404–08, 105410–13, RUCA (10 specimens); Adelbert Mountains: AMNH 105420, 105424–26, 105236–38; Alexishafen: AMNH 105419, AMS R31322,

R31324–27, R31329, R31332, R31395; Astrolabe Bay: RMNH 13196; Madang: FMNH 13942–43, 13947, 13956, SAMA R11855–56; Simbai: VNM 14006–09; Manam I.: AMS R29764–69, R29771–802, R29804–22, R29824–28, RUCA (8 specimens); Karkar I.: AMS R24459, R24715, R24752–54, R24756–57, R24813–14, R24930–34, R24987–89, R250201–09, R25211–33, R25260, R25285, RUCA (10 specimens); Maibang, on coast at north end of Finisterre Mountains: RUCA (12 specimens); Bongo, coast at north end of Finisterre Mountains: RUCA (5 specimens); Genoa, in Kokun Valley: RUCA (18 specimens); Yabob, near Madang: RUCA (11 specimens); Orowca, southwest corner of Adelbert Mountains: RUCA (10 specimens); Malala, coast at north end of Adelbert Mountains: RUCA (10 specimens), Ikundum, in Sogerum Valley: RUCA (11 specimens); Tiap, near Bogia: RUCA (10 specimens); Pes, west of Bogia: RUCA (10 specimens). East Sepik Province: Marienberg: FMNH 65247–59. **Bismarck Islands:** Umboi I.: RUCA (10 specimens); Tolokiwa I.: RUCA (10 specimens). Fourteen specimens, AMNH 62417–24, 72427–28, 62434, 62447, 62449, 62458, from the Idenberg River area, Irian Jaya, are also tentatively assigned to this subspecies.

mivarti complex

Three closely related species have the pale, narrow lateral line extending from the tip of the snout to the groin: *E. mivarti* Boulenger, 1887a from the Admiralty Islands; *E. jakati* Kopstein, 1926 from the Vogelkop Peninsula, Irian Jaya; and a third species described below. *Emoia jakati* has a wide range from numerous localities throughout northern and southeastern New Guinea, small surrounding islands, Bismarcks, Solomons, the Western Carolines, Palaus, and Marianas. Some populations may prove to be valid species or subspecies when more data from further field and laboratory studies become available.

Emoia coggeri n. sp.

HOLOTYPE.—AMS R411140, a gravid female, collected at Singorakai, northern Huon Peninsula, Morobe Province, Papua New Guinea, by Bruce McMillan, November 1963.

PARATYPES.—AMS R41220–39, R41141–47, CAS 159404–05 from the same location as the holotype.

DIAGNOSIS.—SVL of 12 mature females 39.9–49.8 mm and of 11 males 37.5–45.0 mm; midbody scale rows 34–39; dorsal scale rows 44–51; rounded lamellae under fourth toe 33–39; dorsum bronzy green to olive-green, relatively uniform on four to six scale rows, or with dark brown spots in irregular line on outer edge of second row on either side of vertebral line; pale lateral line continuing anterior to ear and along upper labials.

DESCRIPTION OF HOLOTYPE.—Adult female, SVL 47.7 mm; midbody scale rows 34; dorsal scale rows 50; fourth toe lamellae 35.

DESCRIPTION.—SVL 39.9–49.8 mm for 12 mature females and 37.5–45.0 mm for 11 mature males; snout tapered, bluntly rounded, its length 56–61% of HB and 37–41% of HL; HB 62–70% of HL and 15–18% of SVL; eye 73–93% of snout length and 44–52% of HB; rostral forming long, relatively straight suture, with frontonasal; supranasals triangular, usually in contact with anterior loreal; prefrontals narrowly to moderately separated; one pair of nuchals; anterior loreal much shorter and somewhat higher than posterior, in contact with first or first and second upper labials; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; vertebral rows not or scarcely enlarged; midbody scale rows 34–39 ($\bar{x}$ = 35.952; SD = 1.499; n = 21); dorsal scale rows 44–51 ($\bar{x}$ = 48.8; SD = 1.852; n = 20); preanals only slightly enlarged; length of extended hindlimb 92–119% of axilla–groin distance and 43–53% of SVL; rounded lamellae under fourth toe 33–39 ($\bar{x}$ = 35.957; SD = 1.461; n = 23); under first toe 10–11.

COLOR (in preservative).—Dorsal ground color and top of the head bronzy olive-green to greenish, relatively uniform, or with few scattered dark brown blotches, or more frequently, bordered at outer edge of middle four rows by narrow, irregular, dark brown stripe or series of blotches; stripe or blotches terminating anteriorly about midway between ear and forelimb; dorsolateral stripe somewhat lighter than middorsal region; upper lateral surfaces dark brown (as is characteristic of *E. jakati*) marked by pale (whitish) line extending from upper labials through ear and above forelimb to point just anterior to hindlimb; lower lateral surfaces grayish; venter pale bluish white; labials, particularly the lower labials, marked by dark brown blotches.

ETYMOLOGY.—Named for Dr. Harold Cogger of the Australian Museum, who has contributed greatly to our knowledge of the Pacific herpetofauna.

COMPARISONS.—*Emoia coggeri* differs from the sympatric *E. jakati* in the dorsal color pattern being more like that in *E. mivarti*. The difference between the means for midbody and dorsal scale counts of *E. coggeri* and nearby populations of *E. jakati* in Morobe and Madang provinces are significant: (1) midbody scale rows (t = 6.822; df = 55; $P < 0.001$); (2) dorsal scale rows (t = 2.632; df = 55; P = 0.011). *Emoia coggeri* differs significantly from *E. mivarti* in the means for dorsal scale rows and fourth toe lamellae: dorsal scale rows (t = 6.41; df = 44; $P < 0.001$) and fourth toe lamellae (t = 11.646; df = 46; $P < 0.001$).

REPRODUCTION.—Several gravid females have two oviducal eggs.

RANGE.—Known only from the type locality.

Superspecies **Emoia jakati** (Kopstein)

(Figure 2f)

Emoia baudini: (?) de Vis 1892:12.
Lygosoma (Emoa) mivarti: Boettger 1893:106; Werner 1900:62, 1901:8; (part) Sternfeld 1920:412.
Lygosoma mivarti: Boulenger 1895a:30, 1895b:408, 1897a:701, 1898:702; (part) Mehely 1898:169; Werner 1899:371; (part) de Rooij 1915:255; Vogt 1911a: 417, 1912b:356, 1932:292; Kopstein 1926:93; Brongersma 1931b:26.
Emoia mivarti: Barbour 1921:94; (part) Hediger 1933:38, 1934:467; (part) Smith 1937:227; Zweifel 1980:416; Room 1974:442; McCoy 1980:37; (part) Scott, Parker, and Menzies 1977:11.
Lygosoma (Emoa) pallidiceps: Sternfeld 1920:414.
Lygosoma jakati Kopstein, 1926:94 (type loc.: Bintuni Bay, Vogelkop Peninsula, Irian Jaya; lectotype in RMNH).
Emoia baudini baudini: (part) Loveridge 1948:369.
Emoia baudini pallidiceps: (part) Loveridge 1948:370.
Emoia jakati: Smith, 1937:227; Mittleman 1952:25.
Emoia mivarti fuscolineata (nomen nudum) Greer 1970:171.

Kopstein (1926) described *Emoia jakati* from a small sample from the Jakati River drainage on the Vogelkop Peninsula, Irian Jaya. He related it to *E. mivarti,* which he also recorded from Manisnam Island near Manokwari on the north coast of the Vogelkop Peninsula. Subsequent authors have identified *E. jakati* populations as *E. mivarti* or less frequently, *E. baudini.* Loveridge (1948) confused the species with *E. pallidiceps,* but his definition of *pallidiceps* was so broad that it included examples of *obscura* and *loveridgei* as well as *jakati.*

I have examined 64 specimens from the Admiralty Islands including the types of *E. mivarti.* These are readily distinguished

from specimens from New Guinea, the Bismarcks, Solomons, and Micronesia. All agree closely with the types of *E. jakati* with one exception, a population on the Huon Peninsula, which I have described as a new species, *E. coggeri.*

LECTOTYPE (new designation).—RMNH 5087 from type series, collected along the Jakati River, Bintuni-Bai, Vogelkop Peninsula, Irian Jaya, by F. Kopstein, 4 Oct. 1924.

DESCRIPTION OF LECTOTYPE.—A male, SVL 43.7 mm; midbody scale rows 33; dorsal scale rows 49; lamellae under fourth toe 30; tail regenerated.

DESCRIPTION.—SVL 36.9–51.0 mm for 16 males and 43.1–53.3 mm for 20 females; snout tapered and bluntly rounded, its length 37–42% of HL and 57–64% of HB; HB 62–68% of HL and 15–18% of SVL; eye 62–81% of snout length and 39–49% of HB; rostral forming long, nearly straight suture with frontonasal; supranasals long and narrow, in contact with anterior loreal; prefrontals moderately to widely separated; usually seven supraciliaries; one pair of nuchals; anterior loreal much shorter and higher than posterior, in contact with second or first and second (rarely third) supralabials; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 29–39 ($\bar{x}$ = 33.361; SD = 1.313; n = 36); dorsal scale rows 44–58, rarely less than 46 or greater than 56 ($\bar{x}$ = 50.73; SD = 2.987; n = 37); preanals not or only slightly enlarged; length of extended hindlimb 89–115% of axilla–groin distance and 45–54% of SVL; rounded lamellae under fourth toe 30–42, rarely less than 32, ($\bar{x}$ = 35.029; SD = 1.902; n = 32); under first toe 9–12.

COLOR (in preservative).—Dorsal ground color light to dark brown; brown band on the upper lateral surface extends through eye; five narrow, pale stripes (tan or olive-green to almost white); mid-dorsal stripe broadest, two overlapping half-scale rows on body widening to two rows anterior to forelimbs and merging with greenish tan or brown of head region; dorsolateral light stripes at level of supraciliaries somewhat narrower than mid-dorsal; lateral pale stripe beginning on supralabials, passing along neck above forelimb and along side of body; slash of white on upper forelimb; usually dark brown spots on lower labials and frequently two on mental; venter from dirty ivory to tan or grayish.

COMPARISONS.—*Emoia jakati* differs from *E. mivarti* in some features of the color pattern, in the lower number of fourth toe lamellae (barely overlapping, Table 3), and in the differences between means for midbody scale rows (t = 5.057; df = 84; P < 0.001) and dorsal scale rows (t = 3.904; df = 61; P < 0.001). For comparison with *E. coggeri,* see description of that species.

Emoia jakati ranges from the Moluccas throughout northern Irian Jaya and Papua New Guinea into the Solomons and western Micronesia. When populations from Irian Jaya, north and south of the central mountains in Papua, the Bismarcks, the Solomons, and Micronesia are compared with one another, they exhibit less variation than do populations of *E. obscura* or *E. pallidiceps* from different regions of New Guinea.

REPRODUCTION.—Gravid females have two large oviducal eggs. McCoy (1980:37) stated that the female deposits her eggs in ground debris. Three hatchlings measured 21.5–23.0 mm SVL.

HABITAT.—Terrestrial in forest and cleared areas. The species ranges from sea level to above 1800 m in some parts of Papua New Guinea.

RANGE.—Salawati, Batanta, and Ceram islands at the western end of New Guinea; the Vogelkop Peninsula and throughout northern New Guinea; south of the central mountain range in eastern Papua; the small archipelagos at the eastern end of New Guinea; Solomons, Bismarcks, Palaus, and Caroline Islands; and also a few atolls in the Marshall Islands.

MATERIAL EXAMINED.—**New Guinea and satellite islands: Irian Jaya:** Vogelkop Peninsula, Jakti River area: RMNH 5087 (lectotype), 5087a–b, 5514a–c, FMNH 67426 (type series); Manokwari: CAS 54702–04, 54732, MCZ 7664a–d; Sorong: MCZ 7662 (10 spec.), RMNH 8863 (4 spec.); Ceram I.: ZMB 525c; Celebes: RMNH 6901 (9 spec.); Waigeo I.: RMNH 6960a–b; Batanta I.: ZMB 1362a–b, AMNH 94308–11; Salawati I.: RMNH 6962a–b; Missol I.: RMNH 6903a–c; Japen I.: MCZ 7665a–b, RMNH 8862, 8866a–b, BMNH 1984.905–906; Marsiman I.: RMNH 5101, 5513a–b; Jamma I.: MCZ 7661 (12 spec.), AMS R6833; Biak I.: SMF 47861a–b, ZMB 1097–98, MCZ 53619–20; Mios I.: RMNH 5252a–c; Like I.: RMNH 5259, MCZ 49301–09; north of central mountains and east of the Vogelkop in Irian Jaya, Mefoor: RMNH 6963; Tuekee: RMNH 5255; Wanikium: RMNH 5253; Honokiesar: RMNH 5513; Pioneer Bivak: ZMA 14570a; Lake Sentani and Hollandia area: MCZ 19606, SMF 15317, BMNH 1938.6.8.35–39, FMNH 43219–20, 43149–64, BYU 7892, 7894, CAS-SU 11972–73, 11978–95; Doromeana: CAS-SU 12017–18, FMNH 43176–80, 65280–300; Sissaur Sera: SMF 15218–22. **Papua New Guinea:** Sepik Province: Passam: AMNH 105309–28; Wewak: MCZ 152817–19, AMS R30840–47, R30849, R31521–44, R31547–54, R31556–58, R31560–62, R31566–71, R31573–85; Aitape: NMV 7683–85; Kubka: FMNH 14020; Lake Imbiap: MCZ 152815–16; Marienberg: FMNH 13958, 15489, 15527a–b, d; mouth of Sepik Riv.: FMNH 13960a–l; Miliom: AMNH 100277–83; Nuku: AMNH 100284; Mt. Nibo: AMNH 100285–86; Lumi: AMNH 100287–89; Maprik: AMNH 95281–87. Madang Province: Madang: FMNH 13944–46, SAMA R11857, MCZ 124371, 124375–78, 132789, CAS 126806, AMS R24362, R24457, R66809–16; Wanuma: AMNH 105339–49; Tauta: MCZ 84436–45; Sek Harbor: AMS R31326, R31328, R31330–31, R31468–71; Bostrem Bay: AMNH 105302–08; Karkar I.: AMS R24753, R24928–29, R25062, R25104–05, R25192, R25195, R25282, R25426–28, R25539, R25541–45, R25566–68, R25638–40, R25679, R26718–23, AMNH 105329–36. Morobe Province: Busu River: AMNH 95289; Lae: AMNH 66726–28, 103341–42, MCZ 145999, 152940, AMS R60446–48; Garina: AMNH 95890–91, 103312–40, MCZ 149783–84, 149785–90, 149792–99, 150350–92; Wau: MCZ 142562, BPBM (20 uncat.); Boana: MCZ 94696–705; Kui: BMNH 1980.483–84; Lababia: BMNH 1980.485; Bulolo Valley: AMS R12232; Pindiu: AMNH 95728–41, 95743–46, 95747–54; Kabwum: AMNH 95755–57; between Zangaren and Bullum Riv.: AMNH 95288; Mt. Rawlinson: AMNH 95726–27. Northern Province: Bara Bara: BMNH 97.12.10.58–60; Oro Bay: UPS 4323; Kokoda: MCZ 42153–56, AMNH 95290–310; Popondetta: MCZ 141317, 153828, 154600; Mt. Wilhelm: MCZ 47100; Lego: MCZ 140972. Milne Bay Province: Alotau: MCZ 146100; Kiriwani: AMS R4827, R68899–906, R86815. Central Province: Sirinumu: MCZ 146015–17; Mt. Diamond: MCZ 152930; Ogotana: MCZ 146105; Subitana: MCZ 146004; Sogeri area: MCZ 109515–17, 109552–69, 146104, 146021–22, 149824–32; Port Moresby area: MCZ 64251–53, 123702–03, 140787–94, 146012–13, 146018–20, 156441; Albert-Edward Mts.: BMNH 1901.11.27.6–7; Brown Riv.: MCZ 146006–11, 152908–28. Chimbu Province: Kup: AMNH 72755–60; Wahig Riv.: MCZ 84446–47, 87483, 89657–71; Kundiawa: CAS 98719–49, VNM 13425–27, 13441–42, 11522–28, MCZ 101519, 102589–641, 106573–989, 107105–265, 107593–679, 107704–88, 107822–999, 108192–315, SAMA R9524A–C, R5790A–E. Western Highlands Province: Tigi: AMNH 103369–94; Baiyer Riv.: AMNH 103343–68, MCZ 94709–20, 98299–511, AMS R16595, CAS 107227–323; Wapenamand: MCZ 94706–08; Mt. Hagen: AMS R14768–69; Manjimi: AMS R14758–59. Western Province: Kawa I.: AMS R68728–44. **D'Entrecasteaux Islands:** Goodenough I.: MCZ 146102–03; Fergusson I.: BMNH 95.4.26.39–40. **Trobriand Islands:** without specific locality: MCZ 145996, BMNH 95.10.17.29–31; Sim Sim I.: AMS R68745–46, R68748; Kuia I., AMS R86816, R86828–29; Woodlark I., MCZ 142595–96. **Louisiade Archipelago:** AMS R4839–53, CAS 76994–95, AMNH 19894, 20925. **Bismarck Archipelago:** Ambitle I.: MCZ 152026, 152821–24, 152931–39; New Ireland: without specific locality: NMNH 99–288, Kavieng: MCZ 125825–26; Kalili Bay: ZMUC R47658; New Britain: without specific locality: NMNH 00240a–d, 00250a–d, SMF 15307–09, 15374–75; Rabaul: MCZ 65554; Kimbe: MCZ 142475; Keravat: SAMA R8612, R8616, R8618, R11853, MCZ 135425; Kimbe: MCZ 142475; Gazelle Pen.: MCZ 150280, FMNH 13897–98; Willaumez Pen.: MCZ 150853–55; Lavegi: MCZ 152949; Cape Hoskins: MCZ 152946–48, AMS R60465–67, R66817–37; Talasea: SAMA R6717, R6911, R6920; Vudal: SAMA R8537, R8542, R8554, R8574. **St. Matthias Group:** Mussau I.: MCZ 141626–30, 1443888–89,

ZMUC R47721–27, R47755–56, SMF 15304–06; Luskus I.: MCZ 150820; Emirau I.: MVZ 40802–03, 40842; Squali I.: SMF 15250–53. **Solomon Islands:** Bougainville I., Buin: AMS R11262–63, R11458, MCZ 65904, 66498, 67242–43, 87735–39, 94721–25; Kunua: AMNH 91988–92006 (+13), CAS 94007–08, SAMA R5179a–b, R5184a–c, MCZ 72288–507, 73808–17, 75968–86, 76845–901, 77679–759, 83270, 84154–55; Turiboiru: CAS 107324–98, 108948–54, 110395–705, SAMA R8076–78, R8246a–c, MCZ 87484–527, 87733–34, 87758–944, 94555–63, 94571–659, 94726–856, 97316–17, AMNH 101183–91; Topanas: AMNH 101192, CAS 107399–409, VNM 11598, SAMA R8226a–b; Boku: MCZ 67240–41; Tinputz: MCZ 91365–67; Tobago: MCZ 87740–57; Pamanita: MCZ 94534–45, CAS 108978–80; Mutahi: CAS 108975; Kieta: MCZ 64205–10, 64249–50, 65545–56, 65896–903, 67226–39, 72296; Buka I.: MCZ 67683–84, 73818–30, 94529–30. **Palau Islands:** Kayangel: MCZ 111729, 111691–725, USNM 122627–28. **Caroline Islands:** Yap: MCZ 111689–90, 123910, SMF 15215–17, USNM 123910, CAS 85182; Ulithi: FMNH 42769, 195498–99, USNM 122517–30, 122542–44, 122548, 122550, 122552, 122558, AMNH 81575–79, MCZ 48869a–b, SMF 15224; Feis: MCZ 111762–63, SMF 15274; Truk Islands, Moen: MCZ 111726–28; Alenelimo: MCZ 111730; Faro: MCZ 111755–60; Kusaie: AMS R57497, R95944, R95955, USNM 121113–15, 123923; Ponape; MCZ 4096, 111731–47, SMF 15208, AMS R57299–300, 57394–95, 57497. **Marshall Islands:** Lae Atoll: USNM 132261–69, 132271–74; Watho Atoll; USNM 132175–80; Ujae Atoll: USNM 132163–64.

Emoia mivarti (Boulenger)

Lygosoma mivarti Boulenger, 1887a:392 (type loc.: Wild Island, Admiralty Islands; holotype in BMNH); (part) de Rooij 1915:255.
Lygosoma (Emoia) mivarti: (part) Sternfeld 1920:412.
Emoia mivarti: (part) Hediger 1933:38; (part) Smith 1937:226; Tanner 1951:6; Mittleman 1952:27; (part) Brown 1956:1487; (part) Scott, Parker, and Menzies 1977:11.
Emoia baudini baudini: (part) Loveridge 1948:339.

DESCRIPTION.—SVL 46.5–53.6 mm for eight males (one at 41.5 mm is possibly mature) and 43.6–56.5 mm for seven females; snout tapered, bluntly rounded, its length 58–64% of HB and 37–41% of HL; HB 60–66% of HL and 15–17% of SVL; eye 71–85% of snout length and 44–51% of HB; rostral forming long, nearly straight suture with frontonasal; supranasals triangular, usually not in contact with anterior loreal; prefrontals rather widely separated; one pair of nuchals; anterior loreal much shorter and somewhat higher than posterior, in contact with first and second, second, or rarely second and third supralabials; six or seven upper labials, fifth or sixth enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 32–40 ($\bar{x}$ = 35.184; SD = 1.90; n = 49); dorsal scale rows 48–58 ($\bar{x}$ = 53.731; SD = 3.027; n = 26); preanals not or very slightly enlarged; length of extended hindlimb 98–114% of axilla–groin distance and 46–55% of SVL; rounded lamellae under fourth toe 38–46, only two of 45 specimens less than 40 ($\bar{x}$ = 42.120; SD = 2.108; n = 25); under first toe 9–12.

COLOR (in preservative).—Dorsal ground color greenish, tannish green to olive-green, with vertebral rows relatively uniform and with two rows lateral to vertebrals marked by series of dark brown spots or blotches; upper lateral surfaces with dark brown band extending anteriorly onto snout, narrowing on head until it becomes complete or interrupted line on rostral, bordered dorsally by very narrow pale line or series of spots; this lateral dark brown band broken by a narrow (two half to two scale rows) pale, usually whitish line, extending from the upper labials through the ear, above forelimb and along flank to groin; pale line on anterior surface of upper forelimb; upper labials dusky along dorsal half or nearly uniformly creamy; lower labials usually with scattered dark spots along upper margins; venter greenish to grayish white, lighter under chin and in region of hindlimbs.

COMPARISONS.—See descriptions of *E. coggeri* and *E. jakati*.

REPRODUCTION.—Gravid females have two large oviducal eggs.

HABITAT.—Fred Parker (Townsville, Queensland, Australia; pers. comm.) informs me that *E. mivarti* occurs in gardens, secondary growth, and open areas in rain forest. It is a basking species.

RANGE.—Admiralty Islands.

MATERIAL EXAMINED.—**Admiralty Islands:** SMF 15226–31; Wild I.: BMNH 1946.8.10.40–47 (type series); Los Negros I.: BYU 7167–68, 7171, 7186, 7190–92, 7194–95, 7202–3, 7606, 7234–39, CAS–SU 11948–49; Manus I.: AMNH 105337–38, FMNH 25918, 42593, 42595; MCZ 52285, 137600, 152901, 154602, AMS R31084; Lau I. (near Manus?): AMS R19332, R19341–51; Little N'Drove I.: MCZ 135437, 142362, 144394–95.

physicae Group

DIAGNOSIS.—SVL at maturity 39–80 mm (less than 50 mm for three of 11 species); dorsal scales (at least posterior ones) with three to five weak to strong keels; midbody scale rows 30–44; dorsal scale rows 40–67; subdigital lamellae rounded, 27–59 under fourth toe; frontoparietals and interparietal fused into one shield (interparietal very rarely distinct); anterior loreal shorter and higher than posterior; sixth upper labial enlarged and beneath eye for most species; nasal bones fused; parietal eye present; palate alpha type; dorsal ground color greenish brown, light brown, or brown, usually with some darker markings.

This group differs from the *baudini* group primarily in the weak to strong keels on the dorsal and sometimes lateral scales of adults. Eleven species are known. For convenience I recognize two subgroups, one with relatively strong keels and the other with weak keels.

The first keel-scaled species to be described was *Euprepes physicae* Duméril and Bibron, 1839. Gray (1845) did not assign this species to the section *Emoia* of the genus *Mabouya,* as he did *E. baudini,* but instead retained it in the genus *Euprepes.* Peters and Doria (1878) synonymized *E. physicae* with *Euprepes* (=*Emoia*) *baudini,* presumably without having examined the types. For a discussion of the differences between these two species, refer to *E. baudini.*

Brown (1953) treated *E. physicae* as a wide-ranging species with several subspecies. Recent collections have provided many more examples from populations of keel-scaled *Emoia* in New Guinea and surrounding islands. These samples provide data showing that the number of species in this group is much greater than was previously thought, and that *E. tropidolepis* and *E. oribata* are widely separated from and sufficiently differentiated from *E. physicae* that they are best treated as a distinct species.

KEY TO SPECIES OF THE *PHYSICAE* GROUP

1a. Enlarged nuchals absent; dorsal scales usually with only two strong keels ..... *E. callisticta*
1b. One pair of enlarged nuchals; dorsal scales with three to five weak to strong keels 2
2a. Fifth (rarely sixth) upper labial enlarged and below eye; keels on dorsal scales weak to very weak, not forming points at posterior edge of scale and usually limited to posterior half of body 3

TABLE 5. Standard scale counts and measurements for species of the *Emoia physicae* group.

Species	Adult SVL (mm)	Labial below eye				Midbody scale rows	Scale rows parietals to tail	Fourth toe lamellae
		n	5th	6th	7th			
E. ahli	62.0	2	—	2	—	38	—	48–50
E. battersbyi	61.0–77.2	32	2	29	1	32–40	47–56	39–51
E. brongersmai	54.4–69.8	36	3	26	—	35–40	49–56	30–42
E. callisticta	42.5–56.0	18	—	16	—	36–44	43–49	38–45
E. kuekenthali kuekenthali	56.2–79.9	10	—	8	—	40–44	61–67	49–59
E. kuekenthali notomoluccense	54.1–69.5	18	1	10	—	37–42	53–61	41–49
E. montana	52.4–70.2	25	17	8	—	34–38	45–52	35–42
E. oribata	63.3–77.1	10	3	6	—	36–40	50–55	33–40
E. physicae physicae	52.1–77.6	48	4	42	2	32–40	46–54	32–42
E. physicae purari	51.9–77.6	40	2	24	1	35–43	51–58	35–42
E. physicina	38.4–50.7	38	30	5	—	30–38	45–52	35–42
E. pseudopallidiceps	40.9–64.3	40	30	3	—	32–37	50–60	27–36
E. tropidolepis	51.0–73.4	45	6	33	1	33–39	45–52	35–44

2b. Usually sixth (rarely fifth except for *E. oribata*) upper labial enlarged and below eye; keels on dorsal scales moderate to strong (except for *kuekenthali*), often forming small pointed projections at posterior margin of scale 5

3a. Number of dorsal scale rows between parietals and base of tail 50–60; fourth toe lamellae 27–36; keels on dorsal scales weak to scarcely evident, limited to posterior part of body; (distributed south of central mountain range in western Papua New Guinea and Irian Jaya) ..... *E. pseudopallidiceps*

3b. Number of dorsal scale rows between parietals and base of tail 45–52 (rarely greater than 50); fourth toe lamellae 35–42 (rarely less than 36); keels on dorsal scales weak 4

4a. SVL at maturity 38–51 mm; dorsal ground color medium brown with or without darker spots outside vertebral rows; upper lateral surface (5 or 6 rows) darker brown, nearly uniform or with scattered pale scales; (distributed south of central mountain range in Papua New Guinea and eastern border of southern Irian Jaya) ..... *E. physicina*

4b. SVL at maturity 52–70 mm; dorsum and upper lateral surfaces nearly uniform light brown or with few, scattered dark spots on dorsum and pale spots on lateral surfaces; (Baiyer River drainage, central Papua) ..... *E. montana*

5a. Number of fourth toe lamellae 39–59 (rarely less than 42) 6

5b. Number of fourth toe lamellae 30–44 (rarely more than 41) 8

6a. Three strong keels on dorsal scales; dorsal color pattern with light and dark cross bands, which are neither distinctly in transverse bands or irregular; a dark lateral band not distinct; (West Sepik) ..... *E. ahli*

6b. Three to five weak keels on dorsal scales; dorsal color pattern not exhibiting dark and light transverse bands 7

7a. Number of dorsal scale rows between parietals and base of tail 53–67 (rarely less than 56); number of midbody scale rows usually 37–44 (very rarely less than 38); three keels on dorsal scales relatively weak; and usually limited to posterior scales; (islands west of New Guinea) ..... *E. kuekenthali*

7b. Number of dorsal scale rows between parietals and base of tail 47–56 (rarely more than 53); number of midbody scale rows 32–40 (rarely more than 38); three to five weak keels on dorsal scales; (northern New Guinea) ..... *E. battersbyi*

8a. Dorsal scales with strong keels, including scales on anterior part of body and frequently nuchals; lateral scales and those on limbs with prominent keels 9

8b. Dorsal scales with moderate to strong keels, with scales anterior to the forelimbs smooth or with weak keels; lateral scales and those on limbs with low keels 10

9a. Keels not distinctly lighter than rest of scales; color (in preservative) of dorsum brownish with narrow, darker, irregular transverse lines; sides of neck mottled pale and dark and with some pale and dark vertical bars ventrally; (upper Idenburg River, Frieda River, and Sepik River drainages north of Central Divide) ..... *E. oribata*

9b. Keels usually pale ivory, lighter than rest of scale; color (in preservative) of dorsum relatively uniform light brown on head and anterior neck; usually with darker, slanted bars from dorsolateral line to paravertebral rows, pale dorsolateral line or spots usually present, sides of neck brownish with some light flecks; (Mimika River to Fly River and Digul River drainages south of central mountain range) ..... *E. tropidolepis*

10a. Color (in preservative) of dorsum brownish with or without darker transverse markings, lateral surfaces usually darker with a few to moderate numbers of scattered, light scales or small patches of such scales; and for some populations a more or less distinct dorsolateral light line; sides of neck not mottled light and dark; (south of central mountain range to Western Province and from Milne Bay, Northern, and Morobe provinces north and east of central mountains) ..... *E. physicae*

10b. Color (in preservative) of dorsum light to medium brown with dark brown marks on posterior borders of supraoculars and parietals, and a dark brown spot in center of frontoparietal shield, upper lateral surfaces usually somewhat darker and marked by prominent, pale, eyelike spots, with darker borders on neck between ear and

forelimb and sometimes on anterior part of body; (higher elevations of Fly and Digul drainage systems in New Guinea) ..... *E. brongersmai*

physicae Subgroup

This subgroup includes six species (*Emoia ahli, E. brongersmai, E. oribata, E. physicae, E. tropidolepis,* and *E. callisticta*). The keels on the dorsal scales are relatively strong, and for some species, project as sharp points at the posterior margin of the scale. Three to five keels per scale prevail except for two in *E. callisticta.* The sixth upper labial is most often enlarged and below the eye.

Two specimens from Mt. Nok, Waigeo Island (BMNH 1984.994–995) belong to this subgroup, but do not agree in all characters with any of the described species. They differ somewhat in color pattern from that typical of other species. They have more prominent whitish spots on the side of the neck and anterior flanks than does *E. tropidolepis* and also lack the pale dorsolateral line, which is common for that species. They lack the distinctive mottled pattern on the sides of the neck and flanks typical of *E. oribata,* and they lack the dorsal, transverse-banded pattern typical of *E. oribata* and *E. ahli.* They have distinct nuchals and three to five keels on the dorsal scales, which distinguish them from *E. callisticta.* The status of these two specimens is held in abeyance pending the availability of additional specimens.

Emoia ahli (Vogt)

Lygosoma ahli Vogt, 1932:291 (type loc.: Papua New Guinea, headwaters of Sepik River near border of Irian Jaya; holotype apparently lost); Smith 1937:227; Mittleman 1952:21.

Vogt (1932) considered *Emoia ahli* to be near *E. kuekenthali* but having strong instead of weak keels on the dorsals and 38 midbody scale rows as compared to 40–46. His reference to *E. kuekenthali* from New Guinea suggests that he had seen examples of *E. battersbyi,* which is very similar to *E. kuekenthali* in the relatively uniform color and generally weak to moderate keels. However, in comparing *E. ahli* and *E. kuekenthali,* Vogt did not use the New Guinea specimens that he mentioned. Instead, he cites the scale counts and most other characters of *E. kuekenthali,* as given in Boettger's original description of that species from Halmahera Island.

As described by Vogt, *Emoia ahli* fits the *physicae* subgroup, characterized by sharp keels on the dorsal scales. Although I have not seen examples of *E. ahli,* the number of subdigital lamellae suggests that the species may be related to *E. battersbyi,* from which it differs primarily in color pattern and strength of keels. The greater number of subdigital lamellae separates *E. ahli* from *E. physicae* and *E. oribata.* I tentatively retain *E. ahli* as a distinct species.

DESCRIPTION (after Vogt).—SVL 62.0 mm for holotype; snout long and pointed; supranasals widely separated; prefrontals moderately separated; one pair of nuchals; two loreals; sixth upper labial largest and below the eye; six lower labials; dorsal and lateral scales with three sharp keels; 38 midbody scale rows; 48–50 lamellae below fourth toe; tail twice as long as body.

MEASUREMENTS (after Vogt).—SVL 62 mm; total length 120 mm.

COLOR (in preservative).—Dorsal color olive-brown with separate light and dark bands, which are not in transverse lines or regularly arranged; blackish lateral bands indistinct and bordered by small, barely evident light flecks; lower surfaces pale.

COMPARISONS.—*Emoia ahli* differs from other species of the strongly keeled subgroup in the greater number of subdigital lamellae (Table 5). In this character it is similar to *E. battersbyi* and *E. kuekenthali* of the weak-keeled subgroup.

RANGE.—Known only from the type locality, the upper Sepik drainage.

MATERIAL EXAMINED.—None.

Emoia brongersmai n. sp.
(Figure 14)

Collections in the Rijksmuseum van Natuurlijke Historie from the Digul River drainage in southern Irian Jaya (Fig. 32) include large samples of two distinct species of the keel-scaled *physicae* evolutionary lineage. One of these closely agrees with the type series of *E. tropidolepis* Boulenger. The second population in the Digul drainage represents an undescribed species.

HOLOTYPE.—RMHN 21121, collected in the Sibil Valley, upper Digul drainage, Irian Jaya, July 1959, by Brongersma and party.

PARATYPES.—**Irian Jaya:** Digul River drainage, Sibil Valley: RMNH 21117–20, 21122–43, 21489–92, 21556–60, 21564–66, 21570–79, 21598–603, 21613–20, CAS 156681, 156754–56; Mabilabol: RMNH 21604–12; Nimdol: RMNH 21561, 21580–97. **Papua New Guinea:** Western Province: without specific locality: AMS R30759–60; Derongo: MCZ 126389, 131940; Imigabip: MCZ 145136–40, 145148; Migalsimbip: MCZ 142331–36, 145141–45, AMNH 107222–23, 111719; Kawal: SAMA 6242.

DIAGNOSIS.—*E. brongersmai* can be distinguished from other species of the keel-scaled evolutionary lineage by the following combination of characters: usually three to five moderate keels on dorsal and upper lateral scales, occasionally as far anterior as nuchals, or restricted to scales posterior to forelimbs; 35–40 midbody scale rows; 49–56 dorsal scale rows; 30–42 rounded lamellae under fourth toe; usually sixth upper labial enlarged and below eye; SVL 54–70 mm at maturity; color in preservative light to medium brown with greenish iridescence and some vague darker blotches; head marked with dark brown usually on posterior margins of supraoculars and parietals and usually a dark brown spot near center of fronto-interparietal shield; usually few small patches of pale scales along dorsolateral margin anterior to forelimb; usually prominent series of pale (whitish), dark-bordered patches along side of neck, and often anterior part of body beginning at ear; tail with narrow, irregular, brown and blackish transverse bands; labials, at least posteriorly, with dark bars. The pale, dark-bordered spots are more prominent in specimens from the Digul drainage than in specimens from the Fly drainage.

DESCRIPTION.—SVL at maturity 54.4–69.8 mm for 10 males and 55.6–69.8 mm for 18 females; snout tapered, bluntly rounded, its length 48–58% of HB and 34–37% of HL; HB 62–74% of HL and 15–18% of SVL; eye 75–85% of snout length and 38–45% of HB; rostral forming long, nearly straight suture with frontonasal; supranasals broadest anteriorly, in contact with the anterior loreal; prefrontals narrowly to moderately separated; usually seven supraciliaries; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second, second, or second and third upper labials; six or seven

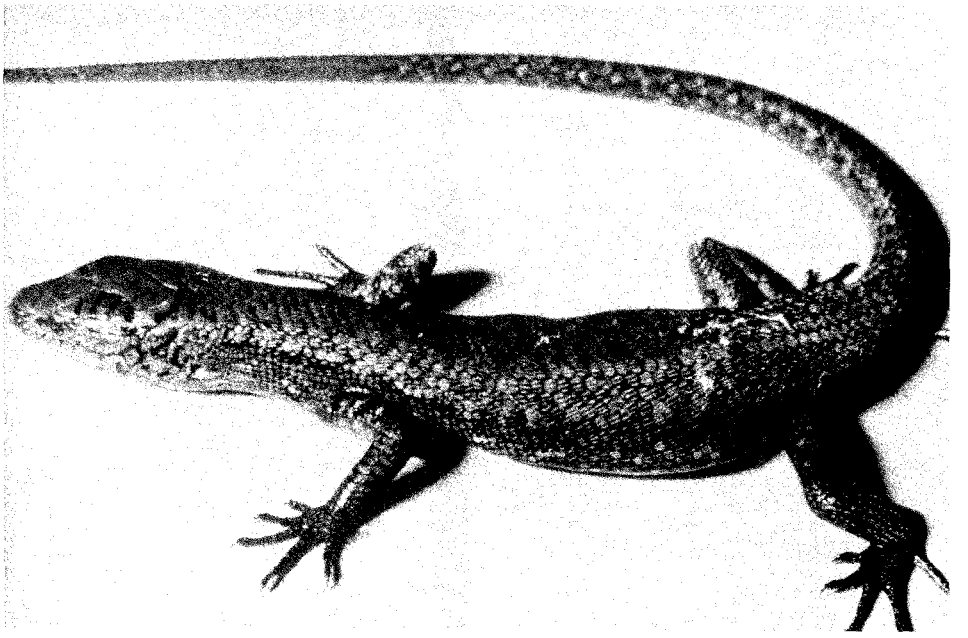

FIGURE 14. *Emoia brongersmai,* showing pattern of dark blotches on head, Papua New Guinea. Photo courtesy of F. Parker.

upper labials, sixth (rarely fifth) enlarged and below eye; six or seven lower labials; dorsal scales, posterior to forelimbs, and upper lateral scales with three (sometimes four or five) moderately strong keels; midbody scale rows 35–40 ($\bar{x}$ = 37.143; SD = 1.264; n = 35); dorsal scale rows 49–56 ($\bar{x}$ = 52.114; SD = 1.694; n = 35), Table 8; preanals slightly enlarged; length of extended hindlimb 96–114% of axilla–groin distance and 49–55% of SVL; rounded lamellae under fourth toe 30–42 ($\bar{x}$ = 35.658; SD = 2.841; n = 38); under first toe 9–10.

COLOR (in preservative).—Dorsal ground color iridescent light to medium brown or greenish brown (more often the last); marked by numerous darker scales or vague darker blotches; top of head about same color as body, with posterior margins of supraoculars and often parietals darker brown; usually a distinct dark-brown spot near center of fronto-interparietal shield; upper lateral surfaces usually slightly darker than dorsum; few small, widely separated patches of pale scales along dorsolateral margins on neck; a row of eye-like, pale (whitish), dark-bordered spots extending from ear onto anterior flanks for most specimens; tail marked by narrow, irregular, light and dark brownish bands; labials usually marked by dark bars, especially posterior ones; venter pale tan to grayish tan.

COMPARISONS.—Three species of keel-scaled *Emoia* are sympatric with *E. brongersmai* in the Digul River and Fly River drainages. Two are smaller, weakly keeled species: *E. physicina* and *E. pseudopallidiceps.* In the past, examples of *E. brongersmai* have been referred to the third species, *E. tropidolepis.* These two species differ in several characters. *Emoia tropidolepis* has strong keels, whereas *E. brongersmai* has moderate keels that are often absent from scales anterior to the forelimbs. *Emoia brongersmai* and *E. tropidolepis* further differ in means for: (1) midbody scale rows (t = 3.484; df = 78; $P < 0.001$), (2) dorsal scale rows (t = 16.214; df = 76; $P < 0.001$), and (3) fourth toe lamellae (t = 5.754; df = 79; $P < 0.001$). Similarly, *E. brongersmai* and *E. physicae purari* differ in the means for: (1) midbody scale rows (t = 2.902; df = 59; P = 0.005), (2) dorsal scale rows (t = 4.874; df = 62; $P < 0.001$), and (3) fourth toe lamellae (t = 4.024; df = 60; $P < 0.001$). *Emoia brongersmai* also exhibits pale, dark-bordered blotches on the sides, but these are not present in *E. tropidolepis, E. physicae purari,* or *E. oribata. Emoia brongersmai* is close to *E. oribata* in scale counts (Table 5), but differs in its weaker keels and in lacking alternating pale and dark vertical bands on the ventral half of the lateral surface, neck, and base of jaws.

ETYMOLOGY.—Named for Professor Brongersma, in honor of his contributions to New Guinea herpetology.

REPRODUCTION.—Gravid females have two large oviducal eggs.

RANGE.—The Fly River drainge in Western Province, Papua New Guinea, and the Digul River drainage in southern Irian Jaya (Fig. 36).

Emoia oribata Brown, NEW STATUS

(Figure 15)

Emoia physicae oribata Brown, 1953:22 (type loc.: Bernard Camp on Idenberg River, Irian Jaya; holotype in AMNH).

Brown (1953) differentiated *E. physicae oribata* from *E. p. tropidolepis* by differences in color pattern and the former's slightly fewer subdigital lamellae. The large series of *E. p. physicae* from Morobe, Madang, Northern, Milne Bay, and Central provinces in eastern Papua New Guinea, of *E. physicae purari* from Gulf, Chimbu and the Highlands provinces, and of *E. tropidolepis* from Irian Jaya and Western Province south of the central divide show that the lamellar-count differences do not hold. The more greenish ground color (in life) and the more pronounced irregular transverse light and dark bands on the dorsum (noted in the original description) distinguish *E. oribata* from other species of the *physicae* subgroup.

DESCRIPTION.—SVL 67.8–77.1 mm for five mature males and 63.3–77.0 mm for two females; snout tapered, bluntly rounded

FIGURE 15. *Emoia oribata*, showing the prominent pale and dark blotches on the side of the neck, Papua New Guinea. Photo courtesy of A. Allison.

at the tip, its length 55–62% of HB and 37–39% of HL; HB 63–71% of HL and 16–18% of SVL; eye 74–79% of snout length and 43–46% of HB; rostral forming nearly straight or slightly convex suture with frontonasal; supranasals broadest anteriorly, in contact with anterior loreal; prefrontals narrowly to moderately separated; one pair of nuchals; anterior loreal about half as long as and higher than posterior, in contact with first and second, second, or second and third upper labials; usually seven upper labials, sixth (occasionally fifth) enlarged and below eye; seven or eight lower labials; dorsal scales with three or four strong keels; lateral scales and those on side of neck also with prominent keels; midbody scale rows 36–40 ($\bar{x}$ = 38.0; SD = 1.50; n = 9); dorsal scale rows 50–55 ($\bar{x}$ = 52.2; SD = 1.476; n = 10); length of extended hindlimb 109–125% of axilla–groin distance and 52–56% of SVL; lamellae under fourth toe 33–40 ($\bar{x}$ = 36.5; SD = 2.173; n = 10); under first toe 9–11.

COLOR (in preservative).—Dorsal ground color brown, usually with broken or more or less continuous, very irregular, narrow darker transverse lines; these dark markings or lines about one scale wide, slightly narrower than the lighter bands; these darker bands extending onto upper lateral surfaces; sides of neck marked by light and dark slanted bars; supraoculars, frontoparietal, and parietals with dark brown markings posteriorly; labials usually darker along posterior edges; venter grayish (slate) ivory, lighter in region of limbs.

COMPARISONS.—The stronger keels and marked differences in color pattern distinguish *E. oribata* from *E. physicae*. It differs from *E. tropidolepis* in color pattern and in mean counts of midbody scale rows (t = 3.851; df = 52; $P < 0.001$). *Emoia oribata* exhibits a much lower number of fourth toe lamellae than does *E. ahli* (Table 5).

RANGE.—Upper Idenburg River and western Sepik River drainages on the north side of the central range.

MATERIAL EXAMINED.—**Irian Jaya:** Upper Idenburg River Valley: AMNH 62414 (*holotype*), AMNH 62413, 62415, 62432–33 (paratypes). **Papua New Guinea:** West Sepik Province: Telefomin: AMS R15227. East Sepik Province: Frieda River area: BPBM 10590–93.

Emoia physicae

The holotype of *E. physicae* is simply labeled New Guinea. French expeditions under Duperrey (1822–25) and Dumont d'Urville (1826–29) landed along the north coast of Papua New Guinea. It is most likely that the holotype of *E. physicae* was collected by the naturalists with the latter expedition, since this species was not described by Lesson (1830) following the voyage of Duperrey. Comparison of the holotype with samples from northern New Guinea indicate that it could have been taken from populations in Milne Bay, Northern, Madang, or Morobe provinces. I restrict the type locality for *E. physicae* to Morobe Province, Papua New Guinea. Populations in Central Province, south of the central ranges in eastern Papua, are indistinguishable from the northern populations and are referred to the nominal subspecies. However, the populations in the Purari River drainage system in Gulf, Chimbu, and Eastern Highlands provinces, southern Papua, differ significantly in numbers of midbody scale rows (t = 6.034; df = 88; $P < 0.001$) and dorsal scale rows (t = 8.515; df = 85; $P < 0.001$). I treat them as a distinct subspecies.

KEY TO SUBSPECIES OF *EMOIA PHYSICAE*

1a. Dorsal scale rows between parietals and base of tail 46–54 (rarely more than 52); prefrontals in contact to moderately separated; color (in preservative) of dorsum light to medium brown; nearly uniform or with a few scattered darker spots; color of lateral surfaces as for dorsum or

somewhat darker on upper part, usually marked by a few, scattered light scales or groups of scales, especially on neck and sometimes bordered on dorsolateral line by light scales; (Milne Bay, Northern, and Morobe provinces e. and n. of central mountain range and from Central Province south) ..... *E. p. physicae*

1b. Dorsal scale rows between parietals and base of tail 51–58 (rarely less than 52); prefrontals usually moderately to widely separated; color (in preservative) of dorsum light to medium brown with scattered darker brown blotches, sometimes forming nearly complete, irregular transverse bands; lateral surfaces, at least upper several scale rows, dark brown bordered dorsally by light scales especially on anterior half of body, and frequently a few light scales within band; (Eastern Highlands, Chimbu, and Gulf provinces) ..... *E. physicae purari*

Emoia physicae physicae (Duméril and Bibron)

(Figure 2g)

Gongylus (Euprepes) physicae Duméril and Bibron, 1839:688 (type loc.: New Guinea; holotype in MNHN); Doria 1874:337; Brygoo 1985:85.
Euprepis physicae: Gray 1845:115.
Euprepes (Tiliqua) baudini: (part) Peters and Doria 1878:353.
Lygosoma baudini: (part) Boulenger 1887a:296; (part) de Rooij 1915:257.
Lygosoma callistictum: Mehely (not Peters and Doria) 1898:170.
Emoia b. baudini: (part) Loveridge 1948:369.
Emoia physicae: Mittleman 1952:29; Scott, Parker, and Menzies 1977:11.
Emoia p. physicae: (part) Brown 1953:20; Greer 1970:171; Zweifel 1980:417.
Emoia tropidolepis: (part) Loveridge 1948:372; Room 1974:443.

DESCRIPTION.—SVL 52.1–77.6 mm for 10 mature males and 56.3–75.7 mm for 20 mature females (juveniles include specimens to 53 mm); snout tapered, broadly rounded at tip, its length 36–41% of HL and 55–62% of HB; HB 64–72% of HL and 15–18% of SVL; eye 72–83% of snout length and 40–47% of HB; rostral forming nearly straight or slightly convex suture with frontonasal; supranasals broadest anteriorly, in contact with anterior loreal; prefrontals moderately separated to moderately in contact; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with second or with second and either first or third upper labials; seven upper labials, sixth (rarely fifth) largest and below eye; six or seven lower labials; scales on dorsal and upper lateral surfaces with three or sometimes four moderate to fairly strong keels (most prominent on posterior part of body); some scales on side of neck usually with two or three low keels; midbody scale rows 32–40, holotype 38 ($\bar{x}$ = 36.078; SD = 1.462; n = 64); dorsal scale rows 46–54, holotype 51 ($\bar{x}$ = 50.741; SD = 1.802; n = 58); length of extended hindlimb 87–112% of axilla–groin distance and 45–53% of SVL; rounded lamellae under fourth toe 32–42 (rarely more than 40), holotype 37, ($\bar{x}$ = 36.948; SD = 2.35; n = 58); lamellae under first toe 10–12.

COLOR (in preservative).—Dorsum and upper lateral surfaces nearly uniform, medium brown, or with a few scattered darker blotches or spots, or upper lateral area marked by fairly broad, slightly darker brown band extending from ear along flank, sometimes bordered dorsally by scattered light scales and marked on flanks by scattered patches of single or small groups of pale scales at level of limbs; sometimes sides of neck with pale blotches; head shields uniform, light brown, or some of them, especially supraoculars, with dark brown spots; venter dirty ivory diffused with slate to primarily slate gray with some ivory or tan in fore- and hindlimb regions.

COMPARISONS.—*Emoia physicae* differs from sympatric *E. battersbyi* in the number of fourth toe lamellae, barely overlapping (Table 5), and the slightly stronger keels. *Emoia oribata* has similar scale counts but has more prominent keels on the dorsal scales and a different color pattern. *Emoia tropidolepis* and *E. physicae purari*, the subspecies in closest proximity, differ in strength of keels, in mean counts of midbody scale rows (t = 5.921; df = 69; $P < 0.001$), and in dorsal scale counts, which barely overlap (Table 5). For comparison with *E. brongersmai*, see description of that species.

REPRODUCTION.—Some females have two enlarged oviducal eggs.

HABITAT.—A ground form from near sea level to 2200 m; in original forest, and also seral and disturbed areas.

RANGE.—Southeastern New Guinea. In the Huon Peninsula, Morobe Province, it is known from localities in the Finisterre-Saurwaged ranges (surrounded by populations of *E. battersbyi* in the lowlands). From the Bulolo drainage to the west, and in Milne Bay and Northern Provinces only *E. physicae* is known. *Emoia physicae physicae* also occurs south of the Owen Stanley Range in Central Province.

MATERIAL EXAMINED.—**Papua New Guinea:** without specific locality: MNHN 2949 (holotype); Central Province: Laloki River area: AMS R14582; Musgrave River area: MCZ 145987; Sogeri area: MCZ 104639–40, 152929; Mafulu: AMNH 59008, 59013, 59016; Tarara: AMNH 58394; Port Moresby: AMNH 82608; Haveri: BMNH 97.12.10.67. Milne Bay Province, Biniguni on Gwariu River: AMNH 74010; 74015, 74017, 74114, 74123, 74127; Kwagira River at Peria Creek: AMNH 74270, 74423; Cape Vogel: AMNH 74174, 74216–17, 74253. Northern Province: Kododa: AMNH 95371–72, 95366, 95369; Popondetta: MCZ 140970; Lego: MCZ 141070; Mt. Victoria: BMNH 96.10.31.18. Morobe Province: Garaina: MCZ 142289, 149822–23, 149834, 152025, AMNH 95894, 103437–44, 105467–68; Waria River: MCZ 149821; Huon Peninsula: MCZ 54262; Kabwum: AMNH 95779–80; Zangaren: AMNH 95778; Masba Creek; AMNH 95772–75; Mt Rawlinson: AMNH 95770–71, 95776–77; Tumnang: AMNH 95330; Kua River area: AMNH 95329; between Zangaren and Bullum River: AMNH 95343–44; between Bullum River and Selimbeng: AMNH 95328, 95336; Wau area: CAS 155996–6001, MCZ 142640, AMNH 126697–702, AMS R60450, R60458, R60460–61, BPBM 8332, 8335–36, 8815, 8817, 8820, 8830–32, 8334, 8849, 8852–55, 8861–62, 8864, 8868–69, 8878–80, 8882, 8885, 8892–94, 8907–08, 8910–12, 8917–20, 8925, 8931, 8936–37, 8942, 8945, 9046–47, 9051, 9053–60, 9074–75, 9077, 9080–81, 9083, 9088–89, 9115, 9118–24, 9137–40, 9142, 9155, 9158–59, 9183–88, 9190, 9192, 9328, 9332–34, 9337, 9339–40, 9442–43, 9969, 9971–88, 9993–98, 10001, 10003–12, 10015, 10020, 10022–26, 10032–44, 10048, 10050, 10057, 10064–69, 10071–75, 10080, 10091, 10105, 10116, 10118, 10122, 10133–36, 10138–42, 10147–48, 10156–71, 10173–89, 10191–93, 10195–10202, 10204–11, 10213–14, 10218–25, 10232–42, 10244–45, 10247–58, 10260, 10263–65, 10268–69, 10272–79, 10284–92, 10296–313, 10315–29, 10332–34, 10336–48, 10350–61, 10363–79, 10381–409, 10411–21, 10423–29, 10431–40, 10442–48, 10450–51, 10453–55, 10457, 10459–65, 10467–73, 10475–80, 10484–98.

Emoia physicae purari n. subsp.

HOLOTYPE.—CAS 117848, collected by Fred Parker at Uraru, Gulf Province, Papua New Guinea, 1 Oct. 1967.

PARATYPES.—CAS 117846–47, 117849, 117754, MCZ 102644–48, SAMA 10995, FMNH 169878–79 (same locality as holotype); Chimbu Province: Karimui: MCZ 96168–70, 98922–25, 99587, 102642, 102649–56, AMNH 98958–59, BMNH 1970.1237–40, SAMA 8366, CAS 110355–59, 118737–40, 118161–62, 118667, MCZ 97308–09; Bomai: MCZ 90977–80, AMNH 97569; Soliabeda: MCZ 104637–38, SAMA 10996; Dege: MCZ 126581; Haia: AMS R115402–05; Yuro: AMS R115401, MCZ 104644; Weiana: MCZ 104642–43; Oroi: MCZ 102536, 131941, 131947; Kikori River: MCZ 150857–58.

The combination of characters given in the Diagnosis distinguishes this subspecies from *Emoia p. physicae*.

DIAGNOSIS.—SVL at maturity about 52–78 mm; midbody scale rows 35–43 ($\bar{x}$ = 38.308; SD = 1.871; n = 26); dorsal scale rows 51–58 ($\bar{x}$ = 54.379; SD = 2.025; n = 29); rounded lamellae under fourth toe 35–42 ($\bar{x}$ = 38.202; SD = 1.56; n = 24); usually sixth upper labial enlarged and below eye; color of dorsum light to medium brown with darker brown blotches, especially outside of paravertebral rows of scales, sometimes forming vague, nearly complete, very irregular transverse bands; lateral surfaces, especially upper 4 to 6 scale rows, distinctly darker brown, bordered along dorsolateral line by a few scattered light scales or almost continuous narrow line of light scales, especially anteriorly.

DESCRIPTION OF HOLOTYPE.—Adult female, SVL 68.5 mm; midbody scale rows 38; dorsal scale rows 54; fourth toe lamellae 39; brown with darker spots and blotches, especially outside of paravertebral rows; lateral surfaces, or at least upper four or five rows, darker brown with pale scales, scattered or in a more or less continuous line along the dorsolateral margin, especially anteriorly.

ETYMOLOGY.—This subspecies is known from the Purari River drainage, hence the name.

REPRODUCTION.—Fred Parker's field notes list two eggs of this subspecies collected in April 1965. A hatchling from them measured 31.5 mm in SVL before preservation.

HABITAT.—The habitat is similar to that of *E. p. physicae.*

RANGE.—Purari River drainage in Gulf, Chimbu, and Eastern Highlands provinces in southern Papua New Guinea.

Emoia tropidolepis (Boulenger)

Euprepes physicae: Doria 1874:337.
Lygosoma tropidolepis Boulenger, 1914:260 (type loc.: southwestern Irian Jaya, syntypes in BMNH); de Rooij 1915:258.
Emoia tropidolepis: (part?) Brongersma 1931b:17; Smith 1937:227; Mittleman 1952:31.
Emoia physicae tropidolepis: Brown 1953:22.

Boulenger (1914) described *E. tropidolepis* from the Mimika River, Setekwa River, and Otakwa River areas south of the central mountain range in western Irian Jaya. He noted that it differed from other species of *Emoia* in its strongly keeled scales. Later authors (Brongersma 1931b; Loveridge 1948; and Room 1974), referred keel-scaled *Emoia* from other areas in New Guinea to *E. tropidolepis.* These were examples of *E. physicae, E. battersbyi,* or other species.

Emoia tropidolepis has stronger keels on the scales than do most species of this subgroup except *E. ahli* and *E. oribata,* but it differs from these two in other characters. Populations of *E. tropidolepis* appear to be confined to southern Irian Jaya and Western Province, south of the central mountain range, and possibly the Aru Islands.

Since Boulenger (1914) did not designate a holotype, I have selected a lectotype from the type series.

LECTOTYPE.—BMNH 1946.8.10.63, an adult male, collected in the Mimika River area south of the central mountain range in southern Irian Jaya by the British Ornithological Union Expedition in 1912.

DESCRIPTION OF LECTOTYPE.—SVL 73.4 mm; midbody scale rows 35; dorsal scale rows 47; fourth toe lamellae 36; sixth upper labial enlarged and beneath eye; dorsal and lateral scales with strong keels.

DESCRIPTION.—SVL 51.0–73.4 mm for 14 males and 56.2–68.4 mm for 11 females (a female measuring 53.9 mm is not quite mature); snout relatively short, tapered, bluntly rounded, its length 49–56% of HB and 33–38% of HL; HB 62–75% of HL and 15–18% of SVL; eye 71–88% of snout length and 38–48% of HB; rostral broader than long, forming moderately long, nearly straight suture with frontonasal; supranasals triangular, in contact with anterior loreal; frontonasals rather widely separated; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second, second, or second and third upper labials; six to eight upper labials, sixth (rarely fifth or seventh) enlarged and below eye; six or seven lower labials; dorsal and lateral scales and those on upper limbs usually with three (occasionally a few scales with four or five) very strong keels (keels frequently projecting as sharp points beyond posterior margin of scale); midbody scale rows 33–39 ($\bar{x}$ = 35.956; SD = 1.445; n = 45); dorsal scale rows 45–52, rarely more than 50 ($\bar{x}$ = 48.349; SD = 1.557; n = 43); preanals slightly enlarged; length of extended hindlimb 102–119% of axilla–groin distance and 51–56% of SVL; rounded lamellae under fourth toe 35–44, rarely less than 37 ($\bar{x}$ = 38.860; SD = 2.156; n = 43); under first toe 10–12.

COLOR (in preservative).—Dorsal ground color light brown (sometimes with a grayish hue), relatively uniform on head and anteriorly on neck; body and posteriorly on neck marked by series of narrow, slanted dark brown bars extending from dorsolateral line to or rarely onto paravertebral scale rows (rarely forming complete transverse lines); keels narrow, pale (sometimes whitish); pale dorsolateral line frequently present; sides of neck brownish with some pale flecks or sometimes pale, irregular, slanted, transverse lines; dark brown of lateral surfaces fading on neck or posterior part of head; upper labials with dusky blotches; venter dusky ivory or with varying amounts of gray under head and middle part of trunk.

COMPARISONS.—*Emoia tropidolepis* shares the character of very strong keels on dorsal and lateral scales with *E. oribata* and *E. ahli* (the latter according to the original description). *Emoia tropidolepis* differs from *E. ahli* in having fewer fourth toe lamellae (Table 5). For comparisons with *E. brongersmai, E. oribata,* and *E. physicae,* see description of those species.

REPRODUCTION.—Gravid females have two large oviducal eggs.

HABITAT.—All specimens from the Digul River area were collected between Tanah Merah, which is some distance inland on the Digul River but still only a few meters above sea level, and Katem at about 200 m elevation on the East Dugul. In 1959 this area was densely forested. Because the expedition collected intensively in the Digul drainage (above Katem to 1300 m elevation) without finding *E. tropidolepis,* the species is probably limited to lower elevations, below 350 m.

RANGE.—Digul, Lorentz, Mimika, Setekwa, and Otakwa drainages in southern Irian Jaya, and Fly River drainage, Western Province south of the central mountain range in Papua New Guinea.

MATERIAL EXAMINED.—**Irian Jaya:** south of the Central Divide, Mimika River area: BMNH 1946.8.10.60–64; Setekwa River: BMNH 1946.8.11.12, 1946.8.10.67–68; Otakwa River: BMNH 1946.8.10.91–92 (syntypes); Lorenz River drainage, Kloofbivak: ZMA 11855a–d; Bivak Eiland: ZMA 11857a–c; Digul River drainage between Tanah Merah and Katem: RMNH 21244–270, CAS 156742–43. **Papua New Guinea:** Western Province: without specific locality: BMNH 1980.489; Oriomo River: AMS R23686–88; Emeti: MCZ 139532–33; Balimo: MCZ 123678; Kiunga: MCZ 126392–93; Menemsore: MCZ 126390; Matkomrae: MCZ 126391;

Migalsimbip: MCZ 126395–97, 142319–21, AMS R40777, SAMA 11635–36, AMNH 107220. AMNH 5079 from Aroe Islands is tentatively assigned to this species. It is possible that some of the specimens listed as *E. physicae* by Doria (1874:337) are examples of *E. tropidolepis*.

Emoia callisticta (Peters and Doria)

Euprepes callictictus Peters and Doria, 1878:355 (type loc.: Sorong, West Irian; holotype in MSNG).
Euprepes physicae: (part) Doria (not Duméril and Bibron) 1874:344.
Lygosoma callistictum: Boulenger 1887a:295; de Rooij 1915:256.
Lygosoma acrocarinatum Kopstein, 1926:95 (type loc.: Jakati River area, Bintuni Bay, Irian Jaya: syntypes in RMNH).
Emoia tropidolepis: (part?) Brongersma 1931b:27.
Emoia acrocarinata: Mittleman 1952:21.
Emoia acrocarinatum: Brown 1953:23.

I am indebted to Dr. Richard Zweifel, who examined the holotype of *E. callisticta* (MSNG 28049). In publication (1980) and in personal communication, he called attention to the similarity of *E. acrocarinata* to this species. The holotype of *E. callisticta* and syntypes of *E. acrocarinata* not only agree closely in scale characters, as pointed out by Zweifel, but both are from the Vogelkop Peninsula in Irian Jaya.

Brongersma (1931b:27) placed *E. acrocarinata* in the synonymy of *Lygosoma tropidolepis*, noting that the number of nuchals vary in some species of *Lygosoma*. My own examination of the syntypes of *E. acrocarinata* and several additional specimens indicates that the species is conspecific with *E. callisticta* and can be distinguished from *E. tropidolepis* and other species of the *physicae* group by the absence of nuchals and in being bicarinate.

DESCRIPTION.—SVL 42.5–56.0 mm for 10 males and 45.5–54.7 mm for five females; snout relatively short, bluntly rounded, its length 50–58% of HB and 33–40% of HL; HB 66–75% of HL and 16–19% of SVL; eye 67–84% of snout length and 34–49% of HB; rostral forming long, nearly straight suture with frontonasal; supranasals narrow; prefrontals widely separated; no nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or second upper labials; seven or eight upper labials, sixth enlarged and below eye; six or seven lower labials; dorsal scales with two (rarely three) strong keels; scales on side of neck keeled; midbody scale rows 36–44 ($\bar{x}$ = 39.636; SD = 2.767; n = 11); dorsal scale rows 43–49 ($\bar{x}$ = 44.636; SD = 1.69; n = 11); length of extended hindlimb 109–132% of axilla–groin distance and 53–57% of SVL; rounded lamellae under fourth toe 38–45 ($\bar{x}$ = 42.273; SD = 2.149; n = 11); lamellae under first toe 9–12.

COLOR (in preservative).—Dorsal ground color rather uniform medium brown to dark brown; color of lateral surfaces about the same or somewhat darker, usually with a patch of four to six pale scales on neck about midway between ear and forelimb; prominent pale and dark vertical bars on posterior labials of some specimens; venter dusky ivory to dusky tan, sometimes slightly darker under head and throat.

COMPARISONS.—*Emoia callisticta* differs from other species of the *physicae* group in the absence of nuchals, the bicarinate dorsal scales, and lower number of dorsal scale rows (Table 5). It is also smaller in size at maturity than other species of the *physicae* group, with the exception of *E. physicina* and *E. pseudopallidiceps*.

HABITAT.—Forest.

RANGE.—Vogelkop (=Gendlawasih) Peninsula at the western end of Irian Jaya and Waigeo Island.

MATERIAL EXAMINED.—**Irian Jaya:** Sorong on Vogelkop Peninsula: MCSN 28094 (type of *E. callisticta*), examined by Zweifel; Bintuni Bay area: RMNH 5078, 5463 (syntypes of *E. acrocarinata*); Waigeo I.: FMNH 14197 (3 specimens), MCZ 52286, RMNH 7354a–c, BMNH 1984.898–904, ZMA 15747, 15763a–d; Batanta I.: RMNH 7353; Gebi (=Gebe?) I.: RMNH 7355.

kuekenthali Subgroup

The five species of this subgroup are characterized by relatively weak keels on the dorsal scales, which are limited to the posterior part of the body. The keels never project beyond the posterior margin of the scales. Three of the five species typically have the fifth upper labial enlarged and below the eye. *Emoia pseudopallidiceps* has extremely weak keels and appears somewhat intermediate between the *baudini* and *physicae* groups in this character.

Emoia battersbyi (Proctor)

Lygosoma (*Emoia*) *battersbyi* Proctor, 1923:1070 (type loc.: Huon Gulf area, New Guinea; holotype in BMNH).
Lygosoma kuekenthali: (part?) Vogt 1932:291.
Emoia tropidolepis: (part) Loveridge 1948:372.
Emoia battersbyi: Mittleman 1952:22; Brown 1953:20; Scott, Parker, and Menzies 1977:11.
Emoia p. physicae: (part) Brown 1953:20; (part) Zweifel 1980:417.

Proctor (1923) described *Emoia battersbyi* from a single specimen from the Huon Gulf area of Papua New Guinea. She distinguished it from *E. tropidolepis* based on: (1) its possession of an interparietal; (2) its enlarged marginal preanals; and (3) some differences in color pattern. My study of more than 30 specimens from Lae, on the Huon Gulf along the northern lowlands, as far west as Toem in Irian Jaya, indicates that the presence of an interparietal scale is rare. It occurs in only one specimen, AMS R13248, from Lae. Also, the keels in the specimens, as well as in the holotype, are usually weak to moderate, not sharp as described by Proctor. The color of the upper surfaces is more brownish than greenish for most specimens.

Emoia battersbyi is close to *E. kuekenthali* based on: (1) the nearly uniform light-brown dorsum and sometimes upper lateral surfaces, with a few light spots on the lateral surface in some: (2) the absence of a pale dorsolateral line; (3) the relatively weak to moderate keels; and (4) size.

DESCRIPTION.—SVL of 10 mature males 61.0–77.2 mm, six mature females 62.0–72.2 mm; snout rather short, tapered, bluntly rounded, its length 37–40% of HL and 52–62% of HB; HB 62–72% of HL and 14–18% of SVL; eye 70–84% of snout length and 38–50% of HB; rostral forming long, nearly straight or slightly curved suture with frontonasal; supranasals broadest anteriorly, in contact with anterior loreal; prefrontals moderately to widely separated; one pair of nuchals; anterior loreal about half as long as posterior, in contact with first and second, or second upper labials; six to eight upper labials, sixth (rarely fifth or seventh) enlarged and below eye; six or seven lower labials; dorsal scales relatively uniform in size; dorsal and upper lateral scales with three (rarely two or four) weak to moderate keels, at least on posterior part of body; scales on side of neck lacking keels or with very weak ones; midbody scale rows 32–40, rarely more than 38 ($\bar{x}$ = 36.341; SD = 1.762; n = 35); dorsal scale rows 47–56 ($\bar{x}$ = 50.667; SD = 2.131; n = 33);

preanals scarcely enlarged; length of extended hindlimb 100–119% of axilla–groin distance and 47–55% of SVL; rounded lamellae under fourth toe 39–51, only one specimen below 40 ($\bar{x}$ = 45.430; SD = 3.178; n = 41); under first toe 11–12.

COLOR (in preservative).—Dorsal ground color light brown to grayish green or greenish olive-brown, nearly uniform or with few to numerous small, darker blotches; upper lateral surface marked by somewhat vague darker slashes or blotches, sometimes bordered along dorsolateral line and just above level of limbs by row of small, faint, pale spots; about half of specimens with two or three pale spots on neck anterior to forelimb, usually closer to forelimb than ear; labials marked by faint, dark vertical bars; venter ivory to ivory-slate.

COMPARISONS.—*Emoia battersbyi* is similar in appearance to *E. kuekenthali* from the Moluccas and was confused with that species by Vogt (1932). The two species differ significantly in the means for midbody scale rows (t = 8.349; df = 57; P < 0.001) and dorsal scale rows (t = 12.037; df = 56; P < 0.001). *Emoia battersbyi* differs from *E. ahli* in (1) the weak to moderate keels of the dorsal scales (described as acute for *E. ahli*), and (2) the lack of light and dark, irregular transverse bands on the dorsum (described as present for *E. ahli*). For comparison with *E. montana* and *E. physicae,* see description of those species.

HABITAT.—A forest species, but I have no detailed information about the habitat.

RANGE.—Toem and Jobi Island in Irian Jaya and lowland areas to the east as far as Lae, Huon Gulf, on the north side of the central mountain ranges in Papua New Guinea.

MATERIAL EXAMINED.—**Papua New Guinea:** Huon Gulf area: BMNH 1946.8.10.88 (holotype). Morobe Province: Lae: AMS R13257–60, AMNH 66324–25: Madang Province: Adelbert Mts.: MVZ 89668. West Sepik Province: Pes: RUCA (6 specimens); Mt. Nibo: AMNH 100275–76; Fak River: MCZ 125422. East Sepik Province: Kairiru I.: MCZ 156516; Marienberg: FMNH 15529–30; Sepik River area: AMNH 36616–17; Frieda River area: BPBM 10692–94. **Irian Jaya:** *without specific locality: CAS 64248; Hollandia:* AMNH 66347; Toem: USNM 119417; Slangernoord: ZMA 11858; Jobi I.: MCZ 7682; Biwak I.: MCZ 21001. BPBM 10691 from the Frieda River area is also assigned to this species, although the lamellar count is lower than for any other specimen.

Emoia kuekenthali (Boettger)

KEY TO SUBSPECIES OF *EMOIA KUEKENTHALI*

1a. Lamellae under fourth toe 49–59 (usually more than 50); dorsal scale rows between parietals and base of tail 61–67; a dark lateral band extending from eye or ear onto flanks; (n. Moluccas) ..... *E. k. kuekenthali*

1b. Lamellae under fourth toe 41–49 (less than 50); dorsal scale rows between parietals and base of tail 53–61; dark lateral band faint or absent; (s. Moluccas) ..... *E. k. notomoluccense*

Emoia kuekenthali kuekenthali (Boettger)

Lygosoma kuekenthali Boettger, 1895:117 (type loc.: Halmahera Island; holotype in SMF); 1900:343; Brongersma 1931a:335; de Rooij 1915:251; Vogt 1932: 291; Daan and Hillenius 1966:132.
Emoia kuekenthali: Smith 1937:237; Tanner 1950:22; Mittleman 1952:26; Greer 1970:171.
Emoia k. kuekenthali: Brongersma 1948:491.

DESCRIPTION.—SVL of five mature specimens 56.2–79.9 mm; snout tapered, moderately depressed, its length 38–41% of HL and 57–64% of HB; HB 63–68% of HL and 16–18% of SVL; eye 60–64% of snout length and 35–40% of HB; rostral forming more or less straight suture with frontonasal; supranasals long, narrowly in contact with anterior loreal; prefrontals separate; one pair of nuchals; anterior loreal slightly longer than high, shorter than posterior, in contact with first and second, second, or second and third upper labials; seven or eight upper labials, sixth enlarged and below eye; six or seven lower labials; posterior dorsal scales with three to five weak keels or nearly smooth; midbody scale rows 40–44 ($\bar{x}$ = 41.333; SD = 1.225; n = 9); dorsal scale rows 61–67 ($\bar{x}$ = 64.0; SD = 2.236; n = 11); length of extended hindlimb 104–124% of axilla–groin distance and 48–53% of SVL; rounded lamellae under fourth toe 49–59 ($\bar{x}$ = 54.0; SD = 3.590; n = 10); under first toe 12–15.

COLOR (in preservative).—Dorsal ground color grayish olive-green to light brown with some small, scattered, darker brown spots; dark brown band extending from eye or ear onto anterior trunk, fading posteriorly or reduced to separated darker spots, bordered on dorsal margin anteriorly by series of bluish-white spots (two or three scales each); lower lateral surfaces tan or bluish green; venter ivory to dirty white with some bluish blemishes under head and throat.

COMPARISONS.—See description of *E. battersbyi.* The eye is smaller relative to snout length or HB than in other species (see ratios in descriptions).

RANGE.—Morotai, Batjan, and Halmahara islands in northern Moluccas.

MATERIAL EXAMINED.—Halmahera I.: SMF 15202 (holotype), 15203–04, MCZ 33544 (paratypes), BMNH 1946.8.10.55 (paratype), USNM 215871; Moratai I.: MCZ 93387, BYU 7648, 7784, 7732, 7825, RMNH 8658, 2517a; Batanta I.: *RMNH 7357a.*

Emoia kuekenthali notomoluccense (Brongersma)

Lygosoma kuekenthali notomoluccense Brongersma, 1931a:335 (type loc.: Ambon Island; holotype in ZMA); Daan and Hillenius 1966:132.
Lygosoma kuekenthali: Kopstein 1926:90.

Brongersma (1931a) stated that this southern subspecies of *E. kuekenthali* differed from the typical subspecies primarily in color pattern. There are also significant differences in the number of dorsal scales and fourth toe lamellae (Table 5).

DIAGNOSIS.—SVL for 10 mature specimens 54.1–69.5 mm; dorsal scales usually with three to five weak keels on posterior scales or nearly smooth; midbody scale rows 37–42 ($\bar{x}$ = 39.333; SD = 1.345, n = 15); dorsal scale rows 53–61 ($\bar{x}$ = 57.667; SD = 2.093; n = 15); rounded lamellae under fourth toe 41–49 ($\bar{x}$ = 44.875; SD = 2.363; n = 16); dorsal ground color relatively uniform light brown or with few, scattered, darker and lighter scales; dark lateral band on neck and anterior part of body, as characteristic of the nominal subspecies.

RANGE.—Ambon, Ceram, and Sula islands in the southern Moluccas.

MATERIAL EXAMINED.—Ambon I.: MNHN 1962.1075–78, 1962.1080–82, FMNH 134589–94, 142352, 142354, BMNH 1946.8.11.1–7; Ceram I.: BMNH 1973.1103.

Emoia montana n. sp.

This species, known thus far only from montane populations in Western Highlands Province on the south side of the divide, resembles *E. physicae purari* in some characters and *E. kuekenthali* and *E. battersbyi* in others.

HOLOTYPE.—CAS 107072, an adult female, collected along the Baiyer River in Western Highlands Province, elevation about 1400–1500 m, Papua New Guinea, by Fred Parker, 23 Oct. 1966.

PARATYPES.—Western Highlands Province: Baiyer River area: CAS 107064–71, 107073–77, AMNH 103445–61, AMS R16596, 16599, MCZ 99588–613 (same locality as holotype), MVZ 89667; 16 miles north of Mt. Hagen Town (at an elevation of 1500 m): AMNH 103462–74; Wapenamanda: MCZ 101518.

DIAGNOSIS.—Color consistently uniformly light brown; keels on dorsal scales weak, usually limited to posterior scales; keels absent or faint on scales on side of neck (this character separates the species from *E. oribata, E. ahli, E. tropidolepis,* and to a lesser degree from *E. physicae*); dorsal scale rows 45–52; midbody scale rows 34–38; fourth toe lamellae 35–42; fifth or sixth (most frequently fifth) upper labial largest and below the eye.

DESCRIPTION OF HOLOTYPE.—SVL 63.2 mm; midbody scale rows 35; dorsal scale rows 49; fourth toe lamellae 42.

DESCRIPTION.—SVL of 16 mature males 52.4–70.2 mm, of 18 mature females 55.5–68.7 mm; snout tapered, bluntly rounded at tip, its length 33–40% of HL and 52–59% of HB; HB 60–71% of HL and 14–18% of SVL; eye 65–80% of snout length and 35–45% of HB; rostral forming nearly truncate or somewhat convex suture with frontonasal; supranasals broadest anteriorly, in contact with or narrowly separated from anterior loreal; prefrontals moderately to widely separated; one pair of nuchals; anterior loreal shorter and higher than posterior loreal, in contact with first and second, second, or second and third upper labials; sixth or seventh upper labials, fifth or sixth (in about equal frequencies) enlarged and below eye; six or seven lower labials; posterior dorsal and upper lateral scales with three or four very weak keels; anterior dorsal scales and those on side of neck usually smooth; midbody scale rows 34–38 ($\bar{x}$ = 35.76; SD = 1.165; n = 25); dorsal scale rows 45–52 ($\bar{x}$ = 49.125; SD = 1.895; n = 24); preanals not or slightly enlarged; length of extended hindlimb 91–111% of axilla–groin distance and 45–53% of SVL; rounded lamellae under fourth toe 35–42 ($\bar{x}$ = 38.667; SD = 2.304; n = 27); under first toe 10–12.

COLOR (in preservative).—Dorsal and upper lateral surfaces more or less uniform light brown or with few, scattered, darker brown spots dorsally, usually occupying less than one scale (rarely more), and some short darker streaks on upper lateral surfaces; rarely a pale blotch of a few scales between ear and forelimb; venter grayish tan, lightest on underside of head and hindlimb areas.

COMPARISONS.—*Emoia montana* is most closely related to *E. battersbyi* or *E. physicae* but differs in some aspects of the color pattern. It also differs significantly from *E. battersbyi* in the means of counts for dorsal scale rows (t = 2.823; df = 55; P = 0.007) and for fourth toe lamellae (t = 9.534; df = 66; P < 0.001). *Emoia montana* differs significantly from nearby populations of *E. physicae purari* in the means for midbody scale rows (t = 5.87; df = 49; P < 0.001) and dorsal scale rows (t = 9.677; df = 51; P < 0.001). *Emoia montana* is a larger species than *E. physicina* or *E. pseudopallidiceps* (Table 5).

ETYMOLOGY.—The name *montana* is a reference to the apparent limitation of the species to the mountains of Western Highlands Province.

REPRODUCTION.—Gravid females have two large oviducal eggs.

HABITAT.—A forest species.

RANGE.—Baiyer River drainage, Western Highlands Province, Papua New Guinea.

Emoia physicina Brown and Parker

Lygosoma baudini: (part) Boulenger 1914:259.

Emoia physicina Brown and Parker, 1985:9 (type loc.: Emeti area, Western Province, Papua New Guinea; holotype in MCZ).

This relatively small, keel-scaled species has been confused with juveniles of *E. physicae.*

DESCRIPTION.—SVL 38.4–50.7 mm for 18 mature males and 43.3–50.0 mm for 17 mature females; snout tapered, broadly rounded at tip, its length 51–60% of HB and 35–39% of HL; HB 60–72% of HL and 15–19% of SVL; eye 72–85% of snout length and 39–46% of HB; rostral forming long, convex or nearly straight suture with frontonasal; prefrontals moderately to widely separated; one pair of nuchals; anterior loreal shorter and slightly higher than posterior, in contact with first or first and second upper labials; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; dorsal scales, at least posterior ones, with three rather weak keels; midbody scale rows 30–38 ($\bar{x}$ = 34.448; SD = 1.572; n = 29); dorsal scale rows 45–52 ($\bar{x}$ = 48.893; SD = 1.812; n = 28); length of extended hindlimb 91–105% of axilla–groin distance and 44–53% of SVL; rounded lamellae under fourth toe 35–42, only two specimens of 24 with more than 40 ($\bar{x}$ = 37.833; SD = 1.834; n = 24); under first toe 8–10.

COLOR (in preservative).—Dorsal ground color (six to eight scale rows) medium brown, almost uniform or with rows of darker brown spots marginal to vertebral rows; upper lateral surfaces (three to five scale rows) usually much darker brown, nearly uniform, or with scattered single or small groups of pale (whitish) scales, but never pale narrow line between ear and forelimb; upper labials dusky, at least on dorsal half; lower labials may or may not have dusky blotches; venter grayish slate, more dusky tan or ivory in limb regions.

COLOR (in life).—Dorsum grayish brown, usually with two rows of dark paravertebral spots; lateral surfaces blackish with scattered pale spots on lower flanks; some specimens suffused with red on upper and lower surfaces of snout.

COMPARISONS.—This species differs from species of the *E. physicae* group other than *E. pseudopallidiceps* by its smaller size and very weak keels, which are limited to posterior scales. It differs significantly from *E. pseudopallidiceps* in the number of fourth toe lamellae and dorsal scale rows (barely overlapping, Table 5).

REPRODUCTION.—Gravid females have two oviducal eggs. One hatchling measures 24.0 mm, SVL.

HABITAT.—Rain forest floor in areas shaded by the canopy. Specimens bask in sun-flecked areas. Ranges from the lowland, near sea level, to more than 1000 m elevation.

RANGE.—Eastern Highlands, Gulf, Chimbu, and Western provinces (the last at lower elevations to about 600 m), Papua New Guinea; the Digul River drainage in southern Irian Jaya. Two specimens from the Mimika River area in southern Irian Jaya are also tentatively referred to this species.

MATERIAL EXAMINED.—**Papua New Guinea:** Western Province: Emeti: MCZ 152287 (holotype), AMNH 111713–14, MCZ 142567–72, 152283–86, 152288, 152290; Menemsore: MCZ 131945–46, 152280; Kiunga: MCZ 152281–82; Derongo: AMNH 111712, MCZ 131938–39, 131942; Matkomrae: MCZ 131943–44. Gulf Province: Pio River area: MCZ 109601–03, 118871–72, AMNH 102233; Koni: CAS 117726–27, MCZ 109514, 109529, 109532; Uraru: MCZ 109572–75, 109577–78, CAS 117729–30, 117753–54; Oroi: MCZ 109833; Weiana: MCZ 109521–23. Chimbu Province: Dege: MCZ 90750; Bomai: MCZ 90478–501, So-

liabeda: MCZ 109509, 109589–96, 109598–99, CAS 117733–34; Karimui: CAS 117731, 117750, 118769–70, 118808, MCZ 97308–09, 99193–96, 109579–82, 109584–88; Haia: AMS R115406–10. Eastern Highlands Province: AMNH 98570a–b (all but CAS 117729–30 and AMS R115406–10 are paratypes). Two specimens, MCZ 112250 and BMNH 1913.10.31.164F, from the Mimika River in southern Irian Jaya are tentatively assigned to this species because they agree in scale characters and their small size. However, the keels appear slightly stronger and the population is far from the known range of the species. It may, when a larger sample is available, prove to represent a distinct species.

Emoia pseudopallidiceps n. sp.

HOLOTYPE.—CAS 127202, collected at Imigabip, at about 1400 m, upper Fly River drainage, Western Province, Papua New Guinea, by Fred Parker, 10 Dec. 1969.

PARATYPES.—**Papua New Guinea:** CAS 127203–12, MCZ 125423–29, AMNH 107216, 107218, same general locality as holotype; other localities in Western Province: Wangbin: MCZ 125446–51; Gialgibip: MCZ 125430–33; Gigabip: MCZ 141318–19; Western Highlands Province: Wapenamanda: CAS 110379; MCZ 109626–31; Wabag: MCZ 109536–39. Southern Highlands Province: Ialibu: AMNH 103426–36. West Sepik Province: Uraphrin: MCZ 125441–43; Tifalmin: AMNH 107219, MCZ 125444–45: **Irian Jaya:** Sibil and Bon valleys in the Digul River drainage, Basisk, Sibil: RMNH 21388–90, 21393–98, 21408–13, 21417–18, 21475–88, 22556; Sibil: RMNH 21421–24, 21493–552, 21444–74; Mabiliboel: RMNH 21426–43, CAS 156750–53; Betabib: RMNH 21214–15.

DIAGNOSIS.—Distinguished by the following combination of characters: four or five weak keels usually present on posterior scales of dorsum; SVL at maturity about 41–64 mm; midbody scale rows 32–37; dorsal scale rows 50–60; fourth toe lamellae 27–36; fifth (rarely sixth) upper labial enlarged and below eye; scattered pale (whitish) scales or pale slanted lines on flanks and short patches or slanted segments on neck.

DESCRIPTION OF HOLOTYPE.—Adult female; SVL 57.3 mm; midbody scale rows 32; dorsal scale rows 53; fourth toe lamellae 33.

DESCRIPTION.—SVL of 17 males 40.9–64.3 mm and of 17 females 40.9–62.3 mm; snout tapered, broadly rounded at tip, its length 45–49% of HB and 30–38% of HL; HB 67–81% of HL and 13–15% of SVL; eye 67–80% of snout length and 31–38% of HB; rostral forming relatively long, straight suture with frontonasal; supranasal triangular, usually in contact with anterior loreal or sometimes narrowly separated; prefrontals narrowly to moderately separated; one pair of nuchals; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; anterior loreal shorter and somewhat higher than posterior, in contact with first and second or only second upper labials; dorsal scales relatively smooth anteriorly, usually with four to six faint keels on posterior scales of body and base of tail; midbody scale rows 32–37 ($\bar{x}$ = 34.576; SD = 1.48; n = 33); dorsal scale rows 50–60 ($\bar{x}$ = 53.871; SD = 2.579; n = 31); preanals slightly enlarged; length of extended hindlimb 89–100% of axilla–groin distance and 44–50% of SVL; rounded lamellae under fourth toe 27–36, rarely less than 30 ($\bar{x}$ = 32.8; SD = 2.041; n = 35); under first toe 8–10.

COLOR (in preservative).—Dorsal ground color greenish brown to light brown with scattered darker brown spots, most numerous outside of paravertebral rows and usually occupying only one scale or part of scale, sometimes forming irregular, transverse rows; upper lateral surface (four to six scale rows) dark brown, marked by scattered whitish scales or small groups of scales at lower margin on both neck and flanks; dorsal margin bordered by row of pale scales from eye to forelimb region; upper arm marked by few scattered pale scales; upper and lower labials with distinct dark bars; venter grayish to slate, frequently exhibiting pattern of narrow, slate-colored crescents on each scale.

TABLE 6. Standard scale counts and measurements for species of the *Emoia cyanogaster* group. Scale counts for the holotype of *E. beccari* (MSNG 28063) are shown in parentheses.

Species	Adult SVL (mm)	n	Midbody scale rows	Scale rows parietals to tail	Fourth toe lamellae
*E. cyanogaster**	62.0–92.0	36	22–28	54–62	70–95
E. kordoana	42.3–60.8	21	24–28 (27)	48–56 (48)	63–82 (74)
E. longicauda	65.0–99.7	33	23–28	52–61	66–94
E. sorex	51.0–59.2	18	28–36	54–60	41–48
E. tetrataenia	54.9–63.5	6	26–28	47–56	68–78

* Number of midbody scale rows is rarely more than 26.

ETYMOLOGY.—Examples of this species were most often labeled as *pallidiceps*, hence the name *pseudopallidiceps*.

COMPARISONS.—*Emoia pseudopallidiceps* resembles *E. physicina*, *E. pallidiceps*, and *E. obscura* in size and general appearance, but differs from the last two primarily in the weak keels on some of the posterior dorsal scales and certain features of the color pattern. It also differs from *E. pallidiceps* in the higher number of midbody scale rows and the broader head relative to HL (see ratios in descriptions). It further differs from *E. obscura* in the shorter snout relative to HB. See description of *E. physicina* for comparison with that species.

REPRODUCTION.—Gravid females have two oviducal eggs.

HABITAT.—A forest species.

RANGE.—Higher elevations in Western Sepik, Southern, and Western Highlands provinces, and at about 600–1500 m in the Bon and Sibil valleys of the Digul drainage.

cyanogaster Group

DIAGNOSIS.—Body length at maturity 42–92 mm; snout long, strongly tapered, and moderately to strongly depressed; scales smooth; midbody scale rows 22–36 (above 28 only for *E. sorex*, Table 6); dorsal scale rows 48–62, scales of paravertebral rows somewhat enlarged, and lateral scales not much smaller than dorsals or ventrals; subdigital lamellae rounded (*E. sorex*), thinned for other species; fourth toe lamellae 41–95; interparietal distinct for three species but fused with frontoparietals for *E. kordoana* and *E. tetrataenia*; anterior loreal relatively long and narrow, almost as long as posterior and not or only slightly higher; nasal bones fused; parietal eye present; palate alpha type; dorsal ground color greenish or bluish gray to greenish tan, tan or light brown with various markings.

The group includes five species in the Moluccas, New Guinea, Bismarcks, Solomons, and Vanuatu.

KEY TO SPECIES OF THE *CYANOGASTER* GROUP

1a. Subdigital lamellae rounded, 41–48 below fourth toe; midbody scale rows 28–36; interparietal distinct; (Celebes, Halmahera, and nearby islands west of New Guinea) ..... *E. sorex*

1b. Subdigital lamellae thin, bladelike, more than 60 under fourth toe; midbody scale rows 22–28 2

2a. SVL at maturity about 42–61 mm; interparietal fused with frontoparietals 3
2b. SVL at maturity 62–99 mm; interparietal distinct 4
3a. Dorsal ground color grayish green to grayish tan with or without darker spots and flecks; sometimes a vague dorsolateral stripe; usually a narrow, broken, or continuous brown band on upper lateral surface between ear and hindlimb; (New Guinea, Bismarck, Admiralty, and Aru islands) ..... *E. kordoana*
3b. Dorsum marked by three narrow (two half-scale rows) blue or greenish-blue stripes, separated by dark brown to blackish stripes; (D'Entrecasteaux and Louisiade islands) ..... *E. tetrataenia*
4a. Dorsum bronze-green to brown marked with darker flecks and spots; generally a row of pale dashes along the dorsolateral line; upper lateral surface with a broad, dark brown to blackish band extending from eye to ear to about midpoint of flank; (New Hebrides, Solomons, and Bismarcks) ..... *E. cyanogaster*
4b. Dorsum grayish to grayish tan or brown, generally marked with scattered light and dark flecks; dark brown to blackish band on upper lateral surface absent or reduced to faint blotches; (New Guinea and some small surrounding islands, the Admiralties, and Cape York, Australia) ..... *E. longicauda*

Emoia cyanogaster (Lesson)

(Figure 2h)

Scincus cyanogaster Lesson, 1826: pl. 3, fig. 4; 1830:47 (type loc.: Oualan (=Kusaie Island?), locality in doubt; holotype in MNHM); Brygoo 1985:28.
Gongylus (Eumeces) cartereti Duméril and Bibron, 1839:651 (type loc.: New Ireland; holotype in MNHN); Duméril and Duméril 1851:157; Brygoo 1985:21.
Mabouia cartereti: Gray 1845:95.
Emoia cartereti: Girard 1858:263.
Mabouia cartereti: Günther 1877:128.
Lygosoma (Emoia) cyanogaster: (part) Boulenger 1887a:292, 1888b:90; Ogilby 1890a:5; (part) 1900:65; Vogt 1912b:356; (part) De Rooij 1915:248; Angel 1935: 55; Baker 1928:297; (part) Loveridge 1948:366.
Emoia cyanogaster: (part) Barbour 1912:94, 1921:102; (part) Burt and Burt 1932: 579; Hediger 1934:466; Mertens 1934:39; (part) Smith 1937:227; Mittleman 1952:23; Brown 1953:264, 1956:1487; Medway and Marshall 1975:440; (part) Scott, Parker, and Menzies 1977:11; Pernetta and Watling 1979:236; McCoy 1980:34; Brown 1983:321.
Lygosoma c. cyanogaster: Sternfeld 1920:404.
Emoia cyanogastra: Schmidt 1932:186.

This is one of three species illustrated by Lesson in 1826 (see discussion under *E. atrocostata*). Lesson (1830) stated that the type of *E. cyanogaster* was from Oualan (=Kusaei) Island in the Carolines. However, limited field work at later periods of the 19th century and more extensive field work during this century in various islands of the Carolines and Marshalls have failed to verify the presence of populations of the species in the Micronesian islands or on islands east of the Solomons and Vanuatu in Polynesia. I, therefore, regard the type locality, "Oualan," as in error. The description by Lesson (1830) and the beautiful color illustration (1826: pl. 3, fig. 4) are in agreement with populations of this species in the Vanuatu, Solomons, and Bismarcks. The COQUILLE, the ship on which Lesson was naturalist, stopped at Buka in the Solomons and New Ireland in 1823. One of these is probably the type locality.

Published records from islands to the east of the Solomons are based on examples of other species. *Emoia cyanogaster tongana* (Werner, 1899), judging from brief description, is based on examples of *E. concolor* and *E. trossula*. Boettger (1893) referred a specimen from the Fiji Islands to *E. cyanogaster*. It was also probably an example of *E. concolor*. SMF 15318 is labeled as from Fiji Islands, but this locality must also be regarded as doubtful.

The existing, unique specimen of this species from the voyage of the COQUILLE (MNHN 2909) may not actually be the same one shown in the figure published in 1826. However, since it is the only extant example of those possibly seen by Bevalet, Coutant, and Lesson, and it may be the one figured, I follow Guibé (1954) in recognizing MNHM 2909 as the holotype.

DESCRIPTION.—SVL 62.0–92.0 mm for 21 mature males and 67.9–90.5 for 13 mature females; snout strongly tapered and round-pointed, its length 40–44% of HL and 68–80% of HB; HB 54–61% of HL and 13–15% of SVL; eye 60–79% of snout length and 43–56% of HB; rostral forming relatively short, nearly straight suture with frontonasal; supranasals triangular, usually not in contact with anterior loreal; prefrontals rather narrowly separated to narrowly in contact; interparietal small to moderate; one pair of nuchals; anterior loreal about as high as, and slightly shorter, to about as long as posterior loreal, in contact with first, first and second, second and third, or only second upper labials, usually seven upper labials, sixth (rarely fifth) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 22–28, rarely more than 26 ($\bar{x}$ = 24.793; SD = 1.048; n = 29); dorsal scale rows 54–62 ($\bar{x}$ = 57.774; SD = 1.892; n = 31); length of extended hindlimb 94–106% of axilla–groin distance and 45–51% of SVL; lamellae under fourth toe 70–95 ($\bar{x}$ = 85.148; SD = 4.873; n = 27); under first toe 20–24.

COLOR (in preservative).—Dorsal ground color grayish green or tan to bluish gray, usually with some scattered brown spots or short, narrow, longitudinal lines; upper lateral surface marked by wide blackish to brown band extending from eye region along neck and anterior part of body, becoming series of scattered lines, spots, or disappearing entirely on posterior part of body, anteriorly may be marked by some small yellowish or whitish blemishes; upper border of band usually marked by row of widely separated whitish scales; venter blue to grayish blue.

COMPARISONS.—See description of *E. longicauda*.

REPRODUCTION.—Females produce a clutch of two eggs. McCoy (1980) stated that eggs are deposited in loose soil, ground litter, or rotting vegetation.

HABITAT.—Medway (1975) reports this species from seral and climax forests to at least 500 m in Vanuatu, but absent from a forest site at 1100 m. It is also found in gardens and other areas with scattered trees. It is primarily arboreal, but forages on the ground as well as in trees.

RANGE.—Bismarcks, Solomons, Vanuatu, occupying most small and large islands.

MATERIAL EXAMINED.—MNHN 2909, holotype (as noted above this specimen is possibly from New Ireland, since MNHN 2908 is from that locality, but almost certainly not from Oualan [=Kusaei]) in the Carolines. **Bismark Islands:** New Ireland: MNHN 2908 (type of *E. cartereti*); New Britain: BPBM 2388, ZMUC R47632, BMNH 98.3.3.13, MCZ 4712, AMNH 82372, AMS R31230. Duke of York I.: BMNH 77.2.24.44; **Solomon Islands:** Bougainville I.: AMS R11418, 11476–77, QM J7167–70, J13948, SAMA R5245, R8091, R8093, R8214, R8225, AMNH 42014–15, 87231, 101180, CAS 108894–99, 108970–73, 108955–56, 108977, MCZ 64200, 64259, 65551, 65558, 65559, 65568, 65864, 65905–06, 67765–67, 72272–86, 73798–99, 75940–44, 76816–21, 77669–76, 88036–47, 89607–14, 91465, 93839–46, 93851, 93853–54, 93858–59, 93861–63, 93866–71,

93874–78, 93880; Buka I.: MCZ 67674; Fauro I.: MCZ 6215 (3 specimens), AMNH 40321; Mono I.: AMNH 40344, 41887; Shortland Is.: MCZ 89177, 89228–29, 90424–25, 98900; AMNH 41839; Treasury I.: BMNH 84.3.24.60; Santa Anna I.: AMS R42088–89, MCZ 15147, CAS 72207; Anuda I.: CAS 72260–61; Velavela I.: BMNH 1937.2.2.57; Gila I.: BMNH 89.3.29.7; Gononga I.: BMNH 1937.2.2.58–59; Isabel I.: AMS R8804, R8653–54, MCZ 14577; Kolombongara I.; BMNH 1936.2.1.12; New Georgia I.: MCZ 112555–65, 112577, BPBM 5866–67; Guadalcanal I.: MCZ 112574; Malaita I.: MCZ 112535–42, 112551–54, 112571–73, 112576, AMS R87406, R10400, CAS 72072–75; Ugi I.: AMS R17012–14, CAS 72251, MCZ 15148–49; San Cristoval I.: CAS 54714–15, 72209–13, MCZ 15103–41, 15146, AMNH 40416; Nggela I.: AMS R91057–59. **Santa Cruz Islands:** BMNH 1933.11.20.2–4, 1956.1.4.48–51, CAS 72272–74, AMNH 42084–85, 42770, SAMA R7469, AMS R9047–48, R9050, R9065–66. **Banks Islands:** AMNH 817272. **Vanuatu:** MNHN 94.223–24; Mako I.: MCZ 19601; Raga I.: BMNH 1925.3.5.92; Efate I.: BMNH 1925.3.5.93; Gaua I.: BMNH 1925.3.5.89–91; Malekula I.: BMNH 1929.12.16.11, 1934.12.8.27, 1973.1640–49, FMNH 13663, AMNH 40168; Makuna I.: AMNH 40546–47; Aoba I.: AMNH 42089–90; Aurora I.: AMNH 42195; Santa Espiritu I.: BMNH 1924.5.25.28; Elephant I.: FMNH 13690.

Emoia kordoana (Meyer)

(Figure 16)

Euprepes (*Mabuya*) *kordoanus* Meyer, Feb. 1874:133 (type loc.: Kordo, Mysore Island, West Irian; holotype destroyed during World War II, fide Obst 1977).

Euprepes beccari Doria, Nov. 1874:338 (type loc.: Wokan, Aru Islands; holotype in MCSN).

Lygosoma cyanurum: (part) Boulenger 1887a:290; Schuz 1929:8.

Lygosoma iridescens Boulenger, 1897a:9 (type loc.: Mt. Victoria, Papua New Guinea; holotype in BMNH), 1898:701, 1914:259; Vogt 1912b:356; (part) de Rooij 1915:252; (part?) Kopstein 1926:91; Kinghorn 1928b:292; De Jong 1930b: 406; Vogt 1932:292; Brongersma 1942:155.

Emoia beccari: Hediger 1934:466; Scott, Parker, and Menzies 1977:11.

Emoia iridescens: M. A. Smith 1937:227; Mittleman 1952:25.

Emoia cyanogaster: (part) Loveridge 1948:366; Tanner 1951:7.

Emoia kordoana: Mittleman 1952:25; Brown 1953:266; Greer 1970:121; Room 1974:442.

The original description of *E. kordoana* is brief and provides no scale counts. Schuz (1929:8), after reexamining the type, followed Boulenger (1897a) in synonymizing the species with *Lygosoma cyanura,* but with some reservations. Brown (1953) noted that *E. kordoana* differs sharply from *E. cyanura* in having a more depressed snout, a longer and lower anterior loreal, and a different color pattern. This combination of characters along with the fused nasal bones places *E. kordoana* in the *cyanogaster* group.

Doria (1874) described *Emoia beccari* from the Aru Islands. It agrees closely with *E. kordoana,* as confirmed by Dr. Richard G. Zweifel (AMNH, pers. comm.), who reexamined the type. Since the number of specimens from any locality other than some in New Guinea is small, and differences in color and other characters are not great, the possibility that the population in the Arus may be a good subspecies cannot be determined at this time. I therefore treat *E. beccari* as a synonym of *E. kordoana.* Although *E. kordoana* does occur in the Bismarck Islands, specimens referred to *E. kordoana* from that locality by Sternfeld (1920) and from the Moluccas by Kopstein (1926) are examples of *E. caeruleocauda.*

DESCRIPTION.—SVL 43.9–60.8 mm for 18 males and 42.3–54.2 for 15 females; snout strongly tapered and round pointed, its length 62–76% of HL and 38–43% of HB; HB 57–63% of HL and 13–16% of SVL; eye 60–73% of snout length and 40–49% of HB; rostral broadly rounded dorsally; supranasals narrow, triangular, usually not in contact with anterior loreal; prefrontals moderately to narrowly separated (barely in contact for one specimen); frontoparietals and interparietal fused into single shield (small interparietal rarely present); one pair of distinct nuchals followed by three to five pairs of scales that are somewhat enlarged; anterior loreal narrow, not distinctly higher than, but as long as or only slightly shorter than, posterior loreal, in contact with first and second, second and third, or first, second and third upper labials; six to eight upper labials, sixth (rarely fifth or seventh) enlarged and below eye; seven or eight lower labials; dorsal scales smooth; midbody scale rows 24–28 ($\bar{x}$ = 26.207; SD = 1.236; n = 29); dorsal scale rows 48–56 ($\bar{x}$ = 53.387; SD = 2.108; n = 31); preanals only slightly enlarged; length of extended hindlimb 84–99% of axilla–groin distance and 44–50% of SVL; bladelike lamellae under fourth toe 63–82 ($\bar{x}$ = 71.7; SD = 5.522; n = 30); under first toe 19–25.

COLOR (in preservative).—Dorsal ground color grayish olive-green, grayish tan, or light brown with lateral margins of scales darker brown or with dark brown spots in two or more rows; narrow, broken, or continuous brown to dark brown band along upper lateral surface from eye region to hindlimb, sometimes bordered dorsally by pale dorsolateral line; lower lateral surfaces and venter bluish white to tan, usually lighter on venter.

COMPARISONS.—*Emoia kordoana* differs from *E. sorex* in the thinner and more numerous lamellae (Table 6) and from *E. tetrataenia* in color pattern and more dorsal scale rows (t = 2.301; df = 35; P = 0.027). *Emoia kordoana* is smaller than *E. cyanogaster* or *E. longicauda* (Table 6), and the interparietal is usually fused with the frontoparietals.

REPRODUCTION.—Several gravid females have two oviducal eggs.

HABITAT.—Fred Parker (pers. comm.) stated that *E. kordoana* is an arboreal and rarely seen species.

RANGE.—New Guinea, some small, surrounding islands, Moluccas, Bismarcks, and Admiralties.

MATERIAL EXAMINED.—**New Guinea:** RMNH 7266; **Irian Jaya:** CAS 64244, FMNH 43174; Sorong: MCZ 7689; Toem: RMNH 8859, MCZ 49217; Stikwa River: BMNH 1913.11.1.80; Mimika River: BMNH 1913. 10.31.149–153; Fak Fak: BMNH 1908.6.30.5–6; Cyclops Mts.: BMNH 1938.6.8.61; Dobo: RMNH 5086; Assike: RMNH 5085, 7062; Jobi I.: MCZ 7683, 7688. Aru Islands: MSNG 28063 (type of *E. beccari,* examined by Dr. Zweifel), RMNH 5086. **Papua New Guinea:** West Sepik Province: AMNH 100266, 99577; Aitape: MCZ 48603a–b. Madang Province: AMNH 105300; Sek Harbor: AMS R31425; Singorakai: AMS R69800. Morobe Province: Lae: AMS R60449, 60452–53. Northern Province: Cape Endiadere: UPS 4311, 4327, CAS-SU 11617; Mt. Lamington: AMS R9354a–b; Kubuna: AMNH 59172; Popondetta: MCZ 140947–49, 153826. Milne Bay Province: Cape Vogel: AMNH 74236, 73321; Fife Bay: AMS R8565. Central Province: Mt. Victoria: BMNH 1946.8.6.95 (type of *Emoia iridescens*); Daviumbu: AMNH 58655; Kuniva River area: MCZ 145992–93; Brown River area: MCZ 152907. Gulf Province: Uraru: MCZ 104604–12, 104613–15; Kikori River area: MCZ 150852, 152023. Chimbu Province: Wahgi: AMS R14767. Southern Highlands Province: Mt Bosari: NMV 49978. Western Province: AMNH 103960, 111708–10; Emiti: AMS R64318–19, MCZ 135567, 141090–141114; Balimo: MCZ 123682; Makomerae: MCZ 123979; Loubip: MCZ 124347; Olsobip: MCZ 124348: Fengkim: MCZ 125421; Derongo: MCZ 125417–20, CAS 127196, 127200–201. **Admiralty Islands:** Pak Is.: MCZ 152906; Manus Is.: ZMUC R47719–20; Los Negros Is.: AMS R97553–59. **Bismarck Islands:** New Britain: BPBM 2298, AMS R12865; Talasea: SAMA R6910; Kandrian: SAMA R8600, A8608.

Emoia longicauda (Macleay)

(Figure 17)

Euprepes longicaudis Macleay, 1877:68 (type loc.: Darnley Island in Torres Strait; lectotype in AMS).

Euprepes simillimus Macleay, 1877:69 (type loc.: Katow [=Mawatta], Papua New Guinea; holotype in AMS).

Lygosoma nigrum: (part) Boulenger 1887a:297.

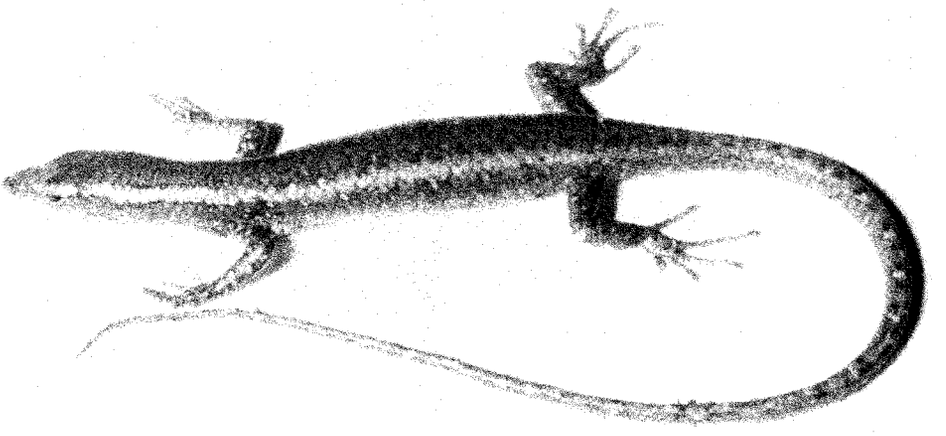

FIGURE 16. *Emoia kordoana,* showing vague, small, pale and dark markings, Papua New Guinea. Photo courtesy of F. Parker.

Lygosoma cyanogaster: (part) Boulenger 1887a:292, 1898:701, 1914:259; (part) De Rooij 1915:248; Brongersma 1931b:25; Vogt 1932:291; (part) Hediger 1934: 34; Tanner 1951:7.

Emoa cuneiceps de Vis, 1890:498 (type loc.: St. Joseph River area, Central District, Papua New Guinea; holotype lost).

Emoia cyanogaster: Barbour 1912:94; (part) Smith 1937:227; Loveridge 1948: 366; Room 1974:442; Cogger 1975:291, 1979:193; (part) Scott, Parker, and Menzies 1977:11; Brown 1983:231.

Lygosoma cyanogaster keiensis Sternfeld, 1920:305 (type loc.: Langgur, Kei Is.; holotype in SMF).

Lygosoma cyanogaster aruensis Sternfeld, 1920:305 (type loc.: Papakula, Aru Is.; holotype in SMF).

Emoia cyanogaster longicauda: Brown 1953:274; Zweifel 1980:416; Ingram 1979: 432.

Emoia longicauda: Cogger, Cameron, and Cogger 1983:162.

Boulenger (1887a) placed *Euprepes simillimus* in the synonymy of *Lygosoma cyanogaster,* and put *Euprepes longicaudis* with a question mark in the synonymy of *Lygosoma nigrum.* He referred one specimen from the Fly River in Papua New Guinea to *L. cyanogaster,* but no specimens of *L. nigrum* were listed from either the islands in Torres Strait or from New Guinea.

De Vis (1890) described *Emoa cuneiceps* from Central Province, Papua New Guinea. His description fits examples of *E. longicauda* except for the number of midbody scale rows, which he gave as 33–36. The type of *E. cuneiceps* has been lost, and extensive collecting in Central Province, Papua, has failed to confirm the presence of a population with the reported scale count of *E. cuneiceps.* I regard the scale count published by de Vis as a probable error, as did Loveridge (1948), and treat *E. cuneiceps* as a synonym of *E. longicauda.*

Barbour (1921) noted that Papuan populations referred to *E. cyanogaster* differ in some characters from populations in the Solomons and Vanuatu. Brown (1953), in reviving the name *longicauda* for the New Guinea populations, treated it as a subspecies of *E. cyanogaster.* In this treatment he was followed by Ingram (1979) and Zweifel (1980). Ingram also designated AMS R31859 as the lectotype of *E. cyanogaster longicauda.* Cogger (1979) regarded *E. longicauda* and *E. simillimus* as synonyms of *E. cyanogaster.* Later, Cogger, Cameron, and Cogger (1983) listed *E. longicauda* as a distinct species but did not discuss their reasons for doing so. I follow their view that *E. longicauda* should be treated as a species distinct from *E. cyanogaster* and that *simillimus* is a synonym of *longicaudis.*

The populations in the Aru and Kei islands west of New Guinea, described as races of *E. cyanogaster* by Sternfeld (1920), are more closely related to *E. longicauda.* Pending the availability of larger samples from these populations, I have tentatively placed *E. c. keinensis* and *E. c. aruensis* in the synonymy of *E. longicauda.* A unique specimen listed from the Malaya Peninsula (BMNH 1928.5.11.8) and labeled as *E. cyanogaster* clearly fits *E. longicauda.* Because it is the only example recorded from an area west of the Moluccas, the locality is in doubt.

DESCRIPTION.—SVL 70.0–99.0 for 15 males and 65.0–99.7 for 15 females; snout strongly tapered, round-pointed, its length 32–41% of HL and 59–69% of HB; HB 52–67% of HL and 13–17% of SVL; eye 52–75% of snout length and 29–48% of HB; rostral forming short to moderate, nearly straight suture with frontonasal; supranasals triangular, not in contact with anterior loreal; profrontals moderately to narrowly separated; interparietal distinct, small to moderate; one pair of nuchals; anterior loreal about as high as, and slightly shorter than to as long as posterior loreal, in contact with first and second, second and third, or first, second, and third labials; six to eight upper labials, sixth (rarely fifth or seventh) enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 23–28, usually 26 ($\bar{x}$ = 26.324; SD = 1.082; n = 37); dorsal scale rows 52–61 ($\bar{x}$ = 55.657; SD = 1.83; n = 35); preanals not or only slightly enlarged, length of extended hindlimb 84–115% of axilla–groin distance and 45–57% of SVL; bladelike lamellae under fourth toe 66–94 ($\bar{x}$ = 77.567; SD = 5.703; n = 30); under first toe 19–24.

COLOR (in preservative).—Dorsal ground color grayish, greenish tan, or brownish, occasionally nearly uniform but usually

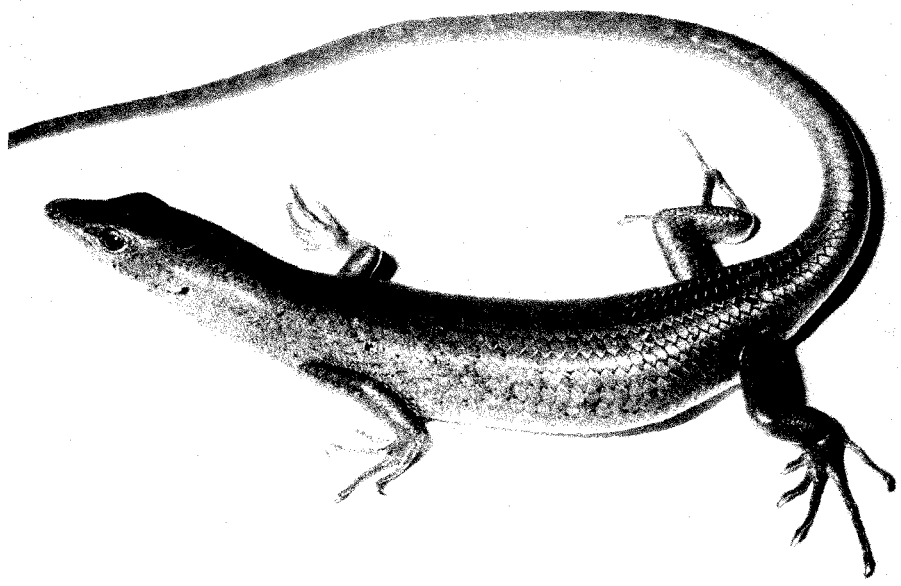

FIGURE 17. *Emoia longicauda,* showing absence of the dark lateral band, Papua New Guinea. Photo courtesy of H. W. Parker.

with dark brown flecks and small spots and usually some pale, almost whitish scales that often give the appearance of irregular transverse rows across the lateral surfaces; sides of neck, posterior head region, and upper labials marked by scattered dark brown flecks and small spots; venter pale blue to bluish gray, more whitish to ivory in limb regions, and sometimes under head and/or neck.

COMPARISONS.—*Emoia longicauda* differs from *E. cyanogaster,* with which it was long confused, in color pattern, the slightly larger size (Table 6), the shorter snout relative to HB (see ratios in descriptions) and a significant difference in means for the three basic scale counts: for midbody scale rows ($t = 5.786$; df = 64; $P < 0.001$); for dorsal scale rows ($t = 4.616$; df = 64; $P < 0.001$); and for fourth toe lamellae ($t = 5.365$; df = 55; $P < 0.001$).

REPRODUCTION.—Gravid females have two oviducal eggs. Two hatchlings from Garaina area, Morobe Province, Papua New Guinea measured 36.2 and 37.4 mm SVL.

HABITAT.—Fred Parker (pers. comm.) stated that in Papua New Guinea this species ranges from sea level to about 1500 m, occurring in habitats from plantations and gardens to wet scrubland and in both secondary and original forest.

RANGE.—New Guinea, some islands immediately to the west, the islands of Torres Strait, Cape York Peninsula in Queensland, Australia, Admiralty Islands and Mussau Island, north of New Ireland.

MATERIAL EXAMINED.—**Torres Strait Islands:** Darnley I.: AMS R31859 (lectotype, Ingram 1979:432), AMS R31856–58, R31860 (paratypes), R42621, R44930; Murray I.: AMS R42563, R42744–45, R42647, R52571–72, R42643, R42489–90, R42554, R44260–67, R44927–29, R45970, R52557, R52649, MCZ 9470; Hammond I.: AMS R44269–71; Duke of Wales I.: MCZ 45505; Soiboi I.: AMS R48351–52. **Australia:** Cape York: AMS R56171, R59061–62. Islands southeast of Papua New Guinea: Fergusson I.: BMNH 95.4.26.32–34. Woodlark I.: BMNH 96.7.8.3. Rossel I.: BMNH 99.4.25.16, AMNH 89363–64. **Papua New Guinea:** Milne Bay Province: S.E. Cape: AMNH 20928; Cape Vogel: AMNH 74037. Northern Province: Sasembata: MCZ 140671; Girua: MCZ 140971; Kokoda: BMNH 1935.5.10.30–41; Popondetta: MCZ 137263. Morobe Province: Garaina: MCZ 140780–82; Maliai: SAMA R8215; Gusiko: AMNH 66678; Busu River; BMNH 1980:479. Madang Province: Karkar I.: AMS R24880, R25020, R25674. Central Province: Katow: AMS R31853–55 (syntypes of *E. simillimus*); Tarana: AMNH 58402. Gulf Province: Uraru: SAMA R11006, MCZ 103340–43; Kikori River: MCZ 150851; Daru I.: MCZ 124498, 126403, 140742, 141014, 141293, 141300. Chimbu Province: Karimui: SAMA R8304, R8358, R8367, AMNH 98934–54, 101118–27, 101215–16, CAS 109108–90, 117661–96, 118045–69, MCZ 83465–83, 93882–932, 103266–334; Elmagale: AMNH 98548, MCZ 88580–84, 88589; Bomai: MCZ 88585–88, 88592–614, AMNH 98927–33, 98550–52; Soleobeda: CAS 117744–45, MCZ 103344–54. Eastern Highlands Province: Nondiri: AMNH 98549, MCZ 88590–91. Western Province: Fly River area, BMNH 1980.482; Lake Murray area: BMNH 1980.480, MCZ 123687, 126402; Derongo: MCZ 124489, 126398–99, CAS 127189–95; Emeti: MCZ 140640–70, 135564; Kawok: UPNG 6708; Kavorabip: MCZ 140777–78, 141636; Megalsimbip: MCZ 127422–25, 142314–17, 142308–13, SAMA R11639–40; Kiunga: MCZ 1416363, 124490–92, 137679–81; Imigabip: MCZ 124499, 126421; Loubip: MCZ 126420; Matkomrae: MCZ 126419; Mawatta (Katow of Macleay): MCZ 141364, 141635; Menemsorae: MCZ 126418; Oriomo River area: MCZ 126417, 135539–40, 135483–84; Olsobip: MCZ 12450–1–03; Sigabaduru: MCZ 136071–72; Silimabip: SAMA R6282; Tengkim: MCZ 124500; Tikam: MCZ 126401; Wimpim: SAMA R11410, MCZ 123686, 124493–96, 124497, 136096. **Irian Jaya:** Doromena: FMNH 43181–82; Hollandia: AMNH 61958–59, BMNH 1938.6.8.34; Stakwa River: BMNH 1913.11.1.74–79; Sibil Valley: BPBM 2493; Mimika River: BMNH 1913.10.31.147–48. Aru Islands: SMF 15336–39 (type and paratypes of *E. c. aruensis*). Kei Islands: RMNH 7362, CAS 127020, 127025, 127189–95, SMF 15334–35 (type and paratypes of *E. c. keinensis*). A unique specimen (BMNH 1928.5.11.8) is recorded from Paulan Senong in Malaya near Singapore. This locality must be regarded as a probable error.

Emoia sorex (Boettger)

Lygosoma sorex Boettger, 1895:118 (type loc.: Halmahera Island; holotype in SMF), de Rooij 1915:249.

Emoia sorex: Barbour 1912:95; Smith 1937:227; Brongersma 1942:155, 1948: 491; Tanner 1950:24; Mittleman 1952:30; Brown 1954:264; Greer 1970:171.

Emoia sorex is realted to the *E. cyanogaster* group in general appearance, the fused nasal bones, presence of a parietal eye, and scale-count characters other than the subdigital lamellae. The number of fourth toe lamellae is low (41–48) as compared to 63–94 for other species. *E. sorex* is about the same size as *E. kordoana* and *E. tetrataenia.*

Sternfeld (1920) referred a single specimen from Fais Atoll, western Carolines to *E. sorex*. That specimen, in general habitus and scale counts, is in agreement with examples of the *E. caeruleocauda* complex from the Carolines. The relatively uniform light color is rather unusual but certainly approached by other uniformly colored examples from the Bismarcks and elsewhere. I regard it as an aberrant example of *E. caeruleocauda*.

DESCRIPTION.—SVL of 10 mature adults 51.0–59.2 mm; snout tapering, strongly depressed, round pointed, its length 41–44% of HL and 68–77% of HB; HB 56–63% of HL and 15–18% of SVL; eye 53–62% of snout length and 38–43% of HB; rostral straight edged posteriorly; supranasals long, narrow, in contact with the anterior loreal; prefrontals separate or in contact; interparietal rather small or fused with frontoparietals; one pair of nuchals; anterior loreal much longer than high and nearly as long as posterior loreal; seven upper labials; sixth enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 28–36, rarely more than 34 ($\bar{x}$ = 31.286; SD = 1.496; n = 7); dorsal scale rows 54–60 ($\bar{x}$ = 57.143; SD = 1.864; n = 7); length of extended hindlimb 106–118% of axilla–groin distance and 47–54% of SVL; rounded lamellae under fourth toe 41–48 ($\bar{x}$ = 43.0; SD = 1.915; n = 7); under first toe 9–13.

COLOR (in preservative).—Dorsal and upper lateral surfaces faintly grayish or bluish olive-green, nearly uniform or with few to numerous, scattered, small, brownish spots; occasionally dorsum marked with scattered bluish-white scales; venter ivory with some bluish-white blemishes.

COMPARISONS.—*Emoia sorex* differs from other species of the *cyanogaster* group primarily in the much less thinned and less numerous subdigital lamellae (Table 6).

RANGE.—Halmahera, Celebes, Obi, Moluccas, and Moratai islands.

MATERIAL EXAMINED.—**Celebes Island:** MZB 367, 662. **Molucca Islands:** Halmahera I.: SMF 15340 (holotype), SMF 15341–44, BMNH 1946.8.11.8–11 (paratypes, same locality as holotype), MCZ 7690–91, RMNH 5467a–b; Obi I.: MCZ 7705a–b; Moratai I.: BYU 7328, 7728–29, 7360, 7362, FMNH 42336, RMNH 7272; Ternate I.: RMNH 4870. **Batanta Island:** RMNH 7356a–b.

Emoia tetrataenia (Boulenger)

Lygosoma tetrataenia Boulenger, 1895b: 30 (type loc.: Fergusson Island, D'Entrecasteaux Group; syntypes in BMNH); de Rooij 1915:250.
Emoia tetrataenia: Smith 1937:227; Mittleman 1952:31; Brown 1954:264; Scott, Parker, and Menzies 1977:11.

This species is close to *E. kordoana* in most characters other than the color pattern.

LECTOTYPE (new designation).—BMNH 1946.8.10.96 (from the type series), an adult female, collected on Fergusson Island, D'Entrecasteau Islands off eastern New Guinea in 1895.

DESCRIPTION OF LECTOTYPE.—An adult female, SVL 60.5 mm; midbody scale rows 27; dorsal scale rows 48; thinned lamellae beneath fourth toe 69.

DESCRIPTION.—SVL of four mature specimens 54.9–63.5 mm; snout long, tapering, strongly depressed, round pointed, its length 40–45% of HL and 66–69% of HB; HB 59–67% of HL and 14–17% of SVL; eye 58–63% of snout length and 39–43% of HB; rostral broadly rounded or nearly truncate at its dorsal edge; supranasals elongate, in contact with the anterior loreal; prefrontals separated; frontoparietals and interparietal fused into one shield; one pair of nuchals; anterior loreal much longer than high, about as long as posterior, in contact with first, first and second, or second and third labials; seven upper labials, sixth enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 26–28 ($\bar{x}$ = 27.333; SD = 0.816; n = 6); dorsal scale rows 47–56 ($\bar{x}$ = 51.0; SD = 3.347; n = 6); length of extended hindlimb 90–96% of axilla–groin distance and 44–47% of SVL; lamellae under fourth toe 69–78 ($\bar{x}$ = 72.5; SD = 3.391; n = 6).

COLOR (in preservative).—Dorsum marked by three longitudinal blue or greenish-blue stripes (about two half-scale rows in width) separated by pair of dark brown or blackish stripes of equal breadth; outer blue stripes bordered by similar brown band, more or less continuous, narrow and broken or marginally interrupted; dorsal surface of head bluish; tail tan or bluish tan, merging with all three dorsal light stripes (as in *E. cyanura*); venter bluish or grayish white.

COMPARISONS.—See description of *E. kordoana*.

RANGE.—Fergusson and Rossel islands in the D'Entrecasteaux and Louisiade groups.

MATERIAL EXAMINED.—Fergusson I., D'Entrecasteaux Islands: BMNH 1946.8.10.95–98 (syntypes); Rossel I., Louisiade Archipelago: AMNH 76740, BMNH 99.3.25.17.

TABLE 7. Standard scale counts and measurements for species of the *Emoia samoensis* group.

Species	Adult SVL (mm)	n	Midbody scale rows	Scale rows parietals to tail	Fourth toe lamellae
E. aneityumensis	71.0–95.5	8	40–42	72–79	36–42
E. campbelli	68.9–97.8	10	30–36	56–64	44–56
E. concolor	52.3–88.9	66	28–34	54–66	44–65
E. erronan	66.0–75.0	7	36–38	77–84	47–53
E. flavigularis	58.9–75.5	22	34–40	53–64	36–48
E. loyaltiensis	60.0–83.2	5	30–34	62–71	51–60
E. murphyi	52.2–74.9	21	26–32	51–58	60–81
E. nigra	85.0–121.0	35	33–40	61–72	32–39
E. nigromarginata	51.8–77.4	26	28–32	56–64	38–48
E. parkeri	45.5–53.8	22	28–34	52–60	34–40
E. samoensis	78.0–118.0	24	30–34	58–68	45–54
E. sanfordi	68.3–115.0	36	28–34	56–64	61–76
E. trossula (Fiji)	66.5–102.0	34	32–40	61–76	43–54
E. trossula (Rotuma I.)	58.1–85.0	29	33–38	65–74	51–65*
E. trossula (Tonga and Cook Is.)	74.9–108.5	21	32–36	61–70	46–55

* Rarely greater than 58.

samoensis Group

DIAGNOSIS.—SVL at maturity 45–122 mm (only one species less than 52 mm); snout tapered and slightly to moderately depressed; scales smooth; midbody scale rows 26–42; dorsal scale rows 51–84; subdigital lamellae rounded to moderately thinned, fourth toe lamellae 32–81; frontoparietals fused; interparietal nearly always distinct, ranging from long and narrow to small; nasal bones separate; parietal eye present; palate alpha type; dorsal ground color for most species greenish or greenish tan, others light to dark brown, usually with darker markings on dorsal and upper lateral surfaces and sometimes pale spots or dashes (Fig. 2f–h).

Eleven of the 13 species are limited to Vanuatu, Fiji, Tonga, and Samoa. One is endemic to the Solomons and one occurs throughout most of Melanesia. This group includes two subgroups of apparently related species and three whose affinities with others in the group are not obvious.

KEY TO THE SPECIES OF THE *SAMOENSIS* GROUP

1a. Fourth toe lamellae 60–81 2
1b. *Fourth toe lamellae 34–65 (more than 60 only for a few populations of E. concolor)* 3
2a. Scale rows between parietals and base of tail 56–64; SVL at maturity 68–115 mm for 15 specimens; color pattern on dorsum nearly uniform greenish, olivaceous, or brownish, marked by few or many small to large dark spots; head frequently marked by a large brownish patch; (Vanuatu) ..... *E. sanfordi*
2b. Scale rows between parietals and base of tail 51–58 (rarely more than 56, Table 7); SVL at maturity 52–75 mm; color of dorsum dull grayish, darker posteriorly with a few vague dark and light spots, especially dorsolaterally; (Samoa and Tonga) ..... *E. murphyi*
3a. Dorsal scale rows between parietals and base of tail 72–84 4
3b. Dorsal scale rows between parietals and base of tail 52–72 5
4a. Fourth toe lamellae 36–42; midbody scale rows 40–42 ..... *E. aneityumensis*
4b. Fourth toe lamellae 47–53; midbody scale rows 36–38 ..... *E. erronan*
5a. Interparietal fused with frontoparietals; prefrontals usually in contact; dorsal color brown with scattered dark or vague transverse lines posteriorly; lateral surfaces slightly darker; undersurface of head and neck yellow; (Solomon Islands) ..... *E. flavigularis*
5b. Interparietal distinct (rarely fused or partly fused with frontoparietals) 6
6a. Interparietal short, about as broad as long; prefrontals moderately to narrowly separated; ground color of dorsum and upper surfaces dark brown to blackish, nearly uniform or sometimes with scattered light flecks laterally, juveniles may be golden-brown dorsally and dark brown laterally; (islands of southern Pacific basin as far west as Vanuatu and Solomon Islands) ..... *E. nigra*
6b. Interparietal long, longer than broad; prefrontals narrowly separated to broadly in contact; ground color of dorsum not brown to blackish 7
7a. SVL at maturity 45–54 mm; number of lamellae under fourth toe 34–40; color pattern marked by a golden-bronze head, a greenish-bronze vertebral stripe about two scale rows in breadth; (Fiji) ..... *E. parkeri*
7b. SVL at maturity 52–118 mm; number of lamellae under fourth toe 38–65 (less than 44 for only one species, *E. nigromarginata*) 8
8a. Midbody scale rows 28–36 (more than 34 only for some examples of *E. campbelli*) 9
8b. Midbody scale rows 32–40 (rarely less than 34); color feature of dorsum usually brownish marked by a few to numerous whitish dashes; (Fiji, Rotuma, Cook Islands, and Tonga) ..... *E. trossula*
9a. Number of lamellae under fourth toe 44–65 (rarely less than 46) 10
9b. Number of lamellae under fourth toe 38–48 (rarely more than 46); color pattern: dorsum greenish or grayish, nearly uniform or with dark flecks or spots; blackish lateral bands or series of dark spots on the upper lateral surface; (Vanuatu) ..... *E. nigromarginata*
10a. Dorsal scale rows between parietals and base of tail 62–71 (rarely less than 64); SVL at maturity 60–73; color (in preservative) of dorsum tannish green, of upper lateral surfaces darker grayish tan, marked by some darker blotches; (Loyalty Islands) ..... *E. loyaltiensis*
10b. Dorsal scale rows between parietals and base of tail 54–68 (only above 64 for some *E. samoensis*, in which case size at maturity is 78–118 mm) 11
11a. Color pattern: dorsum relatively uniform greenish tan with a few to numerous brown to blackish spots, occasionally a series of narrow, pale and dark (in preservative usually brownish), more or less complete transverse bands, or in some populations longitudinal lines; midbody scale rows 28–34 (rarely more than 32); (Fiji and Rotuma) ..... *E. concolor*
11b. Color pattern: middorsal area greenish olive with scattered flecks on sometimes nearly complete light and dark bands; usually marked dorsolaterally by a series of moderate to large yellowish blotches; midbody scale rows 30–36 (rarely less than 32); (Viti Levu Island, Fiji) ..... *E. campbelli*
11c. Color pattern: dorsum nearly uniform greenish to greenish tan, or with brownish to blackish spots, usually forming transverse bands (tiger pattern); without large, yellowish blotches dorsolaterally; midbody scale rows 30–34 (usually 32); (Samoa, Tonga, and surrounding islands) ..... *E. samoensis*

concolor Subgroup

This subgroup includes *E. campbelli, E. concolor, E. erronan, E. aneityumensis, E. loyaltiensis, E. murphyi,* and *E. nigromarginata.*

Emoia aneityumensis Medway

Emoia aneityumensis Medway, 1974:53 (type loc.: Aneityum Island, Vanuatu; holotype in BMNH); Medway and Marshall 1975:441; Brown and Gibbons 1986:42.

DESCRIPTION.—SVL 71.0–88.0 mm for two mature females and 90.3–95.5 mm for two mature males; snout tapered, rounded at tip, its length 56–67% of HB and 38–40% of HL; HB 60–71% of HL and 14–17% of SVL; eye 60–69% of snout length and 33–46% of HB; rostral forming long suture with frontonasal; supranasals narrow, in contact with anterior loreal; prefrontals usually in contact (narrowly separate in one specimen); interparietal moderate, slightly longer than broad; one pair of nuchals; anterior loreal somewhat shorter and slightly higher than posterior, in contact with first and second or second upper labial; six or seven upper labials, fifth or sixth enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 40–42 ($\bar{x}$ = 40.5; SD = 0.756; n = 8); dorsal scale rows 72–79 ($\bar{x}$ = 76.125; SD = 2.295; n = 8); length of extended hindlimb 87–96% of axilla–groin distance and 44–49% of SVL;

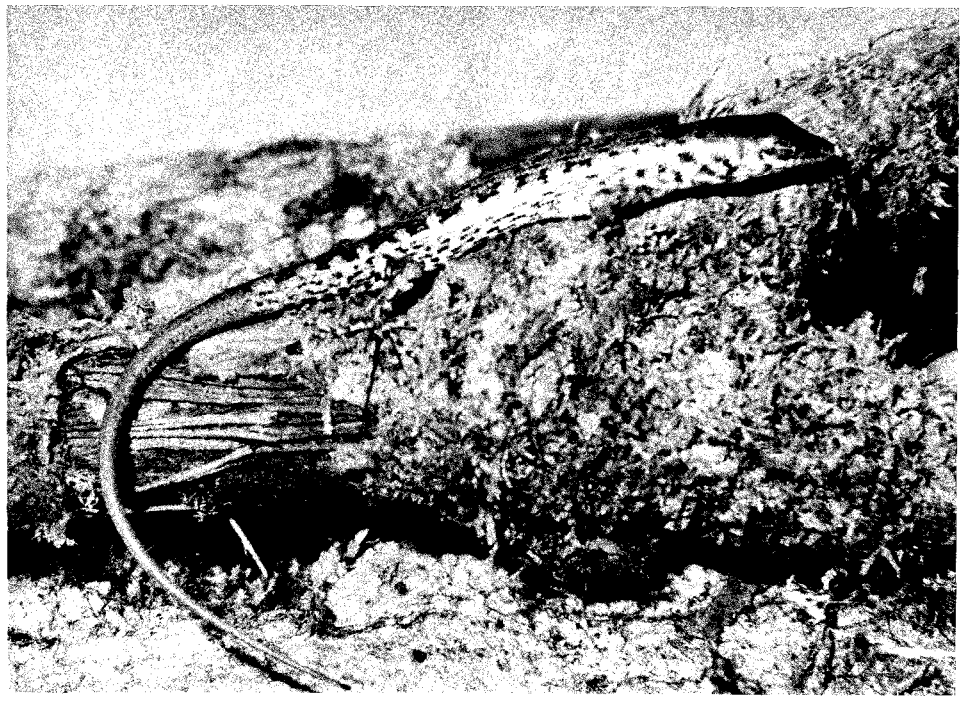

FIGURE 18. *Emoia campbelli,* showing the dark blotches on the dorsolateral surface, Viti Levu Island. Photo courtesy of J. Gibbons.

rounded lamellae under fourth toe 36–42 ($\bar{x}$ = 38.875; SD = 2.167; n = 8); under first toe 11–13.

COLOR (in preservative).—Dorsal ground color grayish brown to brown, relatively uniform or with several vague, irregular, bluish-gray transverse bands; series of widely spaced dark brown to blackish blotches dorsolaterally, between ear and base of tail; lower lateral surfaces brown, marked by blotches and flecks of grayish white; venter relatively uniform grayish white.

COMPARISONS.—*Emoia aneityumensis* exhibits a greater number of midbody and dorsal scale rows than any other species in the *samoensis* group, closest to *E. erronan. Emoia aneityumensis* is readily distinguished from *E. erronan* by the much lower number of fourth toe lamellae (Table 7).

REPRODUCTION.—Medway (1974:54) stated that two adult females had four and five enlarged ova, respectively.

HABITAT.—Medway and Marshall (1975:441) noted that the type series was collected in seral and climax forest.

RANGE.—Aneityum Island, southern Vanuatu.

MATERIAL EXAMINED.—**Vanuatu:** Aneityum I.: BMNH 1956.1.3.65 (holotype), 1956.1.3.63–64, 1973.1534–36 (paratypes); FMNH 69151, 69638.

Emoia campbelli Brown and Gibbons

(Figure 18)

Emoia campbelli Brown and Gibbons, 1986:49 (type loc.: Monasavu, Viti Levu I., Fiji; holotype in CAS).

DESCRIPTION.—SVL 70.4–97.8 mm for four males and 68.9–92.7 mm, for five females; snout tapered, rounded at tip, its length 56–68% of HB and 35–42% of HL; HB 56–70% of HL and 13–17% of SVL; eye 56–72% of snout length and 33–34% HB; rostral forming long, nearly straight suture with frontonasal; supranasals triangular, in contact with anterior loreal; prefrontals in moderate to broad contact; seven or eight supraciliaries; interparietal moderate, somewhat longer than broad; one pair of nuchals; anterior loreal nearly as long as posterior, in contact with first and second, first, second, and third, or second and third upper labials; seven or eight upper labials, sixth (rarely seventh) enlarged and below eye; six or seven lower labials; scales smooth; midbody scale rows 30–36, rarely less than 32 ($\bar{x}$ = 32.929; SD = 1.639; n = 18); dorsal scale rows 56–64 ($\bar{x}$ = 59.143; SD = 2.109; n = 14); length of extended hindlimb 88–107% of axilla–groin distance and 45–52% of SVL; rounded lamellae under fourth toe 44–56 ($\bar{x}$ = 48.929; SD = 3.518; n = 14); under first toe 14–17.

COLOR (of freshly preserved specimens).—Middorsal three or four rows of scales grayish to grayish olive-green or light grayish brown, marked by black spots or dashes (in some specimens black spots forming either broken or very irregular transverse bands); top of head usually darker (slate-brown), occasionally same as body; upper lateral surfaces usually marked by small to large (two to eight scales) yellow blotches alternating with black blotches; lower lateral surfaces mottled grayish tan and bluish green marked by blackish flecks and dashes; venter yellow to greenish yellow with salmon-red diffusion posteriorly and on base of tail; small black dashes posteriorly, along midline, on preanals and sometimes base of tail.

COMPARISONS.—*Emoia campbelli* differs from *E. concolor* not only in color pattern but also significantly in means for midbody scale counts (t = 3.823; df = 31; P = 0.001). It differs from *E. murphyi* in the color pattern and also in the number of midbody and dorsal scale rows, barely overlapping (Table 7).

HABITAT.—Usually on trees and shrubs. *Emoia campbelli* appears to be more arboreal than *E. concolor.*

RANGE.—Rairaimatuku Plateau area, Viti Levu Island.

MATERIAL EXAMINED.—**Fiji:** Monasavu, Viti Levu I.: CAS 156256 (holotype), CAS 155967–73; 156257–58, 156710–12, FM R197, USP 46–48 (paratypes).

Emoia concolor (A. Duméril)

(Figure 4a)

Gongylus (Euprepes) concolor A. Duméril, in Duméril and Duméril 1851:162 (type loc.: Fiji; lectotype in MNHN); Brygoo 1985:26.
Emoia samoensis: (part) Girard 1858:265.
Euprepes samoensis: (?) Steindachner 1867:44.
Euprepes resplendens Peters, 1877:466 (type loc.: Ovalau Island, Fiji; holotype lost [Koepcke, ZMH, pers. comm.]).
Lygosoma samoense: (part) Boulenger 1887a:293; Werner 1901:8.
Lygosoma cyanogaster: (part?) Boettger 1893:106.
Lygosoma cyanogaster tongana (part, Fiji) Werner, 1899:375 (type loc.: Tonga; holotype in ZMB).
Emoia samoense: (part) Schmidt 1923:52.
Emoia samoensis: (part) Burt and Burt 1932:531; (part) Smith 1937:227; (part) Brown 1956:1487; Greer 1970:171; (part) Pernetta and Watling 1979:236.
Emoia concolor: Pernetta and Watling 1979:236; Brown and Gibbons 1986:45.

For about a century attempts to associate the name *E. concolor* with an actual population was hindered because Jacquinot and Guichenot (1853) gave an erroneous type locality and Boulenger (1887a) placed *E. concolor* in the synonymy of *E. samoensis*. Brown and Gibbons (1986) definitively distinguished these and other closely related species of the *E. samoensis* subgroup.

DESCRIPTION.—SVL 52.3–88.9 for 22 males and 52.8–73.5 for seven females (a unique and questionable specimen from Kadavu Island measures about 100 mm); snout tapered, rounded at tip, its length 35–42% of HL and 55–66% of HB; HB 52–68% of HL and 13–17% of SVL; eye 52–70% of snout length and 30–45% of HB; rostral forming a long, straight or slightly concave suture with frontonasal; supranasals long and narrow, in contact with anterior loreal; prefrontals from moderately in contact to rarely narrowly separated; interparietal moderate, only a little longer than broad; one pair of nuchals; anterior loreal somewhat shorter than, to nearly as long as high, usually higher than posterior, in contact with first and second, second, or first, second and third upper labials; usually seven upper labials, sixth (rarely fifth) enlarged and below eye; usually seven lower labials; dorsal scales smooth or with two or three striations; midbody scale rows 28–34 ($\bar{x}$ = 31.212; SD = 1.54; n = 80); dorsal scale rows 54–66 ($\bar{x}$ = 58.888; SD = 2.062; n = 80); length of extended hindlimb 89–104% of axilla–groin distance and 44–53% of SVL; rounded lamellae under fourth toe 44–65 ($\bar{x}$ = 55.154; SD = 6.139; n = 78); under first toe 14–18.

COLOR (in preservative).—Dorsal ground color nearly uniform greenish tan or with few scattered darker spots or short bars (sometimes in transverse lines), or numerous brown dashes in longitudinal lines (see Fig. 3a); venter greenish yellow, intruding in narrow tongues on the lower lateral surface; top of head and lower limbs somewhat darker tan than rest of dorsum.

COMPARISONS.—For comparison with *E. campbelli*, see description of that species. *Emoia concolor* differs significantly from *E. murphyi* in Tonga in the means for: (1) midbody scale rows (t = 8.472; df = 100; $P < 0.001$), (2) dorsal scale rows (t = 9.528; df = 103; $P < 0.001$), and (3) fourth toe lamellae (t = 9.804; df = 100; $P < 0.001$). It differs from *E. murphyi* from Samoa in means for dorsal scale rows (t = 5.149; df = 85; $P < 0.001$) and for fourth toe lamellae (t = 5.53; df = 82; $P < 0.001$). It differs from *E. nigromarginata* in some features of the color pattern and the much higher number of fourth toe lamellae (Table 7).

The variability exhibited by this species suggests that some of the island populations may prove to be good subspecies. For example, five specimens, AMS R109939–43 from Bird Island (178°42′E, 17°59′S) near Viti Levu have white patches on the dorsum reminiscent of, but larger and more vague than, those of *E. trossula*. They also have slightly higher lamellar counts than other populations of *concolor*. Observations in the field as well as larger samples from this and other island populations are needed before the taxonomic status of the various populations can be determined.

REPRODUCTION.—Gravid females have two large oviducal eggs. Three hatchlings measure 26.3 to 28.1 mm in SVL.

HABITAT.—An arboreal species occurring in both the relatively open, intermediate-zone woodlands and lowland coastal forests. Occasionally, this species is found in agricultural and suburban areas (Pernetta and Watling 1979). On islands inhabited by the mongoose, this species is much less common, and on some islands may not have survived. William Beckon (Univ. Calif., Davis, pers. comm.) stated that he observed this species feeding on fruits in addition to insects and suspected it of feeding on bird eggs.

RANGE.—Throughout Fiji. One specimen (BMNH 97.7.29.8) has been recorded from Rotuma Island. However, George Zug (USNM, pers. comm.), stated that while he collected a large series of *E. trossula* on Rotuma in 1986, he did not find *E. concolor* there.

MATERIAL EXAMINED.—**Fiji:** MNHN 7084 (lectotype), 7084a (remaining syntype), AMS R64482a–b, R6449a–b, R6450a–c, R6451a–c, MCZ 9133–9144, BMNH 55.11.7.24, 63.5.11.14–15, 75.12.31.10–13; Eastern Lau Group: AMNH 41750, 40195, 48058; Moala I.: AMNH 41708; Kadavu I.: BMNH 83.8.29.169–70, AMS R30442, R30445, MCZ 15014, 16943–44, FMNH 3497, CAS 155974–85; Cikobia I.: AMNH 29007; Vanua Levu I.: BMNH 87.8.25.41, Pernetta coll. 252, 282; Viwa I.: Pernetta coll. 117–119, 122–123; Yaduataba I.: CAS 156002–04; Dravuni I.: MCZ 16930–40, FMNH 3498a–d; Nagasan I. (=Yagasa I.?): MCZ 16947–48; Lami I.: MCZ 48958; Viti Levu I.: MCZ 6459, FMNH 62796, 69241, 69639, 71764, 71772, 171806, BMNH 1940.1.17.7, 1945.11.5.9, 1947.3.1.86–87, Pernetta coll. 181, 167, 203, 205, 207–09, FM RA1, 4, 12, 43, CAS 102361; Matuki I.: USNM 230222–26; Koro I.: USNM 230019–21; Ovalau I.: FMNH 179761, 13628a–c, 13641, USNM 230104–05; Taveuni I.: BMNH 1959.1.2.32; Rotuma I.: BMNH 97.7.29.8; Gau I.: Watling coll. 501, 526, 543; Bird I. (small island near Viti Levu): AMS R109939–43; Kia I. (small island near Viti Levu): AMS R116157–58.

Emoia erronan n. sp.

Recently while studying a collection in the American Museum, specimens identified as *E. samoensis* from Futuna Island, southern Vanuatu, were found to be quite distinct from examples of that species. This population represents an undescribed taxon in the *E. concolor* subgroup.

HOLOTYPE.—AMNH 60285, collected by L. Macmillan, July 1937, on Futuna (formerly Erronan) Island in southern Vanuatu.

PARATYPES.—AMNH 60277, 60279–81, 60283–84 from same locality as holotype.

DIAGNOSIS.—Midbody scale rows 36–38; dorsal scale rows between the parietals and the base of tail 77–84; fourth toe lamellae 47–53; first toe lamellae 14–17; interparietal of intermediate length, longer than broad; prefrontals in relatively broad contact; color pattern: dorsal ground color greenish tan to dark chocolate-brown; lighter specimens marked by some scattered dark brown flecks or small spots; upper lateral surface with grayish to slate-tan or brown band, marked by row of light blotches or dashes along dorsal margin.

DESCRIPTION OF HOLOTYPE.—Adult female, SVL 73.7 mm;

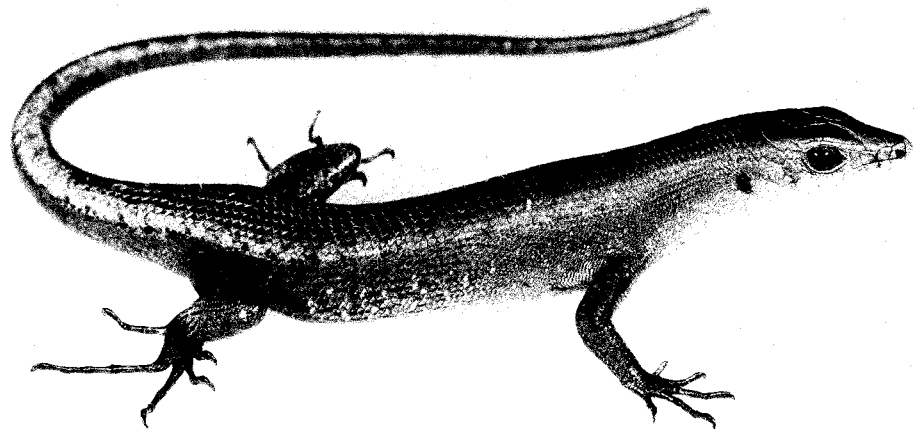

FIGURE 19. *Emoia flavigularis*, showing the rather uniform light brown color with scattered pale flecks on the lateral surface, Guadalcanal Island. Photo courtesy of M. McCoy.

midbody scale rows 38; dorsal scale rows 80; fourth toe lamellae 47.

DESCRIPTION.—SVL 66–75 mm for three adults; snout tapered, rounded at tip, its length 58–68% of HB and 39–42% of HL; HB 61–66% of HL and 15–16% of SVL; eye 52–69% of snout length and 38–41% of HB; rostral forming relatively long, nearly straight or slightly concave suture with frontonasal; supranasals long and narrow, in contact with anterior loreal; prefrontals in relatively broad contact; interparietal longer than broad; one pair of nuchals; anterior loreal slightly shorter and higher than posterior; usually seven upper labials, sixth enlarged and below eye; six or seven lower labials; dorsal scales smooth or occasionally with very faint keels; midbody scale rows 36–38 ($\bar{x}$ = 37.0; SD = 1.0; n = 7); dorsal scale rows 77–84 ($\bar{x}$ = 79.857; SD = 2.268; n = 7); length of extended hindlimb 90–109% of axilla–groin distance and 46–49% of SVL; rounded lamellae under fourth toe 47–53 ($\bar{x}$ = 50.143; SD = 2.116; n = 7); under first toe 14–17.

COLOR (in preservative).—Dorsal ground color grayish green to greenish tan, marked by scattered small, dark brown spots on some scales (in one specimen outer edges of scales dark brown, forming narrow, longitudinal lines); top of head golden-bronze; lateral surfaces brownish gray or slate with uneven dorsal margin marked by intrusion of scattered pale scales; these often continuous with pale bluish, grayish, or yellowish on the venter; labials with dusky blotches; limbs marked by scattered pale and dark scales.

ETYMOLOGY.—Erronan is an older name for the Futuna Island at the southern end of the New Hebrides chain. This older name is chosen instead of Futuna because there is also a Futuna Island in Samoa.

COMPARISONS.—*Emoia erronan* is about the same size as other species of the *E. concolor* subgroup but differs from all but *E. aneityumensis* in the greater number of dorsal scale rows (Table 7). See description of *E. aneityumensis*.

RANGE.—Futuna Island, Vanuatu.

Emoia flavigularis Schmidt

(Figure 19)

Emoia flavigularis Schmidt, 1932:185 (type loc.: Ysabel Island, Solomons; holotype in FMNH); Smith 1937:227; Greer 1970:171; Scott, Parker, and Menzies 1977:11; McCoy 1980:35; Brown 1983:319.
Emoia flavigulare: Mittleman 1952:24.

Schmidt regarded *E. flavigularis* as related to *E. nigra* but noted that it differed in such characters as the more numerous subdigital lamellae, the interparietal fused with the frontoparietals, and some features of the color pattern. McCoy (1980) called attention to its smaller size. He also stated that it is restricted to forested areas, in contrast to *E. nigra* which is abundant in habitats ranging from beach and garden or plantation areas to typical forested areas.

DESCRIPTION.—SVL 68.5–72.7 mm for eight mature males and 58.9–75.5 mm for 10 mature females; snout tapered and bluntly rounded, its length 58–62% of HB and 37–39% of HL; HB 60–65% of HL and 15–17% of SVL; eye 72–89% of snout length and 43–46% of HB; rostral forming long, nearly straight suture with frontonasal; supranasals narrow, in contact with anterior loreal; prefrontals in contact (rarely narrowly separated); one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or only second upper labials; seven or eight upper labials, sixth or seventh enlarged and below eye; six or seven lower labials; dorsal scales smooth; paravertebral rows scarcely enlarged; midbody scale rows 34–40 ($\bar{x}$ = 36.647; SD = 1.967; n = 17); dorsal scale rows 53–64

($\bar{x}$ = 57.625; SD = 3.16; n = 16); length of extended hindlimb 115–138% of axilla–groin distance and 57–62% of SVL; rounded lamellae under fourth toe 36–48, rarely less than 38 ($\bar{x}$ = 40.813; SD = 3.291; n = 16); under first toe 11–14.

COLOR (in preservative).—Dorsal ground color brown with dark flecks or spots, especially posteriorly and on tail; lateral surfaces similar to dorsum or somewhat darker brown with some pale spots on neck and usually some smaller, light, pale-and-dark flecks on flanks; venter gray, paler under head and neck (bright yellow in life).

COMPARISONS.—*Emoia flavigularis* differs from *E. nigra* in its smaller size at maturity, the fusion of the interparietal with the parietals, the lesser number of dorsal scale rows, the greater number of fourth toe lamellae (Table 7), and the yellow throat in life. The limbs are longer relative to axilla–groin distance for both *E. flavigularis* and *E. nigra* than for other species of the *samoensis* group (see ratios in descriptions).

HABITAT.—McCoy (1980) stated that *E. flavigularis* is restricted to forested areas or occasionally those with some more limited canopy cover. It is primarily terrestrial, although it may forage in trees and shrubs, and tends to escape predators by climbing.

RANGE.—Bougainville, Choiseul, New Georgia, Ngilla, Shortland, and Isabel islands in the Solomons.

MATERIAL EXAMINED.—**Solomon Islands:** Isabel I.: FMNH 13793 (holotype), 13781, 13785, 13794, MCZ 32193 (paratypes), AMS R8652; Nggela I.: AMS R93031; New Georgia Is.: MVZ 44962; Bougainville I.: QM 7170; Faro Is.: AMNH 40320, 40322; Choiseul I.: AMNH 40482; Bougainville I.: MCZ 67222–25, 65868–69, 67768, 87600–03, 98933; Shortland I.: AMNH 41837, AMS R93571–71, MCZ 89242, 89698, 90394, BMNH 1969.1538–39.

Emoia loyaltiensis (Roux), NEW STATUS

Lygosoma samoense loyaltiensis Roux, 1913:110 (type loc.: Mare and Lifou islands, Loyalty Islands; lectotype in NMBA); Burt and Burt 1932:532; Medway 1974:55.

Roux (1913) compared his sample from the Loyalty Islands with specimens from Vanuatu, which were at that time referred to *E. samoensis* (=*E. sanfordi*). Burt and Burt (1932) noted that the Loyalty Island population should probably not be treated as a race of *E. samoensis.* Medway (1974) continued to refer not only the Loyalty Islands population but also two examples from a population on Erromanga Island, Vanuatu, to *E. samoensis.* In so doing, he stated that "samples of *E. samoensis* from all parts of its range, from the Loyalty Islands to Fiji and Samoa, provide no evidence of variation." This erroneous conclusion probably resulted from his relatively small samples. The two specimens (BMNH 1860.3.18.8 and 1860.4.18.11) registered as from Erromanga Island, which Medway referred to *E. samoensis,* are in agreement with examples of *E. trossula* from Fiji and not with other populations from Vanuatu or with *E. samoensis* from Samoa. Thus, the locality data for these two specimens must be regarded as probably in error. The population on the Loyalty Islands is actually more closely related to *E. concolor* from Fiji and *E. aneityumensis, E. nigromarginata,* and *E. erronan* from Vanuatu than to *E. samoensis.* I treat *E. loyaltiensis* as a distinct species.

DESCRIPTION.—SVL of two males 66.9–83.2 mm and of two females 60.0–73.0 mm; snout tapered, narrowly rounded at tip, its length 59–66% of HB and 37–41% of HL; HB 60–68% of HL and 15–17% of SVL; eye 58–62% of snout length and 36–38% of HB; rostral forming nearly straight suture with frontonasal; supranasals long, narrow, in contact with anterior loreal; prefrontals separated by small, azygous shield for paratype, narrowly to moderately in contact for others; interparietal about as broad as long; one pair of nuchals; anterior loreal nearly as long as and slightly higher than posterior, in contact with first and second or second upper labials; seven upper labials, sixth enlarged and below eye; seven lower labials; mental much shorter than postmental; dorsal scales smooth or nearly so; midbody scale rows 30–34 ($\bar{x}$ = 32.333; SD = 1.366; n = 6); dorsal scale rows 60–71 ($\bar{x}$ = 66.167; SD = 4.262; n = 6); length of extended hindlimb 85–103% of axilla–groin distance and 45–51% of SVL; lamellae under fourth toe 51–60 ($\bar{x}$ = 55.833; SD = 1.169; n = 6); under first toe 14–18.

COLOR (in preservative).—Dorsal ground color tannish green, more tan on head; upper lateral surfaces (usually four or five scale rows) slightly darker grayish tan, with some darker brown blotches in upper half, especially posteriorly; lower lateral surfaces paler, merging into yellow-green of venter; limbs tan with darker brown mottling.

COMPARISONS.—*Emoia loyaltiensis* is most similar to *E. nigromarginata* when compared with other species of the *concolor* subgroup. It differs from *E. nigromarginata* primarily in the greatest number of fourth toe lamellae (Table 7). The means for midbody scale rows (t = 2.762; df = 35; P = 0.009) and dorsal scale rows (t = 5.679; df = 34; $P < 0.001$) also differ significantly.

RANGE.—Mare Island, Loyalty Islands.

MATERIAL EXAMINED.—**Loyalty Islands:** Mare I.: NMBA 7126 (lectotype), MCZ 19610, AMNH 60460, 60463, 60465.

Emoia murphyi Burt

(Figure 20)

Emoia murphyi Burt, 1930:1 (type loc.: Salailua, Savaii Island, Samoa; holotype in AMNH); Burt and Burt 1932:527; Brown 1956:1487; Brown and Gibbons 1986:42.

Burt (1930) described this species from one specimen (AMNH 41740), separating it from *E. samoensis* by the higher lamellar count and smaller size.

DESCRIPTION.—SVL 56.5–74.9 mm for 21 males and 52.2–67.0 mm for 10 females; snout tapered, rounded at tip, its length 59–64% of HB and 36–44% of HL; HB 62–67% of HL and 15–17% of SVL; eye 54–63% of snout length and 33–38% of HB; rostral forming concave to nearly straight suture with frontonasal; supranasals narrow, elongate, in contact with or very narrowly separated from anterior loreal; prefrontals in contact; interparietal somewhat longer than broad; one pair nuchals; anterior loreal somewhat higher and shorter than posterior, in contact with first and second or first, second and third upper labials; six or seven upper labials, sixth (rarely fifth) enlarged and below eye; seven lower labials; dorsal scales smooth or with faint keels; paravertebral rows only slightly enlarged; midbody scale rows 26–32 ($\bar{x}$ = 28.733; SD = 1.285; n = 30); dorsal scale rows 51–58, rarely more than 56 ($\bar{x}$ = 54.562; SD = 1.795; n = 32); length of extended hindlimb 98–102% of axilla–groin distance and 49–52% of SVL; thinned lamellae under fourth toe 60–81 ($\bar{x}$ = 68.467; SD = 4.703; n = 30); lamellae under first toe 15–19.

COLOR (in preservative).—Dorsum and upper lateral surfaces

FIGURE 20. *Emoia murphyi,* showing the relatively uniform greenish to tan color, Vaseau Island, Tonga. Photo courtesy of J. Gibbons.

grayish tan, greenish tan or grayish, usually with some darker and lighter spots and flecks or vague, transverse bands; lateral surface with some scattered, vaguely paler scales; lower lateral surfaces light grayish; venter yellowish to bluish gray with lighter (more or less ivory) areas under head and limb regions.

COMPARISONS.—See descriptions of *E. campbelli* and *E. concolor.*

REPRODUCTION.—Gravid females have two oviducal eggs.

RANGE.—Upolu, Savaii, and Niatapu islands in Samoa, Varau, and Niaufou islands in Tonga.

MATERIAL EXAMINED.—**Samoa:** Savaii I.: AMNH 41740 (holotype), AMS R116164, FMNH 39205; Upolu I.: BMNH 1924.12.6.5, 1926.3.20.2, FMNH 39204; Western Samoa: BMNH 1969.634; Matapu I.: RMNH 4947. **Tonga:** Vavau I.: FMNH 196830, CAS 158237–40, USNM 259329–30; Niaufou I.: USNM 82875–82957.

Superspecies **Emoia nigra** (Jacquinot and Guichenot)

(Figure 21)

Eumeces niger Jacquinot and Guichenot, 1853:11 (type loc.: not given; holotype lost); Brygoo 1985:73.

Emoa nigrita Girard, 1857:197 (type loc.: Navigator (=Samoa) Islands; holotype in USNM), 1858:268.

Euprepes opelli: Steindachner 1867:44.

Euprepes (Mabuya) niger: Peters 1869:449.

Mabouia nigra: Günther 1877:128; Boulenger 1886:40.

Lygosoma (Emoa) nigrum: Boulenger 1887a:297, 1888a:535, 1900:65; Vogt 1912a: 6; Roux 1913:157; de Rooij 1915:260; Sternfeld 1920:415; Baker 1928:297; Kinghorn 1928a:172; Angel 1935:55.

Emoia nigrum: Barbour 1912:197, 1921:103; Tanner 1951:77.

Emoia whitneyi Burt, 1930:1 (type loc.: Shortland Island, Solomons, holotype in AMNH); Burt and Burt 1932:534; Mittleman 1952:32.

Emoia nigra: Schmidt 1932:185; Burt and Burt 1932:528; Mertens 1934:90; Smith 1937:226; Brongersma 1942:155; Mittleman 1952:28; Brown 1956:1487; Volsoe 1956:124; Greer 1970:171; Clapp 1971:9; Medway and Marshall 1975:442; Pernetta and Watling 1979:238; Schwaner 1980:4; McCoy 1980:37; Brown, Pernetta, and Watling 1980:351; Brown 1983:317; Scott, Parker, and Menzies 1977:11.

Although the type specimen has been lost and the type locality is not given by Jacquinot and Guichenot (1853), the excellent color illustration (pl. 5, fig. 2) and the original description clearly identify this large, dark brown to blackish *Emoia* of the South Pacific islands. *Emoa nigrita* Girard (1857) and *E. whitneyi* Burt (1930) are based on examples of this species. Girard (1858) even listed *E. nigra* as a synonym of *E. nigrita,* although the former was described four years earlier (1853). I have examined the type of *E. whitneyi,* and in scale counts, color, and weak keels on dorsal scales it is typical of juveniles of *E. nigra* populations from some of the Solomon Islands.

DESCRIPTION.—SVL 85–114 mm for 100 plus females and 89–121 mm for 100 plus males (Schwaner 1980); snout tapered, broadly rounded at tip, its length 53–65% of HB and 37–41% of HL; HB 61–74% of HL and 14–18% of SVL; eye 63–79% of snout length and 37–49% of HB; rostral forming moderate to long, nearly straight suture with frontonasal; supranasals long and narrow, in contact with anterior loreal; prefrontals narrowly to moderately separated; interparietal small, usually about as broad as or broader than long; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or rarely only second upper labials; six or seven upper labials; fifth or sixth slightly enlarged and below eye; six or seven lower labials; dorsal scales smooth except for some juveniles; midbody scale rows 33–40 ($\bar{x}$ = 37.268; SD = 1.355; n = 56); dorsal scale rows 61–72 ($\bar{x}$ = 65.491; SD = 2.569; n = 53); length of extended hindlimb 95–122% of axilla–groin distance (only 1 of 20 examples less than 100%) and 46–57% (rarely below 50%) of SVL; rounded lamellae under fourth toe 32–39 ($\bar{x}$ = 35.393; SD = 1.723; n = 56), under first toe 12–14.

COLOR (in preservative).—Dorsal ground color medium brown to almost black, nearly uniform, or with darker spots (sometimes in irregular, broken transverse bands), or heavily mottled with small pale spots; venter from bluish white in younger specimens to grayish tan or darker tan in adults; undersurface of head and

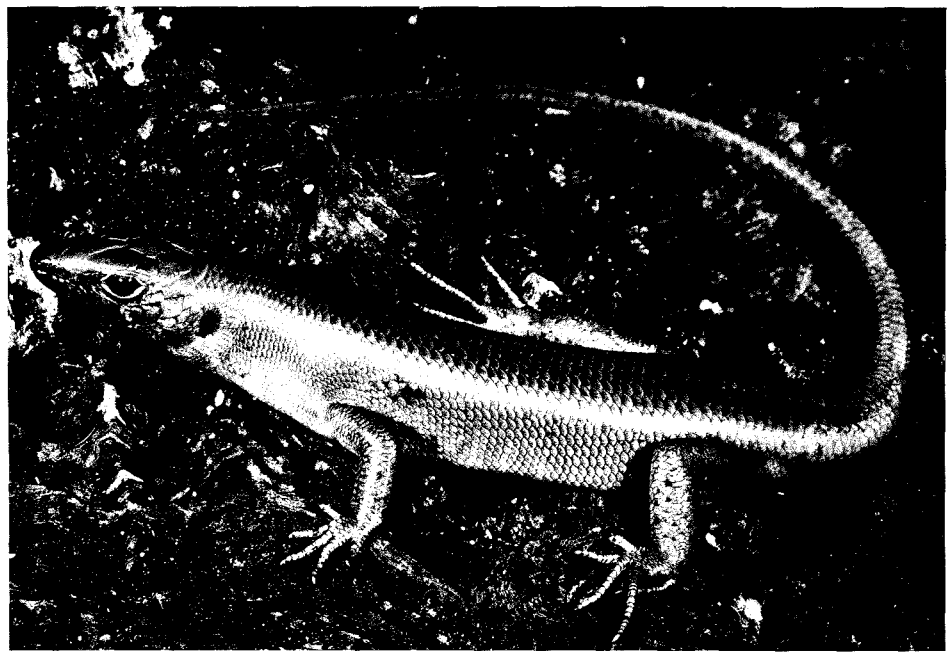

FIGURE 21. *Emoia nigra,* showing the relatively uniform dark-brown color phase, Nggela Island. Photo courtesy of M. McCoy.

throat usually spotted with brown, slate-brown, or almost uniformly dark. (Very young specimens may be light greenish tan or yellowish tan on the dorsum, marked by small, dark brown spots, and dark brown to almost black on the lateral surfaces.)

COMPARISONS.—See description of *E. flavigularis. Emoia nigra* exhibits some variation when populations from different islands are compared. Consideration of possible subspecies or very similar sibling species is held in abeyance pending the availability of detailed field and possibly genetic studies.

REPRODUCTION.—Schwaner (1980) reported clutch size at two to four based on 86 fecund and 31 ovigerous females. SVL for several hatchlings ranged 34.0–41.0 mm. Eggs have been collected from the soil at the base of a rotting coconut stump and under other ground debris. Schwaner also reported collecting eggs from a birdnest fern.

HABITAT.—Forest, second growth, garden, and seashore areas where vegetation is present. This skink forages primarily on the ground, but is known to bask and may take refuge in trees, usually never going more than a few meters above the ground. McCoy (1980) stated that *E. nigra* eats insects, spiders, and small lizards.

RANGE.—Southern Pacific Islands, from Samoa and Tonga groups westward to Fiji, Vanuatu, Solomons, and Bismarcks. I have seen only one specimen from Tench Island, Bismarcks. In view of the lack of examples in recent rather extensive collections from some areas of New Britain and New Ireland, *E. nigra* is almost certainly not widely distributed in the Bismarcks.

MATERIAL EXAMINED.—**Samoa:** AMS R4089–93, CAS-SU 6720–23; Manua, Tau: AMNH 27661, 27663–67, 27674, 27677, 27707, 40454–73; Olosenga I.: AMNH 27678–86, 27693, 28988–94, 29229–30; Tutuila I.: AMNH 27694, 27701, 27703, 29160–68, 42404–06, 42408, 42410–11, CAS 50239–66, 71395–97; Western Samoa: BMNH 1969.620–621, 1969.625–27; Savai I.: CAS 78794–95; Uvea I.: AMNH 40575–76; Upolu I.: MCZ 69495, AMS R10957–58, FMNH 39203, CAS-SU 6709–17. **Tonga:** FMNH 40291–92 (note in catalog: "introduced"); Ninuafau I.: AMNH 40549–54; Tafahi: AMNH 40556–63. **Fiji:** MNHN 5572, 5572a–c, AMNH 40509, 81657; Koro I.: USNM 230073–81; Ovalau I.: CAS: 157979–80. **Banks Islands:** Gaua I.: AMNH 40200–201, 42122–23, 42156. **Santa Cruz Islands:** Matema I.: AMNH 40418, 40548, 42159, CAS 72277–89; Nalago I.: CAS 72302; Naunha I.: AMNH 40437–38; Vanikoro I.: CAS 72268, AMNH 40391–92; Santa Cruz I.: CAS 72269, AMNH 42086–87, 42107–12, 42114, MNHN 2907. **Vanuatu:** Gana I.: BMNH 1925.3.5.82; Elephant I.: FMNH 13696; Aoba I.: AMNH 42091, 81654–67; Dolphin I.: AMNH 40355–57; Efate I.: AMNH 42001; Espiritu Santo I.: AMNH 42151. **Solomon Islands:** Bougainville I., Buin: MCZ 65870–71, 67677–78, 66499, AMNH 89426–27; Empress Agusta Bay: FMNH 44635–36; Kieta: MCZ 64211–16, 65569–70, 65909; Kunna: MCZ 73803–05, 75987–90, 76262–63, 76790–91, 76902–05, 77760–73, 77779–85, AMNH 92007; Mataigu: MCZ 95230, 95252–57; Pamanita: MCZ 95258–64; Topanas, MCZ 89603–06; Torokina: USNM 120201–06; Turiboiru: MCZ 87608–10, 95235–39, 95246–51; Sohano I.: MCZ 64149–51; Buka I.: MCZ 73805, 156532, AMNH 42260–61; Magusaisia I.: MCZ 89185–89, 91000, 90346–50, 99994–98; Shirley I.: MCZ 49226–30; Shortland Is.: MCZ 89248, 95231, AMNH 27715–16, 40528–31, 41838; Fauro I.: AMNH 40339, 40342, 40517–18; Mono I.: AMNH 40519–27; Choiseul I.: AMNH 40371; Santa Isabel I.: AMNH 40204–06; 40348–49; Tunibuli: FMNH 13786, 13791, 13695–99; Arnovon I.: AMNH 41824; New Georgia I.: MCZ 11187–88, FMNH 44277; Munda: FMNH 41332; Lambete: MCZ 111169–86, 111178–86; Gizo I.: AMNH 42097–100; Murray I.: AMNH 42262–63; Malaita I.: AMNH 40535–36; Alikata: MCZ 118249–51; Langusta: MCZ 118246–48, 118332–37, 118506–08; Guadalcanal I.: MCZ 48656–65, 49241, 118381, AMNH 65506, 65510–11, 66215, 41889, 40358–61, 42264–65, 42267–72, CAS 72172–76, BYU 7121–30; Movau Sound: AMNH 41903; Tenaru: FMNH 44512–15; Lunga River area: MVZ 44199–202, 44205, 44216–17, 44228–29; Malimbu River area: MVZ 40745–46; Mbuluminjua: MCZ 118306–15, 118338–43; Betalomba: FMNH 71765–71; Malpa I.: AMNH 40363; Russel I.: AMNH 41840–42, 42259; Savo I.: MCZ 118244–45; San Cristobal I.: AMNH 40362; Ugi I.: MCZ 15070–71; Malaupaina I.: CAS 153233–35; Rennell I.: AMNH 41814, 42392, CAS 72010–23; Bellona I.: CAS 72197–223; Nuguria I.: AMS R8048–51. **Bismarck Islands:** Tench I. (near Musseau): MCZ 40823.

Emoia nigromarginata (Roux)

(Figure 22)

Lygosoma (Emoa) nigromarginatum Roux, 1913:154 (type loc.: Pentecote, Vanuatu; holotype in NMBA).

Lygosoma (Emoa) speiseri Roux, 1913:155 (type loc.: Ambrym, Vanuatu; holotype in NMBA); Baker 1928:297.

Emoia nigra: (part) Burt and Burt 1932:528.

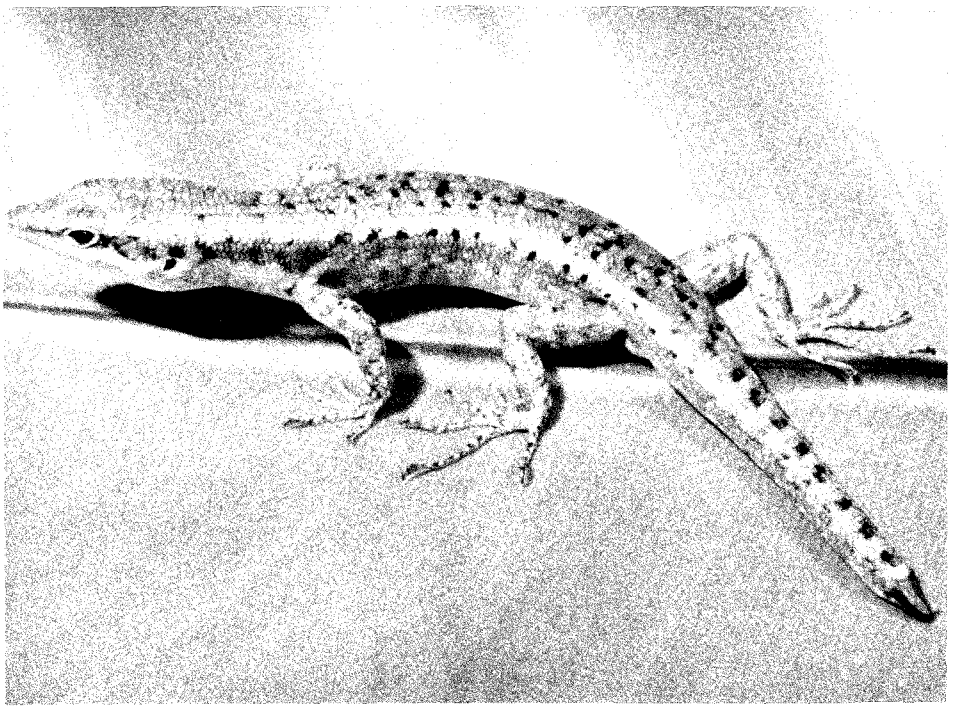

FIGURE 22. *Emoia nigromarginata,* showing scattered dark spots on the dorsum and upper lateral surface, Efata Island, Vanuatu. Photo courtesy of H. G. Cogger.

Emoia nigromarginata: Mertens 1934:39; Brown 1956:1487; Medway and Marshall 1975:441; Brown and Gibbons 1986:42.

Emoia speiseri: Smith 1937:226; Mittleman 1952:30; Brown 1956:1487; Medway 1974:55; Medway and Marshall 1975:441; Brown, Pernetta, and Watling 1980: 351; Brown and Gibbons 1986:42.

Roux (1913) stated that *E. nigromarginata* had 28 midbody scale rows and 44 lamellae and *E. speiseri* 32–34 midbody rows and 44–48 lamellae. He noted differences in the color pattern and also stated that *E. nigromarginata* was related to *E. cyanogaster* and *E. speiseri* to *E. atrocostata.*

I have examined the holotype of *E. nigromarginata* (NMBA 6769), the lectotype of *E. speiseri* (NMBA 6970), and a series of more than 30 specimens from islands in the Vanuatu archipelago. The number of midbody scale rows ranges from 28 to 32 with the following frequencies 28 (f = 1), 29 (f = 0), 30 (f = 20), 31 (f = 3), 32 (f = 10). I counted 30 for the holotype of *E. nigromarginata,* not 28 as stated by Roux. The color pattern is also variable. Most are close to the type of *E. nigromarginata* with some small dark markings but lacking the prominent dark lateral band. A Malekula Island specimen (AMNH 61688) and BMNH 1973.1736 have a broad, dark lateral band, as does the type, and a few other specimens from Malekula and Efate islands have a series of dark blotches. The present series from numerous islands has a range of 38–48 fourth toe lamellae (see Table 7). The lectotype of *E. speiseri* has 48 lamellae, but Roux gave the range as 44–48 for his series.

The differences in midbody scale counts and color pattern upon which Roux separated these two species were actually for examples showing the extremes for these characters. His samples were small, and the variation exhibited by larger samples spans the stated differences. Therefore, I regard *E. nigromarginata* and *E. speiseri* as conspecific; and since the description of *E. nigromarginata* is on page 154 of the original work, the name has priority over *E. speiseri* (page 155).

DESCRIPTION.—SVL of 11 mature males 51.8–77.4 mm, of 12 mature females 59.8–73.4 mm; snout tapering, rounded at tip, its length 61–74% of HB and 39–44% of HL; HB 58–65% of HL and 14–17% of SVL; eye 57–73% of snout length and 38–48% of HB; rostral forming long suture with frontonasals; supranasals small, widely separated, in contact with or separated from anterior loreal; prefrontals usually in contact (separated in one of 14 specimens); interparietals somewhat longer than broad; anterior loreal longer than high, nearly as long as posterior loreal, in contact with first and second or first, second and third upper labials; usually seven upper labials, sixth (rarely fifth) enlarged and below eye; six or seven lower labials; dorsal scales smooth, vertebral rows somewhat enlarged; midbody scale rows 28–32 ($\bar{x}$ = 30.839; SD = 1.186; n = 31); dorsal scale rows 56–64 ($\bar{x}$ = 59.8; SD = 2.058; n = 30); preanals only slightly enlarged; length of extended hindlimb 93–105% of axilla–groin distance and 45–52% of SVL; rounded lamellae under fourth toe 38–48 ($\bar{x}$ = 42.4; SD = 2.415; n = 25); under first toe 12–16.

COLOR (in preservative).—Dorsal ground color grayish, light tan, bronzy tan, or sometimes greenish; color nearly uniform or more often with few to numerous scattered brown or black, mostly dorsolateral spots; occasionally a distinct dark band or series of dark blotches on upper lateral surface of neck and all or part of trunk; venter yellowish, more bluish white beneath head and throat.

COMPARISONS.—See descriptions of *E. aneityumensis, E. concolor, E. erronan,* and *E. loyaltiensis.*

REPRODUCTION.—Gravid females have two or three large oviducal eggs.

HABITAT.—Medway and Marshall (1975) stated that this spe-

FIGURE 23. *Emoia parkeri*, showing a row of pale spots on the dark lateral band, Viti Levu Island, Fiji. Photo courtesy of J. C. Pernetta.

cies is found in areas covered by seral or climax forests, and to a lesser extent, in areas with reduced tree cover such as strand forest, partly cleared forest, tree-studded pastures, and gardens and plantations.

RANGE.—Several islands in Vanuatu.

MATERIAL EXAMINED.—**Vanuatu:** AMS R1809, BMNH 75.12.3.16; Pentecote I.: NMBA 6769 (holotype); Efate I.: AMS R3557, R7252, R110152–53, R110172–74, R110199, BMNH 1925.3.5.64.71, 1973.1739–42, FMNH 13656–58, MCZ 110152–53, AMNH 42001; Espiritu Santo I.: FMNH 13684; Malecula I.: AMNH 81668, BMNH 1973.1735–38; Ambrym I.: NMBA 6970 (lectotype of *E. speiseri*).

Emoia parkeri Brown, Pernetta, and Watling

(Figure 23)

Emoia parkeri Brown, Pernetta, and Watling, 1980:350 (type loc.: Viti Levu Island, Fiji; holotype in CAS); Brown and Gibbons 1986:42.

DESCRIPTION.—SVL 48.5–51.5 mm for five mature males and 45.5–53.8 mm for 10 mature females; snout tapering, round-pointed, its length 40–45% of HL and 68–80% of HB; HB 54–62% of HL and 14–17% of SVL; eye 51–63% of snout length and 37–45% of HB; rostral forming long, relatively straight suture with frontonasal; supranasals small; prefrontals in contact in 17 specimens and narrowly separated in five; frontoparietals not fused in one specimen; interparietal small, about one-third length of fused frontoparietals; one pair of nuchals; anterior loreal much longer than high, almost as long as, and about the same shape as, posterior loreal; usually seven upper labials, sixth enlarged and below eye; six or seven lower labials; dorsal scales smooth or occasionally very faintly keeled; midbody scale rows 28–34 ($\bar{x}$ = 31.5; SD = 1.366; n = 16); dorsal scale rows 52–60 ($\bar{x}$ = 56.375; SD = 2.062; n = 16); preanals slightly enlarged; length of extended hindlimb 93–102% of axilla–groin distance and 45–52% of SVL; rounded lamellae under fourth toe 34–40 ($\bar{x}$ = 37.562; SD = 1.632; n = 16); under first toe 10–12.

COLOR (in life).—Head and upper lip gold-bronze merging into olive-turquoise of dorsum; black stripe on side of head, through eye and along body, becoming gradually less conspicuous and merging with basic greenish bronze color of body; basal half of tail more turquoise-green than rest of body, very conspicuously so in some individuals and in young specimens; limbs bronze-olive on dorsal surface, strongly speckled; venter pale yellow-green (Fig. 23).

COLOR (in preservative).—Middorsal band (two half-scales, or usually two scales in breadth) greenish blue, more or less uniform, bordered laterally by broad blackish band (brownish in faded, older specimens), disrupted or broken by numerous bluish scales or by clusters of light scales; dark band on upper lateral surface, more or less uniform on head and neck but spotted by bluish-white scales on body; dorsal surface of head greenish bronze; venter bluish gray to light tan.

COMPARISONS.—*Emoia parkeri* differs from other species of the *samoensis* group in its smaller size at maturity (Table 7), and some features of its color pattern. It also differs from the sympatric species (*E. campbelli* and *E. concolor*) in having fewer subdigital lamellae.

REPRODUCTION.—A single clutch of two eggs was found in an earth-filled fissure between two trunks of a rain tree (*Samanea saman*) just above ground level. One egg hatched as it was collected. The other, which measured 13.0 by 9.0 mm, hatched two days later. One hatchling measured 24 mm in SVL and 35 mm in tail length.

HABITAT.—A rain forest occupant from near the coast to montane forest at about 500 m. It is also found in secondary forests in intermediate-zone vegetation and in trees on the dry western side of Viti Levu. The species was observed primarily on lower tree trunks at heights to 7 m on large trees. It has not been observed on the boughs, on small branches, or in the foliage. It is usually found on large trees with epiphytes or creepers, or tree species with buttressed roots or deep fissures. When seen on the ground, the animal appeared to be moving from one tree to another.

RANGE.—Viti Levu, Ovalau, Taveuni, and Kandavu islands in Fiji.

MATERIAL EXAMINED.—**Fiji:** MNHN 5573c–d; Viti Levu I.: CAS 146960 (holotype), CAS 146961–66, BMNH 63.5.11.16, AMS R71707, AMNH 117700;

Ovalau I.: BMNH 55.8.16.10; Taveuni I.: AMS R71706, BMNH 1938.8.2.11. Kandavu I.: CAS 147570–73, USP 4111–12 (paratypes); Viti Levu I.: CAS 156005.

samoensis Subgroup

This subgroup includes three species: *E. samoensis* in Samoa, *E. sanfordi* in Vanuatu, and *E. trossula* in Tonga and Fiji.

Emoia samoensis (A. Duméril)

(Figure 4b)

Gongylus (Eumeces) samoensis (part) Duméril, in Duméril and Duméril 1851: 157 (type loc.: Samoa; lectotype in MNHN); Jacquinot et Guichenot 1853:10; Brygoo 1985:95.

Emoia samoensis: (part) Girard 1858:265.

Lygosoma samoense: (part) Boulenger 1887a:293, 1897b:307; Boettger 1893:106; Sternfeld 1920:407.

Emoia samoensis: (part) Burt and Burt 1932:531; Mertens 1934:160; (part) Smith 1937:227; (part) Brown 1956:1487; Mittleman 1952:30; Greer 1970:171; Brown and Gibbons 1986:43.

Emoia samoense: Schwaner 1980:8.

Emoia samoensis was described from two specimens, stated to be from Samoa. Brown and Gibbons (1986) provided the evidence for restricting *E. samoensis* to the Samoan Islands and recognized that populations in Fiji and Vanuatu should be treated as distinct species.

The syntypes in the MNHN were examined by Brown and Gibbons (1986), who pointed out that only one of them, the designated lectotype, was apparently taken from a population in Samoa. The other is in agreement with samples from Fijian populations of *E. trossula.*

DESCRIPTION.—SVL 78–118 mm for 100 mature males and 84–114 mm for 65 mature females (Schwaner 1980:8); snout tapered, rounded at tip, its length 36–40% of HL and 56–68% of HB; HB 57–70% of HL and 13–16% of SVL; eye 52–73% of snout length and 30–42% of HB; rostral forming nearly straight suture with frontonasal; supranasals long, in contact with anterior loreal; prefrontals in moderate contact (occasionally narrowly separated); six or seven supraciliaries; interparietal long and narrow to moderately wide; one pair of nuchals; anterior loreal shorter than to about as long as and somewhat higher than posterior loreal, in contact with first and second, second and third, or first, second and third upper labials; six to eight upper labials, sixth (rarely fifth or seventh) enlarged and below eye; usually seven lower labials; scales smooth; midbody scale rows 30–34 ($\bar{x}$ = 32.043; SD = 0.988; n = 46); dorsal scale rows 58–68, rarely less than 60 or more than 65 ($\bar{x}$ = 62.432; SD = 2.204; n = 44); length of extended hindlimb 86–110% of axilla–groin distance and 46–54% of SVL; rounded lamellae under fourth toe 45–54 ($\bar{x}$ = 49.144; SD = 2.137; n = 44); under first toe 13–17.

COLOR (in preservative).—Dorsal ground color greenish tan to tan marked with few or numerous, dark brown spots varying from less than scale size to vague, irregular, transverse tiger-stripe rows (only one of 50 examples from Samoa exhibit fairly prominent white dashes on dorsum [*trossula* pattern] and two examples a few vague ones); venter uniformly yellowish ivory to dusky tan, occasionally with some small blackish spots under base of tail; top of head about same color as body or distinctly darker.

COMPARISONS.—*Emoia samoensis* and *E. trossula* from Tonga differ in means for midbody scale rows (t = 8.267; df = 69; $P < 0.001$) and for dorsal scale rows (t = 3.63; df = 64; P = 0.001). It differs from Fijian *E. trossula* in means for midbody scale rows (t = 10.638; df = 89; $P < 0.001$) and for dorsal scale rows (t = 7.855; df = 88; $P < 0.001$). It also differs from *E. trossula* and *E. sanfordi* in color pattern and from the latter in the much lower number of subdigital lamellae (Table 7).

REPRODUCTION.—Schwaner (1980) stated that clutch size for 30 specimens ranges from four to seven. He gives a SVL of 31 mm for one hatchling.

HABITAT.—Schwaner (1980) stated that examples of this species were found primarily on tree trunks and low vegetation at heights from near ground level to several meters above ground.

RANGE.—Samoa.

MATERIAL EXAMINED.—**Samoa:** MNHN 7070 (lectotype), MNHN 81, RMHN 3103, ZMC 373–374, BMNH 66.8.25.2, MCZ 3951, 8963; Upolo I.: CAS 157233, MCZ 69487, AMNH 28241, BMNH 1969.631, 1969.633, AMS R1473; Tutiula I.: CAS 50236–38, CAS-SU 13600–603, 18071, AMNH 27695, 27702, 27706, Savaii I.: AMNH 41737–38, 41744; Tau I.: AMNH 27668–73, 27675–76, KU 185513, 185515, 185518–20, 185524, 185526, 185528, 185532, 185534–36, 185540, 185546–48, 185558, 185561–63, 185566, 185568, 185572, 185576, 185578, 185581–82, 185589, 185593–95, 185600–01, 185603–04, 185606; Western Samoa: BMNH 1964.622–24, 1969.628–30, 1969.632.

Emoia sanfordi Schmidt and Burt

(Figure 24)

Lygosoma (Emoa) samoense: (part) Boulenger 1887a:293; Roux 1913:155; Baker 1928:297; Angel 1935:54.

Emoia sanfordi Schmidt and Burt, 1930:1 (type loc.: Elephant and Espiritu Santo islands, Vanuatu; holotype in AMNH); Burt and Burt 1932:553; Mertens 1934: 39; Smith 1937:227; Mittleman 1952:30; Greer 1970:171; Medway 1974:56; Medway and Marshall 1975:30; McCoy 1980:38; Brown and Gibbons 1986: 42.

Emoia sanfordi was described from samples of populations in Vanuatu and two specimens labeled Solomon Islands. The accuracy of the Fauro Island location in the Solomons is in doubt. According to Michael McCoy (Honiara, Guadalcanal, in litt., March 1984), residents from Fauro Island, when shown a color photograph of *E. sanfordi,* stated that such a skink does not now occur there. In Vanuatu, however, it is a conspicuous lizard.

DESCRIPTION.—SVL 78.2–115 mm for 19 males and 68.3–114 mm for 17 females; snout tapered, rounded at tip, its length 54–66% of HB and 37–42% of HL; HB 60–72% of HL and 14–18% of SVL; eye 58–69% of snout length and 32–44% of HB; rostral forming a nearly straight or slightly concave suture with frontonasal; supranasals long and narrow, in contact with anterior loreal; prefrontals in narrow to broad contact; interparietal moderately long and narrow; one pair of nuchals; anterior loreal only slightly shorter than and about as high as, to slightly higher, than, posterior, in contact with first and second, second, or first, second, and third upper labials; six or seven upper labials, six (rarely fifth) enlarged and below eye; usually seven lower labials; dorsal scales usually with two or three striations; paravertebral rows not or scarcely enlarged; midbody scale rows 28–34 ($\bar{x}$ = 31.432; SD = 1.385; n = 37); dorsal rows 56–64 ($\bar{x}$ = 58.75; SD = 1.685; n = 32); length of extended hindlimb 92–105% of axilla–groin distance and 46–52% of SVL; narrow lamellae under fourth toe 61–76 ($\bar{x}$ = 69.606; SD = 3.791; n = 33); under first toe 16–20.

COLOR (in preservative).—Dorsal ground color greenish, gray, bluish to brownish; relatively uniform or more commonly with scattered dark spots; frequently large brown to blackish blotch

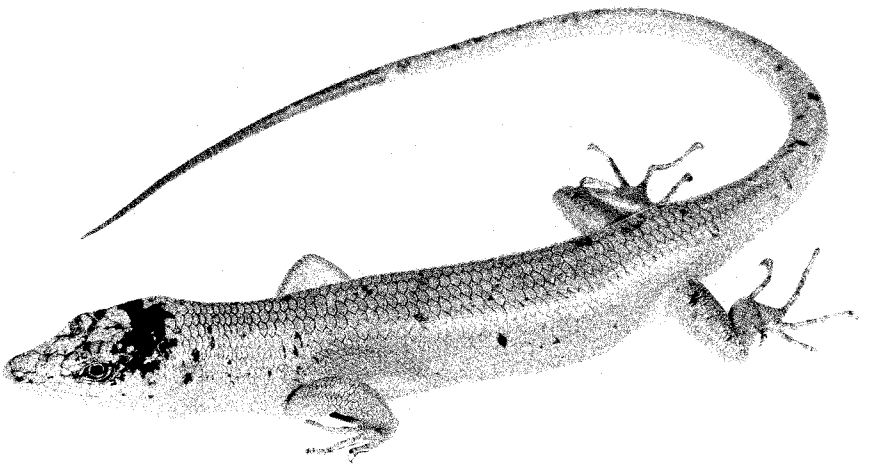

FIGURE 24. *Emoia sanfordi,* showing the large dark blotch on the head, Vanuatu. Photo courtesy of M. McCoy.

on head, sometimes extending posteriorly to forelimbs; lateral surfaces greenish; venter pale yellowish, bluish green or light brownish.

COMPARISONS.—See descriptions of *E. samoensis* and *E. trossula.*

REPRODUCTION.—Gravid females have three to five oviducal eggs.

HABITAT.—Forested areas, primarily arboreal. *Emoia sanfordi* occurs less frequently in well-shaded gardens or other areas with scattered trees (Medway and Marshall 1975).

RANGE.—Vanuatu and Banks Islands.

MATERIAL EXAMINED.—**Vanuatu:** MCZ 47147–48, MVZ 40852–55, AMS R1802–03, R3556, R3562, R3832–33, R6669, R7245, R7251–52, R7061, R11393, FMNH 69131, 10893, 125047; BMNH 1914.5.25.22, 1925.3.5.46–63; 1928.4.15.29. 1929.12.16.10, 1973.1714–34; MNHN 94.229–231, 1934.59–63, CAS 156062, MVZ 40852–55; Elephant I.: AMNH 42957 (holotype); Ambrym I.: MCZ 19609; Aoba I.: AMNH 42088, 42158; Api I.: AMNH 40543, 42152; Aurora I.: AMNH 40172; Espiritu Santo I.: FMNH 13688–89, 13700, 13702; Efate I.: AMNH 42005; Malekula I.: AMNH 40169–70, 40514–16; FMNH 13664; Tonga I.: AMNH 4544–45; Wala I.: FMNH 13667–73. **Banks Islands:** AMNH 40198–99, 42120–21, 42124–25 (paratypes), BMNH 86.3.11.22–24, AMNH 81729–31. **Solomons:** Fauro I. (doubtful): AMNH 40340–41.

Emoia trossula Brown and Gibbons

(Figure 4c, 25)

Lygosoma samoense: (part) Boulenger 1887a:293; Werner 1899:375.
Lygosoma cyanogaster tongana (part) Werner, 1899:374 (type loc.: Tonga; holotype possibly in ZMB).
Emoia samoense: (part) Schmidt 1923:52.
Emoia samoensis: (part) Burt and Burt 1932:531; (part) Brown 1956:1487; (part) Pernetta and Watling 1979; 236.
Emoia trossula Brown and Gibbons, 1986:47 (type loc.: Ovalua Island, Fiji, holotype in AMS); Crombie and Steadman 1986:49.

When *Emoia trossula* was described, Brown and Gibbons (1986) compared it with *Emoia samoensis* from Samoa. They withheld status reference to related populations in Tonga and the Cook Islands because of inadequate material. Crombie and Steadman (1986) identified 11 specimens from Rarotonga, Cook Islands, as *E. trossula.* I have data on 26 specimens from Tonga and Cook Islands and agree with their identification.

These populations are in closer agreement with *E. trossula* from Fiji than they are with *E. samoensis* from Samoa. *Emoia samoensis* differs significantly from Tonga and Fiji populations of *E. trossula* in means for midbody and dorsal scale rows. The Tonga and Fiji populations of *E. trossula* differ in means for dorsal scale counts but not for midbody scale counts. In some aspects of the color pattern, the Tonga and Cook Island populations are somewhat intermediate. John Gibbons (pers. comm.) pointed out that the ventral ground color for *E. samoensis* from Samoa and *E. trossula* from Tonga is dirty orange-brown in life, and more pale bluish for Fijian *E. trossula.* He also noted that a tiger-stripe pattern on the dorsum, similar to that of *E. samoensis* from Samoa, is more frequent in Tonga populations than in Fiji populations. However, the dorsal pattern of vague to distinct, numerous whitish dashes of specimens from the Cook Islands and Tonga (Fig. 29) is more similar to that of the Fiji populations (Fig. 3c) than to that of the Samoa populations (Fig. 3a). Of 50 specimens of *E. samoensis* from Samoa, only two had a few, and one had numerous white dashes; for 26 Tonga and Cook Island examples, only eight of 26 lacked the white dashes; and for 22 Fijian specimens only three lacked the white dashes. I have assigned the Tonga and Cook Island populations to *E. trossula.*

DESCRIPTION.—SVL 67.9–108.5 mm for 15 mature females and 66.5–107.8 mm for 24 mature males (two specimens measuring 59.3 and 60.2 mm appear immature); snout tapered, rounded at tip, its length 33–39% of HL and 51–65% of HB; HB 56–70% of HL and 13–17% of SVL; eye 60–81% of snout length and 34–48% of HB; rostral forming moderate, slightly concave suture with frontonasal; supranasals slightly broader anteriorly, in contact with anterior loreal; prefrontals narrowly separated to moderately in contact; interparietal relatively long and narrow; one pair of nuchals; anterior loreal slightly shorter than, to nearly as long as, posterior and slightly higher, in contact with first and second, second, or first, second and third upper labials; six to eight upper labials, sixth (rarely fifth or seventh) largest and below eye; usually seven lower labials; scales smooth; midbody scale rows 32–40, rarely less than 34 ($\bar{x}$ = 35.111; SD

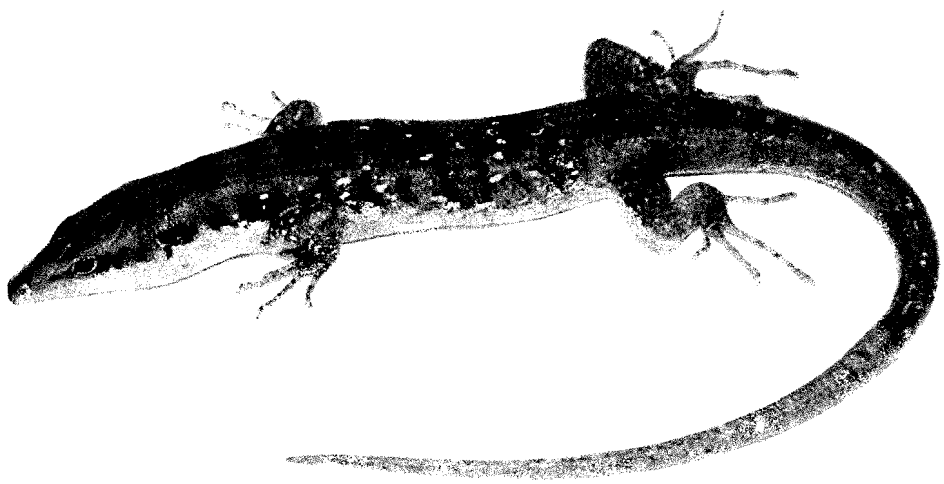

FIGURE 25. *Emoia trossula,* showing the typical white and blackish dashes on the dorsum, Tonga Islands. Photo courtesy of J. Gibbons.

= 1.682; n = 45); dorsal scale rows 62–76, rarely less than 63 ($\bar{x}$ = 67.413; SD = 3.612; n = 46); length of extended hindlimb 96–109% of axilla–groin distance and 47–53% of SVL; rounded lamellae under fourth toe 43–55 ($\bar{x}$ = 48.116; SD = 2.753; n = 43); under first toe 13–16.

COLOR (in preservative).—Dorsal ground color and upper lateral surfaces nearly uniform medium brown to greenish brown, most often marked by irregular, blackish, transverse bands or broken blotches; dark bands or blotches narrower than lighter bands; usually few to numerous, narrow, greenish-white longitudinal dashes occupying median part of each affected scale, primarily on lighter bands and usually in longitudinal rows; lower lateral surfaces bluish gray fading into the bluish white of the venter; posterior venter and undersurface of tail lightly to densely spotted or flecked with small black markings.

COMPARISONS.—*Emoia trossula* differs from *E. sanfordi* in color pattern, in the much lower number of subdigital lamellae (Table 7), significantly in the means for midbody scale rows (t = 10.658; df = 80; $P < 0.001$) and for dorsal scale rows (t = 12.627; df = 76; $P < 0.001$). See description of *E. samoensis.*

REPRODUCTION.—Gravid females have two to five large oviducal eggs.

HABITAT.—William Beckon (Univ. Calif., Davis, pers. comm.) found this species in trees in inhabited areas on Taveuni Island, but on Kadavu Island it was found in the forest on or near the ground.

RANGE.—Numerous islands in Fiji (currently absent from the main island of Viti Levu, although two specimens in the ZMH [R01976–77] were recorded from that island early in the 19th century); Tonga, Roatonga in the Cook Islands, and Rotuma Island.

MATERIAL EXAMINED.—**Fiji:** Ovalau I.: AMS R30433 (holotype), AMS R30576, R30516–18, FMNH 13642, 13644–45, AMNH 40491, BMNH 55.8.16.10; Yaduataba I.: USNM 230301, CAS 155960–62, 156128–29; Kadavu I.: AMS R30466, AMNH 40429, BMNH 82.8.29.185; Aiwa I.: AMNH 29015, 29917–22, 29031–32; Koro I.: AMNH 40506; Thithia I.: AMNH 40196; Moala I.: AMNH 40223; Vatu Vara I.: CAS 156130, AMNH 29010–11; Gau I.: AMNH 40503; Buki Levu I.: MCZ 16945; Lakeba Lau I.: MCZ 16965; Doi Lau I.: MCZ 16941–42; Tuvuca (=Lewuka?) I.: AMNH 40539, BMNH 81.10.12.10; Namena I.: BPBM 1504, AMNH 40441–43, 40445; Taveuni I.: CAS 155958, BMNH 1938.8.2.9; Vitu Levu I.: ZMH R01976–77; Kia I. (small island near Viti Levu): AMS R116160; Komo I.: AMNH 41851; Fiji: MNHN 7070a (one of syntypes of *E. samoensis*), 5573, 5573a–b, USNM 58155, 56166, AMNH 20927, AMS R6466, R8566, A9463, BMNH 62.10.23.4, 75.12.31.6 (paratypes); Rotuma I.: BMNH 97.7.29.9–10, USNM (30 uncatalogued). **Cook Islands:** Rarotonga I.: USNM 249663–66. Tonga: ZMH R01975, AMS R10192, AMNH 40567–68, FMNH 191762; Vavau I.: USNM 259331–32, CAS 158241–43; Eua I.: AMS R96577–79, R96584, CAS 158244–45; Tongatapu I.: BMNH 71.4.16.24a–d, USNM 259333.

Two specimens (BMNH 1860.3.18.8 and 1860.3.18.11) are listed in the catalog as from Vanuatu. This is assumed to be in error, for they are examples of *E. trossula,* which is apparently limited to Fiji, Tonga, and Cook Islands.

ponapea Group

This group includes only *Emoia ponapea.* The group characters are therefore those of the species. The unfused nasal bones and distinct parietal eye link this species with either the *E. samoensis* or *E. cyanura* groups and not with the *E. atrocostata* group, to which the other endemic Micronesian species belong. However, as pointed out by Kiester (1982:9), *E. ponapea* has a palate somewhat intermediate between the alpha and beta types and the unique feature of 13 premaxillary teeth rather than 11, which is characteristic of other groups referred to the genus *Emoia.* I have therefore placed it in a separate, monotypic group.

Emoia ponapea Kiester

(Figure 4h)

Emoia ponapea Kiester, 1982:1 (type loc.: Ponape Island; holotype in MCZ).

DESCRIPTION.—SVL 43.1–50.8 for four mature males, and 44.0–49.5 for two mature females; snout tapered, round-pointed, its length 62–67% of HB and 38–40% of HL; HB 61–63% of HL and 15–16% of SVL; eye 69–77% of snout length and 48–50% of HB; rostral forming broad, nearly straight or slightly convex suture with frontonasal; supranasals broadest anteriorly, in contact with the anterior loreal; prefrontals narrowly to mod-

erately separated; interparietal somewhat longer than broad; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or second upper labials; seven upper labials; sixth enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 29–33 ($\bar{x}$ = 31.25; SD = 1.138; n = 12); dorsal scale rows 52–60 ($\bar{x}$ = 55.923; SD = 2.362; n = 13); length of extended hindlimb 107–117% of axilla–groin distance and 48–53% of SVL; digits slightly expanded laterally; lamellae under fourth toe 38–45 ($\bar{x}$ = 41.538; SD = 2.066; n = 13); under first toe 11–13.

COLOR (in preservative).—Dorsal five or six scale rows brownish tan to light brown, more or less uniform or with scattered dark brown spots covering part of one or more scales; moderately narrow to wide dark band on upper lateral surface with an irregular dorsal margin, marked by scattered lighter scales; limbs mottled brown and light tan; labials marked by some small, dark spots; venter ivory-white.

REPRODUCTION.—Gravid females have two oviducal eggs.

HABITAT.—Known only from floor to heavily forested mountains.

RANGE.—Ponape Island, eastern Caroline Islands.

MATERIAL EXAMINED.—**Caroline Islands:** Ponape I.: MCZ 121040 (holotype), MCZ 121042–43, USNM 138985–86, 138991, 139006–07, CAS 152222 (paratypes), CAS 159812–15, 159824.

cyanura Group

DIAGNOSIS.—SVL at maturity 37–65 mm; scales smooth; midbody scale rows 24–42; dorsal scale rows 49–72; fourth toe lamellae 21–98; interparietal usually fused with frontoparietals into one shield (rarely distinct, except for *E. reimschisseli* and *E. ruficauda*); anterior loreal somewhat shorter and higher than posterior; nasal bones separate; parietal eye present or absent; palate beta type; dorsal ground color, black to light brown; narrow, pale vertebral stripe usually present on head as well as body except in *E. maculata, E. rennellensis, E. schmidti,* and most males of *E. rufilabialis* and *E. taumakoensis* (for these species lamellae are thin and bladelike).

The species in this group can be separated into two subgroups primarily on the basis of the structure and number of subdigital lamellae. *Emoia ruficauda* and *E. isolata* are exceptions, however.

KEY TO SPECIES OF THE *CYANURA* GROUP

1a. Subdigital lamellae rounded; 21–54 (rarely more than 48) under fourth toe 2

1b. Subdigital lamellae moderately thinned or thin and bladelike; 54–98 under fourth toe (rarely less than 64 except for *E. ruficauda* and *E. isolata*) 3

2a. Number of fourth toe lamellae 21–23; color pattern: the narrow, pale, vertebral stripe fades and merges with the tan color of the head and the pale dorsolateral stripes continue anteriorly onto the supraciliaries; (Komodo and surrounding islands) ..... *E. similis*

2b. Number of fourth toe lamellae 33–54 (rarely more than 48 except for populations in the Admiralty and St. Matthias islands); color pattern: dorsally black with pale, narrow vertebral stripe (golden in life) from tip of snout to near base of tail but not merging into blue of tail, pale dorsolateral stripes; or more brownish with stripes faint or absent ..... *E. caeruleocauda*

2c. Number of fourth toe lamellae 32–39 (rarely more than 37); color pattern: dorsally blackish or dark brown with a pale vertebral stripe from tip of snout to base of tail; pale dorsolateral stripes; lateral surfaces usually with yellow spots; tail dusky white; (Moratai and Halmahera islands) ..... *E. reimschisseli*

3a. Number of midbody scale rows 36–42; scale rows between parietals and base of tail 62–72; (Santa Cruz Islands) ..... *E. rufilabialis*

3b. Number of midbody scale rows 26–36; scale rows between parietals and base of tail 49–64 4

4a. Interparietal distinct (rarely fused with frontoparietals); number of moderately thinned fourth toe lamellae 54–63; color pattern: dorsally brownish black with a pale (golden in life) vertebral stripe from tip of snout to base of tail (bluntly ending there) and pale dorsolateral stripes; tail reddish; (southern Philippine Islands) ..... *E. ruficauda*

4b. Interparietal fused with frontoparietals; number of moderately thinned fourth toe lamellae 56–64; color of dorsum tan or greenish tan, pale vertebral stripe lacking; (Bellona Island, Rennell group, Solomons) ..... *E. isolata*

4c. Interparietal fused with frontoparietals; number of bladelike fourth toe lamellae greater than 64 (except for some populations of *E. cyanura*) 5

5a. Pale, narrow middorsal stripe absent from head and usually from body (if present on body, not less than two scale rows in breadth) 6

5b. Pale, narrow (less than two scale rows in breadth) middorsal stripe extending to tip of snout (faint for some examples of *cyanura* or absent for some males of *E. taumakoensis*) 7

6a. Midbody scale rows 30–36; fourth toe lamellae 69–83; ground color of middorsal region (two full-scale rows and two half-scale rows) grayish tan to light brown, which merges anteriorly with the bronze-brown of the neck and head; narrow, pale dorsolateral stripes begin in the supracilliary region; upper lateral surfaces dark brown to blackish with scattered pale scales; (New Georgia and associated smaller islands in the Solomons) ..... *E. schmidti*

6b. Midbody scale rows 28–32; fourth toe lamellae 72–88; dorsal ground color tan to brown with few to numerous, diffuse black markings; distinct, narrow, pale, vertebral stripe not present on head and neck; occasionally present on body, but at least two scale rows in breadth; pale dorsolateral stripes diffuse and very unevenly margined posteriorly; lateral surfaces with pale stripe at level of limbs, and usually numerous, small, scattered, pale spots; (San Cristobal and satellite islands) ..... *E. maculata*

6c. Midbody scale rows 26–32; fourth toe lamellae 64–76; dorsal ground color brown to dark brown; narrow, pale vertebral stripe not present on head and neck, usually present on body, occupying two half-scale rows, dorsolateral pale stripes present; lateral pale stripe at level of limbs not present; small, scattered, pale spots on brown areas of upper lateral surfaces and usually dorsum; (Rennell Islands) ..... *E. rennellensis*

7a. Fourth toe lamellae 59–86 (rarely more than 78, except for some Solomons populations); midbody scale rows (mean 28); tail bluish (sometimes brownish) without prominent black markings; (widely distributed in Pacific islands from Bismarcks eastward) ..... *E. cyanura*

TABLE 8. Standard scale counts and measurements for species of the *Emoia cyanura* group.

Species	Adult SVL (mm)	*n*	Labial below eye		Midbody scale rows	Scale rows parietals to tail	Fourth toe lamellae
			5th	6th			
E. caeruleocauda	40.9–65.0	120	108	9	27–36	49–64	32–54
E. cyanura	38.9–56.5	106	95	9	25–32*	52–64	58–86**
E. isolata	49.1–60.0	11	11	0	31–34	53–59	56–64
E. maculata	39.1–52.5	25	22	2	26–32	52–59	65–88
E. pseudocyanura	45.0–58.8	48	37	8	28–34	53–62	73–98***
E. reimschisseli	39.1–57.4	24	19	3	29–34	49–57	32–39
E. rennellensis	42.2–44.8	19	15	0	26–32	54–58	65–76
E. ruficauda	42.5–53.6	25	10	1	26–29	49–54	54–64
E. rufilabialis	46.1–65.4	19	8	8	36–42	62–72	68–84
E. schmidti	49.3–63.3	35	18	0	30–36	55–64	69–83
E. similis	37.3–42.0	12	11	1	24–30	52–59	21–24
E. taumakoensis	50.1–57.6	10	10	0	32–36	57–61	76–84

* Rarely greater than 30.
** Rarely greater than 75 except for some Solomon Islands populations.
*** Rarely less than 78.

7b. Fourth toe lamellae 76–84; midbody scale rows 32–35; tail grayish blue to brown (dark gray in life); (Duff Islands) ..... *E. taumakoensis*

7c. Fourth toe lamellae 73–96 (rarely less than 78); midbody scale rows 27–34 (mean 30); tail usually bluish, marked by rows of small black spots or sometimes bars; (Guadalcanal, Malaita, Bougainville, Isabel, and Choiseul islands in Solomons) ..... *E. pseudocyanura*

cyanura Subgroup

Eight species are currently assigned to the *cyanura* subgroup. They have thinned, bladelike lamellae numbering 56–98, and for those species exhibiting a pale, narrow vertebral stripe, the stripe merges posteriorly with the pale coloration of the tail. The *E. cyanura* subgroup is centered in the Solomons Archipelago, but one species, *E. cyanura,* ranges northward and eastward through the islands of the Pacific Basin as far as Clipperton Island in the eastern Pacific, and in the Bismarcks in the west.

Superspecies **Emoia cyanura** (Lesson)

(Figure 4d)

Scincus cyanurus Lesson, 1826, pl. 4, fig. 2 (type loc.: Tahiti Island; Society Islands; syntypes in MNHN); 1830:49; Brygoo 1985:29.
Eumeces lessoni Duméril and Bibron 1839:654; Duméril and Duméril 1851:157 (substitute name).
Eumeces cyanurus: Lichtenstein 1856:18.
Mabouya (Emoia) cyanura: (part) Gray 1845:96.
Emoa cyanura: Girard 1858:260.
Euprepes cyanurus: Steindachner 1867:44.
Euprepes (Mabuya) cyanurus: Peters 1872:582.
Mabouia cyanura: (part) Günther 1877:128.
Lygosoma cyanurum: (part) Boulenger 1887a:290; (part?) 1888b:90; (part) 1897b: 307; Ogilby 1890a:5; (part) Boettger 1893:106; Werner 1900:60; Garman 1901: 8; Vogt 1912a:4; Thompson 1912:5; Roux 1913:154; (part) de Rooij 1915:253; (part) Kinghorn 1928a:170; Parker 1925:299; Baker 1928:297; (part) Sternfeld 1920:407; Schuz 1929:9; Angel 1935:55.
Lygosoma impar Werner, 1898:553 (type loc.: New Britain, Bismarck Islands; type presumed lost), 1899:272, 1900:62; Scott, Parker, and Menzies 1977:11.
Lygosoma arundeli Garman, 1899:61 (type loc.: Clipperton Island; type in MCZ).
Emoia cyanura: Stejneger 1899:807; McGregor 1904:116; (part?) Van Denburgh 1912:235, 1917:38; Barbour 1912:93, 1921:103; Schmidt 1923:51, (part) 1932: 106; Ortenburger 1923:60; (part) Burt and Burt 1932:520; Schmidt and Necker 1933:11; Mertens 1934:9; Hediger 1934:466; (part) Smith 1937:227; Fisher 1948:69; Loveridge 1948:367; Marshall 1950:8; Mittleman 1952:23; Oliver and Shaw 1953:90; Brown 1953:268, 1956:1487; Arnow 1954:8; Bryan 1959:15; Greer 1970:171; Clapp and Sibley 1971a:3, 1971b:9; Marshall 1975:22; Medway and Marshall 1975:440; Rehder and Randall 1975:20; Clapp 1971:2; Scott, Parker, and Menzies 1977:11; Pernetta and Watling 1979:238; Brown, Pernetta, and Watling 1980:350; McCoy 1980:35; Schwaner 1980:11; Kiester 1982:9; Ineich 1983:3; Brown 1983:321; Sachet 1983:15, 66; Fosberg, Sachet, and Stoddart 1983:22; McCoy and Webber 1984:572.
Lygosoma cyanurum schauinslandi Werner, 1901:384 (type locality Kalae, Molokai, Hawaiian Islands; disposition of type unknown); Vogt 1912a:5.
Emoia cyanura arundeli: Brown 1954; Sachet 1963.
Emoia pheonura Ineich, 1987:491 (type loc.: Mooréa Island, Society Islands; holotype in MNHN).

Scincus cyanurus is the third species illustrated by Lesson in 1826 and described in 1830 (see discussion under *E. atrocostata*). From 1826 through the early 1900s, small samples from populations in numerous islands in the Pacific Basin as well as Vanuatu, Solomons, New Guinea, and the East Indies, which exhibited the striped color pattern of *E. cyanura* were referred, with a few exceptions, to *E. cyanura.* Exceptions included de Vis (1892), Vogt (1912a), and Parker (1925). These authors noted that the populations could be divided into two species or subspecies, based on the shape and number of subdigital lamellae, and assigned different names to the species having the lower number of lamellae. Later authors, up to 1953, continued to refer these populations to *E. cyanura* if they possessed relatively thinned lamellae numbering from 60 to 98, or to *E. werneri* or *E. caeruleocauda* if the subdigital lamellae were more rounded and numbered less than 50.

In 1953 Brown recognized that samples from some Solomon Island populations previously referred to *E. cyanura* represented three distinct species based on consistent and well-defined morphological and color differences. He described *E. maculata* and *E. schmidti.* Two other related species, *E. rufilabialis* and *E. taumakoensis,* were described by McCoy and Webber (1984). The rationale for their recognition will be discussed in the introductions to those species.

Based on samples from numerous populations of *E. cyanura* from Clipperton Island in the eastern Pacific through Vanuatu, Solomons, and Bismarcks in the west, *E. cyanura* can now be more critically defined, particularly with respect to standard scale counts (see description). The range for number of fourth toe lamellae is less than was previously thought (rarely more than 75, see Table 8). As a result three more species, *E. pseudocyanura, E. isolata,* and *E. rennellensis,* are described in this paper.

Studies of populations of *E. cyanura* throughout its extensive range outside of the Solomons have thus far only led to taxonomic confusion, as emphasized by Crombie and Steadman (1986). Werner (1898) described *Lygosoma* (=*Emoia*) *impar* from New Britain, Bismarcks, primarily because of the fusion of scales in the paravertebral rows into a single row. Garman (1899) described *Lygosoma* (=*Emoia*) *arundeli* from Clipperton Island in the eastern Pacific, emphasizing color differences; and Werner (1901) described *Lygosoma cyanurum schauinslandi* from Molokai Island, Hawaiian Archipelago, also based on color differences. These three taxa have been synonymized with *E. cyanura* primarily because the color characters used do not clearly delimit any population or group of populations. They are not clearly associated with consistent morphological differences such as those used in differentiating sibling species in the Solomons. Some samples from Pacific-island populations show relatively little variation in color and pattern, others exhibit extensive variation that would include the color states emphasized by Garman and Werner for their limited population samples. Crombie and Steadman (1986) discuss this. They note that blue or brown tail color, bold or partial striped, unicolor, and melanistic individuals may all be found in some localized populations, such as those on Rarotonga and Mangaia islands.

Ineich (1987b) has made the most recent effort to demonstrate the presence of two wide-ranging sibling species of the *cyanura* complex in the Pacific islands. Unfortunately, he has only added to the confusion. He described *E. pheonura* from Mooréa Island, Society Group, an island close to Tahiti, the stated type locality of *E. cyanura*. His diagnosis is based on a comparison with specimens that he has identified as *E. cyanura* from Mooréa and other islands in French Polynesia, and with small samples from populations in Tonga Archipelago, Hawaiian Islands, Wallis, Futuna, and Clipperton. He stated that *E. pheonura* differs from *E. cyanura* in: (1) exhibiting a brown or brownish-green color of the tail (not blue); (2) having an occipital stain, blue or black, single, double, or triple; (3) lacking melanistic individuals; (4) having color of venter and thighs pure ivory-white; (5) SVL reaching 57 mm; (6) lacking an incision in the anterior part of the postmental; and (7) lacking a fusion of scales in the middorsal rows.

As previously noted, Crombie and Steadman (1986) observed color differences of tail, body, and in striped pattern great enough to include the extremes emphasized by Ineich in his samples from Rorotonga and Mangaia islands, Cook Group. Ineich gives a range of 43–57 mm for *E. pheonura*; I have a range of 38.9–56.5 mm for 95 specimens of *E. cyanura*. Thus size at maturity is excluded as a diagnostic character. The cleft at the anterior edge of the postmental, which Ineich indicates differentiates French Polynesian *E. cyanura* from *E. pheonura*, seems to be present in less than 50% of the sample of *E. cyanura* that I have examined from French Polynesia. The fusion of scales in the middorsal rows is highly variable for populations in different island groups and is not clearly associated with color differences, as stated by Ineich.

In considering the other names that might be available, Ineich did examine small samples of *E. arundeli* from Clipperton and *E. cyanurum schauinslandi* from Hawaii. In rejecting the name *E. arundeli*, he resurrected it from the synonymy of *cyanura*, stating that it is more like *E. pheonura*, but like *cyanura* it exhibits melanism. He then assigned the non-melanistic examples from Clipperton Island to *E. pheonura* and the melanistic ones to *E. arundeli*. Melanism occurs to some degree in many skinks and is inadequate as a lone diagnostic character in separating species. Ineich does not give reasons as to why *E. schauinslandi* is not available. J. D. Lazell (MCZ, pers. comm.) informed me that the Hawaiian specimens that he has seen have (in life) brown or green-brown tails (never blue). This would associate these populations with *E. pheonura*, according to Ineich's diagnosis.

Furthermore, Ineich stated that *E. pheonura* occurs from New Guinea in the west to Clipperton island in the east, and that in the Solomons, it completely replaces *E. cyanura*—this without citing examination of any examples from the Solomons. The specimens from the Solomon Islands that I refer to *E. cyanura* consistently have a blue tail and the striped color pattern generally thought of as typical of that species. No examples show fusion of scales across the paravertebral rows, but that is about the only way they seem to be in agreement with Ineich's concept of *E. pheonura*.

I regard Ineich's diagnosis as unsatisfactory. He also has not clearly demonstrated that either the name *E. arundeli* or *E. schauinslandi* should not be available. I therefore conclude that the name *E. pheonura* must join others as a synonym of *E. cyanura*.

Lesson (1830) stated that numerous examples of *Scincus cyanurus* were in the collection, but only seven specimens (MNHN 7068, 7068a–b and 7069, 7069a–c) are now known to exist. Both series are labeled as from Tahiti. The rest of Lesson's original series must now be regarded as lost. The 7068 series includes one example (MNHN 7068) of the species I recognize as *E. caeruleocauda*, the other two are *E. cyanura*. The 7069 series includes one specimen of *E. cyanura* (MNHN 7069a) and three examples of *E. caeruleocauda*. The illustration (Lesson 1826: pl. 4, fig. 2) figures the species that has long borne the name *E. cyanura*, as is evident from the fact that the pale vertebral stripe continues onto the base of the tail where it merges into the blue color of the tail. This is not characteristic for *E. caeruleocauda*, whose pale vertebral stripe ends abruptly at the base of the tail.

The presence of examples of *E. caeruleocauda* in the syntypic series creates doubt about the type locality, because that species has not been recorded from islands east of Fiji by recent collectors. Thus, the probability exists that specimens from two different islands were inadvertently mixed and labeled as from Tahiti. However, since *E. cyanura* does occur on Tahiti, that locality should stand as the type locality.

The three syntypes of Lesson that are referable to the superspecies *E. cyanura* are generally dark in color, perhaps the result of preservation for more than 150 years, and none are in agreement with the lighter shades of color illustrated for the species (Lesson 1826, pl. 4, fig. 2). Brygoo (1985:29) designated MNHN 7069a as the lectotype.

DESCRIPTION.—SVL 38.9–56.5 mm for 50 males and 40.5–54.8 mm for 45 females; snout strongly tapered, its length 62–70% of HB and 32–42% of HL; HB 60–65% of HL and 14–17% of SLV; eye 62–73% of snout length and 40–47% of HB; rostral forming moderately long, nearly straight suture with frontonasal; supranasals narrow-elongate to narrowly triangular; prefrontals narrowly to widely separated (rarely in contact); one pair of nuchals; anterior loreal somewhat shorter than, to nearly

as long as and slightly higher than, posterior loreal, in contact with first and second, second, or second and third upper labials and with supranasal; usually six or seven upper labials, fifth (occasionally sixth) enlarged and below eye; six or seven lower labials; scales smooth; midbody scale rows 25–32, not more than 30 except for populations in Fiji and Vanuatu ($\bar{x}$ = 28.646; SD = 1.139; n = 181); dorsal scale rows 52–64, rarely more than 60 ($\bar{x}$ = 57.079; SD = 1.793; n = 164); length of extended hindlimb 90–110% of axilla–groin distance and 43–52% of SVL; thinned, bladelike lamellae under fourth toe 59–86, rarely more than 79 except for the Bougainville Island population ($\bar{x}$ = 69.291; SD = 4.229; n = 151); lamellae under first toe 16–21.

COLOR (in preservative).—Dorsal ground color blackish or brownish, sometimes fading, primarily on posterior body, to some shade of blue, golden-brown or iridescent gold; typically with three narrow, pale longitudinal stripes that may be bluish, golden-tan or ivory-white; median stripe beginning at tip of snout and extending posteriorly onto base of tail and merging with blue or tannish color of tail; tail bluish or tannish, usually lacking black spots or bars; venter bluish white or off white for dark pale-striped specimens, but grayish, grayish tan, or tan for specimens with a more uniformly brownish dorsum.

For those specimens in which the ground color has faded posteriorly, the median stripe usually is evident though less prominent, and it remains narrow. The vertebral stripe usually occupies the overlapping segments of the paravertebral rows along the vertebral line. When these rows are fused, the stripe occupies the median part of the resulting enlarged scale. The lateral pale stripes typically begin on the snout or the anterior border of the eye, extend across the supraciliaries and along the dorsolateral area to merge into the lighter color of the tail. These narrow stripes usually occupy the median part of one scale row. Occasional specimens, particularly in populations of the Marshall Islands, some Polynesian Islands, Hawaiian Islands (for example CAS-SU 7513, USNM 125447, 125427, 125478, CAS 71036–39, 41042–43), and predominantly in the population on Clipperton Island, are rather uniformly golden-brown or tannish, without evidence of the pale stripes or with only part of the vertebral one appearing.

COMPARISONS.—Some or all specimens from populations referred to *E. cyanura,* except for some samples from Clipperton Island, exhibit the three narrow, pale longitudinal stripes, with the vertebral one extending from the tip of the snout to the base of the tail, where it merges with the lighter color of the tail (Fig. 22). Other examples in many populations, especially in the eastern Pacific islands, exhibit a fading of the dorsal ground color and a less conspicuous or very vague vertebral stripe. However, this pattern can be distinguished from the typical patterns of *E. isolata, E. maculata, E. pseudocyanura, E. rennellensis, E. rufilabialis, E. schmidti,* and *E. taumakoensis.* For details of color and other differences, see descriptions of those species and Figures 26–30. Populations of *E. cyanura* from various island regions are relatively uniform in the range of counts for midbody and dorsal scale rows. There are somewhat greater differences in counts for fourth toe lamellae (60–79, rarely greater than 75 for Pacific Basin islands and 63–86, rarely greater than 80 for Solomon Islands). Populations also vary greatly in terms of the extent to which scales of the paravertebral rows are fused.

REPRODUCTION.—Gravid females have two oviducal eggs. Schwaner (1980) noted that in Amerian Samoa the usual communal nesting site was under rocks above a sand substrate. The rocks were usually flat coral plates. McCoy (1980) found eggs in ground debris and in hollows in logs and under rocks. Schwaner (1980) measured hatchlings 20 to 23 mm in SVL. Baker (1947) stated that for this species in Vanuatu the height of the reproductive season was September to December and the low point May and June.

HABITAT.—In the Solomon Islands McCoy (1980:35) found *E. cyanura* in marginal areas, such as along the seashore, gardens, and planted areas, but rarely in forested areas. The species normally feeds on small arthropods.

RANGE.—Ningo Island (west of the Admiralty Islands), Admiralties, Bismarcks, Solomons, and Vanuatu in the west through Polynesia, then north and east through the Marshalls, and scattered islands such as Wake, Midway, Hawaii, and Clipperton Island in the eastern Pacific, Kapingamarangi in the Carolines, and Cocos and Guam in the Marianas. The presence of this species in the Marianas appears to be the result of recent introductions.

MATERIAL EXAMINED.—**Vanuatu:** UMMZ 100005a–f, 100010a–d, AMS B3830, R3554, FMNH 105528; Efate I.: FMNH 83952; Elephant I.: FMNH 13696; Eromanga I.: AMS A2802–03, A2806, R8670; Espiritu Santo I.: AMS R11387, AMNH 41906–07, 81639–43, MCZ 140206; Maffia (?) I.: MVZ 40827–40; Malekula I.: AMS R7063, AMNH 41065, 81638, MCZ 117629, 128513–15. **Loyalty Islands:** Mare I.: AMNH 81767, MCZ 19603; Lifu I.: AMNH 61701; Uvea I.: AMNH 61704–05; Nitche Maci: FMNH 105396. **Banks Islands:** Torres I.: AMNH 42077–83; Vanua Lava I.: AMNH 81714–26. **Santa Cruz Islands:** Vanikoro I.: AMS R9038 (2 specimens), R9039 (one specimen), R9193, CAS 72267; Lomlom I.: CAS 72275–76; Tikopia I.: CAS 158226–28; Matema I.: CAS 72230–35. **Solomon Islands:** Santa Ana I.: MCZ 14548–51, AMS R42086–87, R42091, 42093–94; San Cristobal I.: AMS R80158–66, AMNH 42090–92, CAS 72226, 152094; Ugi I.: MCZ 14623–28, FMNH 13706–08; Malaita I.: MCZ 114122, 114124–35, 114137–43, 114145–59, 114161–65, 114170–84, 114186–87, 114189–91, 114193–210, 1141212, 117652, 117654–60; Guadalcanal I.: MCZ 27940–42, 114477, 114483–85, 114490–93, FMNH 42007–14, CAS 49929–40, 72168–71, 151975–80, 1151982–91, 1152178–87, 1157884–98, AMNH 41811–13, 65507–08, 66232, 66545; Nggela Sule I. (=Florida): AMS R42086–87, R91046–51; Anuda I. (?): CAS 72262–64; Savo I.: AMNH 41811–13; Tulagi I.: UMMZ 99970a–f, 99972a–f; Santa Isabel I.: MCZ 14629, FMNH 191763–64, AMNH 40202–03, 41899–900, AMS R8656, R8785, R9294; Arnavon I.: AMNH 40311, 41823; Choiseul I.: AMNH 40344, 40368; Kulambangara I.: AMNH 40312, 40336, 40338; Bougainville I.: CAS 108905–16, AMNH 41832–34, 41893, 101181–82, MCZ 67675–76, 64201–04, 75957–65, 75966–67, 83262–69, 87590–98, 93977; Mono I.: AMS R96767–76, AMNH 41832–34; Stirling I.: MCZ 49350; Shortland I.: MCZ 93978–80; Poporang I.: MCZ 89714–17, 93997, 94023; Fauro I.: AMNH 41893; Magusaiai I.: MCZ 89234–38, 93981–82, 99762, 101994–102010; Dema I.: AMNH 41863; Karamula I.: AMS R8353, R8782; Howla I.: AMS R738–39; Malalolo I.: BMNH 1935–9.1.48–53; Tola I.: MCZ 75945–56. **Bismarck Islands:** New Britain I.: MCZ 4708, 135427, 141637–45, 171648, 142571–74, AMS R3987 R11195; New Ireland I.: MCZ 152830–34. **Admiralty Islands:** Manus I.: AMS R31109; Los Negros I.: BYU 7182; Wild I.: BMNH 82.8.29.142–143. **Ninigo Island** (west of Admiralties): RUCA (10 uncatalogued). **Fiji:** AMS R4761, R5104, R5106, R6454; Kandavu I.: AMS R30452–61, R30475–91, R30516–27, AMNH 40493–502; Ovalau I.: RMNH 40490, 40492, AMS R30513–15; Fulana I.: AMNH 41655; Moala I.: AMNH 40214, 40216–20, 40222; Tumutha I.: AMNH 40538; Ongea Levu I.: AMNH 41656–57; Wailangilala Lai I.: AMNH 41660; Katafanga I.: AMNH 41661–63, 41951–61; Oneata I.: AMNH 41664–65; Matuku I.: AMNH 41709–12; Totoya I.: AMNH 41737; Komo I.: AMNH 41746; Namuka Lau I.: AMNH 41931–38, 41940; Vanua Moalavu I.: AMNH 41658. **Tonga:** AMS R59952, FMNH 58143, 171553; Tongatabu I.: AMS R96553, MNHN 2910, AMNH 20526–29, CAS 49995, 49998–50000, 50002–08, 50010–17, 50019–26, 50028–32, 50034–38, 50040–42, 50070, 50137; Nikualofa I.: AMS R10099–10100; Nuku I.: CAS 50070; Eua I.: AMS R96574–76, CAS 49991–92, 159499–502, AMNH 40191–92; Niaufou I.: AMNH 40555; Niuatobutabu I.: AMNH 40572–74; Niutua I.: AMNH 20526–29; Takani I.: AMS R80858–63; Vayau I.: CAS 50137; Ofu I.: CAS 158995; Lifuka I.: CAS 49980–81, 49989; Fukau I.: CAS 40095–96, 50101–04; Koloa I.: CAS 50143; Euakafa I.: CAS 50144, 50146–47; Kapa I.: CAS 158998, Vaka'eitu I.: CAS 158989–94. **Samoa:** Upolu I.: CAS-SU 6691–6706, MCZ 69488–

94; Tutuila I.: MCZ 44332, CAS 20687–89, 50195–96, 50198–228, 50231–35, AMNH 22543–45, 42407, 42409; Olosega I.: AMNH 29170. **Wallis Island:** AMS R56943–45. **Niue Island:** MCZ 33538–42. **Ellice Islands:** Funafuti I.: AMS R2079, R2081–82, R2471, R4098, R4100, FMNH 171552. **Takelau Islands:** Atafu I.: USNM 156944–53; Fakaofo I.: USNM 156912, AMNH 41717–21; Nukumono I.: USNM 156922–32. **Danger Islands:** Nassau I.: AMNH 29211–19, 29221–26, 41722–26, 41738; Pukapuka I.: AMNH 29171–80, 29184–92, 29194, 29197–98, 29200–203, CAS 85433–36. **Cook Islands:** Penrhyn I.: CAS 78784–93; Rarotonga I.: AMS R2521–24. **Austral Islands:** Raivavae I.: CAS 54915–16, 71054–68, AMNH 5946–47, 25237; Rapa I.: CAS 71071–72, AMNH 23745; Rimatara I.: AMNH 7919, CAS 71030–31; Rurutu I.: AMNH 7933, 7935, CAS 71939–52; Tubuai I.: CAS 54911–13, AMNH 7923–24, 7927. **Society Islands:** Ahii I.: AMNH 2554–05, 25519–21; Huahine I.: FMNH 171556; Mehetia I.: AMNH 25229–36; Moorea I.: AMNH 25227–36, CAS 54936; Mopelia I.: AMNH 22300–304; Papeete I.: MCZ 16404–05; Tahiti I.: FMNH 109938, AMNH 7878–83, 21512–29, MNHN 7068a–b, 7069a, MCZ 56250. **Tuamotu Islands:** Matahiva I.: AMNH 25272–92; Rangiroa I.: AMNH 24423; Manihi I.: AMNH 43598–619; Ahe I.: AMNH 25384–410; Takaroa I.: AMNH 27391–447, CAS 54931; Aratika I.: AMNH 25256–71; Raraka I.: AMNH 23774–82; Katiu I.: AMNH 25341–68; Fakarawa I.: AMNH 25238–48; Anaa I.: CPS 54927, AMNH 21574-82; Makemo I.: AMNH 25411–21; Raroia I.: AMNH 25249–55; Takume I.: AMNH 25305–14; Puka Puka I.: CAS 85433–36; Tureia I.: AMNH 23721; Marutea I.: AMNH 23804–15; Mangareva I.: AMNH 23870–85; Pitcairn I.: CAS 71086–96, AMNH 23774–82; Oeno I.: AMNH 23714–17; Henderson I.: AMNH 23732–35; Nihiru I.: CAS 54925; Hau I.: 71006–11; Gambier I.: CAS 71076–82. **Marquesas Islands:** Nuku Hiva I.: CAS 70987–96, AMNH 21555, 29150, 29153; Hiva Oa I.: AMNH 7877, 24448–51; Montane I.: AMNH 24421; Fatu Hiva I.: CAS 70999–71001, AMNH 24439–41. **Line Islands:** Fanning I.: CAS 64039–63, MCZ 87260–61, 96039–41, 152531–41; Flint I.: AMS R3899. **Gilbert Islands:** Nauru I.: AMS R3203–04, R7108; Ocean I.: AMS R3205; Tarawa I.: FMNH 171554. **Marshall Islands:** Arno Atoll: CAS-SU 13489–96, USNM 3974, 4004, 4022–23, 4037–38, 4048, 4055–56, 4060, 4078, 4082–83, 4088, 4090, 4099; Majuro Atoll: FMNH 42585, MVZ 40476–79; Ailuk Atoll: USNM 132246–52; Taka Atoll: USNM 132211–12; Utirik Atoll: USNM 132200–10; Rongerik Atoll: USNM 124071–101, CAS-SU 12185–90; Likrep Atoll: USNM 132221–26; Bikini Atoll: CAS-SU 12191–202, 12206–10, USNM 124027–48, 124050–52; Ujae Atoll: USNM 132161; Ujelang Atoll: USNM 132184–85, 132187; Eniwetok Atoll: AMNH 66574a–b, USNM 124071, 124073, 124075; Lae Atoll: USNM 132262–70; Rongelap Atoll: USNM 124106; Bikar Atoll: USNM 132448–49. **Caroline Islands:** Kusaie I.: USNM 121116–17; Ponape I.: AMS R57311, R57390, R57491, MCZ 111493, 111495, 111498, 111500–01, 111504, 111508, 111514, 111517, 111521–22, 111525–28, 111531; Kushae (?) I.: AMS R95942–43; Kapingamarangi I.: CAS-SU 25639–67. **Marianas Islands:** Cocos I.: USNM 216334–36, CAS 139823–24; Guam I.: USNM 122485, 216337–64. **Wake Island:** CAS 14958, 91506, FMNH 63737–38, USNM 132327. **Hawaiian Islands:** Maui I.: CAS 47439–41, CAS-SU 7513; Kauai I.: CAS 20927–28, 44075–76, 47431–38. **Clipperton Island:** MCZ 6463 (holotype of *Emoia arundeli*), MCZ 4955–69, CAS 9025–59, 9061–64, 9070–89, 85677–78, AMNH 20498, USNM 140715–20.

Emoia isolata n. sp.

Emoia cyanura: (part) Slevin 1934:185; (part) Volsoe 1956:123.

HOLOTYPE.—CAS 72195, an adult male, collected on Bellona Island, Rennell Island Group, Solomons, by members of the Templeton Crocker Expedition, 21 May 1933.

PARATYPES.—Solomons, Rennell group, Bellona Island: CAS 72186–94, 72196.

DIAGNOSIS.—SVL at maturity 49.1–60.0 mm (for eight specimens); midbody scale rows 31–34; dorsal scale rows 53–58; moderately thinned subdigital lamellae, 56–64 under fourth toe; narrow middorsal and lateral stripes lacking; dorsolateral stripes present; scattered, pale scales usually present on the dark lateral surfaces.

DESCRIPTION OF HOLOTYPE.—Adult male, SVL 53.0 mm; midbody scale rows 32; dorsal scale rows 57; fourth toe lamellae 61.

DESCRIPTION.—SVL at maturity 53.0–60.0 mm for six males and 49.1–52.9 mm for three females; snout tapered, rounded at tip, its length 53–60% of HB and 33–37% of HL; HB 57–63% of HL and 13–15% of SVL; eye 72–80% of snout length and 39–46% of HB; rostral forming moderate to long suture with frontonasal; supranasals narrow triangular, in contact with anterior loreal; prefrontals moderately to narrowly separated; usually seven superciliaries; one pair of nuchals; anterior loreal somewhat shorter and higher than posterior, in contact with first and second or second upper labials; seven upper labials, fifth enlarged and below eye; five or six lower labials; scales smooth; midbody scale rows 31–34 ($\bar{x}$ = 32.273; SD = 0.786; n = 11); dorsal scale rows 53–58 ($\bar{x}$ = 55.636; SD = 1.247; n = 11); length of extended hindlimb 88–105% of axilla–groin distance and 43–49% of SVL; lamellae under fourth toe 56–64 ($\bar{x}$ = 60.4; SD = 1.955; n = 10); under first toe 15–18.

COLOR (in preservative).—Dorsal ground color faded irridescent tan or greenish tan, almost uniform or with two rows of darker (brownish) spots or dashes lateral to paravertebral rows; pale, dorsolateral lines nearly always evident on neck and sometimes on anterior body (rarely posteriorly); upper lateral surfaces (five to eight scale rows) darker brown to light brown (the latter possibly result of fading), relatively uniform or with numerous pale scales; top of head tan; limbs about same color as dorsum or somewhat darker; tail same ground color as dorsum with few to numerous brown spots in two rows; venter whitish ivory, sometimes with bluish tinge, more flesh-ivory in limb regions and under limbs and chin. The color pattern resembles that of the *E. concolor* complex of the *samoensis* group.

COMPARISONS.—*Emoia isolata* differs from other species of the *cyanura* group in the distinct color pattern. It also differs from all species other than *E. ruficauda* in the moderately thinned and intermediate number of fourth toe lamellae (Table 8). It is most similar to *E. schmidti* in lacking any evidence of a median dorsal stripe. In the somewhat faded condition of this series, the upper lateral surface is slightly darker than the dorsum between the pale dorsolateral stripes. *Emoia isolata* is closest to *E. schmidti* and *E. taumakoensis* in scale counts. It differs significantly from both, however, not only in the much lower number of lamellae below the fourth toe (Table 8), but also from *E. schmidti* in the means for dorsal scale rows (t = 4.68; df = 31; $P < 0.001$) and from *E. taumakoensis* in the means for midbody scale rows (t = 3.733; df = 19; P = 0.001) and dorsal scale rows (t = 5.405; df = 19; $P < 0.001$).

REPRODUCTION.—Gravid females have two enlarged oviducal eggs.

RANGE.—Bellona Island, Rennell Island group.

Emoia maculata

(Figure 4f)

Emoia cyanura: (part) Schmidt 1932:186 (Schmidt noted that his series probably included two or three species); (part) Roux 1934:80.

Emoia maculata Brown, 1953:273 (type loc.: Ugi Island, Solomon Islands; holotype in FMNH); Greer 1970:171; (part) McCoy 1980:36; McCoy and Webber 1984:562.

This species is limited to the southern islands of the Solomon Archipelago, San Cristobal and satellite islands. The middorsal pale stripe may or may not be evident on the body, but in those instances where it is, it always fades on the neck and merges with the tan to brown color of the head rather than continuing to the tip of the snout as is characteristic of *E. cyanura*.

DESCRIPTION.—SVL 39.1–52.5 mm for 20 males and 39.4–50.0 for 16 females; snout tapered, round pointed at tip, its length 38–41% of HL and 61–70% of HB, HB 58–63% of HL and 14–16% of SVL; eye 62–71% of snout length and 40–48% of HB; rostral forming nearly straight suture with frontonasal;

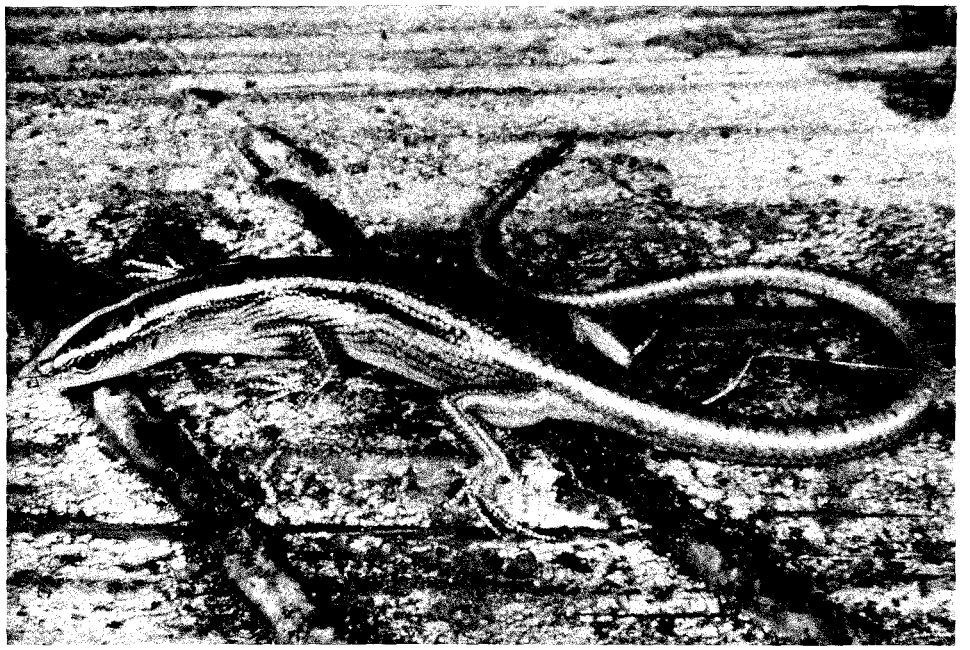

FIGURE 26. *Emoia pseudocyanura,* showing the diffuse broadening of the middorsal stripe posteriorly, Malaita Island. Photo courtesy of M. McCoy.

supranasals long, in contact with anterior loreal; prefrontals narrowly to rather widely separated (rarely in contact); interparietal rarely distinct, and when present small; one pair of nuchals; anterior loreal shorter and usually slightly higher than posterior, in contact with first and second or second upper labials; usually six upper labials, fifth (in one specimen fourth) enlarged and below eye; six or seven lower labials; scales smooth; midbody scale rows 28–32 ($\bar{x}$ = 29.667; SD = 0.907; n = 48); dorsal scale rows 52–59 ($\bar{x}$ = 54.977; SD = 1.406; n = 43); length of extended hindlimb 92–109% of axilla–groin distance and 44–51% of SVL; thinned lamellae under fourth toe 73–88 ($\bar{x}$ = 80.585; SD = 3.527; n = 42); under first toe 15–22.

COLOR (in preservative).—Middorsal ground color tan to brown with bronzy sheen, covering from about two to four plus rows; or vertebral rows bluish and outer rows dark brown to blackish, often with scattered bluish scales; narrow, bluish-white to slate, somewhat uneven-edged, dorsolateral stripes beginning above eye and extending posteriorly onto tail; upper lateral surfaces (three to five or six scale rows) dark brown to black, usually marked by bluish or bluish-white scales; blue of lower lateral surfaces marked by scattered brown to black spots; venter bluish white to dusky white; tail bluish marked with brown or black, or more or less uniform slate-brown.

COMPARISONS.—*Emoia maculata* differs from *E. rufilabialis, E. schmidti,* and *E. taumakoensis* not only in color pattern but also in the lower number of midbody and dorsal scale rows (Table 8). *Emoia maculata* differs from sympatric and other Solomon populations of *E. cyanura* in the distinctive color pattern and significantly in the means for midbody scale rows (t = 7.587; df = 107; $P < 0.001$). *Emoia maculata* differs significantly from *E. pseudocyanura* in the means for dorsal scale rows between the parietals and the base of the tail (t = 5.546; df = 104; $P < 0.001$). Typical *E. maculata* specimens from San Cristobal, Ugi, and Malaupaina Islands in the southern Solomons, as illustrated by McCoy (1980, color pl. 3), also exhibit in life a distinct reddish coloration along the side of the neck and jaws for live specimens, whereas *E. pseudocyanura* lacks this marking as is shown in McCoy (1980, pl. 4) and Figure 2 in this paper. For comparison with *E. rennellensis,* see description of that species.

REPRODUCTION.—McCoy (1980) stated that females deposit the eggs in ground debris or fallen, rotten logs. The clutch size is two eggs.

HABITAT.—McCoy (1980) stated that this species forages over leaf litter in the forest floor or sometimes up to eight meters in shrubs and small trees.

RANGE.—Ugi, San Cristobal, Malaulalo, and Malaupaina islands.

MATERIAL EXAMINED.—**Solomon Islands:** Ugi I.: FMNH 13715 (holotype), 13711–14, 13716 (paratypes); CAS 73252–54; San Cristobal I.: MCZ 49501–05 plus 10 uncatalogued (paratypes), MCZ 40626–27, AMNH 42190, CAS 72214–21, 72223–25, 72227, 152093, AMS R80133–54; Malaupaina I.: AMS R93494, CAS 151992–152018; Malaulalo I.: BMNH 1935.9.1.47.

Emoia pseudocyanura n. sp.

(Figure 4e, 26)

Emoia cyanura: (part?) Barbour 1921:103; (part) Schmidt 1932:186; (part) Burt and Burt 1932:520.

Webster (1969) referred populations of this species from Malaita, Guadalcanal, and Bougainville islands to a superspecies that he called "M" type (=*E. maculata*).* These populations differ in several characters from *E. maculata* populations on San Cristobal and small surrounding islands, and I here treat

* T. P. Webster, Jr. (1969, Unpublished Honors Thesis, Harvard University) placed *E. maculata, E. schmidti,* and samples from populations on Malaita, Guadalcanal, and Bougainville islands, which he recognized as representing an evolutionary entity or entities distinct from *E. cyanura,* in his "M" type (=*maculata*) superspecies. McCoy (1980), aware that I was working on a revision of the genus *Emoia,* followed Webster rather than undertake an independent study of the problem.

them as a distinct species. This sympatry of two sibling species, *E. cyanura* and *E. pseudocyanura,* on Guadalcanal, Malaita, Isabel, Choiseul, Nggela, and Bougainville islands is similar to the sympatry of *E. maculata* and *E. cyanura* in the San Cristobel Island group and *E. schmidti* and *E. cyanura* in the New Georgia Island group.

The holotype and paratypes of *E. pseudocyanura* are from Guadalcanal. Specimens from Malaita differ slightly in color pattern and are not included as paratypes. Specimens from Bougainville that are referred to *E. pseudocyanura* are also not included as paratypes because, despite having a similar color pattern, they differ in means for midbody scale rows ($t = 5.396$; df = 89; $P < 0.001$).

McCoy (1980 and in litt., July 1983) stated that *E. cyanura* is an inhabitant of the more open coastal and river areas of islands and atolls, and does not occur in the inland forested and mountainous area of Guadalcanal and other islands on which he has collected. It is a ground species, in contrast to *E. schmidti, E. maculata,* and *E. pseudocyanura,* which are primarily forest species, semi-arboreal in habit. They occur in close association with *E. cyanura* only in areas with partial canopy cover and in some garden areas with trees.

HOLOTYPE.—CAS 157638, collected at Honiara, Guadalcanal Island, Solomons, by Michael McCoy, January 1984.

PARATYPES.—Guadalcanal I.: AMNH 66233, 128694, MVZ 40740–44; Honiara: CAS 157639–48; Mouluminjua: MCZ 114489–502; Porakokore: MCZ 114575; Perakauru Island (off Guadalcanal): MCZ 110160, 110201–02.

Other specimens referred to this species but not paratypes. Malaita I.: AMS R90942–69, R90971–91002, CAS 72064–71, AMNH 46327; Bitbama: AMS R87408–31; Arabala: CAS 157850–883, 157862–83; Fulisarga: MCZ 117630–39; Buma: MCZ 117640–41; Fiu River: MCZ 117642–44; Namoslabe: MCZ 117661–67; Mage: MCZ 117668–96; Alikato: MCZ 117645–51; Auki: MCZ 117428–59; Lalgalana: MCZ 117653; Makaruka: CAS 151981; Bougainville I. (without specific locality): CAS 108956, Popoheiarai: MCZ 76624; Mutahi: MCZ 87583–86, 87588, 93970–73, 1020212; Ramazon River: MCZ 93967; Choiseul I.: AMNH 40368.

DIAGNOSIS.—SVL at maturity 45.0–58.8 mm (for 40 specimens); midbody scale rows 27–34; dorsal scale rows 53–60; thinned subdigital lamellae, 73–98 under fourth toe; narrow, pale, paravertebral stripe usually limited to head and anterior part of body, becoming broader posteriorly, rows of black dots or short bars on tail; and venter (in life) yellow to light green.

DESCRIPTION OF HOLOTYPE.—Adult male; SVL 53.4 mm; midbody scale rows 32; dorsal scale rows 56; fourth toe lamellae 82.

DESCRIPTION.—SVL at maturity 45.0–58.8 mm for 28 males and 46.9–57.0 mm for 16 females; snout tapered, rounded at tip, its length 58–67% of HB and 37–40% of HL; HB 58–65% of HL and 14–16% of SVL; eye 65–80% of snout length and 40–47% of HB; rostral forming relatively short to moderately long, nearly straight suture with frontonasal; supranasals triangular; prefrontals narrowly to rather widely separated; one pair of nuchals; anterior loreal shorter than and slightly higher than posterior, in contact with first and second, or more frequently, only second upper labials; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; scales smooth, paravertebral rows not or scarcely enlarged; midbody scale rows 28–34, usually 30–32 except for populations from Bougainville ($\bar{x} = 30.096$; SD = 1.169; $n = 73$); dorsal scale rows 53–60 ($\bar{x} = 56.635$; SD = 1.579; $n = 63$); length of extended hindlimb 88–105% of axilla–groin distance and 43–53% of SVL; thinned lamellae under fourth toe 73–96, rarely less than 79 or more than 92 ($\bar{x} = 82.561$; SD = 5.158; $n = 57$); under first toe 17–25.

COLOR (in preservative).—Dorsal ground color dark brownish to blackish on head and at least anterior part of body; three narrow or somewhat broadened, pale longitudinal stripes present, at least in head and neck region, vertebral one beginning at tip of snout and dorsolateral ones at supraciliary region; lateral ones continuing as distinct narrow lines onto posterior body or sometimes base, becoming somewhat broader posteriorly, or for some specimens becoming reduced to scattered pale spots posteriorly; vertebral stripe beginning to widen on neck or forelimb region and fading into tannish, greenish-tan or bluish ground color on posterior part of body; upper lateral surfaces with narrow blackish to dark brown line bordering pale dorsolateral stripe, fading to lighter brown or golden-brown and merging into bluish gray or bluish of lower lateral surface; upper lateral surfaces marked by some pale scales and blackish dashes; upper labials with some dark blemishes on a golden-tan background; venter bluish white; tail bluish marked by narrow, blackish, transverse bars or two rows of spots. The examples from the Guadalcanal population exhibit a higher density of pale spots than does the sample from Malaita Island.

ETYMOLOGY.—This species has long been confused with *cyanura,* hence the name *pseudocyanura.*

COMPARISONS.—*Emoia pseudocyanura* shares with *E. cyanura* a relatively small size; slender habitus; numerous, thinned, subdigital lamellae; and some general similarities in color pattern. *Emoia pseudocyanura* differs significantly from sympatric populations of *E. cyanura* on Guadalcanal and Malaita in means for dorsal scale rows ($t = 2.694$; df = 97; $P = 0.008$), for midbody scale rows ($t = 7.118$; df = 108; $P < 0.001$), and for fourth toe lamellae ($t = 11.348$; df = 87; $P < 0.001$). For comparison with *E. rennellensis* and *E. maculata,* see descriptions of those species.

The populations of *E. pseudocyanura* on Guadalcanal and Malaita islands are in close agreement in scale counts, whereas the sample from Bougainville Island exhibits a somewhat lower count for midbody scale rows. The Guadalcanal population also has the appearance of more numerous small pale spots on the dorsal and upper lateral surfaces.

REPRODUCTION.—Gravid females have two oviducal eggs.

HABITAT.—Semi-arboreal, occurs in forested areas from near sea level to over 1000 m, but sometimes in garden areas with trees and in partially cleared areas.

RANGE.—Guadalcanal, Malaita, Choiseul, and Bougainville islands, Solomons.

Emoia rennellensis n. sp.

(Figure 27)

Emoia cyanura: (part) Slevin 1934:185; (part) Volsoe 1956:123.

Reexamination of Slevin's (1934) and Volsoe's (1956) specimens from the Rennell Islands has shown that they differ from typical *E. cyanura* in some characters and share others with either or both *E. maculata* and *E. pseudocyanura.* It, therefore, seems best to treat them as a distinct species.

HOLOTYPE.—CAS 72007, an adult female, collected on Rennell Island, Solomons, by members of the Templeton Crocker Expedition, 31 May 1933.

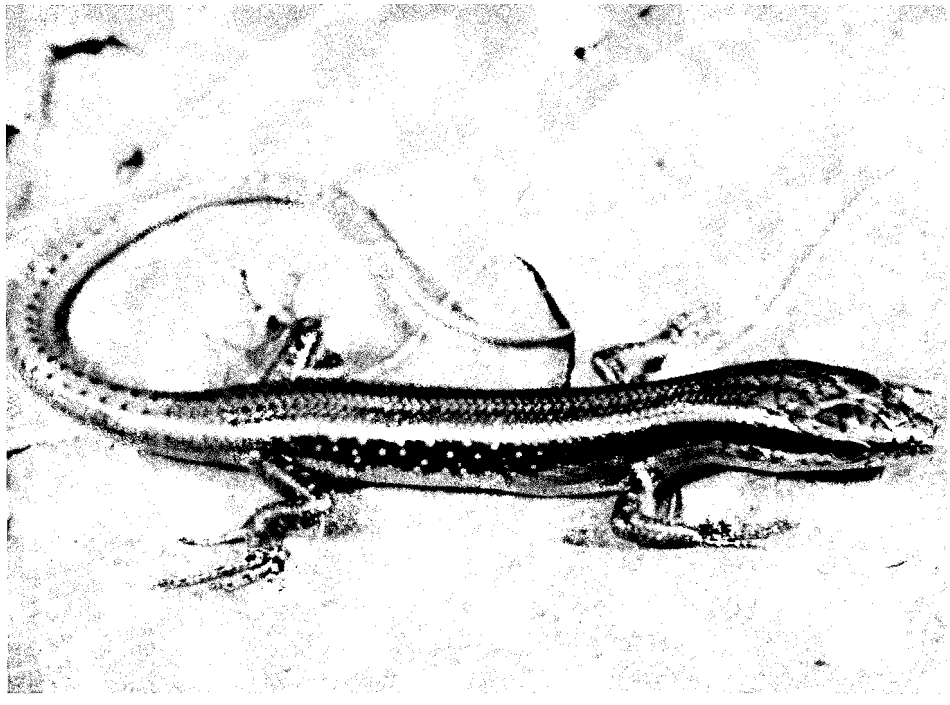

FIGURE 27. *Emoia rennellensis*, showing the absence of a pale vertebral stripe, Rennell Island. Photo courtesy of M. McCoy.

PARATYPES.—Solomons, Rennell Island: CAS 72002–06, 72008–09; ZMUC R4787–89; BMNH 1955.1.13.3–5; AMS R96754–66.

DIAGNOSIS.—SVL at maturity 42–45 mm (for four specimens); midbody scale rows 26–32; dorsal scale rows 54–58; thinned subdigital lamellae, 65–76 under fourth toe; narrow, middorsal stripe present on body but not on head; dorsolateral stripes present but lateral stripe absent; usually scattered, pale spots or scales on dorsum and upper lateral surfaces.

DESCRIPTION OF HOLOTYPE.—Adult female, SVL 44.8 mm; midbody scale rows 28; dorsal scale rows 55; fourth toe lamellae 68.

DESCRIPTION.—SVL at maturity 42.1–42.3 mm for two males and 43.6–44.8 mm for two females; snout tapered, rounded at tip, its length 58–62% of HB and 34–37% of HL; HB 58–62% of HL and 13–15% of SVL; eye 62–79% of snout length and 36–47% of HB; rostral forming moderate, straight suture with frontonasal; supranasals narrow, triangular, in contact with anterior loreal; prefrontals narrowly to moderately separated; seven or eight supraciliaries; one pair of nuchals; anterior loreal shorter and somewhat higher than posterior, in contact with second upper labial; usually seven upper labials, fifth enlarged and below eye; usually six lower labials; scales smooth, paravertebral rows not or scarcely enlarged; midbody scale rows 26–32 ($\bar{x}$ = 28.895; SD = 1.41; n = 19); dorsal scale rows 54–58 ($\bar{x}$ = 55.889; SD = 1.183; n = 18); length of extended hindlimb 88–106% of axilla–groin distance and 45–48% of SVL; thinned lamellae under fourth toe 65–76 ($\bar{x}$ = 69.656; SD = 3.404; n = 18); under first toe 14–16.

COLOR (in preservative).—Dorsal ground color brown to dark brown in two bands extending from parietals or neck to base of tail; pale, narrow vertebral stripe between dark bands, merging with blue of tail (two half-scale rows in breadth), absent from head and often from neck region; pale, narrow dorsolateral stripes beginning at posterior corner of eye; upper lateral surfaces (two to four scale rows) brown to dark brown; pale lateral stripe only rarely evident; dark dorsal and lateral bands usually marked by scattered small pale spots or scales; top of head and often neck tan with or without brown spots or blotches; venter bluish or grayish ivory to nearly uniform ivory.

COMPARISONS.—*Emoia rennellensis* is most similar to *E. maculata* in general color pattern and size. Both lack a pale, narrow middorsal stripe on the head and usually on the neck (differing from *E. cyanura* and *E. pseudocyanura* in this respect). *Emoia rennellensis* also differs from *E. maculata* in lacking a distinct narrow pale stripe on the lateral surface at limb level, in the measurement of fourth toe lamellae (t = 11.732; df = 58; P < 0.001). In addition to the color difference, *E. rennellensis* differs significantly from the nearby population of *E. cyanura* on Guadalcanal Island in the means for dorsal scale rows (t = 3.521; df = 52; P = 0.001). *Emoia rennellensis* differs significantly from *E. pseudocyanura* in means for midbody scale rows (t = 3.82; df = 90; P < 0.001) and fourth toe lamellae (t = 10.391; df = 73; P < 0.001).

ETYMOLOGY.—From Rennell Island, the type locality.

HABITAT.—Volsoe (1956) noted that specimens from Rennell Island were collected in both cultivated and rain forest areas.

RANGE.—Rennell Island, Solomons.

Emoia rufilabialis McCoy and Webber

(Figure 28)

Emoia rufilabialis McCoy and Webber, 1984:573 (type loc.: Graciosa Bay, Santa Cruz Island; holotype in AMS).

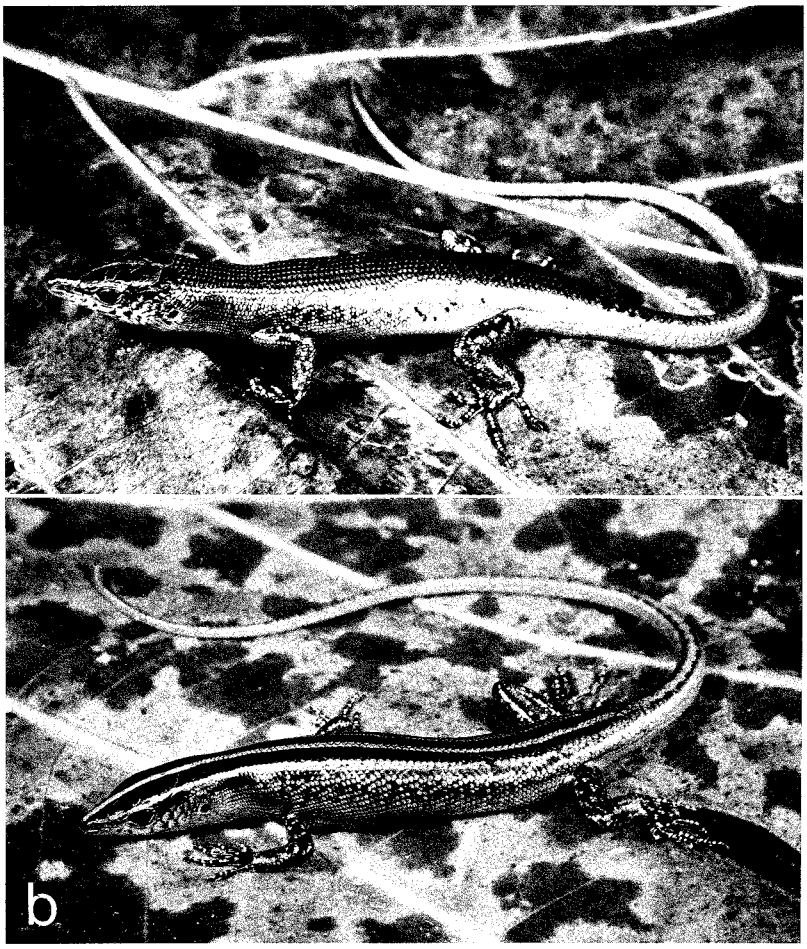

FIGURE 28. *Emoia rufilabialis*, (a) showing the absence of a vertebral stripe, which is characteristic of some older males; (b) showing the pale, narrow vertebral stripe, typical of females and usually younger males, Santa Cruz Islands. Photos courtesy of M. McCoy.

DESCRIPTION.—SVL 47.4–65.4 mm for eight mature males and 46.1–58.3 mm for nine mature females; snout tapered, rounded at tip, its length 56–66% of HB and 35–39% of HL; HB 59–63% of HL and 14–15% of SVL; eye 68–69% of snout length and 41–51% of HB; rostral forming slightly convex or nearly straight suture with frontonasal; supranasals triangular, in contact with anterior loreal; prefrontals moderately to widely separated; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or second upper labials; six or seven supralabials, fifth or sixth enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 36–42 ($\bar{x}$ = 39.286; SD = 1.419; n = 21); dorsal scale rows 62–72 ($\bar{x}$ = 66.471; SD = 2.764; n = 17); length of extended hindlimb 98–110% of axilla–groin distance and 47–52% of SVL; thinned lamellae under fourth toe 68–84 ($\bar{x}$ = 74.05; SD = 4.407; n = 20); under first toe 15–20.

COLOR (in preservative).—Dorsal ground color (8–10 scale rows) of larger adults grayish olive-brown relatively uniform or with faint to fairly prominent pale middorsal stripe and pale dorsolateral stripes (these stripes are most prominent for juveniles and females); lateral surfaces grayish (yellowish in life) with scattered blackish scales or larger blotches; usually with few dark blotches on posterior labials and sometimes along upper margin of supralabials; venter pale bluish to grayish white, lighter on chin and limb regions; tail brownish, relatively uniform or with pattern of light and dark transverse bands; younger specimens darker dorsally with distinct, narrow, light vertebral and dorsolateral stripes.

COLOR (in life).—Bright orange-red on labials; ventral dull yellow to light orange.

COMPARISONS.—*Emoia rufilabialis* resembles *E. cyanura* in color pattern but differs from that species and all others of the *cyanura* subgroup in the higher number of midbody and dorsal scale rows (Table 8).

HABITAT.—Primarily terrestrial, but sometimes found in low shrubs. *Emoia rufilabialis* is most common "... in areas with partial canopy cover, overgrown gardens and coconut plantations are the preferred habitats. The species does not occur in areas lacking canopy cover such as the grassy tracts adjacent to villages around Graciosa Bay. In closed canopy forest only an occasional individual was seen" (McCoy and Webber 1984).

RANGE.—Santa Cruz Islands, southeastern Solomons.

MATERIAL EXAMINED.—**Santa Cruz Islands:** AMS R98205 (holotype), AMS R98206–22 (paratypes), AMNH 42106, 42113; MCZ 15052.

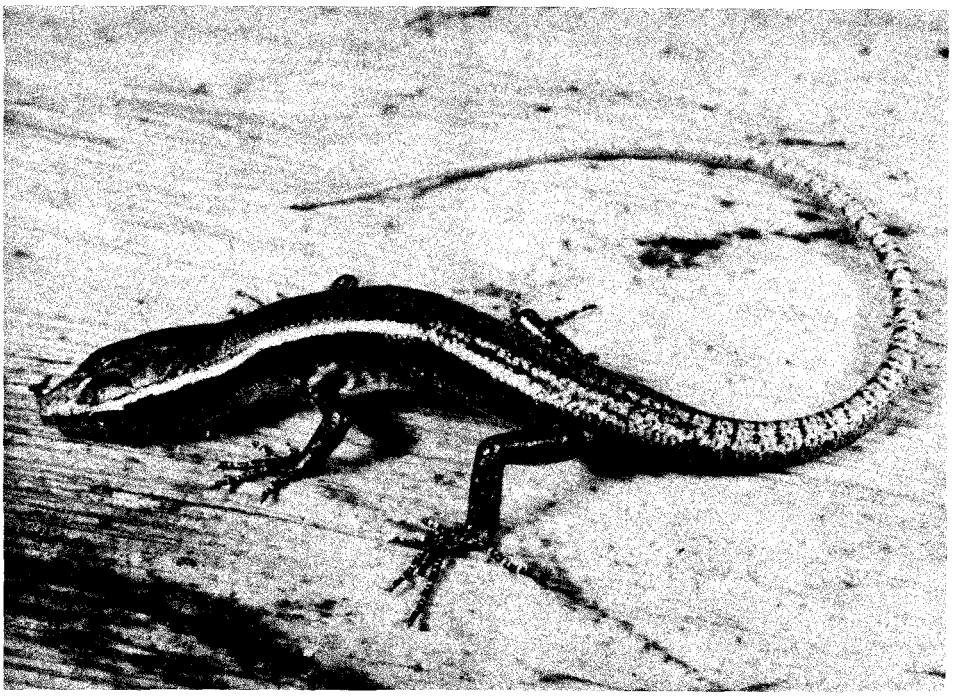

FIGURE 29. *Emoia schmidti*, showing the absence of a pale, narrow vertebral stripe, New Georgia Island. Photo courtesy of M. McCoy.

Emoia schmidti Brown

(Figure 29)

Emoia cyanura: (part) Schmidt 1932:286; Roux 1934:80.
Emoia schmidti Brown, 1953:270 (type loc.: New Georgia Island, Solomon Islands; holotype in FMNH); McCoy and Webber 1984:572.
Emoia maculata: (part) McCoy 1980:36.

DESCRIPTION.—SVL 51.8–63.3 mm for 10 adult males and 49.3–58.2 mm for 10 adult females; snout tapered and bluntly rounded, its length 55–62% of HB and 34–38% of HL; HB 59–66% of HL and 13–15% of SVL; eye 70–85% of snout length and 40–49% of HB; rostral forming nearly straight or slightly curved suture with frontonasal; supranasals triangular, in contact with anterior loreal; prefrontals narrowly to moderately separated; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or second upper labials; usually six upper labials, fifth enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 30–36 ($\bar{x}$ = 32.735; SD = 1.399; n = 34); dorsal scale rows 55–64 ($\bar{x}$ = 58.750; SD = 1.974; n = 28); length of extended hindlimb 95–120% of axilla–groin distance and 46–53% of SVL; thinned lamellae under fourth toe 69–83 ($\bar{x}$ = 76.333; SD = 4.029; n = 27); under first toe 18–22.

COLOR (in preservative).—Dorsal ground color grayish tan to light brown, usually darkest anteriorly; vertebral band narrowest anteriorly, merging into light brown or brownish bronze of head, posteriorly seven or eight rows wide; pale ivory to whitish dorsolateral stripe (two half-scale rows in width) beginning on supraciliaries and extending posteriorly for varying distances behind forelimbs before narrowing and fading; bordered dorsally by a narrow, dark brown line or series of blotches; upper lateral surfaces (three or four scale rows) dark brown, often with few scattered pale scales; lower lateral surfaces grayish, flecked with brown; upper labials dusky along dorsal half or marked with brown spots; venter creamy white or pale bluish white.

COMPARISONS.—*Emoia schmidti* differs from all species of the *cyanura* subgroup in features of the color pattern. It is most similar to *E. taumakoensis* and *E. isolata* in counts for midbody and dorsal scale rows. *Emoia schmidti* and *E. taumakoensis* differ significantly in the means for number of fourth toe lamellae (t = 2.799; df = 36; P = 0.008). See description of *E. isolata*.

REPRODUCTION.—Two oviducal eggs are present in gravid females.

HABITAT.—A forest-edge species, semiarboreal, often found in low vegetation.

RANGE.—Gizo, Kulambangara, and New Georgia islands in Solomons.

MATERIAL EXAMINED.—**Solomon Islands:** New Georgia I.: FMNH 41331 (holotype), FMNH 41327–30, 44276, CAS-SU 13483 (paratypes), MCZ 116255–309, 116230–352, 116365–66, CAS 156057, BPBM 2369–70; Kolombangara I.: AMNH 40312, 40336, 40338, 41311 (paratypes), MCZ 52287–89, AMNH 40997; Arnavon I.: MVZ 44956–61 (paratypes); Gizo I.: CAS 156058–61; Tetipari I.: AMNH 36389; Arundel I.: BMNH 1936.2.1.11; Bellona I.: BMNH 1961.1.8.92–94.

Emoia taumakoensis McCoy and Webber

(Figure 30)

Emoia taumakoensis McCoy and Webber, 1984: 574 (type loc.: Taumako Islands, Duff Islands; holotype in AMS).

DESCRIPTION.—SVL 50.1–57.6 mm for five mature males and 52.8–55.0 mm for four mature females; snout tapered, rounded at tip, its length 62–66% of HB and 37–39% of HL; HB 56–60% of HL and 14–15% of SVL; eye 65–75% of snout length and 40–48% of HB; rostral forming slightly convex to nearly

FIGURE 30. *Emoia taumakoensis*, showing the absence of a pale, vertebral stripe, typical of males, Duff Islands. Photo courtesy of M. McCoy.

straight suture with frontonasal; supranasals narrow, triangular, in contact with anterior loreal; prefrontals narrowly to moderately separated; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with second or rarely first and second upper labials; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; usually six lower labials; dorsal scales smooth; midbody scale rows 32–35 ($\bar{x}$ = 33.6; SD = 0.843; n = 10); dorsal scale rows 57–61 ($\bar{x}$ = 59.0; SD = 1.247; n = 10); length of extended hindlimb 89–109% of axilla–groin distance and 41–50% of SVL; thinned lamellae under fourth toe 76–84 ($\bar{x}$ = 80.091; SD = 2.914; n = 11); under first toe 20–24.

COLOR (in preservative).—Dorsum and upper lateral surfaces brownish marked by a median pale stripe from tip of snout to neck for females and longitudinal pale stripe (one or two scale rows in width) on either side from supraorbital region to tail; males tend to lack the pale stripes, being light to dark olive-brown; lateral surfaces relatively free of spots or blotches; venter is grayish to dusky ivory; tail grayish blue to brown.

COLOR (in life).—Male specimens with light pink area between tympanum and angle of jaw; venter yellowish.

COMPARISONS.—See descriptions of other species of this subgroup.

HABITAT.—Semiclosed forest and some partially cleared areas. McCoy and Webber (1984) found the species on the ground or in low vegetation.

RANGE.—Duff Islands, southeastern Solomon Islands.

MATERIAL EXAMINED.—Duff Is.: AMS R98233 (holotype), AMS R98223–32 (paratypes).

caeruleocauda Subgroup

In contrast to the *cyanura* subgroup of species, members of this subgroup exhibit broadly rounded or only moderately thinned subdigital lamellae. For species other than *E. ruficauda*, the number under the fourth toe is 21 to 54 (rarely above 45 except for the populations of *E. caeruleocauda* from the Admiralty and St. Matthias islands). *Emoia ruficauda* has moderately thinned lamellae, the number under the fourth toe is 54–64. The pale vertebral stripe terminates abruptly near the base of the tail for species of this subgroup, in contrast to the condition in species of the *cyanura* subgroup where the pale vertebral stripe (when present) merges into the ground color of the tail. With the exception of *E. caeruleocauda*, the species of this subgroup are limited to islands west of New Guinea.

Superspecies **Emoia caeruleocauda** de Vis

(Figure 4g)

Scincus cyanurus: (part) Lesson, 1830:49 (type loc.: Tahiti; syntypes in the MNHN).
Eumeces lessoni: (part) Duméril and Bibron 1839:354; Duméril and Duméril 1851: 157.
Tiliqua cyanura: Gray 1839:289.
Mabuya (Emoia) cyanura: (part) Gray 1845:96.
Euprepes cyanurus: (part) Steindachner 1867:44.
Mabouia cyanura: (part) Günther 1877:128.
Euprepes (Mabuya) cyanurus: Peters and Doria 1878:356.
Lygosoma cyanurum: (part) Boulenger 1887a:290, 1895a:30, 1897b:307, 1914: 258; (part) Boettger 1893:106; Mehely 1898:169; Vogt 1911a:417, 1911b:442, 1912b:356, 1932:292; Roux 1913:110; (part) de Rooij 1915:230; Kopstein 1926: 445; Room 1974:442.
Mocoa caeruleocauda de Vis, 1892:12 (type loc.: Sudest Island [=Tagula], Louisiade Archipelago: holotype lost).
Lygosoma (Emoa) cyanurum: Müller 1894:835; Werner 1900:60.
Emoia cyanura: Lucas 1898:358.
Lygosoma callistictum: Mehely 1898:170.
Lygosoma cyanurum werneri Vogt, 1912a:5 (type loc.: Marianas Islands; holotype lost).
Emoia cyanurum: (part) Barbour 1912:93, 1921:103.
Emoia sorex: Sternfeld 1920:406.
Lygosoma kordoanum: Baker 1928:297; Kopstein 1926:91; Sternfeld 1920:411.
Lygosoma w. werneri: Schuz 1929:7; Brongersma 1931b:26.

TABLE 9. Frequency distribution of midbody scale rows for populations of *Emoia caeruleocauda.*

	27	28	29	30	31	32	33	34	35	36
E. caeruleocauda (Louisiade and Trobriand islands)	—	—	—	5	3	9	2	—	—	—
E. caeruleocauda (Admiralty and St. Matthias islands)	—	—	—	2	3	10	2	1	—	—
E. caeruleocauda (Bismarcks)	—	—	—	—	3	2	3	3	1	—
E. caeruleocauda (Solomons and Vanuatu)	—	3	2	10	6	15	2	4	1	1
E. caeruleocauda (Fiji)	—	—	—	1	—	2	—	1	—	—
E. caeruleocauda (Palau Islands)	—	—	—	1	1	9	2	7	—	1
E. caeruleocauda (Carolines and Marianas)	—	13	14	19	2	4	—	—	—	—
E. caeruleocauda (New Guinea)	1	16	7	21	4	7	1	—	—	—
E. caeruleocauda (Moluccas)	—	11	3	3	—	—	—	—	—	—
E. caeruleocauda (Borneo and Philippines)	—	—	2	5	1	3	—	—	—	—

Lygosoma werneri triviale Schuz, 1929:8 (type loc.: New Guinea; disposition of holotype not known).
Emoia triviale: Schmidt 1932:186.
Emoia werneri: Burt and Burt 1932:533; Brongersma 1933:19; Hediger 1934:467; Smith 1937:227; Medway and Marshall 1975:440.
Lygosoma (Emoia) werneri: Angel 1935:55.
Emoia caeruleocauda: Loveridge 1948:368; Tanner 1952:5; Mittleman 1952:23; Pernetta and Watling 1978:236; Brown and Alcala 1980:72; McCoy 1980:33; Kiester 1982:9; Brown 1983:324; McCoy and Webber 1984:572; Scott, Parker, and Menzies 1977:11.
Emoia callisticta: Brown 1956:1487.
Emoia callisticta werneri: Greer 1970:171.
Emoia caeruleocauda caeruleocauda: Zweifel 1980:416.

The availability of de Vis's name, *caeruleocauda,* for this species was not recognized until it was resurrected by Loveridge (1948). The earlier name *Eumeces* (=*Emoia*) *lessoni* of Duméril and Bibron (1839) must be treated, as the authors intended, as a substitute name for *E. cyanura* (Lesson).

Lesson had examples of both *E. cyanura* and *E. caeruleocauda* in his type series of *E. cyanura.* He did not give information on lamellar counts and assigned the series to one species on the basis of color pattern and the absence of differences in squamation of the head. However, details of the color pattern shown in his illustration do identify the species to which the name *cyanura* applies. Boulenger (1887a) also included examples from populations of *caeruleocauda* in the samples upon which he based his description of *E. cyanura.* This is evident from the count (40–60) given for the number of fourth toe lamellae. *Emoia caeruleocauda* can be distinguished from *E. cyanura* on the basis of the rounded lamellae (33–54 under the fourth toe) in contrast to thin and bladelike (60–86 under the fourth toe) for *E. cyanura.*

Kopstein (1926), Baker (1928), and Sternfeld (1920) referred some populations of *E. caeruleocauda* to *E. kordoana* or *E. sorex.* Vogt (1912a) described a population of *E. caeruleocauda* from the Marianas as *E. cyanura werneri.* Schuz (1929) recognized *E. werneri* as a full species and described a subspecies, *E. werneri triviale,* based on a population in New Guinea. Neither Vogt or Schuz mention de Vis's description of *E. caeruleocauda* and presumably were not aware that this name was available.

Mehely (1898) referred an example from one New Guinea population to *E. callisticta.* Brown (1956), without having examined the type, followed this error and used the name *callisticta* in place of *caeruleocauda* for the species, since the name *callisticta* was an older name. The error was corrected by Zweifel (1980), who noted that the type specimen of *callisticta* represented a species in the *physicae* group.

Since the holotype of *E. caeruleocauda* has been lost (Covacevich 1971), I designate a neotype for the following "exceptional circumstances" in keeping with Article 75 of the International Code of Zoological Nomenclature. This species has an extensive range. Some of the island populations may prove to be good subspecies or closely related sibling species. The neotype is from a population on Sudest Island, the type locality.

NEOTYPE (new designation).—AMNH 76761 from Rambuso, Sudest Island, Louisiade Archipelago.

DESCRIPTION OF NEOTYPE.—An adult male, SVL 46.8 mm; midbody scale rows 30; dorsal scale rows 54; fourth toe lamellae 41.

DESCRIPTION.—SVL 40.3–65.0 mm for 30 mature males and 40.9–54.5 mm for 30 mature females (Preston Webster's notes list a male of 66 mm and a female of 57.5 mm; these larger specimens are from populations in the Solomon Islands); snout tapered, rounded at tip, its length 30–40% of HL and 47–66% of HB; HB 53–66% of HL and 13–17% of SVL; eye 74–95% of

TABLE 10. Frequency distribution of scale rows parietals to tail for populations of *Emoia caeruleocauda.*

	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
E. caeruleocauda (Louisiade and Trobriand islands)	—	—	3	3	7	3	1	1	—	—	—	—	—	—	—
E. caeruleocauda (Admiralty and St. Matthias islands)	—	—	—	1	2	2	4	1	2	1	2	—	2	2	1
E. caeruleocauda (Bismarcks)	1	1	1	3	1	—	2	—	1	—	—	—	—	—	—
E. caeruleocauda (Solomons and Vanuatu)	—	1	4	6	6	7	7	3	2	3	2	—	—	—	—
E. caeruleocauda (Fiji)	—	—	—	—	—	—	1	1	1	1	—	—	—	—	—
E. caeruleocauda (Palau Islands)	—	1	1	3	4	4	3	4	—	—	—	—	—	—	—
E. caeruleocauda (Carolines and Marianas)	—	—	1	1	2	6	15	12	7	4	—	—	—	—	—
E. caeruleocauda (New Guinea)	—	—	—	3	10	17	14	7	6	1	—	—	—	—	—
E. caeruleocauda (Moluccas)	1	1	2	2	4	3	6	—	1	—	—	—	—	—	—
E. caeruleocauda (Borneo and Philippines)	—	—	—	—	1	3	3	1	1	1	—	—	—	—	—

TABLE 11. Frequency distribution of fourth toe lamellae for populations of *Emoia caeruleocauda*.

	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
E. caeruleocauda (Louisiade and Trobriand islands)	—	—	—	—	—	—	—	1	2	1	1	2	2	2	1	3	2	—	—	—	—	—
E. caeruleocauda (Admiralty and St. Matthias islands)	—	—	—	—	—	—	—	—	—	—	—	1	3	1	1	4	3	1	—	2	—	1
E. caeruleocauda (Bismarcks)	—	—	—	—	2	1	1	1	3	2	1	—	—	—	—	—	—	—	—	—	—	—
E. caeruleocauda (Solomons and Vanuatu)	1	1	4	6	9	6	8	3	3	1	—	—	—	—	—	—	—	—	—	—	—	—
E. caeruleocauda (Fiji)	1	1	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
E. caeruleocauda (Palau Islands)	—	—	—	—	—	—	1	3	2	7	2	2	2	—	—	—	—	—	—	—	—	—
E. caeruleocauda (Carolines and Marianas)	—	—	—	1	1	6	4	16	6	9	3	3	2	—	—	—	—	—	—	—	—	—
E. caeruleocauda (New Guinea)	1	2	3	2	2	2	7	3	5	6	10	5	2	1	2	2	1	—	—	—	—	—
E. caeruleocauda (Moluccas)	—	—	—	—	1	3	5	2	2	2	2	—	—	—	—	—	—	—	—	—	—	—
E. caeruleocauda (Borneo and Philippines)	—	1	—	1	1	1	1	1	—	1	3	—	—	—	—	—	—	—	—	—	—	—

snout length and 41–56% of HB; rostral forming moderately long, nearly straight or slightly curved suture with frontonasal; supranasals triangular; prefrontals narrowly to rather widely separated; usually seven supraciliaries; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or only second upper labials, and with supranasal; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; scales smooth; midbody scale rows 27–36, rarely more than 34 ($\bar{x}$ = 30.838; SD = 1.778; n = 130); dorsal scale rows 50–64, more than 60 only for populations from the Admiralty and St. Matthias islands ($\bar{x}$ = 55.48; SD = 2.432; n = 125); preanals not or scarcely enlarged; length of extended hindlimb 95–114% of axilla–groin distance and 46–56% of SVL; rounded lamellae under fourth toe 33–54, more than 49 only for populations in Admiralty and St. Matthias islands ($\bar{x}$ = 41.894; SD = 4.528; n = 123); under first toe 9–15.

COLOR (in preservative).—Dorsal ground color grayish green, brownish or blackish, usually marked by three or five narrow, pale (whitish or grayish) stripes, at least for females; vertebral stripe beginning at tip of snout and extending to base of tail, but not merging into bluish or grayish-blue color of tail; dorsolateral stripes beginning anteriorly to eye at level of supraciliaries and merging posteriorly with blue or gray color of tail; some specimens also with prominent, pale, narrow lateral stripes two or three scale rows below dorsolateral stripes at about ear level, beginning on labials near ear, or at forelimb region (in some populations, especially for males, none of the stripes may be evident, or only the vertebral one vaguely evident, particularly anteriorly); upper labials diffused with brown or black to varying degree; lower labials sometimes with dark blemishes; tail typically bluish to grayish blue, usually with some brown or black markings, or brown for some specimens; venter usually ivory or slightly darker, diffused with bluish or grayish especially on throat and belly.

COMPARISONS.—For comparison with *E. reimschisseli, E. ruficauda,* and *E. similis,* see descriptions of those species. This species exhibits some variation between different island populations and also between populations on large islands such as New Guinea. Fred Parker (pers. comm.) noted sexual dimorphism in color pattern in some populations in Papua New Guinea. Females are typically blackish with prominent pale stripes; males are more brownish, often with little evidence of pale stripes. McCoy (1980) noted a similar dichromatism in some populations in the Solomons. Webster (1969) found sexual dimorphism in the Bougainville Island population. Males were notably larger than females. My data also indicate that males in some populations in the Bismarcks are larger.

Populations from the Admiralty and the St. Matthias islands have a higher lamellar count (44–54) than do samples from other areas (Table 11). Moreover, data on midbody scale rows (Table 9) for samples throughout the range of *E. caeruleocauda* indicate that for this character the populations of the Solomons, Admiralties, Bismarcks, Palaus, Vanuatu, and Fiji fall into one group, and the rest of the wide-spread populations (Carolines, Palaus, New Guinea, and islands to the southeast and west of New Guinea) a second group.

REPRODUCTION.—Gravid females have two oviducal eggs. McCoy (1980) found that Solomon Islands populations normally laid two eggs in ground debris. In Vanuatu populations, reproduction takes places year-round, but is at its height from November to February and at its lowest in May and June (Baker 1947).

HABITAT.—Terrestrial form, though individuals may be found at times a few meters above ground on tree trunks or low shrubs. In the Solomons and New Guinea, *E. caeruleocauda* is found in gardens, open areas, and forests. It occurs from sea level to 1500 m in Papua New Guinea.

RANGE.—Marianas, Carolines, Marshalls, Palaus, and Fiji in the Pacific Basin region, and Vanuatu, Solomons, Bismarcks, New Guinea, Moluccas, Celebes, and at least northern Borneo and southern Philippines.

I have seen only four specimens of *E. caeruleocauda* from Fiji, one possibly from Viti Levu and three from Taveuni Island. Neither earlier collections nor recent intensive field work by John Gibbons or George Zug (USNM, pers. comm.) have verified that a viable population exists on Viti Levu. Beckon's relatively recent collection is from a forested area at more than 225 m on mountain slopes of Taveuni Island and presumably represents an established population. This limited range in Fiji suggests a relatively recent introduction for *E. caeruleocauda.*

MATERIAL EXAMINED.—**Marianas Islands:** MNHN 88.4, 88.6–11; Cocos I.: CAS 139821–22, MCZ 111844–49, 160083; Guam I.: CAS-SU 17264; 25634–38, CAS 139812–20, 139829, FMNH 60799–811, 66492–500, 195579–81, 177312–25, MCZ 32598, AMNH 19657, 19659–67, USNM 28219, 28221, 121860–61, 121863, 121866, 121880, 121898, 121903, 121905, 122308, 122471–84; Saipan I.: AMNH 19668, USNM 119526–27, 121966, 121977–78, 121980–81; Agrihan I.: FMNH 188722, 188724–27, USNM 121967–69, 121976; Rota I.: USNM 121873–74, 121882, 121887, 121893, 121896, 121902, 121918, 121921, 121980–83, 122643–44, 122711–12, 122714–15, 122717, 122725–26, 122730, 122436–60, 122965, 122895, 122898; Tinian I.: USNM 121956–57, 121959–60, 123749; Alamagan

I.: FMNH 188731–34, 188737–38; Anatahan I.: FMNH 188742–43, 188746–47; Asuncion I.: FMNH 18749; East Manig I.: FMNH 191825. **Palau Islands:** Koror I.: CAS 160000, 160002-06, MCZ 111829–43; Airai I.: MCZ 111883–97; Kayangel I.: MCZ 111422–82; Babelthuap I.: CAS-SU 7514–22, MCZ 111850–55; Necos I.: MCZ 111880; Arkebesan I.: MCZ 111879, CAS 160010–12. **Caroline Islands:** USNM 102503–510; Ifaluk Atoll: CAS-SU 17265, 21786–88, 21791, 21793; Truk group: MCZ 111536–45, 111817–28, 111856–60, 111998–29, 114674–75, 160084–86, AMS R06603; Yap I.: MCZ 111867–78, 125906–07, AMS R57309–10, R57389, R56391–94, CAS 121128; Ulithi: AMNH 81571–74, FMNH 55498–500, 42665–68, 124243–44, 195583–84, USNM 122531, 122534, 122536–41, 122545, 122547, 122549, 122553–54; Feis I.: SMF 15346. **Marshall Islands:** Arno Atoll: MCZ 111438–92. **Fiji:** Viti Levu I.: Pernetta Coll. 6a; Taveuni I.: Beckon Coll. 143, 145, and 183. **Solomon Islands:** Santa Cruz Is.: AMS R9035–39, R9068–69, R9195–97, R9199–202, FMNH 205960; San Cristobal I.: AMS R69554–56, R80155–58, R93496, CAS-SU 17260–63, CAS 72228–29, 152019–22, MCZ 14552–60, 14562–71, 14573–76, 14595–619; Roviana I.: AMS R9415; Santa Ana I.: AMS R42090; Bougainville I.: AMS R11466–67, R18812, R42012, R55986–87, RMNH 44877–79, 44881, CAS 94006, 107410–15, 108380–421, 108982, 108984–87, 110166–200, MCZ 145355, SAMA R5186, R5252a–c, R8082–84, R8101–04, R8217, R8230, R8337, AMNH 42012; Isabel I.: AMS R8655; Shortland Is.: AMNH 41836, AMS R93501–07, CAS 107416–23, 108422–56; New Georgia I.: FMNH 41317; Bellona I.: CAS 72186–96; Rendova I.: FMNH 41318–26; Kolombangara I.: FMNH 13839–40, 124049–50; Malaita I.: MCZ 14587–94; Choiseul I.: AMNH 40367, 40369, Vella Lavella I.: AMNH 40230, 40239. **Vanuatu:** MNHN 2914, 2914a–b, AMS R1165–66, R3555, R7250, FMNH 171355, AMNH 40166–67, 40178–79, 40329–30, 40337, 40367, 41820–21, 41827–28, 41336, 42012, 81625–37, 87340, 89423–25, 101168–79; Futuna I.: AMNH 60270, 60276, FMNH 69626; Eromanga I.: AMNH 60286, BMNH 1973.1573–90; Aniwa I.: 60196; Tanna I.: BMNH 1973.1627–39, AMNH 60127–28, 60130, 60132–33, 60135–48, 60150–52, 60155–66, 60287, 105096, Malekula I.: AMNH 40166–67, 81632–37, BMNH 1973.1591–1608; Malo I.: BMNH 1973.1546–69; Aneityum I.: BMNH 1973.1538–45; Espiritu Santo I.: BMNH 1973.1610–19, 1973.1622–23, AMNH 81625–31; Aore I.: FMNH 69132, 69138–39. **Loyalty Islands:** Mare I.: AMNH 81766. **Bismarck Islands:** New Britain: SAMA R6901, R6914, R6916, R6919, R6921, R6932, R8529–31, R8542–45, R8547–49, R8552–53, R8558–59, R8570–73, R8575–78, R8610–11, R11850–51, BMNH 98.3.3.12, MCZ 135357, 135436, 142447, 150845, 152941, ZMUC R46636–37, AMS R5993–94, R12864, R28906, R28930–31, R28962–65, R31231–35, R64670, FMNH 13892–96, 13902; ZMUC R47636–37, AMNH 105286–89; New Ireland: MCZ 145354–55, 156184; New Hanover: MCZ 145358–61. St. Matthias Is.: Mussau I.: MCZ 144390, 156186, ZMUC R47633–35. **Admiralty Islands:** Manus I.: MCZ 156185, 156187; Pisik Lou I.: AMS R19331, R19316–20, R19333–35, R19337–40, AMNH 105282–85, FMNH 42590–91, ZMUC R47639; Lou I.: AMS R19336. **Louisiade Islands:** Sudest I.: AMNH 76671, 83970–71; Misima I.: AMNH 76815, 76817–24. **Marshall Bennet Islands:** Woodlark I.: AMNH 76800–01, 76806, 76809. **Trobriand Islands:** Kuia I.: AMS R86813–14, R86827, BMNH 1973.1149. **D'Entrecasteaux Islands:** Fergusson I.: BMNH 95.4.26.30–31. **Papua New Guinea:** Milne Bay Province: AMNH 76761, 76800–01, 76806, 76809, 76815, 76817–22, 76824, 83970; Kwagira River area: AMNH 74093. Northern Province: AMNH 95268–73 (+8 uncat.). Morobe Province: Garaina: MCZ 149778–79; Gusiko: AMNH 66687; Lae: AMS R59960–73, AMNH 66703, 66706a–c, 66729–30, 66993–94, 92327–34, 95274–76, 103309; Pindiu: AMNH 95685–87; Finschhafen: AMNH 95688–92, MCZ 49247, CAS-SU 12078; Singorakai: AMS R69788–93; Wau: MCZ 44195–96, 145990–91. Madang Province: Alexishafen: AMS R31334, AMNH 105260, 105269–70; Madang area: MCZ 132788, AMS R24454–56, R24458; Nubia: BMNH 1976.350; Manam I.: AMNH 105275–80; Karkar I.: AMS R24712, R24718, R24751, R24815, R24925–27, R25055–61, R25111, R25150, R25193–94, R25281, R25406, R25410, R25540, R25678, R25720, R25757, R25767, AMNH 105281; Wanuma: AMNH 105261–65; Miliat Plantation: AMNH 105266–68. East Sepik Province: without specific locality: AMNH 95277–80, 100249–59; Wewak area: SAMA R30839, AMNH 105271–74, AMS R30837–39, R30848, R31545, R31555, R31565; Marienberg: MCZ 110304–05, FMNH 15494–96, 15498–99; Maprik: MCZ 152810, 154737–38. West Sepik Province: Aitape: MCZ 48599–602, 142301–02. Gulf Province: AMNH 102231; Oroi: MCZ 104621; Uraru: SAMA R11002, CAS 117739–41, 117746–49, MCZ 100890–99, 102065–70, 102186–93, 104612–20. Chimbu Province: AMNH 98553, 98925–26, 98955–57, 101116–17, 101128; Karimui: SAMA R8368, CAS 108329–30, 110361–68, 117735–38, 117937–39, MCZ 98882–99, 98901–09, 93963–66, 100783–845, 100851–89, 102180–85, 104622–28; Bomai: MCZ 88615–17; Soliabeda: SAMA R11003, MCZ 102170, 104629–36. Western Province: Emeti: MCZ 139526–28; Derongo: AMNH 103956–57, CAS 127197–99, MCZ 124366–70; Migalsimbip: CAS 126786–87, MCZ 124032, 142301–02; Silimabip: SAMA R6282; Kiunga: MCZ 123684; Menemsore: MCZ 124360–61. Central Province: Moresby area: UPNG 6479. **Irian Jaya:** Djamna: MCZ 7648; Manakwori: MCZ 7650, FMNH 14172a–g; Toem: MCZ 49210–11; Doromena: SAMA R3611a–d, AMS R12988, FMNH 43223 (400+ specimens); CAS-SU 11249–61, 11263–67, 11269–99; Hollandia: AMNH 61805–09, FMNH 43212–18, 43221; Lake Sentani: CAS-SU 11970–71; Idenberg Riv.: AMNH 62455–57; Japen I.: MCZ 7647a–d, 7649a–f, 7654a–c, BMNH 1984.895–897, 1984.955; Waigeo I.: MCZ 7653. **Moluccas Island:** Ceram I.: ZMB 493a–d, 1512, RMNH 8736, MCZ 7151a–c, 7652; BMNH 1975.310, MNHN 2912; Ambon I.: MCZ 22076, 33543, AMS R57521–29, R57301, MNHN 1926.1079, FMNH 134609–14, 142136–40, 142256–63, 142340, 142351, 166665, 166668 (labeled Amboine, but questionable, MNHN 2917, 2917a–b). **Celebes Island:** BMNH 1980.1940–41; Sula I.: ZMB 376a; Karakelang I.: MCZ 45774; Cerain I.: MCZ 7652, 164386–88. **Borneo area:** Kechil Island off north coast: FMNH 63692–93. **Philippine Islands:** Melampa I.: MCZ 26468, AMS R12911; Zamboanga Peninsula, Mindanao I.: USNM 37423–26; Comiran I.: CAS 60577; Palmas I.: USNM 37920–23; Palawan I.: USNM 5633.

Emoia reimschisseli Tanner

Lygosoma werneri: (part) Brongersma 1933:19.
Emoia werneri: Brongersma 1948:391.
Emoia caeruleocauda reimschisseli Tanner, 1950:20 (type loc.: Moratai Island, Molucca Islands; holotype in Department of Zoology, BYU).

This taxon differs sufficiently from populations of typical *E. caeruleocauda* in the Moluccas, without evidence of intergradation, that it is here treated as a distinct species.

DESCRIPTION.—SVL at maturity 39.1–57.4 mm for 18 males and 43.9–56.0 mm for 18 females; snout tapered, round-pointed, its length 52–59% of HB and 32–37% of HL; HB 61–67% of HL and 14–17% of SVL; eye 74–83% of snout length and 39–46% of HB; rostral forming long, nearly straight suture with frontonasal; supranasals triangular, in contact with anterior loreal; prefrontals narrowly to rather widely separated; small interparietal occasionally present; seven supraciliaries; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second upper labials; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; usually six lower labials; dorsal scales smooth or with two or three faint keels; midbody scale rows 29–34, rarely more than 30 ($\bar{x}$ = 30.435; SD = 1.199; n = 23); dorsal scale rows 49–57 ($\bar{x}$ = 53.095; SD = 2.278; n = 21); length of extended hindlimb 98–108% of axilla–groin distance, 48–51% of SVL; rounded lamellae under fourth toe 32–39, rarely more than 37 ($\bar{x}$ = 35.136; SD = 1.699; n = 22); lamellae under first toe 10–13.

COLOR (in preservative).—Ground color of dorsum and lateral surfaces dark medium brown to blackish brown, usually with prominent, narrow (two half-scale rows), pale, vertebral stripe from tip of snout to base of tail (not merging with pale color of tail), very faint or absent for few specimens; sometimes narrow, dorsolateral pale stripe from anterior supraciliaries extending posteriorly and merging with pale color of tail, usually vague; lateral surfaces with pale blotches (two to four in one row on neck, usually two rows on body), or nearly uniform brownish; limbs more reddish, sometimes with pale blotches; tail dirty white to tan with darker spots; venter dirty ivory to almost grayish.

COLOR (in life).—Dorsum dark brown to blackish, usually with three narrow, yellowish, longitudinal stripes; sides marked by yellow spots and blotches; orange spot on side of throat; undersurfaces whitish; tail white to dirty white (after Reimschissel).

COMPARISONS.—*Emoia reimschisseli* differs from *E. caeruleocauda* in the Molucca Islands in color pattern and in means for counts of midbody scale rows (t = 5.674; df = 38; $P < 0.001$)

TABLE 12. Primitive (+), derived (−), and intermediate (±) characters for evolutionary lines of *Emoia*: *samoensis* (sam.), *ponapea* (pon.), *cyanura* (cyanu.), *atrocostata* (atr.), *adspersa* (ads.), *physicae* (phy.), *baudini* (bau.), *cyanogaster* (cyano.).

	sam.	pon.	cyanu.	atr.	ads.	phy.	bau.	cyano.
Nasal bones: separate (+), fused (−)	+	+	+	−	−	−	−	−
Anterior loreal: short & high (+), long & low (−)	−[1]	+	+	+	+	+	+	−
Scales: keeled (+), smooth (−)	−[2]	−	−[2]	−	−	+	−	−
Interparietal: present (+), absent (−)	+	+	−[3]	+	+	−	−	+[4]
Lamellae: rounded (+), thinned (−)	+	+	−[5]	+	+	+	+	−[6]
Parietal eye: present (+), absent (−)	+	+	+	+	+	−	−	+
Body scales: large (+), small (−)	+	+	+	+	−	+	+	+
Palate: alpha (+), beta (−)	+	±	−	+	+	+	+	+

[1] Moderately long and low.
[2] Rarely faint keels on some scales.
[3] Present for *E. ruficauda.*
[4] Absent for *E. kordoana.*
[5] Rounded (*caeruleocauda* subgroup) and thinned (*cyanura* subgroup).
[6] Rounded for *E. sorex.*

and fourth toe lamellae (t = 8.36; df = 37; $P < 0.001$). For comparison with *E. ruficauda* and *E. similis,* see under those species.

REPRODUCTION.—Gravid females have two oviducal eggs.

HABITAT.—The holotype was collected in low vegetation on a coral ledge (Tanner 1950).

RANGE.—Moratai and Halmahera islands.

MATERIAL EXAMINED.—**Moratai Islands:** BYU 7416 (holotype), 7333, 7336, 7418–20, 7422, 7497, 7500, 7504, 7507, 7509, 7513, 7516, 7518, 7553, 7684, 7691–92, 7698, 7702, CAS-SU 11944–47 (paratypes), MCZ 93694–98, FMNH 42334–35, AMNH 66612, RMNH 2556, 8660. Also tentatively included with this species is one specimen from Halmahera I., RMNH 5609.

Emoia ruficauda Taylor

Emoia ruficauda Taylor, 1915:98 (type loc.: Agusan Prov., Mindanao Island; holotype lost); 1922:224; Smith 1937:227; Mittleman 1952:29; Brown and Alcala 1970:113; Greer 1970:171; Brown and Alcala 1980:71.

The holotype, listed as Philippine Bureau of Science No. 1778, was lost when the Philippine Bureau of Science was destroyed during World War II. Collections by Taylor and others of examples of this species from Agusan Province, Mindanao, and southern Mindanao are available in various museums (see Material Examined).

DESCRIPTION.—SVL 45.9–53.6 mm for 12 mature males, and 42.5–53.0 mm for 12 mature females; snout long, tapering, rounded at tip and somewhat depressed, its length 37–42% of HL and 55–68% of HB; HB 51–60% of HL and 15–18% of SVL; eye 58–68% of snout length; 35–42% of HB; rostral forming long, nearly straight suture with frontonasal; supranasals long and narrow, in contact with anterior loreal; prefrontals moderately to widely separated; interparietal distinct but small; one pair of nuchals; anterior loreal shorter and higher than posterior, in contact with first and second or second upper labial; six or seven upper labials, fifth (rarely sixth) enlarged and below eye; six or seven lower labials; dorsal scales smooth, vertebral rows not or scarcely enlarged; midbody scale rows 26–29 ($\bar{x}$ = 27.586; SD = 0.78; n = 29); dorsal scale rows 49–55 ($\bar{x}$ = 51.074; SD = 1.708; n = 27); 9–10 rows across nape between ear openings; preanals not much enlarged; length of extended hindlimb 92–105% of axilla–groin distance and 42–50% of SVL; thinned lamellae under the fourth toe 54–63 ($\bar{x}$ = 58.967; SD = 2.442; n = 30); under first toe 11–16.

COLOR (in preservative).—Dorsal ground color brownish black (black in life) with narrow, pale bluish vertebral and dorsolateral stripes (golden in life, according to Taylor); vertebral stripe beginning at tip of snout and extending onto base of tail but not merging with light color in tail; dorsolateral stripes beginning above eye and merging posteriorly with reddish color of tail; similar lateral line at level of labials may be distinct or may be continuous with grayish tan to cream color of venter; tail light tan to cream (reddish in life).

COMPARISONS.—The general color pattern and the abrupt termination of the vertebral stripe on the base of the tail is shared with *E. caeruleocauda* and *E. reimschisseli,* but the color of the tail differs. The subdigital lamellae are more thinned and numerous than is true for other species of this subgroup (Table 8).

HABITAT.—Taylor (1915) states that specimens were collected in tall grass along the Agusan River in northern Mindanao.

RANGE.—-Mindanao, Philippines.

MATERIAL EXAMINED.—**Philippines:** Mindanao I., Agusan Province: CM 1803–4, FMNH 17923 (paratypes); Southern Mindanao: CAS-SU 23721–23; MCZ 26482–91, 26493–500, 154704–36; SMF 28034, BMNH 1974.2373–75, 1929.6.1.96–99, FMNH 61668–70, 106977, AMNH 90105.

Emoia similis Dunn

Emoia similis Dunn, 1927:9 (type loc.: Komodo Island: holotype in AMNH); Smith 1937:227; Mittleman 1952:30; Auffenberg 1980:81.

Leiolopisma k. kadarsani Darevsky, 1964:84 (type loc.: Komodo I.; holotype in MZB).

Leiolopisma kadarsani padariensis Darevsky, 1964:86 (type loc.: Padar I.; holotype in MZB).

Leiolopisma sembilunica rintjana Darevsky, 1964:86 (type loc.: Rintja I.; holotype in MZB).

Dunn (1927) regarded *E. similis* as probably most closely related to *E. lessoni* (=*E. cyanura*). Darevsky (1964), in describing *Leiolopisma kadarsani,* stated that a supranasal scale was not present even though his figure shows a partially fused scale in the position of the supranasal. Auffenberg (1980), on examining Darevsky's type material and finding a supranasal, placed *Leiolopisma k. kadarsani* from Komodo Island and *L.*

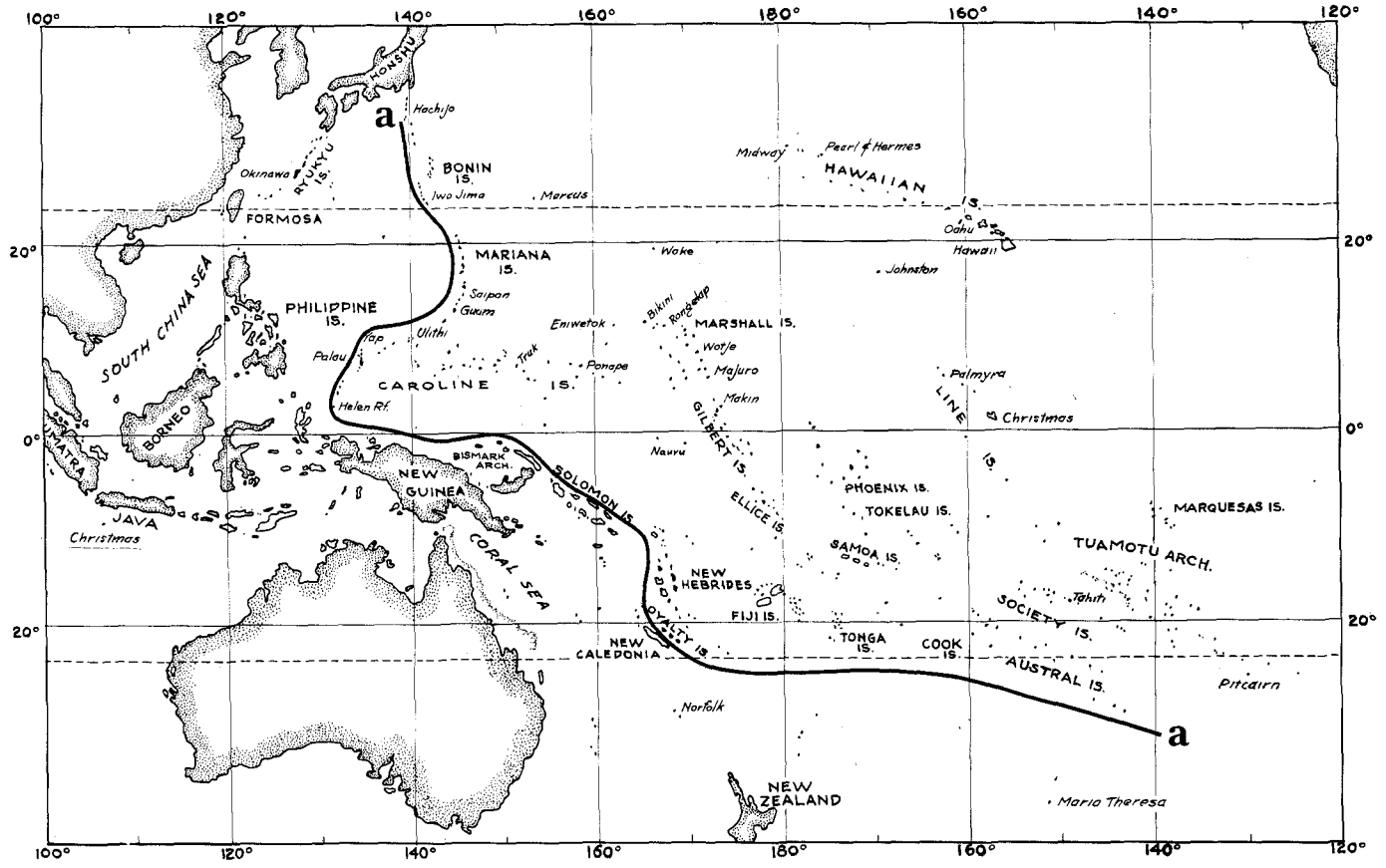

FIGURE 31. Map of islands of central, southwestern, and western Pacific in relation to the Australian and Asiatic continents, with Pacific Basin boundary indicated by line "a."

k. padariensis from nearby Pardar Island in the synonymy of *E. similis*.

DESCRIPTION.—SVL 37.3–42.0 mm for four males and 37.7–39.1 for three females; snout tapered, bluntly rounded, its length 46–51% of HB and 30–34% of HL; HB 63–67% of HL and 12–14% of SVL; eye 45–54% of snout length and 21–27% of HB; rostral forming a moderate, nearly straight or broadly rounded suture with frontonasal; supranasals triangular, in contact with anterior loreal; prefrontals narrowly to relatively widely separated; one pair of nuchals; anterior loreal much shorter and higher than posterior, in contact with first and second or only second upper labials; six upper labials, fifth enlarged and below eye; six or seven lower labials; dorsal scales smooth; midbody scale rows 24–30 ($\bar{x}$ = 26.9; SD = 1.729; n = 10); dorsal scale rows 53–59 ($\bar{x}$ = 56.1; SD = 1.853; n = 10); preanals scarcely enlarged; length of extended hindlimb 60–78% of axilla–groin distance and 33–41% of SVL; rounded lamellae under fourth toe 21–23 ($\bar{x}$ = 22.222; SD = 0.667; n = 9); under first toe 6–8.

COLOR (in preservative).—Dorsal color pattern dark brown with three narrow, pale (grayish white) stripes (brown interspaces normally slightly wider than the pale stripes, but occasionally the median pale stripe wider); middorsal pale stripe fades anterior to forelimbs and merges into tan ground color of head; two lateral pale stripes continuing across supraciliaries onto snout; all three pale stripes usually remaining distinct on basal part of tail; dark brown of upper lateral area usually one full and two half-scale rows in breadth; lower lateral surface grayish ivory, variably mottled with brown; venter creamy white or slightly grayish; upper labials variably marked by brownish flecks or blotches.

COMPARISONS.—*Emoia similis* differs from the three other species of the *caeruleocauda* subgroup primarily in its smaller size, lower number of subdigital lamellae (Table 8), smaller eye, and shorter hindlimbs (see ratios in descriptions).

REPRODUCTION.—Auffenberg (1980) found two oviducal eggs in each of two gravid females.

HABITAT.—Grasslands, savanna, and bamboo thickets from sea level to 600 m.

RANGE.—Komodo, Flores, Padar, and Rintja islands in the East Indies.

MATERIAL EXAMINED.—**Komodo Island:** AMNH 31977 (holotype), 31978 (paratype), UF 28865–66, 28868–70, 28873–77, CAS 165829.

OBSERVATIONS ON THE EVOLUTION, RELATIONSHIPS OF SPECIES GROUPS, AND DISTRIBUTION OF *EMOIA*

POSSIBLE ANCESTOR.—Of the combination of four characters used in the diagnosis of *Emoia* (Table 12), two (supranasals present and limbs well developed) are primitive and two (frontoparietals fused and lower eyelid with a window) are derived. The two derived characters are in the primitive state in one of

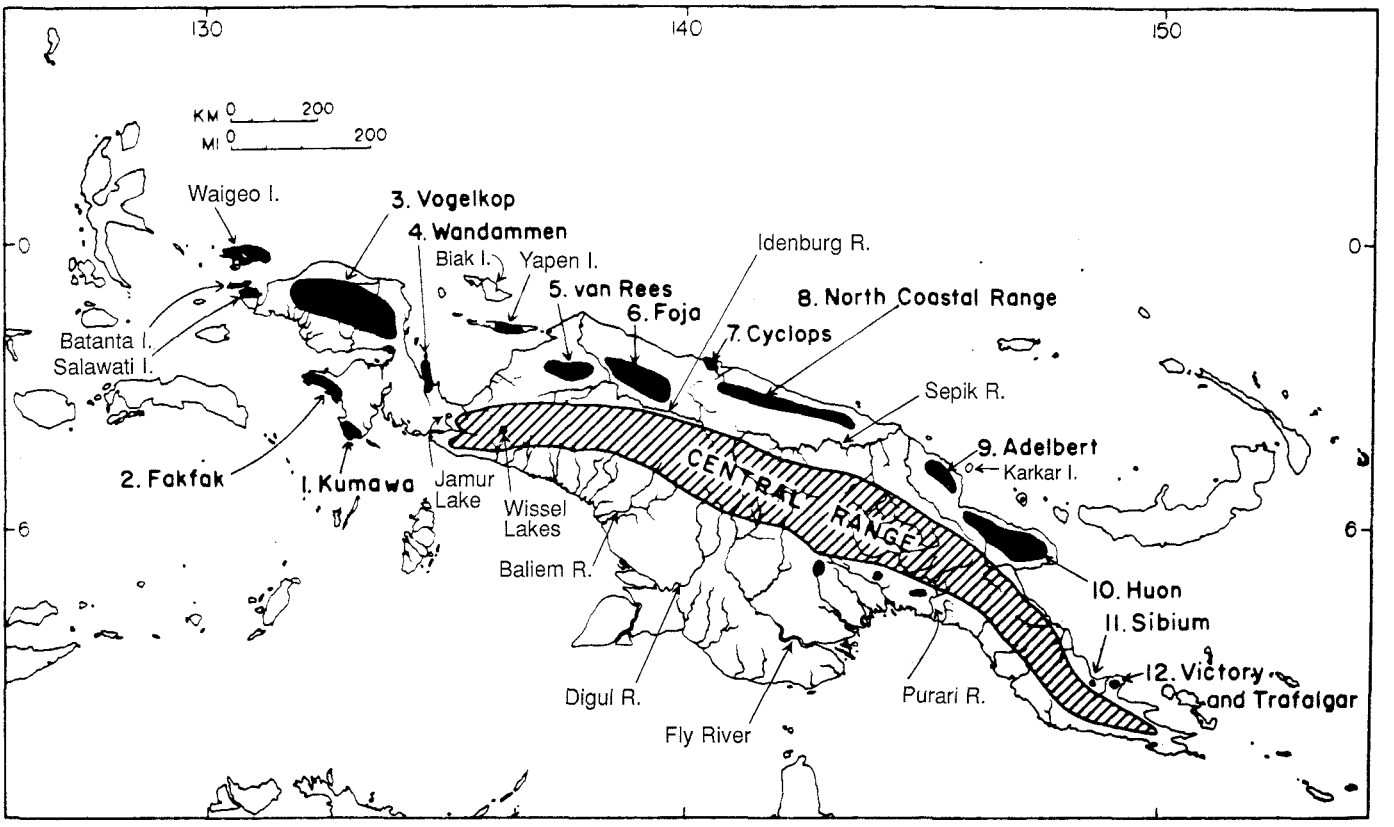

FIGURE 32. Map of New Guinea showing main mountain ranges, drainage systems, and satellite islands. Modified from Diamond (1985).

Greer's (1974) proposed ancestors, a *Eugongylus*-like stock. His other hypothesized ancestor (*Leiolopisma spenceri*-like stock) is less certain on two counts—distribution and the more advanced stage of the window in the eyelid, which characterizes *L. spenceri.* I regard a *Eugongylus* stock as the more logical ancestor.

RELATIONSHIPS OF SPECIES GROUPS.—The species groups of *Emoia* differ in other derived characters. Some of these involve the alternatives of whether or not bones of the skull or head shields are distinct. The distinct state is generally accepted as more primitive than the fused condition (Greer 1974), although there are exceptions in some scincid genera. Fragmentation of the head shields is derived, for example, in the genus *Corucia.* As to specific characters that vary among the groups (Table 12), interparietal distinct is regarded as the primitive state, and fused with the frontoparietals is regarded as derived (see Greer 1974). Smooth scales are regarded as derived, because hatchlings and/or young of several species have weak keels, whereas the adults of the species are smooth scaled. Rounded or broad subdigital lamellae I regard as more primitive than thinned lamellae. Thinned lamellae are limited to some of the species in two groups of the genus *Emoia* and occur only rarely in a few other genera of skinks, apparently independently derived. A long, relatively low, anterior loreal, which accompanies a more depressed skull, I also regard as derived. Body scales relatively large (usually in 40 or fewer rows at midbody) is more primitive than body scales small (usually in 50 or more rows at midbody). Size (SVL) moderate to large I considered more primitive than size small, but size is more useful at the species level. Parietal eye present is primitive, absent is derived.

Five of the eight groups (*atrocostata, adspersa, baudini, physicae,* and *cyanogaster* groups) share the derived character of fused nasal bones (Table 12), a rare trait in skinks. Of the five groups, the *atrocostata* group has the primitive state for the greatest number of traits. The *adspersa* group can be readily derived from the *atrocostata* group by reduction in size of the scales. They are presumably closely related.

The *baudini* and *physicae* groups can be derived from a pre-*atrocostata*-like ancestor, before the loss of keeled scales, by the acquisition of two derived characters: loss of the parietal eye, and fusion of the interparietal with the frontoparietals. Presence of an interparietal has been recorded for a few examples of *E. battersbyi,* in the *physicae* group. The *baudini* group is very closely related to the *physicae* group, differing in one additional derived character: smooth scales. Two species are somewhat intermediate, exhibiting very weak keels on the posterior, dorsal scales only. However, I treat the *baudini* and *physicae* groups as being distinct, because they exhibit independent radiations in New Guinea.

The *cyanogaster* group can be derived from an *atrocostata*-like stock on the basis of two additional derived traits: a change in the shape of the snout involving elongation of the anterior loreal, and a thinning of the lamellae for most species. The interparietal is distinct for *cyanogaster* and *longicauda,* and occasionally distinct for *kordoana* and *sorex.*

The *samoensis, ponapea,* and *cyanura* groups differ from the

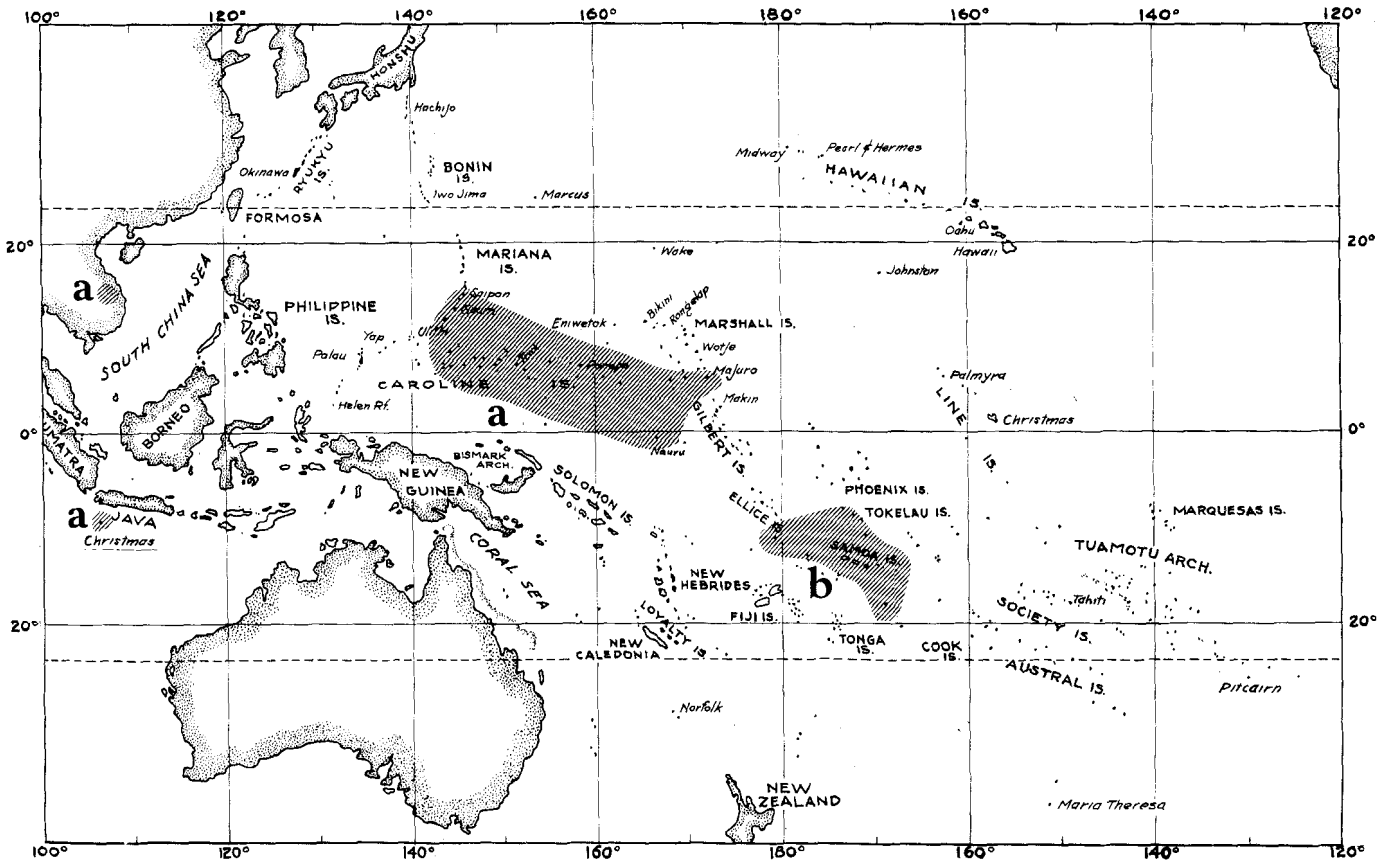

FIGURE 33. Ranges of (a) *Emoia atrocostata* group exclusive of *Emoia atrocostata,* and (b) *adspersa* group.

preceding five groups in retention of the primitive state, nasal bones distinct. The *samoensis* group exhibits two derived characters other than those used in the generic diagnosis. These are a low, elongated anterior loreal and smooth or nearly smooth scales. The former is shared only with the *cyanogaster* group, but apparently arose independently. The latter character is shared with all groups other than the *physicae* group.

The *ponapea* group, known from one species on Ponape Island in the eastern Carolines, also exhibits only two derived characters other than those of the genus. These are smooth scales and 13 premaxillary teeth (other groups have 11). The palate is somewhat intermediate between alpha and beta types (Kiester 1982).

The *cyanura* group shares with most groups the derived trait of smooth scales, but differs from all others in having a beta-type palate, rather than an alpha-type palate. Greer (1974) notes that the beta palate has apparently arisen in this group of *Emoia* independent of other beta-skinks. Two other derived traits, interparietal fused with frontoparietals and digital lamellae thinned, characterize some species of this group.

RANGES AND AREAS OF ENDEMISM.—Four widespread, highly variable species or superspecies (*E. atrocostata, E. caeruleocauda, E. cyanura,* and *E. jakati*) essentially account for the total range of the genus, though no one of them occupies the entire range. These superspecies represent three groups, the *atrocostata,* the *cyanura,* and the *baudini.* Each of the remaining 68 species occupy much more restricted ranges. Each species group exhibits a concentration of endemic species on isolated islands, clusters of islands, or limited areas (isolated mountain ranges or drainage systems on large islands such as New Guinea [Fig. 32]).

The *atrocostata* group has a primary area of endemism in the islands of Micronesia (Marianas, Carolines, Marshalls, Gilberts, and a few nearby islands), with three endemic species in addition to the widespread *E. atrocostata* (Fig. 33). These three endemic species are limited to a few islands or clusters of islands within that region. There are also small and widely separated pockets of endemism for this group in the western part of the range of the genus, that of *E. nativitatis* on Christmas Island to the south of Java and *E. laobaoense* in Southeast Asia (Fig. 33). It is interesting that *E. atrocostata* itself does not occupy much of the Micronesian region, being known only from the Marianas, Ulithi, Yap, and Palaus at the edge of the Pacific Plate. Its range extends southward to Vanuatu and Cape York in Australia, but not Fiji or Samoa. To the west, it ranges through New Guinea, the Philippines, the East Indies to the Malay Peninsula, Taiwan, and Ryukyu Islands. The two species of the *adspersa* group are endemic to Samoa, Tonga, and nearby islands, which are southeast of Micronesia (Fig. 33).

The *samoensis* group occurs in Samoa, Tonga, Lau, Fiji, and Vanuatu, where there are 11 endemic species. Each of these is endemic to only a part of the range, sometimes to a single island

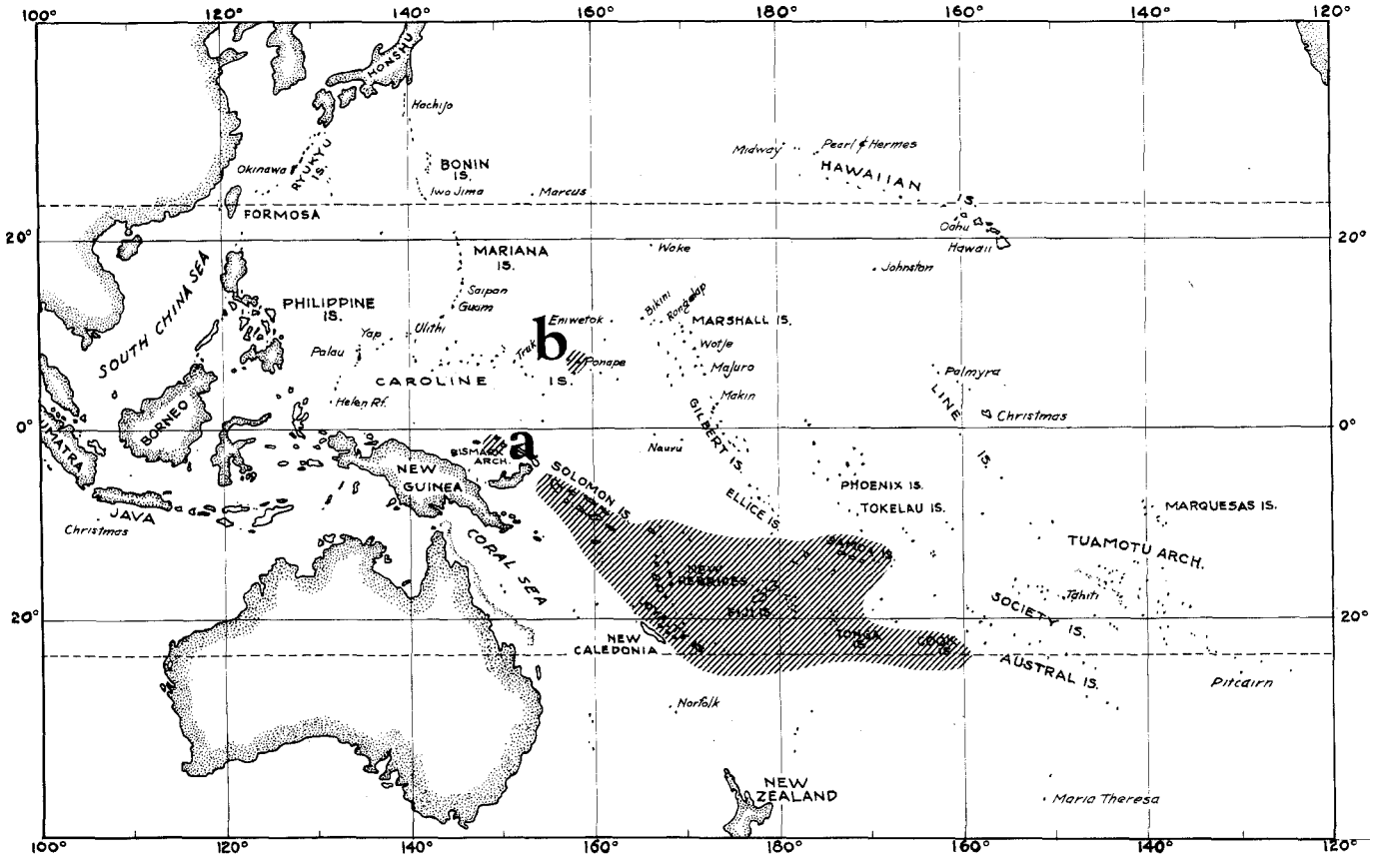

FIGURE 34. Ranges of (a) *Emoia samoensis* and (b) *ponapea* groups.

or cluster of islands. One species is endemic to the Solomons, and a 13th species, *E. nigra,* is recorded from all of these islands plus Tench Island in the Bismarcks (Fig. 34). The single species of the *ponapea* group is known only from Ponape Island in the Carolines (Fig. 34).

Three groups, *physicae, baudini,* and *cyanogaster,* are concentrated in New Guinea but vary somewhat in the extent of their ranges outside of New Guinea. The *physicae* group includes 11 species; all are endemic to New Guinea, the Moluccas, and some surrounding small islands (Fig. 35). Several species have very limited ranges within New Guinea, sometimes a single drainage system or only the upper part of one.

The *baudini* group of 22 species is endemic to New Guinea, small surrounding islands, and the Bismarcks (Fig. 36). Like the *physicae* line, most of the New Guinea species have limited ranges within New Guinea. Only three species are known from the Bismarcks: *E. bismarckensis* (which is endemic), *E. pallidiceps,* and *E. jakati.* The last species is one of the four wide-ranging species of the genus. Its range extends from the Moluccas eastward through New Guinea, to the Solomons and Vanuatu in the south, and to the Palaus and Carolines in the north.

The *cyanogaster* group includes five species. They range from Vanuatu and the Solomons westward through New Guinea and the Moluccas (Fig. 37). *E. cyanogaster* is limited to Vanuatu, Solomons, Bismarcks, and nearby islands. Two species, *E. longicauda* and *E. kordoana,* occupy most of New Guinea and satellite islands. *E. longicauda* also is found on Cape York in northern Australia. *Emoia tetrateania,* which is closely related to *E. kordoana,* is recorded only from the D'Entrecasteau Islands southeast of New Guinea. *E. sorex* is known only from the Moluccas.

The *cyanura* subgroup of the *cyanura* group has three endemic species in the main Solomon Islands, two in the Duff and Santa Cruz islands immediately to the southeast, and two in the Rennell Islands to the southwest (Fig. 38). The remaining species (superspecies), *E. cyanura,* ranges from the Admiralties, Bismarcks, Solomons, and Vanuatu eastward and northward through most of the islands of the Pacific Basin.

The *caeruleocauda* subgroup has three endemic species (*E. reimschisseli, E. ruficauda,* and *E. similis*) in isolated pockets in the islands to the west and north of New Guinea (Fig. 38). The remaining species of this subgroup, *E. caeruleocauda,* is similar to *E. cyanura* in having a very expanded range, which, however, extends from Borneo and the Philippines through New Guinea to the island arcs bordering the Pacific Plate, such as Fiji and Vanuatu, and northward to the Palaus, western Carolines, and Marianas. It overlaps with *E. cyanura* in the Carolines, Marianas, Fiji, Vanuatu, Solomons, and Bismarcks.

In the islands to the west and northwest of the Moluccas and the Southeast Asian peninsula, only six species representing two groups (*atrocostata* and *cyanura*) occur. Two of the species are the wide-ranging superspecies *E. atrocostata* and *E. caeruleocauda.* The other four (66.6%) are isolated endemics, two in the *atrocostata* group and two in the *cyanura* group. The Moluccas

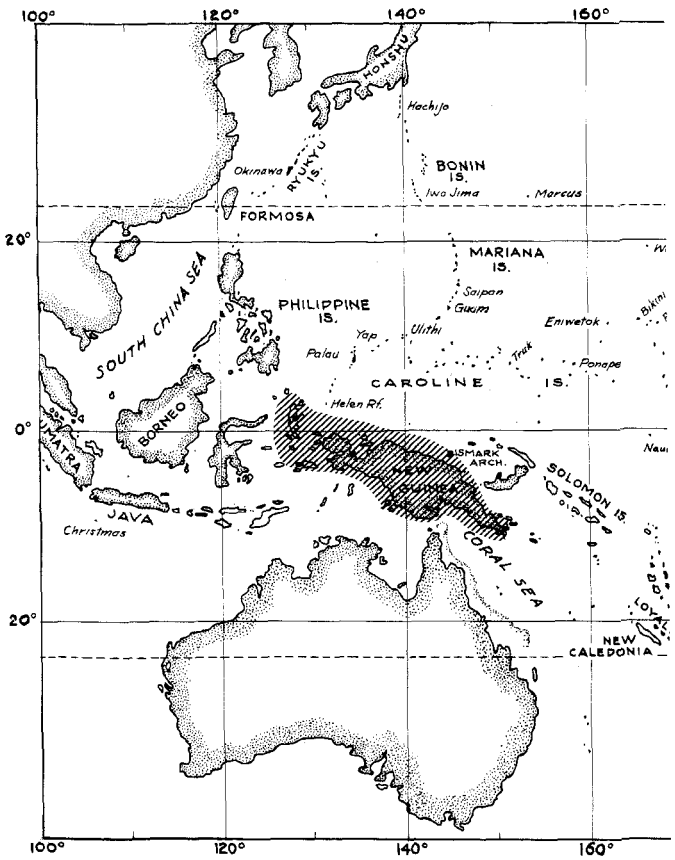

FIGURE 35. Range of *Emoia physicae* group.

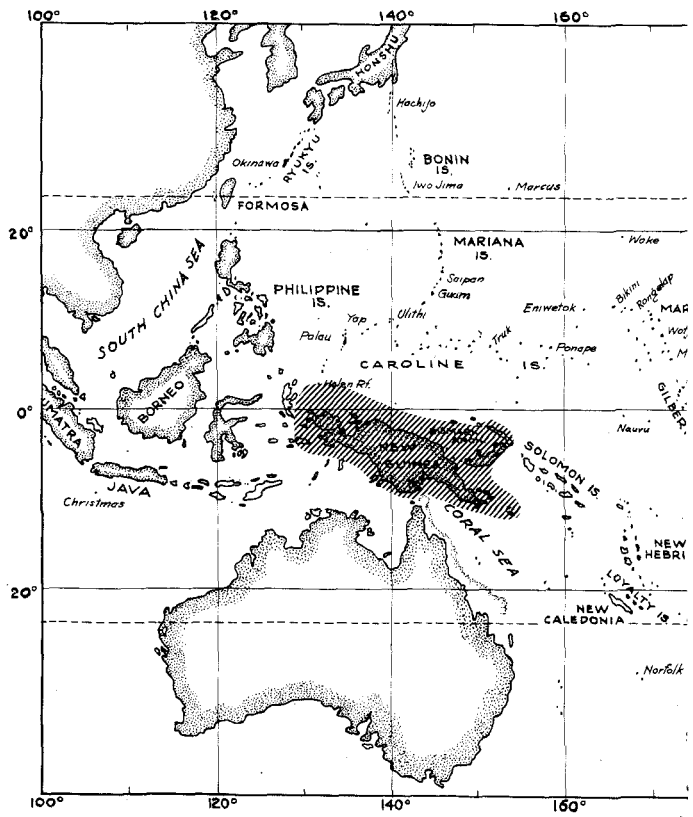

FIGURE 36. Range of *Emoia baudini* group exclusive of *Emoia jakata*.

have seven species distributed in five of the species groups. Three or possibly four (50 to 66%) are endemic. New Guinea and small satellite islands have 35 species in five groups. Thirty (84%) are endemic. The Bismarcks and Admiralties have 11 species in five groups. Only two species (18%) are endemic. The Solomons have 14 species in four species groups with eight (57%) being endemic.

Vanuatu, Loyalties, Fiji, Tonga, and Samoa along the southwestern border of the Pacific Plate have 18 species in four groups, with 13 (72%) endemic. The Marianas, Caroline, and Marshall islands to the north on the Pacific Plate have eight species in three groups, with four (50%) endemic. Only *E. cyanura* occurs in the Pacific Basin islands east of the Cook Islands in the south and the Marshall Islands in the north. A list of species recorded from various areas throughout the range of the genus is given in Appendix A.

ENDEMISM AND DISTRIBUTION OF OTHER REPTILES AND ANIMALS IN PACIFIC-BASIN ISLANDS.—Forty-three species of terrestrial reptiles in addition to the 24 *Emoia* have been recorded from the islands of the Pacific Basin. These 43 species include one to four species for any given genus. They can be grouped into four categories: (1) widespread species that generally have ranges extending outside the Pacific Basin islands westward through the Indo-Australian Archipelago and/or Philippines, sometimes as far as Southeast Asia (this is similar to the range of *E. atrocostata*); (2) those which have entered only one or a few islands or arcs on the western border of the Pacific Basin and also are found on numerous islands to the west, with ranges similar to *E. caeruleocauda* and *E. jakati*; (3) known recent introductions from various parts of the world; and (4) endemic species.

The last category is the one of primary interest at this time. The genera involved are found primarily in the island arcs along the western border of the Pacific Basin. Among these are the endemic geckonid genus *Perochirus* with three species, the endemic iguanid genus *Brachylophus* with two species, the scincid genus *Tachygia* with one species, and the elapid genus *Ogmodon* with one species. Non-endemic genera include: *Lepidodactylus* in the Gekkonidae with three of four endemic species, the agamid genus *Hypsilurus* with one endemic species, *Leiolopisma* and *Sphenomorphus,* both in the Scincidae and each with one endemic species, the typhlopid genera *Typhlops* and *Ramphotyphlops,* each with one endemic species. Only the genus *Brachylophus* is believed to have a New World origin (Gibbons 1981). None of these genera approach *Emoia* in number of species (24) or endemics (17).

When the distribution patterns of other southwest Pacific reptiles are compared with that of *Emoia,* the latter is unique in several respects. First, most species of *Emoia* are found in New Guinea and those groups of islands to the east and north along the Pacific Plate boundary. *Emoia* is poorly represented in the islands west of New Guinea. Other genera of reptiles that are well represented in New Guinea and sometimes the Solomons are usually abundant in islands to the west, but very poorly represented in, or absent from, the islands to the east of the Solomons or the Philippines. Secondly, *Emoia* has a far greater

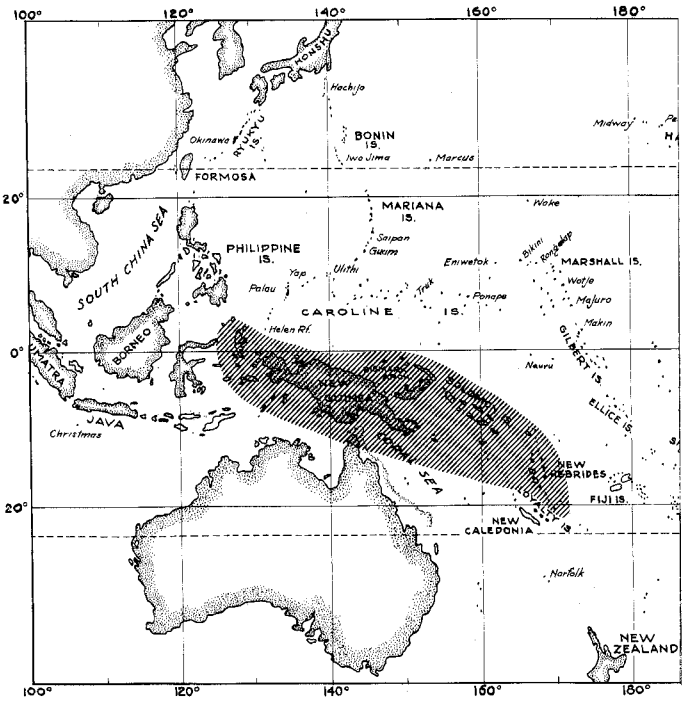

FIGURE 37. Range of *Emoia cyanogaster* group.

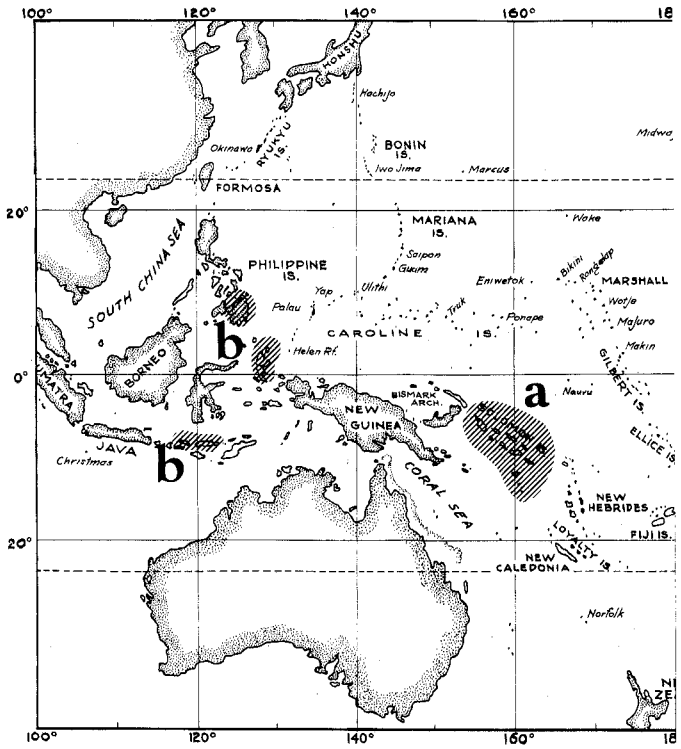

FIGURE 38. Range of (a) *Emoia cyanura* subgroup exclusive of *Emoia cyanura*, and (b) of *caeruleocauda* subgroup exclusive of *Emoia caeruleocauda*.

number of species (mostly endemic) in either Micronesia in the north, or the Vanuatu-Fiji-Tonga arcs and oceanic Samoa in the south, than do all the other genera of skinks taken together (Table 13).

Studies of some non-reptilian animals from the Pacific islands also provide extensive data on diversity of species, endemism, and distribution. Solem (1976) reports that among the small land snails occurring in the Pacific-Basin islands, the endemic family Endodontidae consists of hundreds of species distributed throughout the islands. The Charopidae is only slightly less widely dispersed in the Pacific Basin, with many endemic genera and species. It also occurs to the west and south, with many species in Australia, New Zealand, and New Caledonia. Solem (1981) noted that in addition to the Endodontidae, three other families are restricted to high Pacific islands. These include the Partulidae, the Achantinellidae, and the Amastridae, the latter known only from Hawaii. Fossil records are known only for the Achantinellidae (Paleozoic of North America) and for the Endodontidae (Miocene in the Marshalls). He also noted that whereas other animals and plants show Pacific-Basin island endemism at the generic level, endemism at the family level is known only for the land snails. Gressitt (1956) suggests that small snails might be transported by birds, wind-borne, or water-borne debris.

Springer (1982) summarized available data on shorefishes and several groups of terrestrial and marine organisms found on Pacific-Basin islands or in offshore waters. In discussing bat distributions, he noted that they are not subject to widespread introductions by man. Seven bat species occur on Pacific Plate islands in non-marginal areas (Koopman 1970). One (a western hemisphere derivative) is found in Hawaii. The other six species (with Indo-Pacific origins) are in island groups on the western part of the Plate. These include four species endemic to the eastern Carolines.

Springer (1982) provided little comparative data on the extensive insect fauna of Pacific islands. He noted that Bell (1979) listed three species (two endemic) of deadwood beetles, genus *Rhysodine,* as occurring in the eastern Carolines, with others being endemic to the border islands of Yap, Ulithi, and Palau. Gressitt (1956) provided much more information on insects, basing his tentative conclusions concerning faunal distribution patterns in the Pacific islands primarily on data for several families. He noted a gradual decrease both quantitatively and qualitatively at all taxonomic levels as one progresses from west to east. He also emphasized the sharp drop, particularly in higher categories of insects, for islands east of the Solomons and Philippines.

Beetles, particularly small beetles, are the dominant insects in Pacific Basin islands, with fragile-winged and large insects absent or limited to islands along the western edge of the region. For example, weevils are found throughout the Pacific Basin, as far east as the Hawaiian and Easter islands; cerambycids, the Hawaiian and Society islands; chrysomelids, the Marshalls, Samoa, and Tonga islands; and cicadas, the Carolines and Samoa.

Insects exhibit a high degree of endemism. One genus of the Cerambycidae is endemic to Fiji and another to the Carolines and Marshalls. A genus of the Chrysomelidae is endemic to Vanuatu, Fiji, Tonga, and Samoa. At the species level, Gressitt noted that of 100 cerambycids recorded from Micronesia, 88% are endemic; for Samoa, 23 of 35 species (66%); and for Fiji, 105 of 112 species (94%). At the time of Gressitt's report, the insect fauna of Hawaii was more completely known than that

TABLE 13. Total number of species for lizard families (endemics in parentheses) in Pacific Basin islands with data on the Solomons for comparison.

	Emoia	Other skinks	Gekkonids	Agamids	Iguanids
Solomons and Santa Cruz Is.	14 (8)	23 (15)	13 (5)	1 (0)	0 (0)
Vanuatu and Loyalty Is.	10 (5)	5 (0)	9 (1)	0 (0)	0 (0)
Fiji, Tonga, Samoa, and surrounding islands	11 (8)	4 (1)	8 (2)	1 (0)	2 (2)
Polynesia e. of Samoan Is.	1 (0)	2 (0)	5 (0)	0 (0)	0 (0)
Caroline, Gilbert, and Marshall islands (Micronesia)	8 (4)	7 (2)	9 (2)	1 (1)	0 (0)

of Fiji, Samoa, or Micronesia. He hypothesized that three original colonists in Hawaii have given rise to at least 100 endemic species of cerambycids. He also noted that in the Cicadidae, seven endemic species are known from the Carolines and Fiji, three from Samoa, and two from the Bonins.

As to the shorefish fauna, Springer (1982) included over 1300 species in 461 genera and 111 families as known from waters around Pacific-Plate islands. Ten genera are currently thought to be endemic to the Pacific Plate, and 20 to 25 percent of the species are endemic.

Other than the recently introduced *Bufo marinus, Rana catesbeiana,* and *Hyla regilla,* only three amphibians (*Platymantis,* Ranidae) occur in islands east of the Philippines and Solomons, one in the Palaus, and two in Fiji. All are endemic.

EARLIER CONCEPT OF PACIFIC-ISLANDS GEOLOGY AND ZOOGEOGRAPHY.—Prior to the mid-twentieth century, hypotheses put forth to explain distributions of terrestrial vertebrates were restricted by the prevailing geologic concept of relatively fixed continents, fringing archipelagoes, oceanic arcs, and isolated islands. One attempt to reconcile disjunct distributions was to build land bridges. The more common explanation, however, was dispersal across water. Thus, the biota of an island was thought to be determined by size of the island, over-water distance from a probable source, and the dispersal ability of organisms across water.

It has generally been recognized that the Pacific-Basin boundary is the eastern limit or point of sharp reduction in number of genera or higher taxa of terrestrial animals as well as some marine organisms (Gressitt 1956; Usinger 1963). Springer (1982) states that a sharp drop is also evident for shore fishes if one follows a line of islands due east from New Guinea, but is more gradual if one proceeds southeastward from Fiji along a line to Easter Island. With regard to the terrestrial vertebrates other than birds, the generally accepted hypothesis was that most species of the amphibian, reptilian, and mammalian faunas of Pacific-Basin islands were relatively recent immigrants, although several species of reptiles, two amphibians, and a few mammals were presumed endemic. Darlington (1957) summarized this view. He termed the pattern an immigrant one, with limits for various faunal elements essentially proportional to their relative ability to disperse over salt-water barriers. He noted that freshwater fishes and turtles do not occur east of New Guinea, frogs and flightless mammals not east of Fiji, lizards with a few exceptions not east of Samoa, Fiji, and Tonga, bats Samoa, and land birds not east of the farthest Tuamotus. He further noted that the most striking relic in the vertebrate fauna is the iguanid lizard *Brachylophus.* At that time, only one species was known. There are now two, both from Fiji. He concluded his summary with the following statement:

> Certain frogs, snakes, lizards and rats occur beyond the limits given; and some of them on remote islands have been supposed to be native, endemic forms. Perhaps some of them are. But they are all too far out, too little differentiated, in some cases too little known, and too much associated with man to be accepted without question. They are all eaten by man, or eat his food, or live in his houses, or are likely to be carried by him accidentally. Some or all of these animals have probably been carried beyond their natural limits by man within the last few thousand years. To what extent these island populations are really differentiated, and what the differentiation means, is still to be determined in most cases. (Darlington 1957:509)

About the same time, Brown (1956), in reviewing the distribution of reptiles of the Pacific-Basin islands, recognized that the genus *Emoia* was disproportionately represented, with 15 of 45 known reptilian species (39 lizards and six snakes) and nine of the 15 species regarded as endemic. *Emoia* was stated to be Papuan in origin.

Work of the past three decades has provided further data indicating that the number of species of reptiles and the number of endemics occurring in these Pacific islands are somewhat greater than previously thought, but has not altered the position of *Emoia* (now 24 species with 17 endemic).

CHANGING GEOLOGIC CONCEPTS.—Since the early 1960s, the concept of plate tectonics has affected ideas about the geology and biogeography of the Indo-Pacific and Australian regions. Hypotheses concerning the origin of strictly oceanic islands and fringing archipelagoes are still the same. Elevation or subsidence of the sea floor may create or change such islands; and sea-floor spreading may alter the distances between them. Similarly, expansion or contraction in size, emergence or submergence of low islands, and alteration of distance between islands may also result from changes in sea level during ice ages and intervening warm periods.

The concept of plate tectonics has, however, greatly altered our ideas about the processes that brought about geologic changes in plate boundary areas. Islands, most of them in volcanic arcs, are prominent along active boundaries of adjoining, oceanic plates; for example, Vanuatu, Fiji, Tonga, Solomons, Loyalties, and Bismarcks. Until the late Miocene, islands of the Vanuatu arc were situated in a relatively straight line between the Fiji and Solomon arcs. The Vanuatu arc began its southward rotation about six to eight million years ago. Tonga is a good example of a cluster of islands derived from two different sources. It has been hypothesized that Eua Island at one time (late Eocene and early Miocene) drifted eastward from the Rennel arc to join the Tonga group, which is otherwise related to the Fiji group (see Hamilton 1979; Kroenke 1984).

New Guinea is an example of accretion of islands in the formation of a larger island, a result of plate tectonics (Hamilton 1979). It also provides an insight into the geologic timing of some of the major plate actions affecting the southwest Pacific

region. New Guinea lies to the west of the Bismarcks and Solomons, and is a geologically complex island. The southern part of New Guinea is derived from the leading edge of the Australian Plate, the northern part from islands formerly on the Pacific Plate. The northern edge of the Australian Plate apparently collided with the Papuan Arc along the line of the Aure and Moresby trenches in the middle to late Eocene, 40 to 45 million years ago. This was followed by collision with the New Guinea-Trobriand Arc in the early Miocene, about 15 to 20 million years ago. Most of the isolated northern ranges are believed to have collided with the rest of New Guinea in the late Miocene not more than 10 million years ago (Fig. 32) (Hamilton 1979).

Thus, at times in the past (perhaps as recently as middle Miocene), a continuous chain or chains of islands extended from southeastern Asia across plate boundaries to Fiji or Tonga (Hamilton 1979). Conceivably, this involved not only shorter distances between islands but at times larger island masses.

The actual age of exposure of present islands above sea level is also important in discussion of the biogeographic history of the islands. The exact age of an island, since it was most recently submerged, is often difficult to determine. Maximum possible ages of oceanic islands can be stated in terms of the estimated age of the underlying basement crust for any given island or group of islands. Thus, Fairbridge (1975:412) states that some young atolls are constructed of reef materials as recent as 6000 years of age. He also states that the basement age for different groups ranges from 2 to 5 million years for the Easter Island area to more than 135 million years for Mariana and Wake islands. Some of the islands in these regions could be nearly as old as the indicated maximum, though there is no firm evidence for this.

Some authors (Solem 1976) suggest that few if any of the present islands are older than the Eocene. Others (Gressitt 1956; Thorne 1963) suggest that in pre-Eocene times, as far back as the Cretaceous, islands may have been more numerous, based on the present distribution of basaltic seamounts and coral-capped volcanoes. The present high and apparently older islands include Society, Marquesas, and isolated islands such as Rapa and Ponape.

Some of the island arcs along the boundaries of the Pacific, Australian, and minor plates, although not always situated in their present positions, are also old. Kroenke (1984) placed the Loyalty Islands as late Miocene in origin. He regards the Rennell Arc as early Tertiary. Other arcs which contributed to the formation of the present Solomon and Bismarck archipelagoes probably range in age from the middle to early Miocene (10 to more than 40 million years). Solem (1981:217) states that recent potassium-argon dating indicates that some of these arcs may have histories of more than 60 million years. Islands of the Vanuatu, Santa Cruz, and Fiji arcs range in age over about the same period (10 to 40 million years).

SOURCE AND ZOOGEOGRAPHY OF *EMOIA*.—The following hypothesis is proposed to explain the observed distribution pattern and regional endemism exhibited by the species groups of *Emoia*. The genus is presently represented by a small number of species in two groups in the area from Indochina to the Moluccas. The ancestral stocks that gave rise to the *baudini, physicae,* and *cyanogaster* groups arrived in New Guinea from the west by way of the clusters of islands that converged and fused over millions of years to form most of the northern half of New Guinea, contributing to the central mountain ranges (Fig. 32). Some of these stocks dispersed in New Guinea to the south and southeast, giving rise to species endemic to those regions. Another invasion by derivatives of the same ancestral stocks arrived in New Guinea with more recent island fusions that formed the north-coast ranges such as the Huon, Adelbert, Cyclops, North Coastal, Foja, Van Rees, the northern mountains of the Vogelkop Peninsula, and others (Fig. 32). This concept is supported by the presence of isolated endemics in these areas, such as *E. baudini, E. cyclops,* and possible endemics in the mountains of Waigeo and Japen islands. *Emoia popei* may be an example of a species in the process of dispersing from the northern mountain areas. Diamond (1985) states that many of these isolated, north-coast mountain ranges also have endemic birds at the subspecific or specific levels.

This proposed history for these three groups has further support in the fact that only one species (*E. longicauda* in the *cyanogaster* group) has become established in the Cape York region of northeastern Australia. This species and *E. atrocostata,* the only other *Emoia* that has reached Australia, may well have done so during the Pleistocene when Cape York and New Guinea were presumably connected. Also, the total number of species, as well as the number of endemics (13 of 24), is somewhat greater for the northern and western parts of New Guinea when compared to the southern part (7 of 21). The ancestral stocks of the *baudini, physicae,* and *cyanogaster* groups apparently had not succeeded in dispersing very far, if at all, into the more easterly arcs of the outer chain (the Bismarck, Solomon, Vanuatu, Fiji arcs) at the time of the collision that led to the formation of northern New Guinea, since all three groups are represented by only six species in the Admiralties, Bismarcks, Solomons, and Vanuatu. Only three (*E. mivarti, E. bismarckensis,* and *E. cyanogaster*) of the six are endemic to these island groups.

The large number of species in New Guinea, particularly for the *baudini* and *physicae* groups (21 and 11, respectively), is an example of continental radiation on a large, diverse island (Diamond 1984). A few species have ranges extending through most of New Guinea, but most have restricted ranges that are correlated with major physiographic features, such as isolated mountain ranges, as noted for *E. baudini* and *E. cyclops.* Others, such as *E. submetallica, E. oribata, E. montana, E. irianensis, E. paniae,* and *E. bogerti,* are found in the central ranges. Still others are apparently restricted to major or minor drainage systems, *E. guttata, E. aenea, E. brongersmai, E. tropidolepis, E. digul,* and *E. aurulenta,* for example. *Emoia maxima* appears to be limited to northern Irian Jaya and the Vogelkop, *E. baudini* to the Vogelkop, *E. jamur* to the Jamur Lake area and the Vogelkop, and *E. popei* to northern Papua New Guinea.

The *cyanogaster* group has four species in New Guinea. Why it has not achieved a radiation similar to that of the *baudini* and *physicae* groups is not clear. Perhaps the ancestor to the *cyanogaster* group was among the last (most recent) to arrive.

The ancestral stock of the *atrocostata* group presumably occupied the Caroline Islands by the middle Miocene, perhaps about the same time that the ancestors of the *physicae* and *baudini* lines reached northern New Guinea. This Micronesian stock radiated to give rise to the three endemic species of the *atrocostata* line in the Carolines and Marshalls, and a branch of this stock, in Samoa and surrounding islands, gave rise to

the two species in the *adspersa* group. The *atrocostata* group also has two relic endemics in the Oriental region, *E. nativitatis,* on Christmas Island south of Java and *E. laobaoense* in Vietnam. This suggests that the ancestral stock once had a wide range, but has been reduced to isolates in Micronesia, Christmas Island, southeast Asia, and some unknown locality for the presently widely dispersed *E. atrocostata.*

The ancestral stock that gave rise to the *samoensis* group was also probably present at least in the Fiji-Vanuatu arcs in the early or middle Miocene when these arcs were still in a nearly straight alignment with the Solomons. The invasion of Tonga, Samoa, and Loyalty Islands is probably the result of more recent migrations. Extensive radiation has since resulted in several endemic species in the Fiji and Vanuatu archipelagoes, two in Tonga and Samoa, and one (*E. flavigularis*) in the Solomons (the last may be a relic). This distribution is interpreted as an example of intra-archipelagic speciation (Diamond 1984). The wide dispersal of such species as *E. trossula* and *E. concolor* within Fiji, and *E. nigromarginata* within the Vanuatu group may be in part the result of relatively recent changes in interisland distances owing to ice-age changes in sea levels, as suggested by Gibbons (1985).

Emoia ponapea, which is isolated on Ponape Island in the eastern Carolines, is a relic of a stock that probably entered the Pacific islands by way of the Caroline conduit, perhaps at about the same time or prior to the invasion by the *atrocostata* group.

The stock which gave rise to the *cyanura* branch of the *cyanura* group probably occupied the Solomons and Santa Cruz Island arcs by at least middle Miocene and gave rise to the endemics of that region. The stock giving rise to the *caeruleocauda* branch of this group probably occupied some part of the island area to the west of New Guinea at about the same time and gave rise to the isolated endemic species *E. similis, E. ruficauda,* and *E. reimschisseli.* Extensive ranges characterize the superspecies *E. cyanura* in the Pacific-Basin islands and *E. caeruleocauda* westward from the western Carolines, Solomons, and Vanuatu to Borneo.

The wide ranges of the species *atrocostata, jakati, nigra, cyanura,* and *caeruleocauda* may have, in part, resulted from relatively recent dispersals. One line of evidence supporting this view is the nature of the habitats these species occupy, beach and mangrove areas for *E. atrocostata,* and lowlands (often around human habitations in part) for the others. Such habitats would seem to provide chances for occasional dispersal from island to island, whether or not assisted by man. Zweifel (1980) refers to these as weed species. Three of these superspecies (*E. atrocostata, E. caeruleocauda,* and *E. jakati*) have ranges extending westward from the border arcs, and *E. cyanura* has a very wide range on the islands of the Pacific Basin and the border arcs to the east of New Guinea. These distribution patterns raise some doubts that the above explanation is the complete answer.

This evidence from current ranges and radiation patterns for the groups fits an hypothesis of early or pre-Miocene dispersal of the ancestral stocks from the Oriental region along island chains on the western and southwestern borders of the Pacific Plate. This concept of Oriental origin for the *atrocostata, baudini, cyanura, cyanogaster,* and *physicae* groups is supported by the presence of isolated species in the Moluccas and further west. It is also supported by the fact that only two rather wide-ranging species (*E. atrocostata* and *E. longicauda*) are known from Australia; and both are limited to Cape York in the northeast, the Torresian subregion of Cogger and Heatwole (1981). An Oriental origin is most probable for the *samoensis* group as well, but there is no clear, closely related relic west of the Solomons. Should the *samoensis* and *ponapea* lines prove to be related as has been suggested, it would add further support to the concept of an Oriental origin for both.

COMPARISON WITH OTHER PACIFIC-ISLAND FAUNAL ELEMENTS.—The proposed dispersal pathways and times of entry for *Emoia* are supported by the interpretations of other investigators of the evidence for their faunal elements. For example, Springer (1982) proposes that the Carolines have acted as a conduit not only for rhysodine beetles and bats, but also for other terrestrial and marine organisms, in addition to several genera of shore fishes. Gressitt (1956) and Usinger (1963) emphasize that the Pacific-Basin fauna is essentially Oriental (by way of Papua, or earlier island chains in this region, and to a lesser degree the Philippines); and that the Australian influence is very weak beyond New Caledonia and New Guinea.

Tyler (1979) and Zweifel and Tyler (1982) regard the New Guinea frogs of the families Microhylidae and Ranidae as having used the Oriental route, via the arcs which contributed to the formation of northern New Guinea. The microhylids have dispersed as far as the Bismarcks and a couple of regions in northern Australia. They have undergone extensive radiation in New Guinea and to a lesser degree in Australia. Presumably, the microhylids have been there since the earliest accretion of Pacific-Plate islands.

Zweifel and Tyler (1982) propose that the genus *Rana* (Ranidae), with a similar distribution pattern (but only one species in the Solomons), has presumably been added to the New Guinea fauna by sporadic increments over much of the time since the early Miocene.

The genus *Platymantis* (Ranidae) shows a different distribution, similar in the New Guinea and Philippine areas to that exhibited by *Lipinia* in the Scincidae. But *Platymantis* differs from *Lipinia* in also having a major radiation center in the Bismarcks and Solomons as well as the Philippines. The ancestral stock for *Platymantis,* according to Tyler (1979), may have dispersed to the Bismarcks and Solomons from the Philippines by the early Miocene. He proposes that later, secondary dispersal of *Platymantis* includes: one westward to the arcs that contributed to the northern part of New Guinea and one eastward to Fiji. Neither Tyler (1979) nor Zweifel and Tyler (1982) attempt to explain the presence of the endemic platymantine genera *Ceratobatrachus, Discodeles,* and *Palmatorappia* in the Solomons. It is probable that the platymantine ranids arrived in the Solomons arc at least by the early Miocene (probably before) and have since undergone extensive radiation.

This proposed dispersal path for *Platymantis,* from Philippines to the Bismarcks and Solomons and then westward to New Guinea, seems to me to be no more likely than the following alternative. An Oriental ancestral stock dispersed to the Philippines and, at the same time, into the more southern island chains that have been proposed as the migrational pathway for ancestral stocks of the *Emoia.* The subsequent introduction of the *Platymantis* stock into New Guinea resulted from the later island accretions, and at the same time as the ancestors of the *Emoia* species that are limited to the north coastal mountains.

Perochirus (Gekkonidae), one of three genera of lizards en-

demic to the Pacific Basin, has three species, one in Vanuatu and the other two in the Carolines and Marianas. The ancestral stocks may have dispersed into these islands by the early Miocene and have become extinct in islands to the west. *Tachygia* and *Brachylophus,* the other endemic genera, are known from one species in Tonga and two in Fiji, respectively. The gekkonid genus *Lepidodactylus,* with radiations in the Philippines and Solomons and a few endemics in the Fiji-Tonga area, strongly resembles the amphibian genus *Platymantis.* However, *Lepidodactylus* has a similar radiation in New Guinea and relics in Christmas Island off Java and in the Moluccas, in contrast to *Platymantis* with only a few species in northern New Guinea. I suggest that their dispersal pathways and time of dispersal were similar, but that *Lepidodactylus* reached New Guinea earlier than *Platymantis.*

Allison (1982) stated that eight genera of New Guinean lizards are Australian, eight Indo-Malayan, five Papuan, and eight widespread. Those genera that did reach New Guinea, and also such island arcs as the Bismarcks and the Solomons, by the Oriental route (some examples include the genera *Lepidodactylus, Arua, Hypsilurus* [Moody 1980], *Crytoblepharus, Lipinia,* and *Sphenomorphus*) probably did so by way of those island arcs that contributed to the formation of northern New Guinea (as has been proposed for *Emoia*). Others of Indo-Malayan origin and the widespread *Emoia* species may have arrived more recently.

Solem (1976) suggests that the dispersal of land snails into the islands of the Pacific Basin occurred in the Mesozoic, and that the fossil evidence from the Marshall Islands indicates the presence of Endodontidae and Charopidae in those islands throughout the Miocene.

The distribution patterns (Springer 1982) for a number of shorefish genera, for example *Nemateleotris, Labroides, Amphiprion,* and *Mirolabrichthys* in the West Pacific and on the Pacific Plate are similar to that of the genus *Emoia.* Springer (p. 124) further notes that several genera (for example *Periophthalmus, Butis,* and *Omox*) are possible examples of dispersal onto the Pacific Plate by way of the Caroline Islands conduit as I have proposed for the *Emoia atrocostata* group. The distribution patterns of a number of insect genera are also very similar (Gressitt 1956). Some of the Oriental and West Pacific genera of shorefishes and some insect genera have dispersed to the northern edge of Australia, as have the *cyanogaster* and *atrocostata* groups of *Emoia.* The strong correlation of the ranges of a number of shorefish genera with the range of the genus *Emoia* or with the ranges of the various species groups of *Emoia* strongly suggests that these two faunal elements used the same routes of dispersal, probably at the same time.

Shorefishes differ from *Emoia* or other terrestrial vertebrates (excluding birds), however, in that there are numerous endemic species in shallow waters off islands to the east of the Samoa and Lau groups in the south, and in the Hawaiian and other groups or isolated islands east of the Marshalls in the north.

The recent evidence that a much greater proportion of many taxa of terrestrial animals as well as shallow-water marine animals associated with islands of the Pacific Plate and southwestern border arcs east of the Solomons are endemic is in opposition to the view, prevalent a few decades ago, that most of the terrestrial vertebrates were probably recent invaders (often aided by man). The concept of plate tectonics has provided the basis for interpretations that recognize means of dispersal for terrestrial animals other than chance rafts or assistance by man in crossing over presumed relatively wide and stable marine barriers. Also, as our knowledge of the tectonic events affecting these same groups of islands has grown, the time of the probable dispersal into the islands and the time available for the evolution of these endemic faunal elements has been extended back millions of years.

Appendix A

Distribution of Species of *Emoia* by Regions (see Fig. 31)

Southeast Asia (Malay Pen., Cambodia, Vietnam, and Hainan Island)
E. atrocostata, E. laobaoense

Christmas Island
E. atrocostata, E. nativitatis

Greater Sundas (Sumatra, Java, Lomboc, Bali, satellite islands)
E. atrocostata, E. caeruleocauda

Borneo, Celebes, and satellite islands
E. atrocostata, E. caeruleocauda

Philippine Islands
E. atrocostata, E. caeruleocauda, E. ruficauda

Taiwan and Ryukyu Islands
E. atrocostata

Lesser Sundas (Sumbawa to Timor)
E. atrocostata, E. caeruleocauda, E. similis

Moluccas (Batan, Halmahera, Moratai, Obi, Ternate, Buri, Ceram, Kei, and Aru islands)
E. atrocostata, E. caeruleocauda, E. sp. (*baudini* group), *E. kuekenthali, E. longicauda, E. reimschisseli, E. sorex*

New Guinea and satellite islands
E. aenea, E. atrocostata, E. ahli, E. aurulenta, E. battersbyi, E. baudini, E. brongersmai, E. bogerti, E. caeruleocauda, E. callisticta, E. coggeri, E. cyclops, E. digul, E. guttata, E. irianensis, E. jakati, E. jamur, E. klossi, E. kordoana, E. longicauda, E. loveridgei, E. maxima, E. montana, E. obscura, E. oribata, E. pallidiceps, E. paniae, E. physicae, E. physicina, E. popei, E. pseudopallidiceps, E. submetallica, E. tetrataenia, E. tropidolepis, E. veracunda

Australia
E. atrocostata, E. longicauda

Bismarck and Admiralty islands
E. atrocostata, E. bismarckensis, E. caeruleocauda, E. cyanogaster, E. cyanura, E. jakati, E. kordoana, E. longicauda, E. mivarti, E. nigra, E. pallidiceps

Solomon, Duff, and Santa Cruz islands
E. atrocostata, E. caeruleocauda, E. cyanogaster, E. cyanura, E. flavigularis, E. isolata, E. jakati, E. maculata, E. nigra, E. pseudocyanura, E. rennellensis, E. rufilabialis, E. schmidti, E. taumakoensis

Vanuatu, Loyalty, and Banks islands
E. aneityumensis, E. atrocostata, E. caeruleocauda, E. cyanogaster, E. cyanura, E. erronan, E. loyaltiensis, E. nigra, E. nigromarginata, E. sanfordi

Fiji, Rotuma, and Tonga islands
E. caeruleocauda, E. campbelli, E. concolor, E. cyanura, E. lawesi, E. murphyi, E. nigra, E. parkeri, E. trossula

Samoa, Nuie, Tokelau, Ellice, Phoenix, Baker, and Howland islands
E. adspersa, E. cyanura, E. lawesi, E. murphyi, E. nigra, E. samoensis

Cook Islands
E. cyanura, E. trossula

Palmyra, Fanning, Christmas, and Jarvis islands
E. cyanura

Marianas Islands
E. atrocostata, E. caeruleocauda, E. cyanura, E. slevini

Palau and Yap islands
E. atrocostata, E. caeruleocauda, E. jakati

Caroline Islands
E. atrocostata, E. arnoensis, E. boettgeri, E. caeruleocauda, E. cyanura, E. jakati, E. ponapea

Marshall, Gilbert and Nauru islands
E. arnoensis, E. boettgeri, E. cyanura

Society, Tuamotu, Marquesas, Hawaiian, and Line islands
E. cyanura

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