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ABSTRACT

The Huon Peninsula forms the eastern end of the Finisterre-Saruwaged mountainous region, nearly 300 km. long, which rises to 4000 m. above the sea and nearly that far above adjacent lowlands. Thirty-eight species of frogs and 52 of lizards are recorded from the Peninsula, many of them for the first time. Endemism is slight: none of the lizards and only three of the frog species appear to be endemic. Most of the lizards (92%) and frogs (54% of non-endemic species) are lowland forms, although many of these range into uplands as well. Populations of four species of lizards and 16 of frogs evidently are disjunct from conspecific populations elsewhere, almost all of which are in mountains to the southwest of the Peninsula, across the Ramu-Markham River Valley. The disjunct species are ones with lower elevational limits at about 1000–1400 m., some lower. Frog species restricted to high mountain forests or grasslands elsewhere in New Guinea are absent from the Peninsula.

Geological evidence indicates that the mountain mass of which the Huon Peninsula is part has undergone 3000 m. of uplift since the late Pliocene, and that for part of its existence the area was insular. In the Pleistocene, glaciers existed on the highest peaks, montane grassland expanded and cooler temperatures prevailed. It is hypothesized that these altered climatic conditions permitted immigration of such upland species as are present and now, with changed climate, exist in disjunct populations. Climate did not change sufficiently to permit immigration of high montane species. Lowland species—especially skinks—would have become established shortly after the land mass first appeared above the sea, and the more balanced lowland fauna would have been achieved when the Ramu-Markham area became dry land. The scarcity of endemic forms suggests that the Finisterre-Saruwaged region has not been isolated long enough or continuously enough to permit speciation of isolated populations. The frog and lizard faunas provide no evidence of a former land connection between New Britain and the Huon Peninsula, and the scarcity of lowland New Guinea frog species in New Britain argues against any such connection.

One new species of microhylid frog—*Cophixalus pipilans*—is described, and distributional, ecological, and systematic notes are given for many of the species.

INTRODUCTION

The Seventh Archbold Expedition to New Guinea, led in 1964 by Hobart M. Van Deusen, established collecting stations on the Huon Peninsula ranging from sea level to 3500 m. For more than six months, from April to October, members of the Expedition collected both botanical and zoological materials, emphasizing among the latter mammals, amphibians, and reptiles. In the course of a separate trip to New Guinea, I participated in the Expedition for a little more than two weeks, June 17 to July 3. It was Mr. Van Deusen's plan to organize a multi-authored report on the Expedition, to which various specialists would contribute chapters based on their studies of the Expedition's collections and, in some instances, their experience as members of the Expedition. This goal was frustrated by Mr. Van Deusen's death in 1976, and only a summary compiled from partly completed manuscript (Van Deusen, 1978) and one report on vegetation (Costin, Hoagland, and Lendon, 1977) have been published. The present report derives from a manuscript submitted to Mr. Van Deusen in 1972, now extensively revised to meet the circumstances of its independent publication and to incorporate information gathered since then.

The purposes of this report are to record the species of frogs and lizards known to occur on the Peninsula, to provide pertinent notes on ecology, systematics and distribution, and to examine the frog and lizard faunas in a biogeographic context. There have been no comprehensive faunal reports on amphibians or reptiles from major regions of New Guinea, such as are available for birds. The principal reason for this situation is that even where good collections have been made (as on the several Archbold Expeditions, or by Fred Parker at numerous localities), there

remain so many unresolved systematic problems that attempts at comparative faunal studies would be woefully incomplete. It will be evident that this difficulty has encumbered the present study.

METHODS

A series of species accounts, one for each species of frog and lizard of which I have examined one or more specimens from the study area, precedes the biogeographic discussion. A few species were neither collected by the Archbold Expedition nor examined by me from other collections. I have not prepared accounts of these, but all are included in table 1 and some are treated in discussions.

Specimen numbers unaccompanied by museum abbreviations refer to specimens in the American Museum of Natural History. Other museum names are abbreviated as follows: BBM, Bernice P. Bishop Museum, Honolulu; BMNH, British Museum (Natural History), London; MCZ, Museum of Comparative Zoology, Harvard University; MSNG, Museo Civico Storia Naturale, Genoa; SAM, South Australian Museums, Adelaide; YPM, Yale Peabody Museum, Yale University.

Other abbreviations and notations used include: TL (tibia length, from heel to outer surface of knee); SV (length from snout to vent); E–N (distance between anterior corner of eye and center of external naris); IN (distance between centers of external nares); HW (head width, measured at level of tympanum); Eye (horizontal diameter of orbit, from anterior to posterior corner). The symbol "±" precedes one standard error of the mean.

ACKNOWLEDGMENTS

My primary debt is to Mr. Hobart M. Van Deusen, late Archbold Assistant Curator, for his invitation to join the Seventh Archbold Expedition at its Gang Creek Camp on the Huon Peninsula. My fieldwork in New Guinea in that year (1964) was supported by National Science Foundation grant GB-2217. Other fieldwork pertinent to the present study took place in 1968 (supported by National Geographic Society grant no. 674) and 1969 (as a member of the R/V "Alpha Helix" Expedition to New Guinea, sponsored by the Scripps Institution of Oceanography, funded by the National Science Foundation).

Mr. Greenfield Sluder was my able field assistant in 1964. Members of the Alpha Helix Expedition, notably Dr. Harold Cogger, Dr. Herbert Dessauer, and Mr. Robert Storez, were co-workers in the field and contributed valuable specimens and much help. Mr. John Womersley, then Chief of the Division of Botany, Lae, was a never-failing source of logistical assistance. Data gathered from specimens borrowed over many years for several projects from various museums contributed to this study. For their kindness in making long-term loans, I am particularly indebted to Mr. Michael Tyler, Dr. Ernest E. Williams, and Dr. Alan Ziegler. Mr. Tyler and Dr. Allen Greer provided helpful criticism of the manuscript.

THE GEOGRAPHIC SETTING

The Huon Peninsula juts into the Solomon Sea, forming the northern boundary of Huon Gulf and the southern boundary of Vitiaz Strait. New Britain, across the strait, is only 90 km. away at the closest point (fig. 1). The Peninsula is the eastern end of a rugged, mountainous region, the Finisterre and Saruwaged ranges (elevations to 4100 m.) separated from the central ranges to the west by the low-lying Markham-Ramu River Valley (maximum elevation, about 300 m.), and from the Adelbert Mountains to the north by the similarly low Gogol River drainage. The limits of the study area were dictated by the area covered by the Expedition. From the standpoint of biogeography it would be more reasonable to study the Finisterre-Saruwaged region as a whole, but in fact it makes little difference to restrict the study to the Huon Peninsula (defined by a north-south line touching the western edge of Huon Gulf), for scarcely anything is known of the herpetofauna of the Finisterre Mountains, west of the Huon Peninsula.

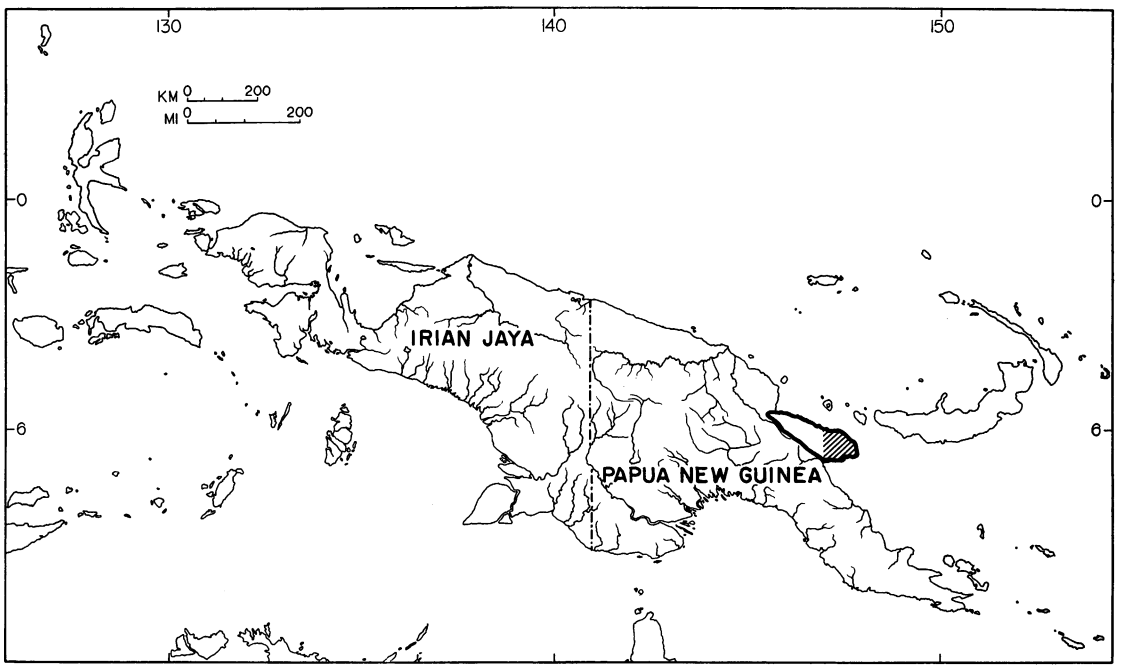

FIG. 1. New Guinea and nearby islands. The Finisterre-Saruwaged uplift region is outlined, and the Huon Peninsula shaded. The valley of the Markham and Ramu rivers lies along the southwestern margin of the uplift zone.

LOCALITIES ON THE HUON PENINSULA: Almost all the localities recorded in the following species accounts are mapped and included in the gazetteer in Van Deusen (1977). Exceptions are the following: Bukaua (40 km. E. Lae, sea level); Lialun (given as "bei Kap König Wilhelm" by Vogt [1911, p. 420], equivalent or close to Sialum); Sakimbang (not found, = Selimbeng?); Tobo (not found, probably = Tobou); Tuwap (not found, probably = Tewep); Ulap (12 km. N. Kabwum); Waran (8.5 km. S., 6.5 km. E. Kabwum).

PREVIOUS WORK IN THE AREA

Herpetological exploration of the Huon Peninsula dates from about the beginning of the present century, when persons working at mission stations and administrative centers established during the period of German rule brought collections to Europe. Lönnberg (1900) and Vogt (1911) published annotated lists that included specimens from the Huon Peninsula, and Méhelÿ (1901) used specimens from this region in an important revisionary work. Most herpetological collections made in German New Guinea at this time, however, were assembled to the west—around Astrolabe Bay and at sites along the north coast and up the Sepik River.

Following the change of government that took place during the First World War, herpetological fieldwork languished, and it was not until military activities in World War II fortuitously brought herpetologists to the area that significant collecting resumed. Loveridge (1948) summarized collections of New Guinea amphibians and reptiles in the United States National Museum and the Museum of Comparative Zoology, and included all specimens from the Huon Peninsula in these museums at that time. The most notable collection was made by W. H. Stickel, but other persons contributed as well.

Revisionary studies of varied scope (e.g., Brown, 1953; Brown and Parker, 1977; Par-

ker, 1934; Tyler, 1965, 1968; Zweifel, 1969, 1972a, 1972c) have treated frogs and lizards from the Huon Peninsula, but the fauna has been poorly known. Previous to the Seventh Archbold Expedition, collectors had done little more than sample the fauna of the coastal fringe; the montane fauna was virtually unknown. It is not surprising, therefore, that the collections made in the interior of the Peninsula by members of the Seventh Archbold Expedition substantially increase our knowledge of the fauna.

SYSTEMATIC ACCOUNTS

SALIENTIA

BUFONIDAE

Bufo marinus (Linnaeus)

Lae (52591–52592+4, 66957–66969).

This introduced species is abundant in the Botanic Garden in Lae. Zug et al. (1975) reported *marinus* from Lae and some localities to the north of Lae, on the Huon Peninsula, but had no records for more inland and easterly localities.

LEPTODACTYLIDAE

Lechriodus aganoposis Zweifel

Numbut, 1340 m. (75790, 75791); Gang Creek, 1340 m. (74646).

The specimens listed are the holotype and two of the paratypes (Zweifel, 1972c). The species is known elsewhere from moderate elevations in the central mountainous chain as far west as Sibil in the Star Mountains, about 50 km. into Irian Jaya. Farther west it evidently is replaced by a closely related species, *Lechriodus platyceps* Parker.

HYLIDAE

Litoria amboinensis (Horst)

Busu River, *ca.* 24 km. (by road) N. Lae, 200–250 m. (80902).

This frog was calling at night from high in a banana plant overhanging a still pool in a small valley; others called nearby. Tyler (1968) recorded the species from Sattelberg on the Huon Peninsula.

Tyler (1968) studied a large number of *amboinensis* from Mabilabol in the southern drainage of Irian Jaya, and in a sample of 341 adult individuals (the majority males) found the largest male to measure about 59–60 mm. snout-vent length, with the modal length about 43 mm. (estimated from Tyler's fig. 5).[1] The AMNH specimen measures 61 mm., and thus exceeds all the males measured by Tyler. Tyler reported that the male holotype of *Hyla papuensis* Werner (from "German New Guinea"), a name Tyler synonymizes with *amboinensis*, measures 54 mm. Although within the range of the Mabilabol sample, this size still is attained by no more than three or four individuals in that large sample. There seems little doubt that *amboinensis* is a much smaller frog in the Mabilabol region than to the east in the Huon Peninsula region. The question of the status of *papuensis* may need to be reopened when more eastern material becomes available.

The call of *L. amboinensis* has not been described. My rather poor recording (fig. 2) gives a general impression of the call but is of little use for fine analysis. The call lasts about 2 seconds (in the example illustrated) and is comprised of 33 closely spaced notes about 0.05 sec. in length. The energy peak is at about 2500 Hz. The information may be of use in verifying the synonymization of *H. papuensis* when calls of *amboinensis* from the south coast of New Guinea become available. However, a highland member of the same (*peronii*) species group (Tyler and Davies, 1978), *Litoria darlingtoni* (Loveridge), has a chattering call much like that of the

[1] There is some confusion about the maximum length. The histogram shows males as large as 59–60 mm. (data were pooled in 2 mm. increments), but Tyler and Davies (1978) gave maximum length of the male for the *peronii* group as 54 mm.

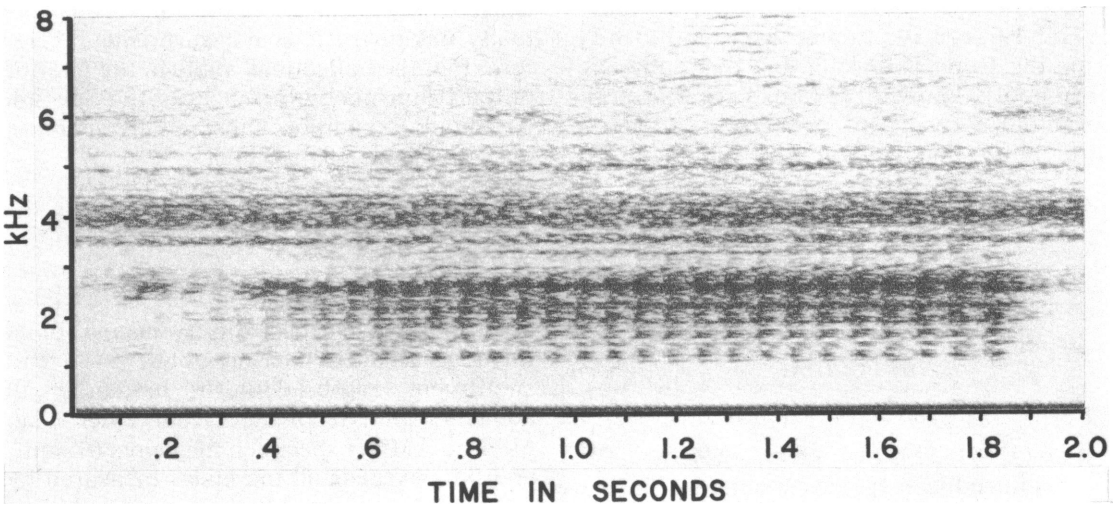

FIG. 2. Audiospectrogram (50 Hz filter) of call of *Litoria amboinensis*, recorded Aug. 25, 1968, 24 km. N. Lae, Morobe Prov., Papua New Guinea; AMNH 80902, temperature not recorded, Dept. Herpetology tape no. 187.

amboinensis I recorded. It may be that calls in allopatric species of this group are not well differentiated.

In their diagnosis and definition of the *peronii* species group, Tyler and Davies (1978, p. 39) stated: "Flash markings of black and yellow or orange are present in all individuals," and the "posterior surface of the thighs . . . are black and yellow or black and orange." This is not true of my specimen of *amboinensis*, nor was it true of *amboinensis* from the Vogelkop Peninsula of Irian Jaya described by Brongersma (1953): "Posterior surfaces of thigh and tibia uniformly greyish except close to the vent."

Tyler and Davies (1978) did not mention a distinctive and presumably synapomorphic character of the *peronii* group—the shape of the pupil. In living *amboinensis*, *darlingtonii*, and *rothi* that I have examined, the pupil is diamond-shaped when contracted, in contrast to the horizontal slit of all other *Litoria* I have seen and the vertical slit of *Nyctimystes*. The pupil appears diamond-shaped in a preserved *L. everetti* and evidently has the same shape in the remaining species, *peronii*, for Barker and Grigg (1977) remarked on its being the "shape of a cross."

Litoria angiana (Boulenger)

Mountains at head of Kua River Valley, 1610–2160 m. (75837); Avengu (75838–75840); Indagen, *ca.* 1830 m. (75841, 75842); vic. Pindiu, 1320 m. (BBM 2922); Kwama River, 20 mi. SW. Kabwum, 2000 m. (BBM 5208).

These specimens agree well with the definition and description given by Tyler (1968, pp. 33–38). The species ranges along the central mountainous spine of New Guinea from the Vogelkop Peninsula to the vicinity of Garaina (Tyler, 1968; Zweifel, 1976). The present specimens are the first recorded from the Huon Peninsula. Because this species is associated with montane streams, the population of the Huon Peninsula presumably is disjunct from the main body of the species.

Litoria eucnemis (Lönnberg)

Busu River, 13 km. N. Lae (74702–74718); *ca.* 24 km. N. Lae, 200 m. (80772).

The type locality, Sattelberg, is the only other locality for this species on the Huon Peninsula. Tyler (1968) provided specific locality records, and Menzies (1976) referred to "scattered records . . . through the northern and southern lowlands. Because of the

possibility of confusion between this species and *L. genimaculata,* some discussion is required.

Menzies (1976) stated that *eucnemis* and *genimaculata* are "not easy to distinguish" and aside from noting that males of *eucnemis* reach a body length of 48 mm. compared with 41 mm. in *genimaculata,* he offers no distinguishing physical characteristics. Menzies describes the call of *genimaculata* as "a very quiet ticking, about 15 ticks in a series lasting 2 or 3 seconds," whereas *eucnemis* gives a "rather louder . . . series of low-pitched notes at intervals sounding like "waa-waa-waa."

Tyler (1968) did not make diagnostic comparisons between *eucnemis* and *genimaculata.* He compared *eucnemis* only with species having fully webbed fingers, and *genimaculata* with "lowland species whose adults are within the size range of adult *H. genimaculata.*" Evidently there was some confusion regarding the range of elevations occupied by *eucnemis,* for Tyler excluded it from his key to lowland species ("0–3.500 ft above sea level"), where *genimaculata* keys out, and included it only in his key to submontane species ("3.000–5.000 ft above sea level"). One of the localities Tyler cites for *eucnemis* (Oomsis Creek, Morobe Province, Papua New Guinea) is at only 100 m. elevation.

If I have identified my specimens correctly, *eucnemis* and *genimaculata* are highly similar. Their color patterns are variable but much alike (see color photos in Menzies, 1976, and Zweifel, 1977),[2] and body proportions commonly of use in distinguishing species of *Litoria* are of little help. My segregation is based on size and finger webbing, bolstered by some information on mating calls.

Among 36 adult male *eucnemis* (all have thumb pads) from Madang and Morobe provinces, the range in snout to vent length is 38 to 51 mm., mean 46.7 ± 0.45. Comparable statistics for seven adult male *genimaculata* from Morobe Province are: mean, 38.9 ± 0.55, range 37–40. Overlap in the samples is slight, for only one *eucnemis* measures less than 41 mm.

Tyler (1968) characterized *eucnemis* as having fully webbed fingers. Few of my male specimens could be so characterized, as the webbing in most does not reach to the disc of the third finger; I would call them three-quarters webbed. However, a large female (SV 61 mm.)—the specimen from Oomsis Creek examined by Tyler (AMNH 66964)—has fully webbed fingers. The specimens of *genimaculata* have much less webbing, commonly about one-third webbed. The differences between the two samples are evident enough when specimens can directly be compared, although isolated specimens in the intermediate size range might give pause.

The single *eucnemis* I tape-recorded (others were heard giving the same call) produced groups of low, soft, chuckling notes and finished the series with several louder, shorter, pulsed calls (figs. 3B, 3C). These terminal calls have the appearance of shorter, more rapidly pulsed versions of the preceding groups. I suspect that these terminal notes are the same as the "waa-waa-waa" calls Menzies described.

A *genimaculata* that I recorded (again, others were heard giving the same call) produced soft, ticking notes (as described by Menzies) at a rate of about 6 per second (fig. 3A). The number of notes within six call groups varied widely—from nine to 65. The call is exceedingly soft; I had to place my microphone within 10 cm. of the frog in order to get a signal loud enough to be heard over the other night noises. The softness of the calls of the two species is no doubt related to the absence of a vocal sac (confirmed by me), an unusual condition in the genus *Litoria* (Tyler, 1971).

The specimen of *genimaculata* that I recorded has a snout-vent length of 37 mm., the *eucnemis,* 49 mm. Finger webbings conform to the norms discussed above. I consider that the information on vocalizations, although meager, validates the species seg-

[2] The frog illustrated in color in Zweifel, 1977, p. 29, as "*Litoria genimacotata*" is *L. eucnemis* from Sempi, Madang Province.

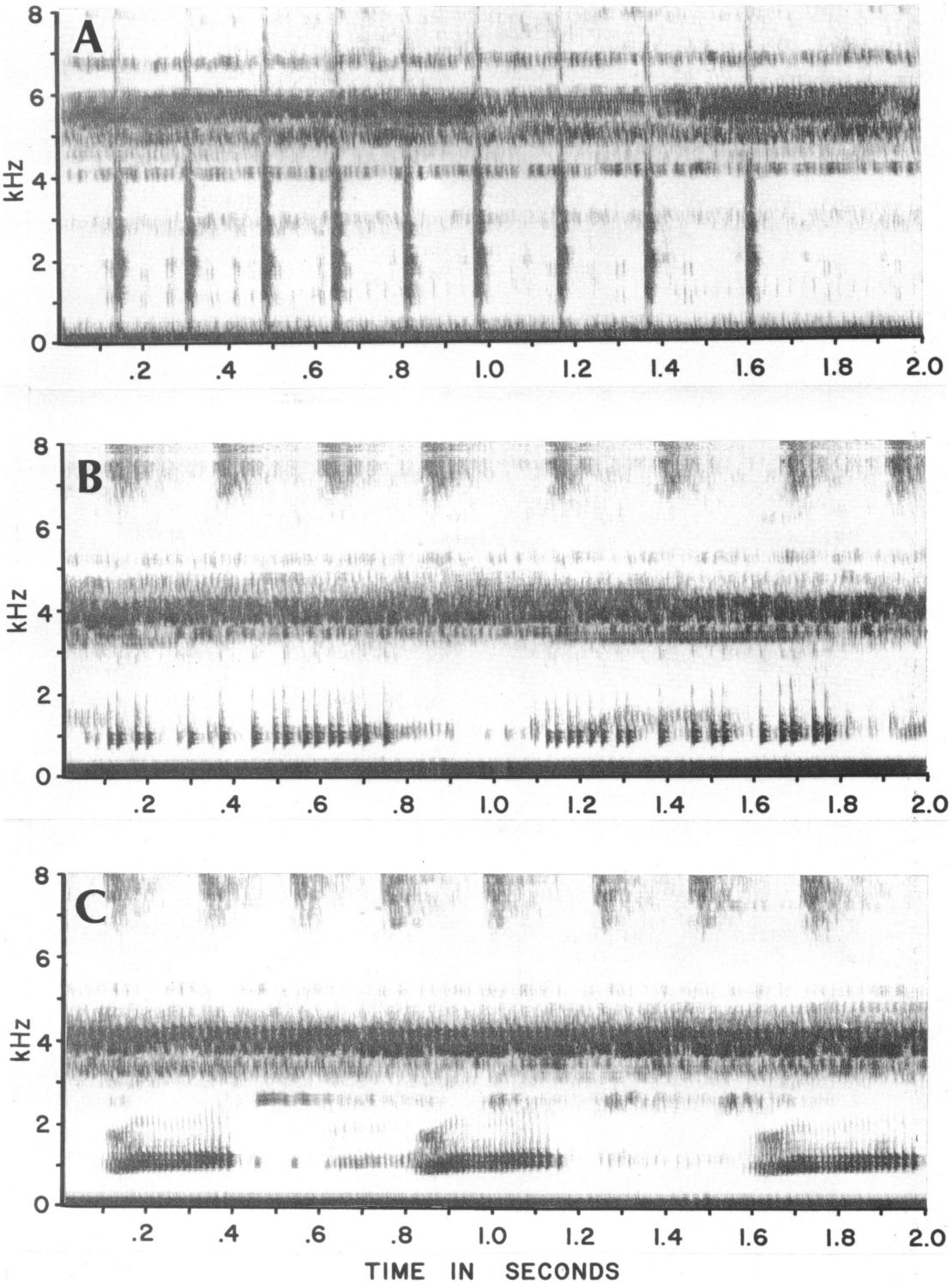

FIG. 3. Audiospectrograms (300 Hz filter) of calls of *Litoria*. A. *L. genimaculata*, recorded August 15, 1964, 21 km. NW. Lae, Morobe Prov., Papua New Guinea; AMNH 74725, air 24.5° C., Dept. Herpetology tape no. 143. B. *L. eucnemis*, recorded Aug. 4, 1969 at Wanuma, Adelbert Mountains, Madang Prov., Papua New Guinea; AMNH 82611, air 21.2° C., Dept. Herpetology tape no. 189. C. Same call as B, but terminal notes of series.

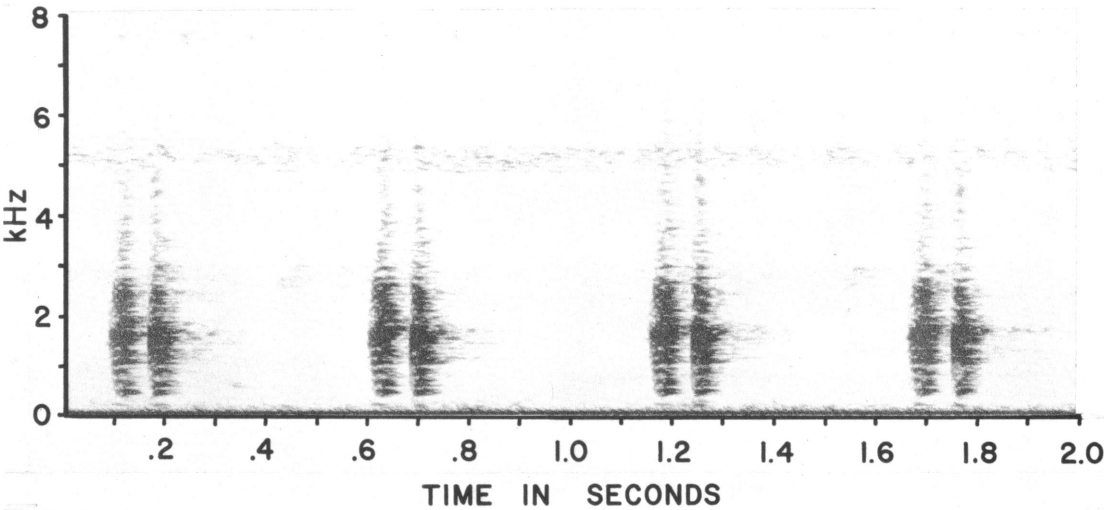

FIG. 4. Audiospectrogram (50 Hz filter) of call of *Litoria infrafrenata*, recorded Aug. 3, 1964, at Lae, Morobe Prov., Papua New Guinea; no specimen, air 24° C., AMNH Dept. Herpetology tape no. 142.

regation on the basis of size and finger webbing.

Litoria genimaculata and *L. eucnemis* appear to be sibling species with broadly overlapping distributions and at least some microsympatry. I have collected them together at two places, and in neither instance did I distinguish the species in the field. I found four *genimaculata* and three *eucnemis* in the Markham Valley, 21 km. northwest of Lae, elevation lower than 75 m. They were on low shrubs in forest at night beside a shallow, sand-bottomed stream no more than 5 feet wide. The stream vanished into the sand within a few yards of where the frogs were. The other area of sympatry was similar, where two individuals were on bushes over a stream about 24 km. north of Lae, elevation about 200 m.

Litoria genimaculata (Horst)

Ca. 24 km. N. Lae, 200 m. (80773).

For discussion of this species, see the preceding account of *L. eucnemis*. This record and others for the lower Markham River Valley within 16–24 km. of Lae are the northernmost for the species on the north coast of New Guinea, separated by about 440 km. from the other published north coast record on the mainland west of Goodenough Island (Peria Creek, Tyler, 1968). Elsewhere, *genimaculata* evidently ranges over the southern lowlands of New Guinea (Menzies, 1976).

Litoria infrafrenata infrafrenata (Günther)

Finschhafen (75956); Lae (52579, 52580+19, 52587, 58690–58693, 74729–74731).

This common lowland species was not encountered at the inland sites. One of the specimens, a female, from Lae (74729) with a snout to vent length of 141 mm., is the largest *L. infrafrenata* I have collected and may be the largest specimen of a hylid frog.

Barker and Grigg (1977) accurately described the call of *L. infrafrenata* as a "loud, harsh double note." The call is illustrated in figure 4. As do frogs of many species, *L. infrafrenata* sometimes gives a "fright scream" when grasped (fig. 5).

Litoria micromembrana (Tyler)

Gang Creek, 1310–1370 m. (75898–75947, 74668–74670, 99383–99424); Kotkin, 1220 m. (75955); Selimbeng, 1370 m. (75948–75954).

These frogs are readily identifiable as *micromembrana* as defined by Tyler (1968, p.

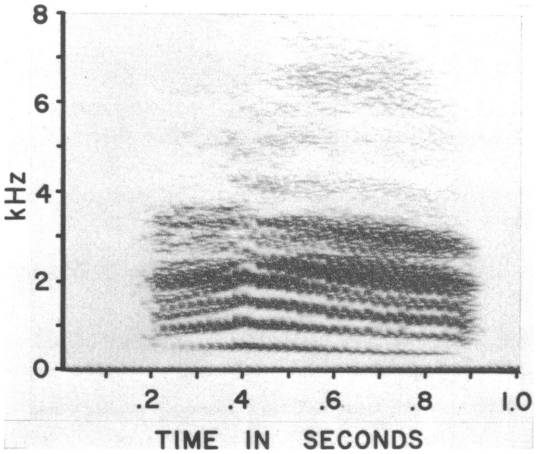

FIG. 5. Audiospectrogram (50 Hz filter) of fright scream of *Litoria infrafrenata,* recorded Aug. 3, 1964, at Lae, Morobe Prov., Papua New Guinea; AMNH 74730, air 24° C, Dept. Herpetology tape no. 142.

131), except that they evidently represent a population of somewhat smaller body size. The range in length from snout to vent of 98 adult males is 28–33 mm. (mean 30.1 mm.), compared with a range of 30.2 to 35.9 mm. given by Tyler. This smaller size lends a similarity to *Litoria modica* (Tyler), but the specimens from the Huon Peninsula agree with *micromembrana* (and differ from *modica*) in the relatively larger eye, longer tibia, and more curved canthus rostralis.

All individuals of this species that I captured were found at night on bushes or trees beside or overhanging rushing streams. On one occasion I characterized the call as "a peep repeated sometimes several times," and on another as "a series of short, rasping chirps" (field notes).

Tyler's (1968) records for the distribution of this species range from the Snow Mountains of eastern Irian Jaya to Okapa in the Eastern Highlands, and specimens studied by Dessauer, Gartside, and Zweifel (1977) extend the range 220 km. to the southwest to Saureli in Morobe Province. The present specimens come from about 180 km. east of Okapa and 150 km. north of Saureli, and are the first recorded from the Huon Peninsula.

Duellman (1967) used one of the Expedition specimens (74668, "*H. becki*") in a study of chromosomes.

Litoria thesaurensis (Peters)

Pindiu, *ca.* 850 m. (75957, 75958); Gusiko (52576); Lae (66960, 74752, 80901).

This widespread species is characteristic of coastal lowlands. See Menzies and Zug, 1979.

Litoria wollastoni (Boulenger)

Gang Creek, 1310–1370 m. (74662–74667, 75849–75897+18); Numbut, 1340 m. (75845); Mt. Rawlinson, 1830 m. (75846); north slope of Mt. Rawlinson (75847); ridge above Gang Creek (75848); Pindiu, *ca.* 850 m. (75843, 75844).

Litoria arfakiana of earlier authors (e.g., Tyler, 1968, p. 39) includes two species that are so similar morphologically that they cannot be distinguished with certainty except by means of their distinctly different calls (Menzies and Zweifel, 1974). The call that I tape-recorded at Gang Creek is that of the species for which Menzies and Zweifel (1974) use the name *wollastoni* Boulenger. Hence, I refer all specimens to this species, although it is possible that *Litoria arfakiana* (Peters and Doria) also is represented in the series.

Duellman's (1967) "*H. arfakiana*" is one of the Expedition specimens (no. 74666).

Litoria wollastoni is notable for the considerable variation in color and pattern in local populations. I recorded the following variations among 30 specimens collected in one evening: 21 frogs uniform greenish brown dorsally; four brown with a darker central pattern on the back; three brown with the top of the head bright green from a mid-ocular line to the tip of the snout and the back of the tarsus green; two all green except for black canthal and supratympanic stripes.

The frogs call at night from bushes or trees above turbulent streams.

Nyctimystes disrupta Tyler

Gang Creek, 1310–1370 m. (74818, 74819, 74824, 75991–75993); near Zangaren, 1370 m.

(75994–75999); Numbut (76000–76002); Kotkin, 1220 m. (76003).

Tyler (1963b, pp. 111–112) showed that the syntypes of *Nyctimystes papua* (Boulenger) are not all conspecific and later (1963c, pp. 118–120) he described *N. disrupta*, a "species with a close affinity to *N. papua*," from the Schrader Mountains and the Baiyer River region.

The specimens from the Huon Peninsula resemble *disrupta* more than *papua*, particularly in the amount of finger webbing, a character to which Tyler attributes significance. Identification of the Huon Peninsula specimens as *disrupta* is tentative, pending further studies on *N. papua* and its relatives.

I recorded the following colors in life for number 74818: dark green dorsally with reddish brown flecks and other markings; dorsal surfaces of hind limbs dark green, mottled and banded with reddish brown; chin and chest pale green with reddish brown markings; abdomen, groin, anterior and posterior surfaces of thighs, and webbing of hands and feet purplish red; iris green; palpebral venation golden but faint. The holotype (in preservative) had "copper" ventral surfaces to the limbs, hands and feet, and "lilac" abdomen (Tyler, 1963c, p. 119), which suggests a coloration in life similar to that of the specimens from the Huon Peninsula.

This species has not previously been recorded east of the Western Highlands District, although it is, in fact, fairly widely distributed. I have collected specimens referable to *disrupta* at about 13 km. southwest of Goroka, 2190 m., Eastern Highlands Prov., and at Wagau, 1100 m. (about 24 km. southwest of Lae), Morobe Prov.

Duellman (1967) reported chromosome numbers from Expedition specimens ("*N. papua*" Nos. 74819, 74824).

Nyctimystes foricula Tyler

Gang Creek, 1310–1370 m. (74767–74770, 75964–75967, 75969); Numbut, 1220 m. (75962); Kotkin (75963); Tumnang, 1340 m. (74764–74766).

Most literature records for this species refer to localities in the Schrader Mountains region (Tyler, 1963c; Bulmer and Tyler, 1968; Woodruff, 1972), but the species is widely distributed in the mountains of New Guinea as attested by collections made by the Sixth Archbold Expedition, by Fred Parker, and by me. The range extends at least from Ialibu in the Southern Highlands District (elev. 1920 m.) to the vicinity of Wau (elev. 1400 m.), Morobe District (Zweifel, 1976), and to mountains just south of the mouth of the Markham River (Wagau, Herzog Mountains, 1100 m., AMNH 74771–74779), about 65 km. from localities on the Huon Peninsula. Presumably the populations of *N. foricula* and other *Nyctimystes* on the Huon Peninsula are disjunct from the populations south and west of the Markham and Ramu river valleys, for these valleys appear to offer no suitable habitat for frogs that breed in fast-flowing streams.

Specimens that I captured were calling from bushes and shrubs by small streams. An individual from Gang Creek (74767) had the following colors in life: dorsal body surface bright green with some green and yellowish green mottling; anterior and posterior surfaces of thighs immaculate cadmium yellow; undersurfaces of hind limbs less bright yellow; ventral body surfaces lemon-yellow; upper arm green, forearm yellow above and below; iris virtually black, pupil indistinguishable; palpebral venation composed of oblique, parallel, golden lines.

Duellman (1967) published chromosome numbers determined from Expedition specimens (Nos. 74767, 74769).

Nyctimystes kubori Zweifel

Gang Creek, 1310–1370 m. (74794–74801, 75970–75984, 75986–75990, 100861–100869); Zangaren, 1370 m. (75985); Tumnang (74793).

These specimens are the first of their species recorded from the Huon Peninsula. Most records published previously are for areas far to the west (mountains flanking the Wahgi Valley and the Schrader Mountains: Tyler, 1963b, p. 109; Tyler, 1963c, p. 123; Zweifel, 1958, p. 21), but there now are specimens in several museums from localities closer to the Huon Peninsula. I have, for ex-

ample, collected *kubori* in the vicinity of Wau (Zweifel, 1976) and at Wagau, 1100 m. (AMNH 74780–74792). The latter locality is in the Herzog Mountains 65 km. from Gang Creek, across the Markham River Valley.

I found *N. kubori* calling from riparian vegetation in company with *N. foricula, Litoria wollastoni,* and *L. micromembrana.*

In life, different individuals of *kubori* from the Huon Peninsula showed a variety of dorsal ground colors, ranging from light yellowish brown to gray and dark brown. The dorsum was immaculate, lightly spotted with darker gray or brown, or rather heavily mottled. The only bright coloration was in the webbing of the feet, which in some individuals was largely orange, although in others only a peach tint relieved the otherwise gray webbing. The vertical pupil could scarcely be distinguished against the blackish brown iris. The densely reticulate palpebral venation was grayish gold.

Duellman (1967) used Expedition specimens in determining chromosome numbers (Nos. 74794, 74800, 74801).

Nyctimystes pulchra (Wandolleck)

Mt. Rawlinson, between Maran and Zangaren (75961); near Zangaren, 1370 m. (76004); Pindiu, 850 m. (76005).

Tyler (1964b) resurrected the name *Hyla pulchra* Wandolleck and showed that on the basis of the original description, the species belonged in *Nyctimystes* rather than *Hyla.* He was unable to carry his investigation further, however, because the types had been destroyed and no additional specimens had been collected in the region of the type locality (Torricelli Mountains).

In 1966 Dr. Jared Diamond collected a large series of these frogs (AMNH 77857–77875+56) in the Torricelli Mountains, and comparison of these specimens with others leaves me no doubt that the specimens I formerly referred to *Nyctimystes semipalmata* Parker (Zweifel, 1958, pp. 38–42) are the same species as Wandolleck's *pulchra.* Also, since writing my 1958 paper, I have examined the holotype of *semipalmata* and have collected topotypes, and I do not question that it is a species distinct from *pulchra.* I have collected the true *semipalmata* only at Kokoda (type locality) and at Garaina, about 130 km. northwest of Kokoda (Zweifel, 1976). *Nyctimystes semipalmata* is morphologically similar to *N. cheesmani,* with which it is sympatric at Kokoda and Garaina. In life, they are readily distinguished by differences in calls and pigmentation (webbing bright orange in *semipalmata,* gray in *cheesmani*).

Nyctimystes sp.

Pindiu (75959); *ca.* 24 km. N. Lae, 250 m. (80933–80939).

These specimens possibly represent an undescribed species of the *cheesmani*[3] group (Menzies, 1976). In my now somewhat outdated key to *Nyctimystes* (Zweifel, 1958), the specimens would be identified as *N. montana* Parker (= *N. cheesmani* Tyler, a substitute name). I have collected what I think is true *cheesmani* at several localities: Garaina and the vicinity of Wau (Morobe Province); Kokoda (Northern Province); and Baiyer River Wildlife Sanctuary (Western Highlands Province). Specimens from these localities invariably had a dark brown iris, so dark that the pupil was scarcely visible. In contrast, the iris of the Pindiu specimen (as seen in a color photograph) was russet, and in the Lae specimens (my field notes) was gray-brown with a golden tint, the pupil quite distinct.

The call of *N. cheesmani* is a monotonously repeated series of quacking notes (fig. 6B). The call of the pale-eyed form is similar (fig. 6A), but in my single recorded sample seemed to be given with less regularity. Also, individual notes are longer and less rapidly pulsed. In the examples illustrated, the pulse rate in *N. cheesmani* is about 100 per sec., compared with 80 per sec. in the pale-eyed form. Differences cannot be attrib-

[3] Menzies (1976) emended this name to *cheesmanae.* This was an unjustified emendation, since the XVIth Congress of Zoology in 1963 reduced Article 31 of the International Code to the status of a Recommendation.

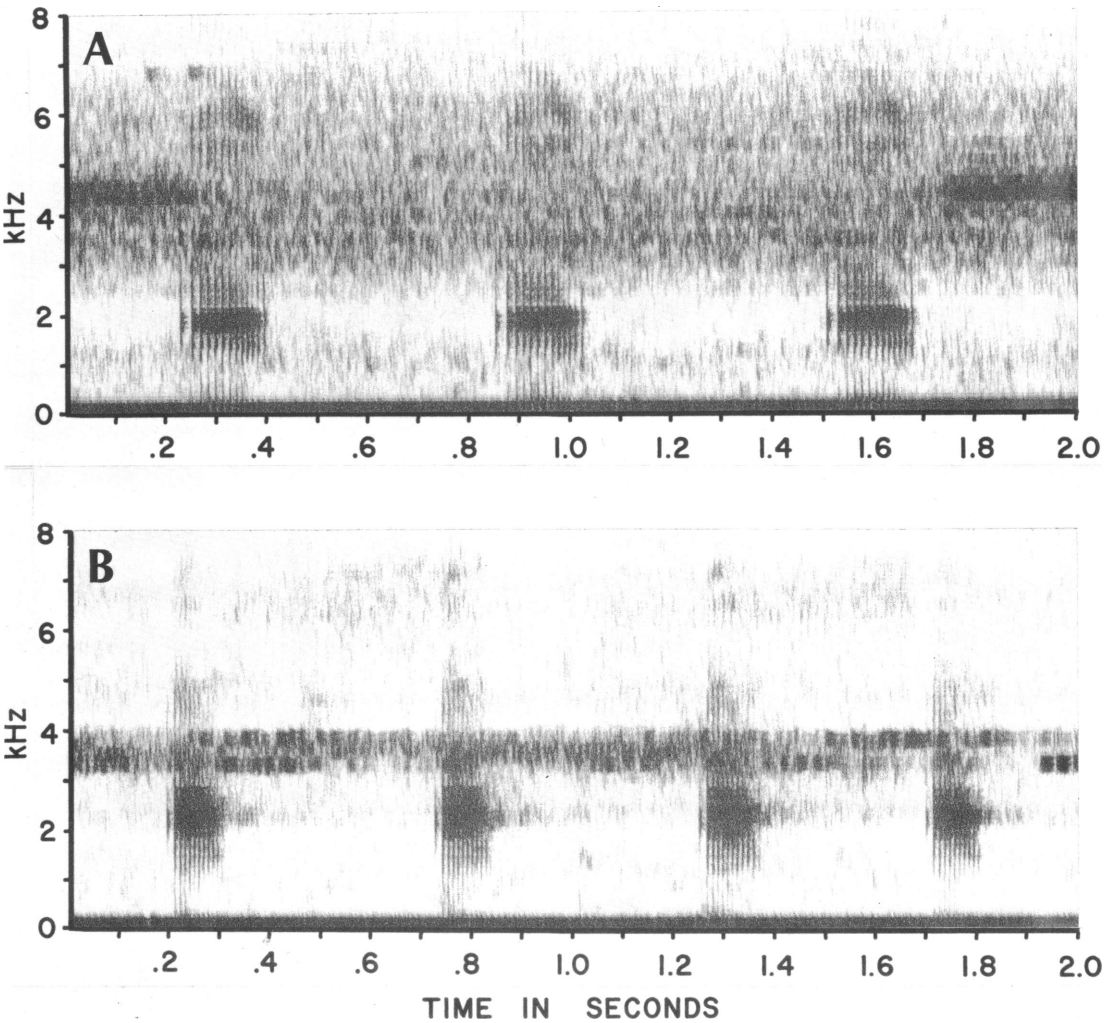

FIG. 6. Audiospectrograms (300 Hz filter) of calls of *Nyctimystes*. A. *N.* sp., recorded Aug. 25, 1968, 24 km. N. Lae, Morobe Prov., Papua New Guinea; AMNH 80933, body 22.8° C., Dept. Herpetology tape no. 187. B. *N. cheesmani,* recorded July 7, 1968, at the Baiyer River Wildlife Sanctuary, Western Highlands Prov., Papua New Guinea; AMNH 80941–80945 vouchers (individual recorded not determined), air 20° C., Dept. Herpetology tape no. 182.

uted to temperature, as the calls of the cooler frog were more rapidly pulsed.

I refrain from naming the possibly new species because the identity of *N. cheesmani* needs to be confirmed through tape-recordings of the calls of topotypes, and the status of other named forms similarly needs to be clarified. I have collected what I think is the undescribed species near Saureli, Morobe Province, and have seen color photographs of specimens much like it from Kiunga, Western Province (MCZ field no. 30605) and Ramu Gorge (Province?) (MCZ field no. 22138), collected and photographed by Fred Parker. Menzies (1976, pl. 9a) illustrated what may be the same species. Seven specimens in the South Australian Museum (SAM 4250) from Finschhafen may represent

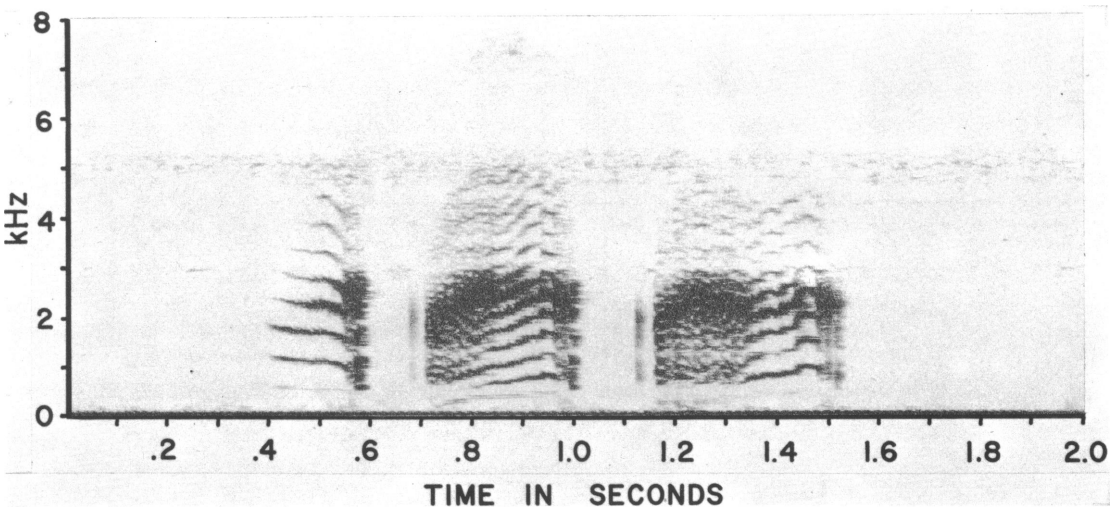

FIG. 7. Audiospectrogram (50 Hz filter) of call of *Rana daemeli,* recorded July 17, 1964, at Lae, Morobe Prov., Papua New Guinea; AMNH 74864, air 25.5° C., Dept. Herpetology tape no. 140.

this species, but without data on eye color in life their status cannot be confirmed.

RANIDAE

Platymantis papuensis Meyer

Masba Creek, 610 m. (75792–75803); Gusiko (52574); Lae (52575, 52581, 52584, 52586, 66961, 66962, 74828–74832, 75804, 102961–102973).

This species is widespread at low elevations throughout northern New Guinea (Zweifel, 1969), and was absent from all but the lowest of the inland camps on the Huon Peninsula. The binomial is used because of evidence that supposed subspecies of *papuensis* in the Bismarck Archipelago and Solomon Islands are actually one or more distinct species (Menzies, unpublished data).

Rana daemeli (Steindachner)

Lae (74863, 74864, 81292, 81293).

The systematics of New Guinea *Rana* are in a confused state. Only one species—*Rana grunniens* Daudin—is sufficiently distinctive morphologically that it can be recognized at a glance. The widespread *Rana arfaki* Meyer could be confused with the little-known *R. jimiensis* Tyler. None of these has been found within the area covered by this report. The several remaining species, which may informally be called the *Rana papua* group, are similar enough so that associating the many names in the literature with animals in hand or observed in the field is difficult or impossible.

The type locality of *Rana daemeli* is Cape York, Queensland, Australia. Recent authors (Cogger, 1975; Barker and Grigg, 1977) have recognized only this one species of Australian *Rana,* although Loveridge (1948, p. 413) considered *Rana grisea* to be there as well. Limited evidence indicates that *Rana daemeli* ranges through the lowlands of southern New Guinea and along the north coast from Milne Bay to Finschhafen on the Huon Peninsula (Menzies, 1976, p. 25). Menzies describes the call as "rather like the noise made by a duck," and Barker and Grigg describe a "low, reedy quacking." The call of the frogs I identify as *daemeli* (fig. 7) fits these descriptions. I have recorded it at Wipim, Western Province, directly north of Cape York, as well as at Lae. I did not hear the species in the vicinity of Alexishafen, Madang Province, nor at Maprik,

East Sepik Province, which accords with the distribution Menzies postulates.

Tyler (1972) considered *Rana daemeli* a synonym of *Rana papua* Lesson. The type locality of *papua,* Waigeo Island, is off the northeastern tip of New Guinea, far from the known range of *daemeli.* Despite frequent use of the name *papua* in the literature, it probably will not be possible to determine which (if any) of the mainland species is *papua* until fresh specimens are collected and recordings of the call made at the type locality.

Rana grisea Van Kampen

Masba Creek, 610 m. (75815–75820); Pindiu, 790–880 m. (75806–75814); Zangaren, 1370 m. (75822); Tumnang, 1340 m. (74849); Numbut, Mt. Rawlinson, 1340 m. (74850, 75821); Gang Creek, Mt. Rawlinson, 1310 m. (74861, 74862); Indagen, *ca.* 1830 m. (75823–75834); Waran, *ca.* 1890 m. (75835, 75836).

The name *Rana grisea* has been used for frogs from high elevations throughout much of New Guinea. These are large, long-legged frogs readily distinguished from *R. daemeli* and *Rana* sp. (see following species account) in size, proportions, and some aspects of color pattern. However, frogs closely similar in size, proportions, and pattern also occur at low elevations over much of New Guinea. Menzies (1976, pp. 34–35) characterized this lowland form as a stream-breeding species that calls with "a loud, rattling series of notes usually lasting two to three seconds." Apart from differences in vocalization, Menzies finds nothing to distinguish the lowland form from *grisea* except for yellow ventral coloration in young *grisea,* lacking in young of the lowland form and in adults of both species.

Menzies mentions that the lowland form occurs at Lae (where I have heard but have not collected it), in sympatry with *R. daemeli* and *Rana* sp. (see following account). The identity of the specimens I record here as *grisea* is questionable. Menzies states that *grisea* "probably does not occur below 1400 m.," whereas the lowland form is found "perhaps up to 1400 m." The Huon Peninsula specimens come from both higher and lower elevations. In this regard, it is pertinent to note that the type-locality of *R. grisea* is given as "Went-Gebirge, ± 1300 m." (Van Kampen, 1913). I do not question Menzies's conclusion that highland and lowland forms are different species (based on vocalizations), but assignment of the name *grisea* to the high-elevation species may be incorrect. As is the case with *Rana papua,* the problem is not likely to be adequately resolved unless topotypes can be collected and tape-recorded.

Duellman (1967) reported the chromosome number of one of the Huon specimens (74850).

Rana sp.

Pindiu, *ca.* 880 m. (75805).

I identify this specimen with the "pond-dwelling, lowland" species that Menzies (1976, pp. 25–26) reports sympatric with *Rana daemeli* and the lowland, stream-dwelling species (similar to *grisea,* see above) in the Botanic Garden at Lae. The chief distinguishing characteristic is the call, which he describes as "single notes rather like plucking a flat string on a violin." I offer here an audiospectrogram (fig. 8) of the call of this species, recorded at Wau, Morobe Province.

This species ranges along the north coast of New Guinea at least from Popondetta, Northern Province (Menzies) to Maprik, East Sepik Province (my specimens and tape-recording). Menzies regards this species and *daemelii* as indistinguishable morphologically except for the occasional presence in the north coast species of a yellow vertebral line. I find other differences in pigmentation and proportions that, at least in my samples from Lae and the lower Markham Valley, permit segregation.

MICROHYLIDAE

Cophixalus biroi (Méhelÿ)

Gang Creek, 1370 m. (74904); Sakimbang, 1390 m. (84504).

Information on this species is summarized

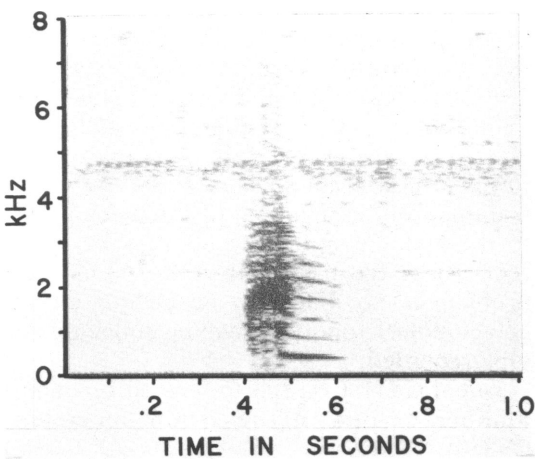

FIG. 8. Audiospectrogram (50 Hz filter) of call of *Rana* sp., recorded July 22, 1968, at Wau, Morobe Prov., Papua New Guinea; AMNH 81291, substratum (lily pad) 19.4° C., Dept. Herpetology tape no. 184.

in Zweifel (1979b). The type locality is Sattelberg, on the Huon Peninsula. The species occurs in the north coast ranges of Papua New Guinea, westward into Irian Jaya.

Cophixalus cheesmanae Parker

Lae (52589); *ca.* 24 km. N. Lae (81075, 81076); Finschhafen (SAM 4249, 16 specimens).

This is a common species of foothill rain forest, where males call from low shrubs at night. Menzies (1976) illustrated the species in color, and Zweifel and Parker (1977) presented an audiospectrogram of the call. For diagnostic and distributional information, see Zweifel (1979b).

Cophixalus pipilans, new species

HOLOTYPE: AMNH 83004 (field no. RZ 8724), an adult male, collected by R. G. Zweifel (in company with R. Storez) in the vicinity of Sempi, 9 km. north of Alexishafen, Madang Province, Papua New Guinea, elevation between sea level and 50 m., on August 25, 1969.

PARATYPES: YPM 5281–5283, collected at the same time and place as the holotype; AMNH 83000 and 83001, collected at the type locality on July 13 and 14, 1969; AMNH 83003, Wanuma, Adelbert Mountains, 700 m., Madang Province, August 6, 1969; AMNH 83005–83008, 3.5 km. northwest of Alexishafen, elevation 40 m., Madang Province, September 14 and 15, 1969; MCZ 89228–89234, 4 km. north of Lae, Morobe Province, collected by Fred Parker, March 3, 1974.

DIAGNOSIS: A small species of *Cophixalus* (males to 18.5 mm. snout-vent length, females to 22.3 mm.) that differs from most species of the genus in having the first finger short, less than half the length of the second, and without a broadened disc (fig. 9), whereas the remaining fingers have well-developed discs smaller than those on the toes. Two species share the diagnostic character of the first finger (fig. 9) with *C. pipilans*: *C. ateles* (Boulenger) and *C. shellyi* Zweifel. The new species differs from the latter in leg length (TL/SV 0.53 or greater in *pipilans*, maximum of 0.53 in *shellyi*) and in having more widely spaced nostrils (E–N/IN minimum 0.76 in *pipilans*, maximum 0.77 in *shellyi*). *Cophixalus ateles* resembles *C. pipilans* in its E–N/IN ratio, although *ateles* averages and ranges higher, but the leg length of *ateles* is markedly shorter: maximum TL/SV in *ateles*, 0.49, minimum in *pipilans*, 0.53. The three species are compared at greater length in a section that follows.

DESCRIPTION OF HOLOTYPE: An adult male, calling when captured; the subgular vocal sac is not evident externally.

Head moderately wide (HW/SV, 0.36), with slightly oblique, nearly flat loreal region, obtusely pointed snout, rounded canthus rostralis, and nostrils much nearer to snout tip than to eye; internarial distance wider than distance from eye to naris (E–N/IN, 0.823; IN/SV, 0.106, E–N/SV, 0.087; eyes moderately large (Eye/SV, 0.124); eyelid one-half width of interorbital span; tympanum obscure, about one-half diameter of eye.

Dorsal surfaces of body and legs smooth—no obvious skin folds or warts.

Fingers unwebbed, relative lengths 3>4>2>1, the first finger less than one-half

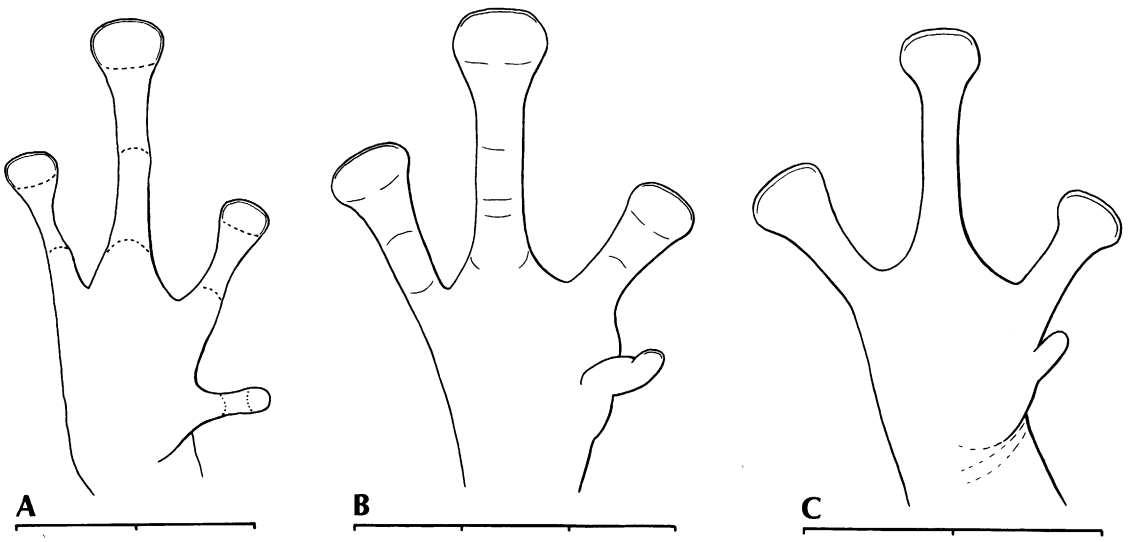

FIG. 9. Palmar views of right hands of *Cophixalus* (scale lines marked in mm.). A. *C. pipilans*, AMNH 83004 (holotype); B. *C. shellyi*, AMNH 58551 (holotype); C. *C. ateles*, British Museum (Nat. Hist.) 1947.2.12.7 (paralectotype).

the length of the second; second, third, and fourth fingers with enlarged discs with terminal grooves; first finger tip rounded without disc or groove; disc of third finger slightly less than twice the width of the penultimate phalanx, but larger than other discs; low, rounded subarticular and inner metacarpal tubercles barely indicated. Toes without webbing or fringes, relative lengths 4>3>5>2>1, third much longer than fifth; toe discs larger than those on fingers, that of the fourth toe about twice the width of the penultimate phalanx; low, rounded subarticular tubercles; inner metatarsal tubercle barely indicated. Hind legs long (TL/SV, 0.565).

Maxillae eleutherognathine (not meeting in front of premaxillae); no vomerine, premaxillary or maxillary teeth; sternum cartilaginous; clavicles, procoracoids and omosternum absent.

Ground color of dorsal surfaces of body and limbs brown in preservative, paler with a dark stipple of melanophores on the side of the body; an indistinct, dark hourglass-shaped mark on the back of the head and shoulder region; side of head—snout to below eye—dark; a short, dark mark from posterior corner of eye above tympanum, and a similar dark mark at same level on body just posterior to arm insertion; a dark mark at the wrist; legs with no distinct darker markings but anterior and posterior surfaces of thighs obscurely mottled; chin and chest with a dark stipple of melanophores broken by small clear spots; abdomen largely pale; undersides of hind legs light brown with pale mottling.

MEASUREMENTS (IN MM.): SV, 16.1; TL, 9.1; HW, 5.8; Eye, 2.0; E–N, 1.4; IN, 1.7; disc of third finger, 0.6 (penultimate phalanx, 0.35); disc of fourth toe, 0.8 (0.4).

VARIATION IN THE TYPE SERIES: The largest male in the series measures 18.5 mm. SV, and males are mature (found calling) at as least as small as 16.1 mm. Six gravid females measure between 18.1 and 22.3 mm. SV. The principal diagnostic proportions vary as follows: TL/SV, mean 0.563 ± 0.006 (0.53–0.62), N = 18; E–N/IN, mean 0.806 ± 0.009 (0.72–0.87), N = 18. A comparison of the subsamples from Morobe and Madang provinces shows no significant differences in these proportions. The first finger is typically

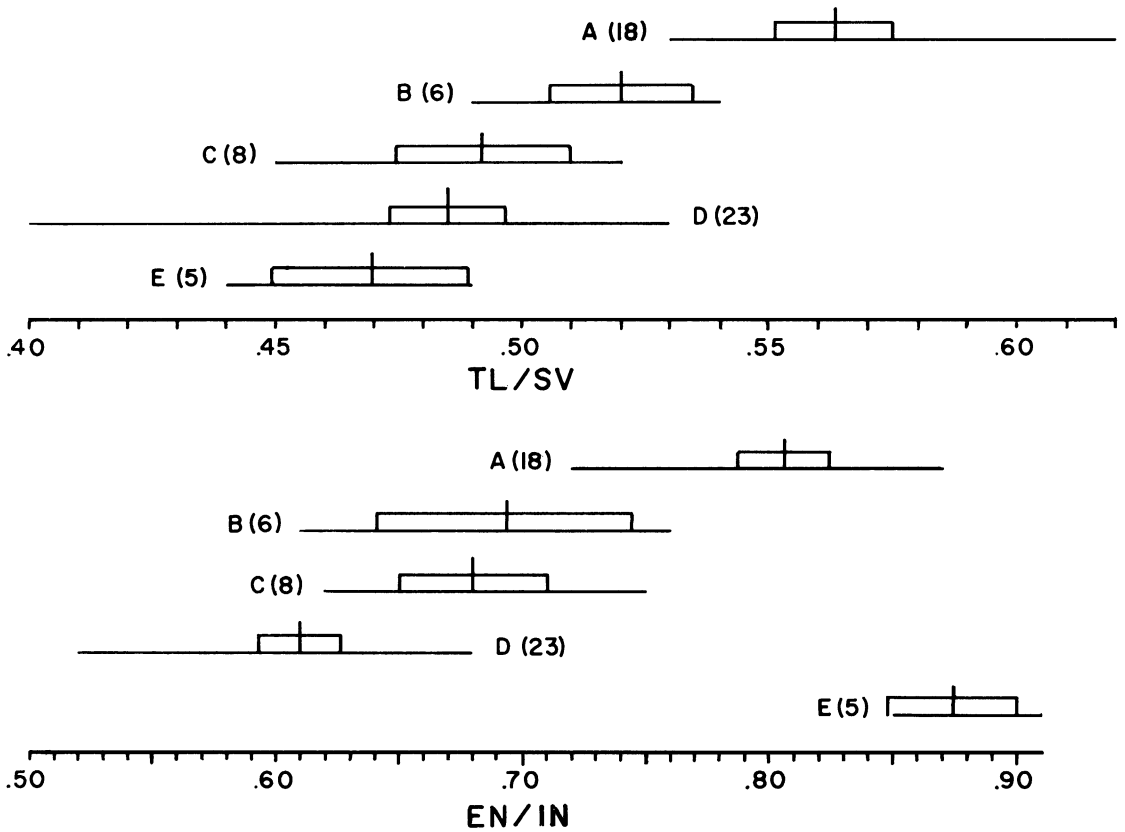

FIG. 10. Ratios of tibia length to snout-vent length and of eye-naris distance to internarial distance in five samples of *Cophixalus*. Ranges indicated by horizontal lines, means by vertical lines, with boxes marking two standard errors on each side of mean, sample sizes in parentheses. A. *C. pipilans*, entire sample; B. *C. shellyi*, Huon Peninsula; C. *C. shellyi*, vicinity of Wau; D. *C. shellyi*, Highlands region; E. *C. ateles*, type series.

short in all specimens. However, in some the tip is disclike (although not perceptibly broadened) and bears a faint terminal groove.

The dorsal color is brown to yellowish tan in life, the face mask black. When frogs are in light phase (as at night), the intensity and contrast of the face mask are reduced. One specimen has the middle of the back much paler than, and sharply distinguished from, the sides. The groin and anterior and posterior surfaces of the thighs have a pink to reddish orange color. The throat and chest are gray with pale flecks.

COMPARISONS WITH OTHER SPECIES: *Cophixalus pipilans* is so closely similar to *C. shellyi* in size, color, and nature of the first finger that when I encountered *pipilans* in the field I took it for *shellyi*, though puzzled by the appearance virtually at sea level of a species known before from elevations of from 1200 to 2700 m. The almost complete separation between *pipilans* and *shellyi* in certain proportions (fig. 10), and evidence for distinctive vocalizations (following section) lead me to regard the two as different species. No instances of sympatry are known, but typical examples have been tak-

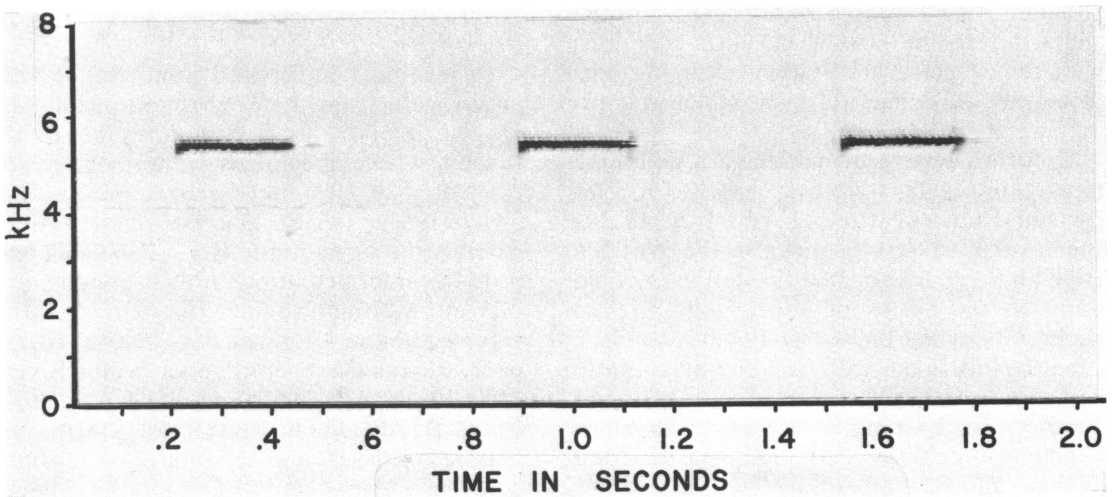

FIG. 11. Audiospectrogram (50 Hz filter) of call of *Cophixalus pipilans*, recorded Aug. 25, 1969, at Sempi, Madang Prov., Papua New Guinea; AMNH 83004 (holotype), air 24.0° C., Dept. Herpetology tape no. 190.

en within a relatively short distance of one another. I obtained a *pipilans* at Wanuma, 700 m., Adelbert Mountains, and a specimen of *shellyi* (BBM 5788) comes from 15 km. north-northwest of Wanuma, 1500–1600 m.

Comparison with *Cophixalus ateles* is hampered because that species is known from only the type series of tiny (largest, 15.3 mm. SV), soft, and somewhat faded specimens. I have examined the lectotype (MSNG 29116A) and seven syntypes (MSNG 29116B, five specimens; BMNH 1947.2.12.6, 1947.2.12.7). The type locality, "Moroka, Bartholomew Range, 2300 feet" (Boulenger, 1898), is south of the Owen Stanley Range, some 300 km. from the closest locality for *C. pipilans*.

Even with allowance for the difficulty of accurately measuring such tiny specimens in poor condition, the difference in relative length of hind legs between *ateles* and *pipilans* (fig. 10) is much greater than might be expected among populations of one species of *Cophixalus*. The E–N/IN ratio appears to differ between the two, also (fig. 10), but there is overlap in the ranges. Boulenger (1898) described the toes of *ateles* as having "large discs which are smaller than those of the fingers." The lectotype and three syntypes of *ateles* that are in the best condition have the finger discs slightly broader than those on the toes, as Boulenger described. In contrast, the toe discs are the broader ones in all specimens of *pipilans*. The evidence here too points to the distinctiveness of the two forms.

CALL: Knowledge of the call (fig. 11) is based on recordings of three individuals made at Sempi and 2.5 mi. north-northwest of Alexishafen, Madang Province, on August 25, September 14, and September 15, 1969. The call is a series of rather soft, high-pitched peeps given in groups of 20 to 33 (N = 6 calls) with from 6 seconds to almost 2 minutes elapsing between call groups. At air temperatures of 24.0°, 24.7°, and 25.6° C., the average call rates of the three individuals were, respectively, 93.8, 88.6, and 93.2 notes per minute. Approximate lengths of individual notes in the same order were 0.23, 0.28, and 0.24 sec. The dominant frequency was approximately 5300, 4900, and 5300 Hz in the three individuals. The second individual in the series, with the slowest call rate, longest notes and lowest dominant frequency is the larger (SV 17.1, compared to 16.1 and

16.2 mm.), a possible explanation for the slight difference in its call. No correlations with temperature are evident over the narrow range of temperatures at which recordings were made.

Unfortunately, I do not have a definitive tape-recording of *Cophixalus shellyi* for comparison. I have heard (and seen) frogs of this species call at two localities in the Western Highlands, and described the call in my field notes as a "series of short, high-pitched peeps . . . [which] may last 10–20 seconds." What I think is the call of *shellyi* may faintly be heard in the background of a recording of another species made at one of the Western Highlands localities. An audiospectrogram of this call (air temperature 14.4° C.) shows a note repetition rate of about 340 per minute, note length of about 0.1 sec., and dominant frequency of 5200 Hz. The great difference in note repetition rate between the call of the new species and the presumed call of *shellyi* (it should be even greater at comparable temperatures) is evidence for their specific distinctness.

ECOLOGICAL NOTES: My specimens came from lowland forest on hillsides at elevations close to sea level, probably no more than 50 m. One captured in the daytime was in leaf litter, whereas those taken at night were on low shrubs, no more than 1 m. high. Few if any frogs called when no rain had fallen recently, but many were heard on excessively humid nights.

ETYMOLOGY: The specific epithet, meaning "peeping," comes from the Latin verb *pipilo*.

DISTRIBUTION: *Cophixalus pipilans* is at present known only from the vicinity of Lae, Morobe Province, the coastal region immediately north of Alexishafen and the Adelbert Mountains, Madang Province (fig. 12). The known range spans about 270 km., but probably extends both north and south along the coast from the presently known extremes. All known localities are given in the foregoing paragraph on paratypes.

Cophixalus shellyi Zweifel

Tumnang, 1340 m. (74984–74989); head of Kua River Valley northwest of Avengu, 1610–2160 m. (76009); Tobo, 1450–1650 m. (84509).

Previously published records of this species are from the Highlands, in the Mt. Hagen, Kubor, and Wahgi-Sepik Divide ranges, where specimens came from elevations of 1520–2900 m. (Zweifel, 1956b, 1962; Tyler, 1963a, 1963c). Material reported here extends the range to the Huon Peninsula and provides intermediate records in the vicinity of Wau, Morobe Province (fig. 12): Mt. Missim, *ca.* 10 km. NE. Wau, *ca.* 1600 m. (BBM 6428, 6433–6436, 6438); Upper Watut River, 1100–1600 m. (BBM 6743); Kunai Creek, Edie Creek Road, 1350 m. (AMNH 81148).

Frogs of the Huon Peninsula and the Highlands agree in details of coloration, being grayish brown dorsally with the side of the head black and with peach color prominent in life in the groin and on anterior and posterior surfaces of the thighs. They share this same color and pattern with *Cophixalus pipilans*. There are some indications of geographic variation in proportions in *C. shellyi* (fig. 10), but the ranges of variation in three samples overlap broadly, in contrast to their relationship to *C. pipilans*.

The specimens I obtained on the Huon Peninsula were collected by children who found them in the daytime (along with *Cophixalus variegatus* and *Oreophryne* sp.) in the hollows of cut bamboo stems and in the leaf axils of banana plants.

Tyler (1963a, 1963c) referred specimens of this species to *C. ateles* and considered *shellyi* to be questionably valid. In addition to the great difference in the E–N/IN ratio (fig. 10), *C. ateles* differs in having the toe discs slightly broader than those on the fingers, whereas in *shellyi* only rarely is the disc of the third finger as wide as that on the fourth toe; see the foregoing description of *C. pipilans*.

Cophixalus variegatus (van Kampen)

Tumnang, 1340 m. (74990–74996+4; MCZ 28401); Gang Creek, 1340–1550 m. (74997, 76010–76011+2); Mt. Kembiam, *ca.* 1400 m., inland of Wasu (BBM 6506, 6507); near Ibang village, 1450 m., inland of Wasu (BBM 5813, 5814, 5816).

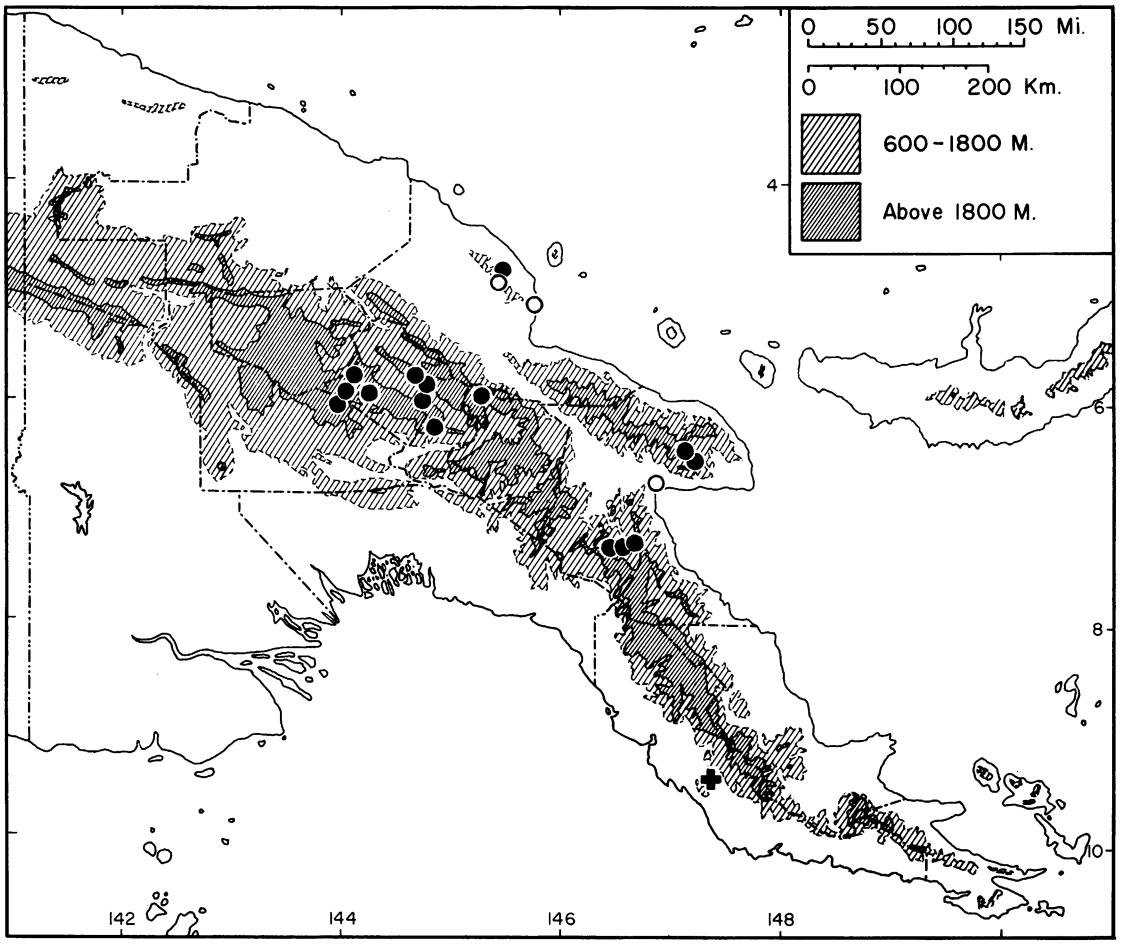

FIG. 12. Distribution of *Cophixalus pipilans* (open circles), *C. shellyi* (closed circles), and *C. ateles* (cross) in Papua New Guinea.

Cophixalus variegatus belongs to a group of small scansorial or arboreal species characterized by having the fifth toe longer than the third. In last reviewing these frogs (Zweifel, 1962), I recognized only three species with this characteristic, the others being *C. darlingtoni* Loveridge and *C. rostellifer* Wandolleck. The latter has, with good reason, been transferred to a resurrected, monotypic genus, *Choerophryne* (Menzies and Tyler, 1977).

Since the publication of my 1962 paper I have had the opportunity to tape-record and study *variegatus*-group frogs in the field, and it is now clear that several morphologically similar undescribed species exist. Use of the name *variegatus* for the Huon Peninsula frogs is tentative and will require review when the whole group can be studied. The type locality of *variegatus*, Digoel River, Irian Jaya, is about 800 km. west of the Huon Peninsula. I have collected frogs of the same species as those on the Huon Peninsula (judged by similarity of the calls) on Mt. Kaindi near Wau, Morobe Province, and at an intermediate locality, Wagau, Herzog Mountains.

Frogs that I collected were calling at night from low bushes. Dr. R. G. Hoogland found them in the daytime in clumps of fruit grow-

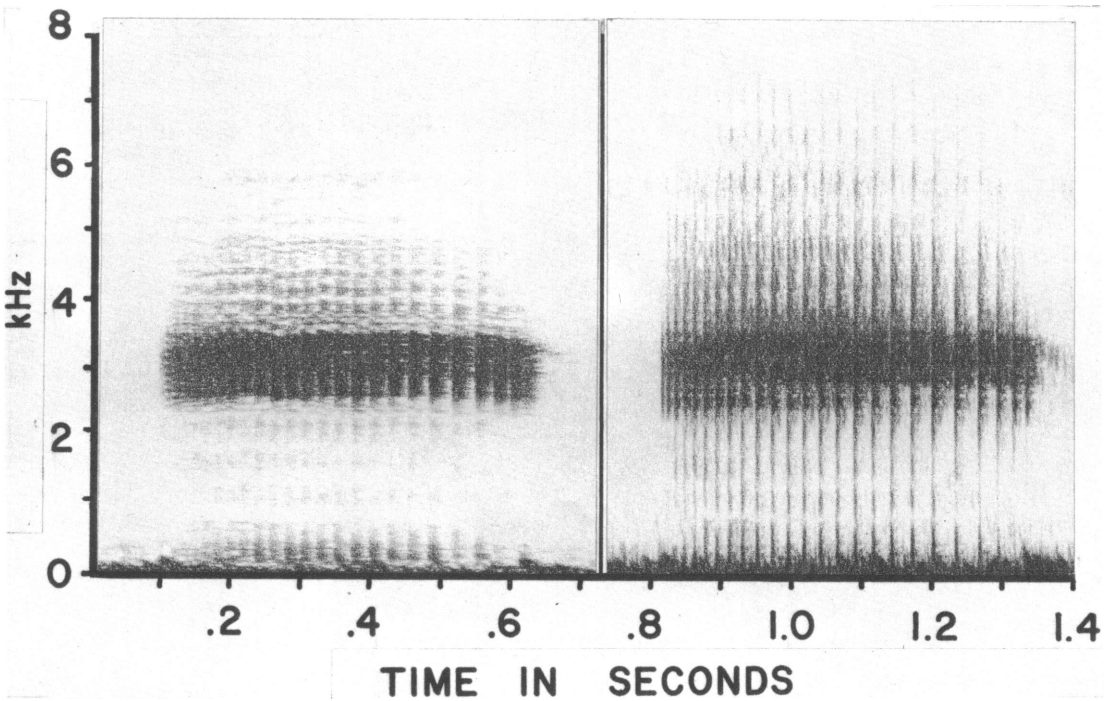

FIG. 13. Audiospectrogram (50 Hz filter left, 300 Hz filter right) of call of *Oreophryne* sp., recorded by S. Grierson on May 27, 1964, at Pindiu, Morobe Prov., Papua New Guinea; AMNH 76030, temperature not recorded, Dept. Herpetology tape no. 204.

ing on the trunks of *Ficus* trees, and other collectors found them in cut bamboo stems and in banana plants.

Copiula fistulans Menzies and Tyler

Lae (81131, 81132, 83032–83036; MCZ A79706); 4 km. N. Lae (103191; MCZ 89221–89227).

Menzies and Tyler (1977) resurrected the genus *Copiula* (formerly synonymized under *Cophixalus*) and included in it this species, type locality 11 km. north of Lae. Other localities include Sattelberg on the Huon Peninsula and near Popondetta, Northern Province. Presumably Méhelÿ's (1901) record of *Copiula oxyrhina* from Sattelberg represents this species. Menzies and Tyler dealt only with *Copiula* in eastern Papua New Guinea. Because the three species of *Copiula* are distinguished mainly on the basis of their mating calls, the systematic status of *Copiula* on several of the islands southeast of New Guinea, on the north coast of Papua New Guinea and into Irian Jaya remains to be resolved.

I captured my specimens in the Botanic Garden at Lae in August 1968 and September 1969. All are males which attracted my attention at night with their quiet trilled call (Type 2 call of Menzies and Tyler). Two were in depressions in the soil covered by wet leaves, the others in depressions in mowed grass several inches high. None was truly "subterranean," as characterized by Menzies and Tyler.

Hylophorbus rufescens rufescens Macleay

Tumnang, 1340 m. (75018–75022); Gang Creek, Mt. Rawlinson, 1340 m. (75023, 75024, 76012–76023); Pindiu, *ca.* 790 m. (76024); inland (S.) of Wasu Patrol Post, 1450 m. (BBM 5812, 5815).

The type locality of a synonym of this common ground frog, *Metopostira ocellata* Méhelÿ, is Sattelberg, on the Huon Peninsula (Zweifel, 1972a).

Oreophryne sp.

Tumnang, 1340 m. (75026–75040+14); Pindiu, 820–914 m. (76025–76030); Lae (75041–75044, 81195).

A user of the key in Parker (1934, pp. 160–161) could identify these frogs as *Oreophryne biroi* (Méhelÿ). I hesitate to use that name for these specimens, despite references in the literature to *biroi* from the Huon Peninsula (Sattelberg: Méhelÿ, 1901, p. 252; Parker, 1934, p. 170, refers to the same specimens as Méhelÿ) because of evidence that more than one species may currently be covered by the one name.

The type locality of *O. biroi* is "Friedrich-Wilhelmshafen" (= Madang; Méhelÿ, 1897). Near Sempi, about 20 km. north of Madang, I collected specimens of an *Oreophryne* that also keys out to *biroi* in Parker's key but has a mating call vastly different from that of the frogs on the Huon Peninsula and differs as well from them in some proportions not treated by Parker. An additional complication is produced by a specimen from Madang itself that, on the basis of its proportions, may represent a third species—possibly the true *biroi*. Unfortunately, I have no information on the mating calls of frogs at Madang. Parker treated several published names as junior synonyms of *biroi*, but there is no way at present to justify assignment of any of these names to populations discussed here. A frog from Sattelberg identified by Vogt (1911) as *Hylella brachypus* and by Tyler (1964a) as *Oreophryne* sp. may represent the species collected on the Archbold Expedition.

The form found on the Huon Peninsula evidently is fairly widely distributed, for I have collected it as well as Kokoda (identification based on recordings of mating calls as well as on morphology). Native collectors and I found these frogs at Tumnang hiding during daytime in banana plants and in cut bamboo stems in gardens and in second growth. Hobart M. Van Deusen and S. O. Grierson captured individuals at Pindiu that were calling (fig. 13) from sites 4 to 8 feet up in banana and pandanus plants, and I found calling males similarly situated at Lae. I neither found nor heard this species at Gang Creek in the tall primary forest. A photo of an individual of this species from Lae identified as *Oreophryne biroi* appears in Zweifel (1972d, fig. 5).

Phrynomantis lateralis (Boulenger)

Masba Creek, 610 m. (76007, 76008); Lae (74888, 81058); *ca.* 24 km. N. Lae, 240 m. (81059).

Most individuals were calling on the ground in rain forest when captured; one was under a log. Méhelÿ (1901, p. 220) recorded this species from Sattelberg. For a photograph, audiospectrograms, and distribution map see Zweifel (1972a).

Phrynomantis robusta (Boulenger)

Tumnang, 1340 m. (74889).

The only specimen of this species captured on the Expedition is a juvenile found in a hole in the cut bank of a trail in second growth forest. Other localities for the species within the area of this report are given by Zweifel (1972a, p. 499): Aregenang, Mindik, Sattelberg, Simbang, and Tewep.

Sphenophryne mehelyi Parker

Mindik, 1200–1600 m. (BBM NG 55310, field number); 4 km. N. Lae (MCZ 89220).

The type locality of this species is Sattelberg (Parker, 1934, p. 157). The two specimens on which Parker based the species (specimens referred to *Chaparina fusca* by Méhelÿ, 1901) have been destroyed, and no others have heretofore been reported from New Guinea, although Tyler (1967) identified specimens from New Britain as *S. mehelyi*.

The Huon specimens agree closely with Parker's and Méhelÿ's descriptions. Ventral color patterns—dusky throat and chest with small light spots, abdominal area paler with brown mottling—are virtually identical with that of one of the typical specimens illus-

trated in color by Méhelÿ (1901, pl. 12, fig. 3).

I have examined 23 specimens of *Sphenophryne* from New Britain, including three studied by Tyler and referred by him to *S. mehelyi*. These specimens are all remarkably similar in having all lower surfaces—chin, chest, abdomen, and limbs—uniform brown with small white spots. Thus, they differ from the Huon specimens, which agree with Parker's (1934, p. 156) description: "lower surfaces dirty white, the throat and chest washed with pale brown and irregularly spotted with white." The specimen from Lae measures 30 mm. snout to vent, whereas no specimen among 55 in the New Britain series measured by Tyler was as long as 21 mm. In his key to *Sphenophryne*, Parker (1934, p. 153) gave "*circa* 28 mm." as the size of *mehelyi*, although the type measured 20 mm. (p. 157), and Méhelÿ (1901, p. 257) stated, "das grössere 24.5 mm. lang." As Tyler (1967) noted, differences in methods of measuring may contribute to the apparent variation.

Differences in size and coloration leave little doubt that the specimen from Lae (and, by association, the smaller and less well-preserved specimen from Mindik) belongs to a species distinct from the New Britain sample, which represents an undescribed species.

Sphenophryne palmipes Zweifel

Gang Creek, 1340 m. (75048–75053, 76038–76047); near Zangaren, *ca.* 1370 m. (76031, 76032); Numbut, *ca.* 1220 m. (76034–76037); Masba Creek (76033); Tuwap, 1350 m. (BBM 1048); Finschhafen (SAM 5684 [eight specimens]); Ulap, 800–1100 m. (BBM 5322).

Originally described on the basis of specimens from Mt. Dayman and Goodenough Island on the southeastern tail of New Guinea (Zweifel, 1956a), *Sphenophryne palmipes* proves to have an extensive range on the northern slopes of eastern Papua New Guinea. Tyler and Menzies (1971) reported it from Alotau, on Milne Bay, the Fifth Archbold Expedition obtained specimens on Normanby Island, and I found it at Kokoda, Garaina and near Wau (Zweifel, 1976). The northernmost specimens are from Boana, 40 km. west-northwest of Lae (MCZ field nos. X23502–X23523, X23585). A peculiar aspect of the distribution of *S. palmipes* is its presence south of the central mountain range, where Fred Parker obtained numerous specimens on the Pio River drainage south of Mt. Karamui (MCZ). The pattern of distribution described is closely paralleled by that of another microhylid, *Cophixalus cheesmanae* (Zweifel, 1979b).

Sphenophryne palmipes is riparian, being found beside and in small streams. It is possibly the only New Guinean microhylid with aquatic habits. The frogs are dull-colored in life, greenish brown dorsally with obscure darker markings, and gray beneath with darker gray flecks and mottling on the chin.

Xenobatrachus rostratus (Méhelÿ)

Gang Creek, 1340 m. (76048, 76049); divide between Ogeramnang and Tobou, 1830–1980 m. (76050–76052); head of Kua River Valley, northwest of Avengu, 1650–2160 m. (76053–76098+7); Indagen, north slope of Mt. Kiren (76099); near Indum (76100), vic. Ibang Village, south of Wasu, *ca.* 1450 m. (BBM 6501, 6502).

Two specimens from Gang Creek were found in leaf litter when trees were being felled for the campsite clearing. Hobart M. Van Deusen and S. O. Grierson collected several individuals that were calling from within the humus during gentle daytime rains.

Méhelÿ (1901, p. 233) recorded this species from Sattelberg. Zweifel (1972a, pp. 524–527) considered *X. rostratus* divisible into three morphologically and geographically distinct groups, one of which comprised the sample from the Huon Peninsula.

Xenobatrachus subcroceus Menzies and Tyler

Ca. 11 km. N. Lae (90767); 4 km. N. Lae (MCZ 89312).

The first specimen cited is a paratype of this recently described species (Menzies and Tyler, 1977), kindly donated by Mr. Men-

zies. This species is quite distinct from *X. rostratus* which occurs at higher elevations on the Huon Peninsula, but is exceedingly similar to *X. mehelyi* (Boulenger), known from the southern drainages of Papua New Guinea. Although Menzies and Tyler describe the call of *subcroceus*, recordings of *mehelyi* unfortunately are not available for comparison. Evidence of different vocalizations would strengthen support for the distinctness of *subcroceus*, which now rests largely on geography.

SAURIA

GEKKONIDAE

Cyrtodactylus loriae (Boulenger)

Near Pindiu, *ca.* 910 m. (95647).

This dull, gray-brown-colored gecko is found on tree trunks in forest. The iris is light brown, conspicuous against the grayer color of the head.

Cyrtodactylus louisiadensis (de Vis)

Lae and near Lae (66702, 95652); Busu River, 13 km. N. Lae (95169); *ca.* 24 km. N. Lae (103240); Masba Creek, 610–640 m. (95648–95651).

This species, like *C. loriae*, is typically a tree dweller, although two of the specimens from Masba Creek were found on rocks. Others were on tree trunks, including one lizard 15 feet above the ground. The eyes reflect a deep red color in the beam of a flashlight.

Cyrtodactylus novaeguineae (Schlegel)

Lae (95165–95168); Busu River, 13 km. N. Lae (95175).

This magnificent gecko (snout-vent length of the two largest American Museum specimens, 172 mm.) is widely distributed in the lowlands of New Guinea, although rarely mentioned in the literature. Brongersma (1934) established the validity of the species and gave several localities on the north and south coasts of western New Guinea, as well as less specific ones for eastern New Guinea. Specimens in the American Museum of Natural History, in addition to those cited above from Lae and vicinity, establish the presence of the species along the north coast of Papua New Guinea in the Adelbert Mountains and near Alexishafen (Madang Province), at Maprik (East Sepik Province), and at Lumi and Mt. Menawa (West Sepik Province).

Like the other large *Cyrtodactylus*, this species is arboreal and nocturnal, and readily found by its deep red eye shine in a flashlight beam. Curiously, despite its large size it may be found on saplings scarcely as wide as its body, but it inhabits larger trees also.

Cyrtodactylus pelagicus (Girard)

Lae (66731, 66732, 95177, 95653); 11 km. N. Lae (103242–103244); Gusiko (66668).

Earlier records from the Huon Peninsula include Vogt (1911) and Loveridge (1948). This adaptable species is widespread over the Pacific islands. On New Guinea it is both terrestrial and arboreal, found on tree trunks at night, and sheltering in cocoa husk piles in the daytime. I have even seen it active on a shaded tree trunk in the daytime, which is unusual for a *Cyrtodactylus*.

Cyrtodactylus vankampeni (Brongersma)

Lae (95654, 103257, 103258).

So far as I have been able to determine, this species has been reported in the literature only once since the original description. Brongersma (1933) described it on the basis of two specimens from "the surroundings of Modderlust" in former Netherlands New Guinea. De Rooij had earlier (1919) listed the same specimens as *Gymnophthalmus pelagicus* from "Modderlust am Tami-Fluss" and "Zwischen Modderlust und Kasawari an der Humboldtbai." Neither Modderlust nor Kasawari appears on any map available to me, but the former appears to be no more than about 10 km. south or southeast of Humboldt Bay. Loveridge's (1948) record for Aitape (Papua New Guinea: West Sepik Province) is about 180 km. east-southeast of the type locality, and the specimens from Lae extend the range another 680 km. east-southeast.

The similarity of *C. vankampeni* to *C. pe-*

lagicus was noted by Brongersma (1933) and is implicit in de Rooij's confusion of the two species. In the field, the obviously gravid condition of such a small lizard (snout-vent length, about 33 mm.) called my attention to the distinctiveness of *vankampeni*. I found my two specimens on the ground beneath broad pieces of banana stems in the Botanic Garden.

Gehyra mutilata (Wiegmann)

Lae (66707–66711, 92315, 95219, 103261).

Loveridge (1948) recorded this species from Finschhafen and Gusiko. Typically a house-gecko, *mutilata* sometimes is found in more "natural" habitats, as two of the Lae specimens found by M. C. Kurtz in a cave.

Gehyra vorax Girard

Lae (95216).

Gehyra vorax was included within the synonymy of *G. oceanica* by Wermuth (1965, p. 35), who stated "syn. fide de Rooij 1915." De Rooij, however, treated *oceanica* and *vorax* as distinct species. Burt and Burt (1932) considered *vorax* "probably" a synonym of *oceanica*. I treat *vorax* as a species on the advice of Mr. and Mrs. Wm. Beckon, who have accumulated evidence that the two are distinct in sympatry and who examined the specimen cited.

My specimen was on the buttress region of a small tree at night. The species is widespread in the Pacific islands, but there are no other records for the Huon Peninsula.

Gekko vittatus Houttuyn

Pindiu, *ca.* 810 m. (95657, 95658); Lae (66704, 95656).

This widespread gecko of arboreal habits often is found around dwellings, but also occurs in forest at low elevations.

Hemidactylus frenatus Duméril and Bibron

Lae (92304–92314, 95217, 95218).

This widely distributed house-gecko does not appear previously to have been recorded from the Huon Peninsula.

Lepidodactylus lugubris (Duméril and Bibron)

Lae (92316, 92317); Gusiko (66666).

This parthenogenetic house-gecko and the similar bisexual species *L. novaeguineae* occur sympatrically at Gusiko, where M. Kurtz collected both on trunks of palm trees at night. Loveridge (1948) reported specimens from Gusiko and Finschhafen.

Lepidodactylus magnus Brown and Parker

Lalang, 1400 m. (95655).

The specimen is a paratype of this recently described species (Brown and Parker, 1977). Unlike other Papuan *Lepidodactylus,* it is a lizard of interior upland regions, found in the central mountainous region of Papua New Guinea as well as on the Huon Peninsula.

Lepidodactylus novaeguineae Brown and Parker

Gusiko (66665, 66667).

These specimens are paratypes (Brown and Parker, 1977). Loveridge (1948) reported this species (as *L. pulcher*) from Gusiko and Finschhafen. Records given by Brown and Parker outline a distribution at low elevations along the north coast of New Guinea from the area of Jayapura (Hollandia) to the Huon Peninsula. See remarks under *L. lugubris,* above.

PYGOPODIDAE

Lialis jicari Boulenger

Lae (95659).

This specimen represents the only record for the Huon Peninsula, although the species is widespread in lowlands on both north and south coasts of New Guinea, and ranges as high as 1500 m. (Kluge, 1974).

AGAMIDAE

Gonocephalus modestus Meyer

Between Zangaren and Bullum River (95158); Masba Creek, *ca.* 640 m. (95644).

One was found on the ground in second growth in the daytime, and another on the ground in rain forest at night, but my expe-

rience elsewhere indicates that individuals of this species are more often in trees. In light phase, the dorsal body surface of *G. modestus* is bright green with little or no trace of pattern. An individual can darken, however, so that green is largely replaced by brown, dark crossbands appear on the body and crossbands faintly evident on the tail in light phase become much more distinct. The ventral surfaces of the body and limbs are white. The iris is brown.

In the spelling of the generic name of this species, I follow Wermuth (1967).

Gonocephalus papuensis (Macleay)

Lae (95646, 104861).

The genus is in need of revision, therefore the identification is tentative. Vogt (1911) recorded *papuensis* from Sattelberg.

SCINCIDAE

Generic subdivision of the Scincidae, especially of the subfamily Lygosominae, has run the gamut from lumping (Smith, 1937) to splitting (Mittleman, 1952). Subsequent contributions by Greer and by Fuhn have provided reasonable solutions to many of the problems of generic assignment. With exception made for later work I have followed the generic usage of Greer (1970a, 1974).

Carlia fusca (Duméril and Bibron)

Finschhafen, sea level to 150 m. (95661–95669); Pindiu, 850 m. (95660); Kua River Canyon between Tumnang and Kwenzengzeng (95221); Gusiko (66679–66681+10, 66688–66690+12).

Loveridge (1948, pp. 360–365) recognized four races of this widespread species (two on the mainland of New Guinea), whereas Forcart (1953, pp. 66–67) could not separate mainland populations on a basis logical for both geography and morphology. A more thorough study than has been made so far is needed before this variable species is properly understood; hence, I use the binomial.

Cryptoblepharus boutonii pallidus Mertens

Lae (95255–95258, 103292–103297).

This subspecies has been reported only from the somewhat indefinite type locality, "Sepik-Gebeit" (Mertens, 1931), and from two localities on the lower Sepik River (Hediger, 1934). In addition to the specimens from Lae, I collected a series at Hayfields (10 km. south of Maprik), East Sepik Province (95248–95254), and the Sixth Archbold Expedition obtained one (92364) at Oomsis, 35 km. (by road) west of Lae, Morobe Province.

These lizards in life have a pale grayish brown dorsal ground color with an indistinct paler dorsolateral band on each side, a golden sheen to the head, and the lining of the mouth black or nearly so. The color pattern is thus much as described and illustrated for *pallidus* by Mertens (1931), and contrasts with the more distinctly striped condition of *C. b. novaeguineae* of the northwest coast of New Guinea. Loveridge (1948) recorded a specimen from Gusiko as *novaeguineae,* but his description suggests an animal with indistinct striping.

The lizards taken at Lae were sunning on the trunks of large trees in company with *Lamprolepis smaragdina*. The color of *Cryptoblepharus* blends well with that of the tree bark, and the lizards' depressed body form enables them to hide readily under loose flakes of bark.

Emoia atrocostata irrorata (Macleay)

Finschhafen, sea level (95676–95682).

The specimens were collected in the tidal zone of a coral shore. I find no previous records for this *Emoia* on the Huon Peninsula, although it is abundant on rocky coral shores elsewhere in New Guinea.

Emoia baudini verecunda Brown

Pindiu, *ca.* 880 m. (95683); Masba Creek (95684); between Zangaren and Bullum River (95317, 95319); between Bullum River and Selimbeng (95337, 95338).

These specimens agree closely with *E. b. verecunda* as described by Brown (1953). The ventral surfaces are relatively pale, the sides are dark brown (almost black) with scattered light spots but without stripes, and there is a broad, bronze dorsal band six and

two half-scales wide on the body. The scale counts extend slightly out of the ranges given for *verecunda* by Brown (1953, pp. 4, 6), but his sample included only eight specimens.

These lizards bear a close resemblance to *E. loveridgei*, a sympatric species of similar size. The unspotted (but usually striped) sides and heavily barred labial region of *loveridgei* serve to distinguish that species from *baudini*. I noted in living *baudini* a yellowish tint to the labial region that was not present in *loveridgei*.

Previous records for this species lie on the north coast of New Guinea. The closest given by Brown (1953) to the localities reported here is Marienberg, about 450 km. northwest.

Emoia caeruleocauda caeruleocauda (de Vis)

Finschhafen, sea level (95688–95692); Pindiu, 850–880 m. (95685–95687); Gusiko (66687); Lae (66703+3, 66729, 66730, 92327–92334, 95274–95276, 103309).

Brown (1956) and Greer (1968) used the name *Emoia callisticta* for this species, which earlier authors (e.g., Loveridge, 1948) had called *caeruleocauda*. I have examined the holotype of *Euprepes callistictus* Peters and Doria, 1878 (MSNG 28049) and find it to be, as originally described, a lizard with strongly bicarinate dorsal scales. This is in marked contrast to the smooth scutellation of *caeruleocauda*, and I do not doubt that the two are different species. The species that appears closest to *Euprepes callistictus* is *Lygosoma acrocarinatum* Kopstein, 1926 (*Emoia acrocarinata*: Brown, 1953, p. 23). The two agree in pertinent characteristics of scutellation, including numbers of scale rows around midbody, numbers of rows from occiput to rump, number of lamellae under the fourth toe, absence of enlarged nuchals, and the bicarinate nature of the dorsal scales. The type localities of both species are on the Vogelkop Peninsula of Irian Jaya. I suspect that a more detailed study (I have not seen the holotype of *acrocarinatum*) will establish that *acrocarinatum* is a junior synonym of *callistictus*.

The captures of *caeruleocauda* on the Huon Peninsula were at moderate to low elevations, as is typical of this species.

Emoia cyanogaster longicauda Macleay

Gusiko (66678).

Brown (1954, p. 265) identified this specimen.

Emoia loveridgei Brown

Pindiu, 880–910 m. (95312, 95693); Gang Creek, 1340 m. (95694, 95707–95718); Kotkin, 1220 m. (95695–95698); Zangaren, 1370 m. (95699–95706); between Zangaren and Bullum River (95314–95316, 95318); between Selimbeng and Zangaren (95313); between Bullum River and Selimbeng (95320–95322); between Selimbeng and Tumnang (95339); Tumnang, 1340 m. (95323); between Tumnang and Kua River (95324, 95325); between Kua River and Kwenzengzeng (95326, 95327); near Numbut (95719–95725+6); Gusiko (66686, 109522, 109523); 2 km. N. Bonga (66685).

The majority of these specimens agree closely with the original description (Brown, 1953, pp. 10–11). There is a broad, light brown dorsal band, the sides are dark brown and unspotted, and there is a weak light line from axilla to groin, extending anterior to the forelimb in some individuals. Occasional lizards show scarcely a trace of the lateral light line even when alive.

The specimens from Gusiko and 2 km. north of Bonga are paratypes. They were cited by Brown (1953, p. 10) as AMNH nos. 66685, 66686 and two uncatalogued. The previously uncatalogued specimens have been assigned numbers. Brown listed the specimen from 2 km. north of Bonga as having come from Gusiko, owing to a mistake in a catalogue entry that has been corrected by reference to the collector's field catalogue.

Emoia mivarti (Boulenger)

Pindiu, *ca.* 850–910 m. (95728–95754+26); between Zangaren and Bullum River (95288); Kabwum, *ca.* 1370 m. (95755–95757); Lae (66726–66728, 103341, 103342).

Emoia mivarti is somewhat of a reptilian weed, often abundant in disturbed habitats but scarcely, if at all, penetrating mature forest. The absence of specimens from the Gang Creek camp in contrast to its abundance at Pindiu reflects this habitat preference. I have not found previous references to this species on the Huon Peninsula, but probably specimens were referred to other species.

Emoia pallidiceps pallidiceps de Vis

Between Selimbeng and Tumnang (95340, 95341); Gang Creek, 1370 m. (95342, 95763–95767); Zangaren, 1370 m. (95758–95762); Kotkin, 1220 m. (95768, 95769).

These specimens have dark, unspotted sides and a light lateral line that passes from the ear to the groin. This is the pattern characteristic of *pallidiceps* as Brown (1953) defined this species. The mean number of scales around midbody in eight specimens from the Huon Peninsula is 33.1 (range 32 to 34), and so by Brown's criteria the specimens represent the nominate subspecies rather than *E. p. maxima,* which has a range in this scale count of 38 to 42. Several specimens from the Huon Peninsula exceed the maximum snout to vent length of 52 mm. given by Brown for *pallidiceps*; the largest measures 59 mm.

A specimen from Gang Creek (95342) had the following colors and pattern in life: top of head bronze, fading along back to greenish brown in lumbar region; a narrow dorsolateral light line faintly indicated, strongest on the neck; a black lateral band bordered below by a more distinct light line running from ear to groin with a branch onto anterior side of forearm; ventral surfaces, including underside of tail, rust-colored; iris bronze.

Brown (1953) cited no records for this species on the Huon Peninsula, but he examined specimens from areas to the northwest, west and south.

Emoia physicae physicae
(Duméril and Bibron)

Masba Creek, 610 m. (95772–95775); Kotkin, 1220 m. (95770); Gang Creek, 1340 m. (95771); Numbut (95776, 95777); Zangaren, 1370 m. (95778); between Zangaren and Bullum River (95343, 95344); between Bullum River and Selimbeng (95328, 95336); Tumnang, 1340 m. (95330); Kua River Canyon, between Tumnang and Kwenzengzeng (95329); Lae (66724, 66725).

These are brown skinks with little contrast in the color pattern. One adult female had, in life, a darker brown dorsolateral streak bordered below by lighter brown, the same as that of the back. Another adult female had the sides slightly darker than the back and spotted with grayish white, but without clear demarcation between the color of the sides and that of the back. Lateral spotting is more distinct in juveniles, especially on the neck. In both juveniles and adults the head has a slight bronze tint, the labial scales are dull yellow and the ventral surfaces gray. An adult had yellow eyelids.

Brown (1953) recorded the specimens from Lae. I assume that Loveridge's (1948) record for *E. tropidolepis* from Gusiko refers to this species, since Brown considered *tropidolepis* a subspecies of *physicae*.

Emoia submetallica popei Brown

Masba Creek (95781); Lae (66705).

The color pattern of the lizard from Masba Creek agrees with Brown's (1953) description of *Emoia s. popei,* except that a trace of a light line is present between the ear and the groin. There is no light line on the side of the body, only obscure spotting on the dark field. The number of scale rows around midbody (36) and number of fourth toe lamellae (40) are relatively high, as is characteristic of this form, and help to distinguish it from the somewhat similar species *E. baudini* and *E. loveridgei* which occur in the same general region.

Brown (1953) recorded *E. s. popei* from localities to the northwest and southeast of the Huon Peninsula, but not from the Peninsula proper.

Eugongylus rufescens (Shaw)

Lae (103490, 103491).

Loveridge (1948) recorded this large, ground-dwelling skink from Finschhafen.

Lamprolepis smaragdina perviridis (Barbour)

Finschhafen, sea level (95670–95673+8); Gusiko (66684); Lae (66722, 66723, 92320, 92321, 94559, 95259, 95260, 95674).

The Archbold Expedition found this common tree skink only at the lowest-elevation camp. It is common in the Botanic Garden at Lae, where clearing has exposed the trunks of large, forest-grown trees to sunlight. I follow Greer (1970b) in the use of the generic name *Lamprolepis,* rather than the more familiar *Dasia,* which he restricts to other species.

Lipinia longiceps (Boulenger)

Gusiko (66697); Lae (92326).

Melvin C. Kurtz found the Gusiko lizard on a tree trunk, which agrees with Stickel's observations (Loveridge, 1948, p. 357). For a photograph, distribution map, and key characters of this species see Zweifel (1979a).

Lipinia noctua (Lesson)

Finschhafen (95802).

I have elsewhere (Zweifel, 1979a) reported on the variation and geographic distribution of this species and have concluded that *Lygosoma miotis* Boulenger is a junior synonym of *L. noctua*. Other locality records for the Huon Peninsula include Lae and Gusiko (Zweifel, 1979a).

Lipinia pulchra (Boulenger)

Lae (66703, 131175–131179).

This appears to be the only record for the species on the Huon Peninsula, although the species is widespread at low elevations on the north coast of New Guinea. See Zweifel (1979a) for a distribution map, photograph, and discussion.

Lobulia elegans (Boulenger)

Gang Creek, 1340–1370 m. (95784, 95785); Mt. Ulur, 2380–2440 m. (95786–95800).

This species was known under the substitute name *elegantoides* Ahl 1925 for many years; Greer (1974) restored *elegans*. When Loveridge (1945) described *Lygosoma elegantoides lobulus,* he had available only the type series of 16 specimens from Mt. Wilhelm. He knew the typical subspecies only from Boulenger's (1897) original description of the holotype from Mt. Victoria and from additional information on that specimen and one from Moroka communicated by Malcolm Smith (Loveridge, 1945, pp. 49–51). The new form was distinguished by having more scale rows around midbody (34 to 36 as opposed to 32) and by having the distal subdigital lamellae "not or scarcely differentiated from those of the basal" part of the toe (more marked differentiation in the typical form). A specimen in the American Museum of Natural History (59046) is from Mt. Tafa, 2070 m., about 80 km. west-northwest of the type locality of *elegans*. It has 36 scales around midbody and 19 subdigital lamellae that show essentially the same amount of differentiation as in topotypic *lobulus* with which I compared it. I do not regard *lobulus* as sufficiently well characterized, so I use the binomial for the Huon lizards.

Lobulia elegans, although mentioned infrequently in the literature, is a common species at moderate to high elevations all along the mountainous backbone of New Guinea. The specimens collected on the Archbold Expedition evidently are the first found on the Huon Peninsula. Those from Mt. Ulur were in grassland or at the grassland-forest boundary; one was in a hollow tree-fern log.

Lobulia stanleyana (Boulenger)

Gang Creek, 1340 m. (95803–95817); ridge north of Gang Creek, 1580 m. (95818); Kotkin, 1220 m. (95819–95821); Kabwum, *ca.* 1370 m. (95822–95825); between Selimbeng and Tumnang (95413, 95414, 95416); between Selimbeng and Zangaren (95415); Gevak, 1460 m. (93009–93011).

Loveridge (1948, pp. 358–359) considered *Leiolopisma morokana* Parker (1936) a subspecies of *L. stanleyana*. I have elsewhere

(Zweifel, 1972b) given reasons for treating *L. morokana* as a separate species, so I use the binomial here.

Lobulia stanleyana is a common species in primary forest throughout the entire central mountainous region of New Guinea. It has not previously been reported from the Huon Peninsula, undoubtedly because of the dearth of herpetological collections from higher elevations there. The specimens from Kotkin (1200 m.) are from the lowest elevation I know of for this species. Principally a forest-dweller, *L. stanleyana* occurs above the forest growth, as on Mt. Hagen (Western Highlands Province) where E. Thomas Gilliard collected specimens (71200–71225) "on steep grassy slope leading to summit [3440 m.]" (field notes).

Lobulia stanleyana and *L. elegans* frequently are found in sympatry. The former typically is seen in sunny spots on the leaf litter, whereas the latter is more often off the forest floor on rocks, stumps, or low on tree trunks.

Prasinohaema flavipes (Parker)

Kabwum, *ca.* 1370 m. (95826–95829); Gang Creek, 1370 m. (95831); Kotkin (95830).

Brongersma (1949) described "*Lygosoma (Leiolepisma) flavipes paniaiense*" from the Wissel Lakes region of Irian Jaya, and diagnosed it as differing from *L. flavipes* Parker "in having a distinct (although sometimes divided) palpebral disc, a slightly higher number of supraciliaries, and in having a higher number of scales from the parietals to the posterior border of the hindlimbs." The dorsal scale counts given are 70 to 88 for 23 specimens of *paniaiense* and 58 to 66 for three specimens of *flavipes* from Mt. Wilhelm. Parker (1936, p. 89) described the holotype as having "no palpebral discs." Loveridge (1948, p. 354) described the "distinct, though small" palpebral discs of the specimens from Mt. Wilhelm, and Brongersma referred to a specimen from this locality as "showing a small disc, although it is more granular than in *paniaiense*." Brongersma suggested that the specimens from Mt. Wilhelm may represent a third subspecies.

The six specimens from the Huon Peninsula are the first to be recorded from there. The number of dorsal scales ranges from 67 to 76 (mean, 71) and so does not agree with *paniaiense* or *flavipes* as diagnosed by Brongersma. The palpebral disc is small but undivided. Whether any geographic populations of this species deserve nomenclatural recognition can be determined only by study of the large amount of material of this species that has accumulated in museums since Brongersma's work was done. For the present, I prefer not to give a subspecific assignment to the specimens from the Huon Peninsula.

This species is notable for great individual variation in color and pattern, evidently a polymorphic condition (Greer and Raizes, 1969; Woodruff, 1972). Two specimens in the present series have a broad brown dorsal band, eight scale rows wide, that contrasts with the light tan of the sides. The remaining four lizards have a pattern on the body of dark brown crossbands on a slightly lighter ground color. One of the crossbanded specimens had, in life, a gray-green ground color on the body with dark brown crossbands. The top of the head was bronze, the iris brown, the palms and soles bright yellow, and the tongue and lining of the mouth blue. The color of the mouth and tongue results from the blue-green color of the lizard's blood (Greer and Raizes, 1969).

This species has suffered more than many others from instability in its generic placement. Originally described as a *Lygosoma* by Parker (1936), it was placed in *Leiolopisma* by Loveridge (1948) and in *Sphenomorphus* by Mittleman (1952). Greer (1970a) listed it as a member of the *flavipes* species group of *Leiolopisma,* but earlier, Greer and Raizes (1969) indicated that generic status was warranted for *flavipes* and two related forms. Adding to the confusion, Maderson (1970) used Greer's unpublished manuscript name *Chlorohaemus* for *L. flavipes* and *L. virens*. Finally, Greer (1974) provided the name used here.

Prasinohaema virens virens (Peters)

Gusiko (66693–66696, 66698).

Loveridge (1948) reported specimens from Gusiko.

Sphenomorphus anotus Greer

Masba Creek (95880, 95881).

At the time of its description (based on specimens collected on the Seventh Archbold Expedition; Greer, 1973), this species was known only from the type locality. However, Dr. Greer informs me (*in litt.*) that subsequently the Museum of Comparative Zoology has received specimens collected at Popondetta, Lego, and Sangara, all in Northern Province.

What appears to be the closest relative of *Sphenomorphus anotus* is *S. microtympanus* Greer (1973). It was found at Garaina, about 200 km. south of Masba Creek and 160 km. northwest of Popondetta.

Sphenomorphus derooyae (Jong)

Masba Creek (95867); Gang Creek (95504, 95868–95874); Kabwum (95875–95877).

These are secretive skinks of the forest floor. I found one beneath a log, and others were captured when they wandered out of the leaf litter and onto adjacent bare ground in the camp clearing.

Identification of the specimens as this species, which has scarcely been mentioned in the literature since its original description (deJong, 1927), is based on comparison with specimens identified as *derooyae* by Greer and on the concordance between characters of scutellation of my sample and of a sample reported by Greer and Parker (1974, table 2). Eight of the 12 specimens in my sample are larger than the maximum of 71 mm. snout-vent length given by Greer and Parker (my maximum, 85 mm.), but this could merely reflect geographic variation or the larger sample size.

This is an elongate, relatively short-legged form with the following scutellation: no supranasals, prefrontals in contact, four supraoculars, paired frontoparietals, parietals enclosing a large interparietal, eyelid without a disc, two to five enlarged nuchals on a side (only one specimen has two, and only on one side), two median rows of dorsal scales slightly broadened, 95 to 109 (mean 101.5; N = 10) scale rows from occiput to base of tail, 34 to 36 (mean 34.9; N = 10) scale rows around midbody, the sixth (nine individuals) or the fifth (three individuals) supralabial directly beneath the eye, and 20 to 25 (mean 22.6; N = 10) keeled lamellae beneath the fourth toe, which is notably longer than the third.

The dorsal ground color is gray-brown to dark brown with small light gray or light brown spots arranged roughly in transverse rows. The abdomen was yellowish green in a juvenile, but peach color in adults. The underside of the tail is heavily pigmented with dark gray, the chin and throat somewhat less so. The three largest specimens measure 81, 84 and 85 mm. snout to vent.

These specimens are the first of their species to be identified from the Huon Peninsula.

Sphenomorphus granulatus (Boulenger)

Masba Creek (95782, 95783).

The specimens from the Huon Peninsula were taken on the ground in rain forest. They agree in all pertinent characteristics with Boulenger's (1903) description and illustration of the type-specimen, supposedly captured at an elevation of 6000 feet in the Albert Edward Mountains, but possibly from a lower elevation (see Zweifel, 1979a, p. 16).

I find only three literature references to specimens of this species since the original description. Vogt (1912) mentioned, without comment, eight specimens from an indefinite locality in the interior of Irian Jaya. In a later paper (1932) he recorded eight additional specimens from the Sepik region, but again without specific locality. Greer (1970a, p. 172) examined the skull of one of the Masba Creek specimens.

Sphenomorphus jobiensis (Meyer)

Finschhafen, sea level (95832); Masba Creek, 610 m. (95836–95845); Pindiu, *ca.* 850–910 m. (95846–95858+5); between Pindiu and Kwenzenzeng, 940 m. (95474); Zan-

garen, 1370 m. (95833, 95834); Numbut, 1220 m. (95835); Gusiko (66692, 95923); Lae (66700, 66701+1, 92322, 95475, 103609–103611).

This abundant and widespread species has suffered much nomenclatural confusion. Loveridge (1948, p. 346) recorded specimens from the Huon Peninsula as *Lygosoma megaspila papuense* and used the name *Lygosoma variegatum jobiense* for the form now known as *Sphenomorphus stickeli melanopleurus*. Inger (1958) described *S. melanopleurus* from the north coastal region of New Guinea without reference to Loveridge's paper, but later (1961) he corrected this oversight and recognized *melanopleurus* as a subspecies of Loveridge's *Lygosoma variegatum stickeli,* which he raised to specific rank as *Sphenomorphus stickeli*. He diagnosed the specific differences of *Sphenomorphus stickeli* and *Sphenomorphus jobiensis* but failed to note that *jobiensis* was the same species Loveridge had identified as *L. m. papuense*.

Another contribution to the confused synonymy of *S. jobiensis* was Loveridge's (1948, p. 348) treatment of "*Lygosoma* (*Sphenomorphus*) *aruense* (Doria)," the name he applied to lizards of the Highlands of New Guinea since named *Sphenomorphus leptofasciatus* by Greer and Parker (1974). I have examined the four syntypes of *Eumeces aruensis* Doria (Museo Civico di Storia Naturale di Genova no. 27901) and am convinced that Boulenger (1887, p. 247) was correct in considering *aruensis* a junior synonym of *Sphenomorphus jobiensis*.

Sphenomorphus jobiensis is found in lowland rain forest and evidently only sparingly as high as recorded here (4000–4500 ft.). Its absence from collections made at Gang Creek, a cool and heavily forested location at an elevation of 4500 feet, may indicate that it occurs at higher elevations only where the mature forest has been opened somewhat.

Sphenomorphus minutus (Meyer)

Finschhafen (66995); Masba Creek (95859, 95860); Tumnang, 1340 m. (95501). A specimen from Masba Creek was found on the ground in rain forest.

Sphenomorphus solomonis (Boulenger)

Lae (66682, 66683+1, 66712–66721, 92325, 103616, 103617); Pindiu, *ca.* 910 m. (95862–95865); Zangaren (95866); Tumnang (95493, 95495–95500); between Zangaren and Bullum River (95454).

The dorsal color, recorded for specimens from the last two localities listed above, is olive-brown with little trace of pattern except for slight dark edging to the scales. The head tends to be reddish brown, most markedly so in the snout region of juveniles. The chin is gray, the chest generally yellow changing gradually to peach color in the region of the hind legs. Two juveniles were entirely gray beneath.

This is one of the more abundant ground-dwelling species of low elevations; Greer and Parker (1974) map its distribution.

Loveridge (1948, pp. 350, 353) recorded both "*Lygosoma* (*Sphenomorphus*) *pardale moszkowskii* Vogt" and "*Lygosoma* (*Lygosoma*) *solomonis schodei* Vogt" from the Huon Peninsula. The scale counts and notes on color in life he gave (recorded by W. H. Stickel) show no obvious differences between the forms. I examined three of the four specimens Loveridge recorded as *moszkowskii,* and regard two from Finschhafen and Sorong to be the same species as the lizards I here identify as *S. solomonis*. Greer and Parker (1974) do not consider *schodei* a valid subspecies.

Sphenomorphus stickeli stickeli (Loveridge)

Masba Creek (95861); Gusiko (109524–109529); *ca.* 2 km. N. Bonga (66691, 95922).

For a discussion of some of the nomenclatural confusion surrounding this species, see the foregoing account of *Sphenomorphus jobiensis*. The specimen from Masba Creek was shot on a log 4 feet above the ground in rain forest. One of the specimens from Gusiko (which are topotypes) was found "on coral at bank of stream in jungle. Often seen climbing on coral to bask in the sun" (field notes of M. C. Kurtz; "coral" presumably refers to coral limestone outcrops).

Tiliqua scincoides gigas (Schneider)

Lae (95879).

Loveridge (1948) recorded this widespread species from Finschhafen and Gusiko, and Vogt (1911) had specimens from Sattelberg and Lialun.

Tribolonotus gracilis de Rooij

Lae (92318, 95438, 103625–103627).

Vogt (1911) recorded *T. novaeguineae* Schlegel from Bukaua on the Huon Peninsula. The status of *gracilis* as a species distinct from *novaeguineae* is questionable (Zweifel, 1966), and it is doubtful whether two species of *Tribolonotus* occur on the Huon Peninsula or anywhere on mainland New Guinea. The Huon Peninsula localities are the easternmost in the distribution of *Tribolonotus* along the north coast of New Guinea.

VARANIDAE

Varanus indicus indicus (Daudin)

Near Pindiu, 910 m. (95882).

Loveridge (1948) recorded this species from Gusiko, and Vogt (1911) from Bukaua. It ranges widely over New Guinea.

Varanus prasinus prasinus (Schlegel)

Vicinity of Lae (92335–92337).

This beautiful arboreal monitor is widespread in New Guinea. There is an earlier record for Sattelberg on the Huon Peninsula (Mertens, 1942).

BIOGEOGRAPHY

THE GEOLOGIC SETTING

The Finisterre and Saruwaged ranges—the mountainous backbone of the Huon Peninsula—are among the results of the long-continued interaction between the Australian tectonic plate on the southwest and the Pacific plate on the northeast that produced the main island of New Guinea (Dow, 1977). These ranges, together with other lesser ranges of mountains along the north coast of New Guinea, are landlocked parts of a Paleogene island arc system of which New Britain, New Ireland, and other associated islands still form free-standing segments (Jaques and Robinson, 1977). From the biogeographic standpoint, the most significant aspects of the Huon Peninsula region are its relatively late development in geologic time, its isolation from the mainland of New Guinea, and the effects of climatic change during the Pleistocene.

The collision between plates evidently proceeded from west to east, with the Huon Peninsula region being uplifted relatively late. Dow (1977, pl. 7) showed no land in the area in Middle Miocene. Jaques and Robinson (1977, p. 295) stated "the northern Finisterre Range-Huon Peninsula region . . . was not uplifted until the Pliocene. Uplift since then has been rapid: some 3000 m of uplift has occurred since the late Pliocene." The region is still tectonically active. Studies of terraces on the north side of the Huon Peninsula indicate rates of uplift ranging from 0.5 m. to 3.0 m. per 1000 years during the last 220,000 years (Chappell, 1974). For part of the time while the ranges were being uplifted, they remained isolated from the mainland. In his discussion of Pliocene to Holocene sedimentation, Dow (1977) said that "the Ramu-Markham Fault Zone was a narrow arm of the sea in which was deposited up to 2000 m of sandstone and conglomerate. . . ." Just when a dryland connection between the Peninsula and the rest of New Guinea formed does not appear to have been established; it may have been as late as the period of lowered sea level in the first glaciation.

The higher reaches of the Finisterre and

Saruwaged ranges were glaciated in the Pleistocene. Loeffler (1971) illustrated glacial features of the landscape and placed the Pleistocene snowline at 3650 to 3700 m. He noted that this is some 100 m. higher than on some mountains in the central ranges at the same latitude, and attributed the difference to post-Pleistocene uplift of the Peninsula rather than a different local climate. In a later paper Loeffler (1972, p. 33) stated: "The Pleistocene climate in the mountainous area was relatively uniform and temperatures were about 5 to 6° C lower than at present. . . . Pleistocene climate in Papua and New Guinea was little different from the present-day climate except for the temperatures." At the peak of the most recent glaciation (the only one for which there is firm evidence), montane grassland was greatly expanded, but not to the extent that cool, montane habitats connected the Huon Peninsula ranges with the Bismarck Range across the Ramu-Markham Valley (Hope and Hope, 1976). Deglaciation took place some 11,000 to 15,000 years ago (Hope and Peterson, 1975).

FAUNAL DISTRIBUTIONAL RELATIONSHIPS

Endemism

Table 1 lists 38 species of frogs (one introduced) and 52 species of lizards recorded from the Huon Peninsula. A curious aspect of the fauna is the scarcity of endemic species, considering the range of habitats available and the isolation of the mountainous areas of the Huon Peninsula. Among the frogs, only three of 37 native species appear to be endemic, and these are poorly known. *Nyctimystes obsoleta,* known from a single specimen from Simbang, a coastal locality near Finschhafen, appears to be distinct from any other known *Nyctimystes* (Tyler, 1965), but confirmation through the study of additional specimens is greatly needed. *Sphenophryne polysticta* is now known only from the original description (Parker, 1934) and from Méhelÿ's (1901) illustrations, the type-specimen having been destroyed. Knowledge of *Sphenophryne mehelyi* is scarcely more satisfactory, with only two specimens now considered to represent the species (see foregoing species account).

If evidence for endemism is weak among frogs, it is nonexistent among lizards. Sufficiently close attention might reveal differences on a subspecific level, but all forms now recorded are readily referred to species also found off the Peninsula.

Distributional Relationships Within New Guinea

Excluding the introduced *Bufo* and the three possible endemics, there remain 34 species of frogs to be considered. Nineteen of these are widely distributed at low elevations. Distributions of most of the remaining 15 species probably are disjunct across the low Ramu-Markham Valley.

Evidence for disjunctions of ranges is, of course, basically negative—the absence of collection records in the intervening regions. In many instances, however, information on habitat preferences or apparent altitudinal limitations (possibly reflecting temperature requirements) strengthens the case. Several of the apparently disjunct frog species are known or assumed to breed in mountain streams of a turbulent, even torrential nature, and the Ramu-Markham Valley provides no suitable breeding habitat. These include four species of *Nyctimystes* and *Litoria angiana, L. micromembrana,* and *L. wollastoni,* all hylids. The distribution of *Lechriodus aganoposis* is poorly known, but no specimen has come from below 1200 m. Three species of microhylids, *Cophixalus biroi, C. shellyi,* and *C. variegatus* appear to be similarly limited. Two species of microhylids, *Sphenophryne palmipes* and *Xenorhina doriae,* may be disjunct across the Ramu-Markham Valley, but occur at low elevations in hilly areas elsewhere. *Xenobatrachus rostratus* cannot be classified at present: the peninsular population appears to be distinctive and restricted to high elevations, yet elsewhere (as nearby as the type locality, Astrolabe Bay) frogs referred to this species evidently occur at sea level. The Huon *Rana grisea* probably represent a disjunct popu-

TABLE 1
Frogs and Lizards Recorded from the Huon Peninsula

Family and Species	Source or Authority[a]
Bufonidae	
Bufo marinus (Linnaeus)	AMNH
Leptodactylidae	
Lechriodus aganoposis Zweifel	Archbold Expedition (AMNH)
Hylidae	
Litoria amboinensis (Horst)	AMNH
Litoria angiana (Boulenger)[b]	Archbold Expedition (AMNH)
Litoria eucnemis (Lönnberg)	AMNH
Litoria genimaculata (Horst)	AMNH
Litoria i. infrafrenata (Günther)	Archbold Expedition (AMNH)
Litoria micromembrana (Tyler)[b]	Archbold Expedition (AMNH)
Litoria nigropunctata (Meyer)	Menzies, 1972
Litoria thesaurensis (Peters)	Archbold Expedition (AMNH)
Litoria wollastoni (Boulenger)	Archbold Expedition (AMNH)
Nyctimystes disrupta Tyler[b]	Archbold Expedition (AMNH)
Nyctimystes foricula Tyler[b]	Archbold Expedition (AMNH)
Nyctimystes kubori Zweifel[b]	Archbold Expedition (AMNH)
Nyctimystes obsoleta (Lönnberg)	Tyler, 1965
Nyctimystes pulchra (Wandolleck)[b]	Archbold Expedition (AMNH)
Nyctimystes sp.[b]	Archbold Expedition (AMNH)
Ranidae	
Platymantis papuensis Meyer	Archbold Expedition (AMNH)
Rana daemelii (Steindachner)	Archbold Expedition (AMNH)
Rana grisea van Kampen[b]	Archbold Expedition (AMNH)
Rana sp. (pond form)	Archbold Expedition (AMNH)
Rana sp. (stream form)	Menzies, 1976
Microhylidae	
Cophixalus biroi (Méhelÿ)	Archbold Expedition (AMNH)
Cophixalus cheesmanae Parker[b]	AMNH, SAM
Cophixalus pipilans, new species[b]	AMNH, MCZ, YPM
Cophixalus shellyi Zweifel[b]	Archbold Expedition (AMNH)
Cophixalus variegatus (van Kampen)	Archbold Expedition (AMNH)
Copiula fistulans Menzies and Tyler	AMNH
Hylophorbus r. rufescens Macleay	Archbold Expedition (AMNH)
Oreophryne sp.	Archbold Expedition (AMNH)
Phrynomantis lateralis (Boulenger)	Archbold Expedition (AMNH)
Phrynomantis robusta (Boulenger)	Archbold Expedition (AMNH)
Sphenophryne mehelyi Parker	BBM, MCZ
Sphenophryne palmipes Zweifel[b]	Archbold Expedition (AMNH)
Sphenophryne polysticta (Méhelÿ)	Parker, 1934
Xenobatrachus rostratus (Méhelÿ)	Archbold Expedition (AMNH)
Xenobatrachus subcroceus Menzies and Tyler	AMNH, MCZ
Xenorhina doriae (Boulenger)	Zweifel, 1972a
Gekkonidae	
Cyrtodactylus loriae (Boulenger)	Archbold Expedition (AMNH)
Cyrtodactylus louisiadensis (de Vis)	Archbold Expedition (AMNH)

TABLE 1—(*Continued*)

Family and Species	Source or Authority[a]
Cyrtodactylus novaeguinea (Schlegel)	Archbold Expedition (AMNH)
Cyrtodactylus pelagicus (Girard)	AMNH
Cyrtodactylus vankampeni (Brongersma)	Archbold Expedition (AMNH)
Gehyra interstitialis Oudemans	Vogt, 1911
Gehyra mutilata (Wiegmann)	Archbold Expedition (AMNH)
Gehyra vorax Girard	AMNH
Gekko vittatus Houttuyn	Archbold Expedition (AMNH)
Hemidactylus frenatus Duméril and Bibron	Archbold Expedition (AMNH)
Hemiphyllodactylus t. typus Bleeker	Loveridge, 1948
Lepidodactylus lugubris (Duméril and Bibron)	Archbold Expedition (AMNH)
Lepidodactylus magnus Brown and Parker	Archbold Expedition (AMNH)
Lepidodactylus novaeguineae Brown and Parker	AMNH
Pygopodidae	
Lialis jicari Boulenger	Archbold Expedition (AMNH)
Agamidae	
Gonocephalus dilophus (Duméril and Bibron)	Lönnberg, 1900
Gonocephalus modestus Meyer	Archbold Expedition (AMNH)
Gonocephalus papuensis (Macleay)	Archbold Expedition (AMNH)
Scincidae	
Carlia fusca (Duméril and Bibron)	Archbold Expedition (AMNH)
Cryptoblepharus boutoni pallidus Mertens	Archbold Expedition (AMNH)
Emoia atrocostata irrorata (Macleay)[b]	Archbold Expedition (AMNH)
Emoia baudinii verecunda Brown[b]	Archbold Expedition (AMNH)
Emoia c. caeruleocauda (de Vis)	Archbold Expedition (AMNH)
Emoia cyanogaster longicauda Macleay	AMNH
Emoia loveridgei Brown	Archbold Expedition (AMNH)
Emoia mivarti (Boulenger)[b]	Archbold Expedition (AMNH)
Emoia p. pallidiceps de Vis[b]	Archbold Expedition (AMNH)
Emoia physicae physicae (Duméril and Bibron)	Archbold Expedition (AMNH)
Emoia submetallica popei Brown[b]	Archbold Expedition (AMNH)
Eugongylus albofasciolatus (Gunther)	Vogt, 1911
Eugongylus rufescens (Shaw)	Archbold Expedition (AMNH)
Lamprolepis smaragdina perviridis (Barbour)	Archbold Expedition (AMNH)
Lipinia longiceps (Boulenger)	Archbold Expedition (AMNH)
Lipinia noctua (Lesson)	Archbold Expedition (AMNH)
Lipinia pulchra (Boulenger)	Archbold Expedition (AMNH)
Lobulia elegans (Boulenger)[b]	Archbold Expedition (AMNH)
Lobulia stanleyana (Boulenger)[b]	Archbold Expedition (AMNH)
Prasinohaema flavipes (Parker)[b]	Archbold Expedition (AMNH)
Prasinohaema v. virens (Peters)	Loveridge, 1948
Sphenomorphus anotus Greer	Archbold Expedition (AMNH)
Sphenomorphus derooyae (Jong)[b]	Archbold Expedition (AMNH)
Sphenomorphus granulatus (Boulenger)[b]	Archbold Expedition (AMNH)
Sphenomorphus jobiensis (Meyer)	Archbold Expedition (AMNH)
Sphenomorphus minutus (Meyer)[b]	Archbold Expedition (AMNH)
Sphenomorphus muelleri (Schlegel)	Vogt, 1911
Sphenomorphus pratti neuhaussi (Vogt)	Vogt, 1911

TABLE 1—(*Continued*)

Family and Species	Source or Authority[a]
Sphenomorphus solomonis (Boulenger)	Archbold Expedition (AMNH)
Sphenomorphus stickeli stickeli (Loveridge)	Archbold Expedition (AMNH)
Tiliqua scincoides gigas (Schneider)	Archbold Expedition (AMNH)
Tribolonotus gracilis de Rooij	Archbold Expedition (AMNH)
Varanidae	
Varanus i. indicus (Daudin)	Archbold Expedition (AMNH)
Varanus p. prasinus (Schlegel)	Archbold Expedition (AMNH)

[a] Where specimens were collected on the Archbold Expedition, this is indicated. References for specimens examined including those collected on the Expedition are: AMNH (American Museum of Natural History); BBM (Bernice P. Bishop Museum); SAM (South Australian Museum); MCZ (Museum of Comparative Zoology, Harvard University); YPM (Yale Peabody Museum). Where no specimens were examined, the most pertinent literature reference is cited.

[b] First published record for the Huon Peninsula; records for some other species collected for the first time on the Huon Peninsula by the Archbold Expedition have been published elsewhere.

lation, though there is possible confusion with a lowland form (see foregoing account).

The lizard fauna of the Huon Peninsula is composed almost wholly of species widespread at low elevations (though many range up into the mountains). Only four of the 52 species are upland forms almost certainly disjunct across the Ramu-Markham Valley: *Lepidodactylus magnus* (Gekkonidae); *Lobulia elegans, L. stanleyana,* and *Prasinohaema flavipes* (Scincidae). A fourth species of skink, *Sphenomorphus brunneus,* is recorded from Boana to the west of the Huon Peninsula and probably has its range interrupted by the Valley (Greer and Parker, 1974).

Figure 14 illustrates the distributions of most of the species of frogs and lizards with disjunct populations on the Huon Peninsula. One relationship is immediately evident: almost all the species occur in the mountain mass west of the Peninsula (see fig. 12 for elevations), and some of these extend into the mountains along the southeastern tail of New Guinea.

Only one clearly north coast distribution is seen—that of *Cophixalus biroi* (fig. 14I). But even in this instance, the most closely similar species are in the mountains to the south and west (Zweifel, 1979b). *Sphenophryne palmipes* is an oddity (fig. 14K). It is found along the north flanks of the eastern ranges, occurs close to sea level at Milne Bay (and possibly also at Finschhafen, if that locality is to be taken literally), and has a disjunct population in the southern drainages west of its major distributional area. *Xenorhina doriae* (not mapped) is distributed much like *S. palmipes,* including a possibly disjunct western population, but is found on both northern and southern slopes of the southeastern mountains. *Cophixalus variegatus* and *Rana grisea* (not mapped) are not amenable to analysis because of unresolved problems with sibling species.

Although it is possible to identify an upland assemblage of species in the Huon Peninsula disjunct from populations elsewhere, this is not a fauna restricted to high elevations. Lower elevational limits for most of the species are in the vicinity of 1100–1200 m., with none higher than 1400 m. At least five species (*Litoria wollastoni, Nyctimystes pulchra, Cophixalus biroi, Sphenophryne palmipes, Lobulia elegans*) are known below 1000 m., although this may not be characteristic. In fact, one of the remarkable features of the frog fauna of the peninsular mountains

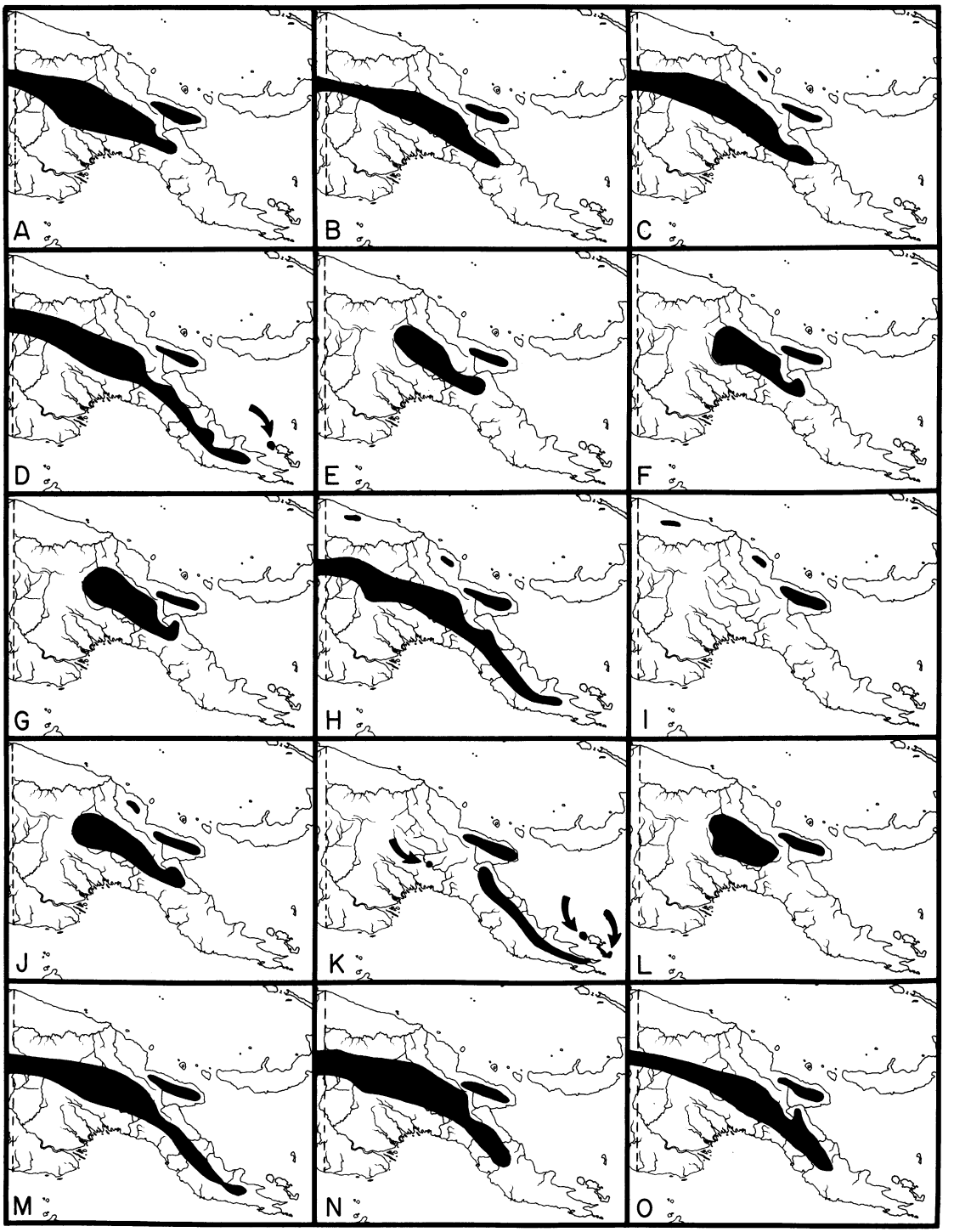

FIG. 14. Distributions in Papua New Guinea of frogs and lizards with disjunct populations on the Huon Peninsula. A. *Lechriodus aganoposis*; B. *Litoria angiana*; C. *L. micromembrana*; D. *L. wollastoni*; E. *Nyctimystes disrupta*; F. *N. foricula*; G. *N. kubori*; H. *N. pulchra*; I. *Cophixalus biroi*; J. *C. shellyi*; K. *Sphenophryne palmipes*; L. *Lepidodactylus magnus*; M. *Lobulia stanleyana*; N. *Prasinohaema flavipes*; O. *Lobulia elegans*.

is the apparent absence of high altitude species. For comparison, in the mossy forest at 2000–2200 m. on Mt. Kaindi, about 120 km. south-southwest of similar elevations in the Saruwaged Range, one encounters several microhylids apparently limited to high elevations: *Barygenys flavigularis* Zweifel, *Cophixalus cryptotympanum* Zweifel, *C. kaindiensis* Zweifel, *C. parkeri* Loveridge, *C.* sp., and *Phrynomantis stictogaster* Zweifel. None of these has been found on the Peninsula, and only *C. kaindiensis* and its sibling *C. parkeri* have a possibly close relative there (*C. biroi*). It is unlikely that inadequate collecting is the explanation. Hobart Van Deusen spent the month of August 1964 at the "Plains of Ulur Camp" at 2380 m. in the Cromwell Mountains (Van Deusen, 1978) and ascended nearby peaks to 2800 m. Experienced in collecting frogs in high altitude forest on Mt. Kaindi, Mt. Wilhelm, and other Papuan peaks, he was astonished at the lack of frogs. In a letter written August 12, he mentioned "have not heard a frog here." On August 24 he commented: "This gives us a record of rain every day except one since we arrived here! . . . We have not heard a frog in the area! Incredible but true."

Because the Huon Peninsula region is geologically related to the north coast ranges of New Guinea, it is appropriate briefly to compare the faunas of the Huon Peninsula and the Adelbert Mountains, the coastal range closest to the Finisterre-Saruwaged mountain mass. The Adelberts are a relatively low range, maximum elevation about 1500 m. Foothills of the two upland areas lie only about 30 km. apart, with the Gogol River in the intervening lowlands.

Information on the herpetofauna of the Adelberts is relatively limited, but I and other members of the Alpha Helix Expedition collected there in 1969, the American Museum of Natural History has a small collection made by E. Thomas Gilliard in 1959, and a collection of frogs, including specimens from high elevations, is at my disposal thanks to Dr. Alan Ziegler of the Bishop Museum. I have records of 60 species (31 lizards, 29 frogs) from the Adelberts and the adjacent coastal region. At least two-thirds of these are common to the Adelbert region and the Huon Peninsula, and for the most part constitute widespread forms of lowland and foothill habitats. Four apparently disjunct forms are mapped in figure 14. Several among the remainder are yet to be resolved taxonomically.

A peculiar feature of the herpetofauna of the Adelbert Mountains is the presence there of a number of species absent from the Huon Peninsula, so far as is known, but recorded in coastal ranges 300 km. or more to the west of the Adelberts. The group includes two lizards and five microhylid frogs: *Cyrtodactylus sermowaiensis* (de Rooij) and *Lobulia brongersmai* (Zweifel); *Choerophryne rostellifer* (Wandolleck), *Sphenophryne cornuta* Peters and Doria, *Sphenophryne schlagenhaufeni* Wandolleck, *Xenobatrachus obesus* Zweifel, and *Xenorhina oxycephala* (Schlegel).

Collecting along the north flank of the Finisterre Range adjacent to the Adelbert Mountains may alter the picture, but at present the short distance between the Adelberts and the Finisterres appears zoogeographically greater than the much larger gap between the Adelberts and the other north coast ranges.

Faunal Relationship to New Britain

Because of the proximity of New Britain to the Huon Peninsula, and especially because of the geologic relationship of the two areas as part of the same island arc system, comparison of their faunas is called for. It is at once evident (fig. 14) that the areas share no highland component, although western New Britain has elevations in excess of 1900 m. Two species of frogs common to the two faunas—*Litoria infrafrenata* and *L. thesaurensis*—are abundant, widespread, lowland forms. The single *Rana* known on New Britain probably falls in the same category, but the systematics of that genus remain to be elucidated. The highly endemic frog fauna of New Britain is composed mostly of ranids whose relatives are in the Solomon Islands to the east rather than in New Guinea. In contrast to the frogs, there are many species of lizards common to the two areas (Hediger,

1934, pp. 563–564), but these are lowland forms, many of which have demonstrated their potential for overwater dispersal by colonizing volcanic islands such as Karkar. In short, the frogs and lizards show no special faunal relationship between New Britain and the Huon Peninsula. Faunal similarities among the lizards can reasonably be attributed to overwater dispersal, and the absence from New Britain of virtually all of the lowland frog component of the Peninsula speaks for the lack of any previous land connection between the two regions.

HISTORY OF THE PENINSULAR FAUNA

The following points may be gleaned from the preceding discussion: (1) the block of land of which the Huon Peninsula is part underwent most of its uplift since the late Pliocene and from its origin through part of its history was an island, separated from the mainland of New Guinea by an arm of the sea along the axis of the present Ramu-Markham Valley; (2) endemism among frogs is so low as to be virtually negligible and is nonexistent at the species level among lizards; (3) 48 of 52 species of lizards in the study area (92%) and 19 of 35 nonendemic species of native frogs (54%) inhabit lowlands: (4) among the species of frogs and lizards with disjunct populations on the Peninsula, all range at least as low as 1400 m., most to 1100 m., and some even below 1000 m.; (5) the Peninsula appears to lack a high altitude frog fauna such as is present at similar elevations along the central montane axis of New Guinea.

Given the foregoing observations, the following hypothetical history of the frog and lizard faunas is advanced. The first lands of the Finisterre-Saruwaged mass rising above the tropical sea in the Pliocene were populated by a variety of lizards, mostly skinks but some geckos, dispersing across the relatively narrow waterway from larger land masses to the south and west. The potential for such dispersal seems high, in view of the relatively diverse reptile faunas of small volcanic islands such as Karkar (about 30 species: Cogger, 1966), almost certainly never with a dry-land connection to the mainland. Establishment of frog populations on the new island(s) went forward more slowly (Karkar has only four species of frogs). Interruption of the waterway as the Ramu-Markham Valley rose above sea level permitted further invasion by lizard and frog species living in low, coastal habitats, merging the insular, waif fauna with the more diverse and widespread lowland assemblage of the New Guinea mainland. Elements of this coastal fauna invaded the uplands in varying degree, but higher elevations had relatively meager faunas. The coming of Pleistocene glaciation, with concurrent cooling and lowered sea level, changed the climate of the Ramu-Markham Valley sufficiently to permit a variety of lower montane species of frogs and lizards to disperse across the Valley and become established before changing climate again made the Valley unsuitable. Never did the climate change sufficiently to permit forms now restricted to high, cool elevations of the major New Guinea mountains to make the crossing.

Thus, the present-day frog and lizard faunas of the Huon Peninsula are seen to be composed of two principal elements: lowland species, many of them widespread, with access (in a genetic sense) to populations outside the Peninsula; and a minority of species occupying higher elevations and presently cut off from conspecific populations off the Peninsular uplands. For the disjunct species, the stage is set for allopatric speciation events, but the degree of endemism detected so far is minimal. In this instance, geologic evolution seems to have outpaced organic.

These hypotheses of the derivation of the fauna may be testable by comparison with other animal groups with similar dispersal potentials. If these prove to have high degrees of endemism and well-developed high montane faunas, then one must look to other views of distributional and geological history or to vastly different rates of speciation for alternative explanations.

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