

THE BIRDS OF TIMOR AND SUMBA

ERNST MAYR

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Curator of the Whitney-Rothschild Collections

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INTRODUCTION

THE MALAY ARCHIPELAGO has fascinated naturalists ever since Wallace "put it on the map." The fact that it is the home of a greater number of endemic species and subspecies of animals than any other island region in the world has been a great stimulus to the collector who wants to discover new species. But the scientific significance of these islands goes much deeper, in view of the almost ideal conditions which they offer for the study of species formation and for the investigation of various zoogeographic problems. From the time of Wallace until today, the number of investigators who have devoted their lives to a study of these problems is legion; still the field does not even begin to be exhausted. The one point which emerges again and again from these studies is that truly lasting conclusions can be based only on adequate data. It is for this reason that new expeditions and collectors continue to visit the Indo-Australian islands to gather additional data and to fill gradually one gap in our knowledge after the other.

Although the birds of this region are better known than any other group of animals, there is still much to be learned even about their taxonomy and distribution. To fill some of the remaining gaps, in particular those concerning the central region between Bali, Celebes, and Timor, a number of expeditions were sent out during the years 1925-1937 by the museums of Berlin, Buitenzorg, Tring, and New York, all four institutions working more or less closely together. Dammerman visited Sumba in 1925 and sent collectors to Bali and Flores. Rensch in 1927 made a thorough survey of Lombok, Sumbawa, and Flores and a more casual one of Bali. Baron Plessen visited Bali in 1925, and the Djampea group and the islands of Alor and Lomblen in 1927. Heinrich devoted himself to an intensive

ornithological exploration of Celebes, which lasted from May, 1930, to February, 1932. The taxonomic and zoogeographical results of these expeditions have been published in a number of substantial books and monographs, of which I shall single out only Rensch's "*Geschichte des Sundabogens*" (1936) and Stresemann's "*Vögel von Celebes*" (1939-1941). References to preliminary and more technical papers are included in these two works.

It was in connection with this program of exploration that Dr. Erwin Stresemann suggested to Mr. J. Sterling Rockefeller that he sponsor an expedition to Sumba and Timor, two islands of which the bird fauna was insufficiently known. This plan was eagerly taken up by Mr. Rockefeller, and Mr. Georg Stein was selected to conduct the expedition. Mr. Rockefeller, who took a very keen interest in Stein's work and who had originally intended himself to prepare the scientific report on the collection, deserves the gratitude of ornithological science for his patronage of this important research.

Professor H. Frade (Lisbon) extended his kind offices in obtaining the necessary permits for the work in the Portuguese territory, and Dr. Dammerman did the same in the Dutch areas. Both Portuguese and Dutch officials did everything in their power to facilitate the work of the expedition. However, more than to anybody else, the expedition owes its success to the enthusiasm of Mr. and Mrs. Georg Stein, who began their Timor work immediately after the completion of their exhausting exploration of New Guinea and who collected 1354 bird skins on Timor and 608 on Sumba in spite of many difficulties and hardships. They are to be congratulated on this splendid success.

THE BIRDS OF TIMOR

HISTORY OF EXPLORATION

TIMOR WAS ONE of the first islands of the Malay Archipelago to be explored ornithologically. A French expedition under Captain Baudin collected from August 18 to November 13, 1801, near Kupang and came back for a second visit lasting from April 30 to June 3, 1803. The naturalists of this expedition, Peron, Maugé, and Lesueur, made considerable collections from which a number of new species were described by Vieillot and Temminck. The subsequent exploration of Timor, which is connected with the names of S. Müller, A. R. Wallace, A. Everett, and C. B. Haniel, has been described in detail by Hellmayr in his classic work on the birds of Timor (Hellmayr, 1914). It would be mere repetition if I were to go over the same ground again.

Wallace in 1864 listed 118 forms for Timor, but by 1914 the number of species and subspecies known to Hellmayr had increased to 144 (not including the doubtful *Parus* nor the five forms known only from Semau Island). Even so it was obvious that the bird fauna was still insufficiently explored. It was for this reason that Stein was sent to Timor Island with specific instructions to concentrate on the fauna of the higher altitudes. The result of his exploration has far surpassed all expectations. So far as I can determine, Stein added no fewer than 25 new species and subspecies to the Timor list: *Podiceps novaehollandiae timorensis*, *Ixobrychus sinensis*, *Hieraaetus fasciatus renschi*, *Circus assimilis rogersi*, *Circaetus gallicus*, *Gallinula tenebrosa frontata*, *Squatarola squatarola*, *Charadrius alexandrinus ruficapilla*, *Charadrius mongolus stegmanni*, *Erolia ruficollis*, *Gallicolumba hoedtii*, *Tanygnathus megalorhynchos hellmayri*, *Caprimulgus macrurus*, *Mirafra javanica timorensis*, *Hirundo striolata rothschildiana*, *Motacilla cinerea caspica*, *Geokichla doherthyi*, *Turdus poliocephalus sterlingi*, *Pnoepyga pusilla timorensis*, *Acrocephalus arundinaceus orientalis*, *Acrocephalus arundinaceus sumbae*, *Bradypterus montis*, *Seicercus montis paulinae*, *Dendrobiastes hyperythrus clarae*, and *Zosterops montana steini*. Eight of these are winter visitors, and the remaining 17 are new records of breeding species or subspecies. Of

the 11 typical mountain birds (not collected below 1000 meters), only five had been previously known from Timor. If we add the three species to the Timor fauna, which up to now are known only from little Semau Island (*Fregata minor*, *Megapodius freycinet*, and *Falco cenchroides*), we get a grand total of 176 species and subspecies. If full species only are counted the total is 168. Of these, 137 are assumed to be breeding species and 31 migrants or visitors. There is little reason to believe that this figure will be increased materially in the future. Even though Timor is by far the largest of the Lesser Sunda Islands, with an area of about 32,000 square kilometers, its bird fauna is actually poorer than that of Flores Island with 143 breeding species. The reason for this faunal poverty is twofold, namely, the peripheral position of Timor and the great aridity of the island. Java with an area of 125,000 square kilometers has about 340 species, and Celebes with 180,000 square kilometers has about 220 species.

DIFFERENCES BETWEEN WESTERN AND EASTERN TIMOR

It is well known that the elongated islands of the Lesser Sunda chain show considerable faunistic differences between their eastern and western districts. Java is a striking example of this phenomenon. Of its 340 species of breeding birds, about 80 are restricted to the western half of the island, and probably less than 200 reach the easternmost district. The same is true, to a lesser extent, for Sumbawa and Flores, as Rensch has indicated. Timor is no exception to this rule, as shown by Stein's exploration. Hellmayr (1914) knew only of a single case (*Trichoglossus iris*) of a subspecific difference between west and east Timor birds; Stein has added four additional ones:

GEOGRAPHIC VARIATION ON TIMOR ISLAND

Species	Western Subspecies	Eastern Subspecies
<i>Synoicus ypsilophorus</i>	<i>raalteni</i>	near <i>castaneus</i>
<i>Trichoglossus iris</i>	<i>iris</i>	<i>rubripileum</i>
<i>Geokichla peronii</i>	<i>peronii</i>	<i>audacis</i>
<i>Turdus poliocephalus</i>	<i>schlegelii</i>	<i>sterlingi</i>
<i>Philemon inornatus</i>	<i>inornatus</i>	<i>robustus</i>

Additional differences between western and eastern Timor are indicated by the fact that a number of species have so far been collected only either in western or in eastern Timor, as the appended tabulation shows. Everett's collecting station Atapupu has been included by me with western Timor. The number of collectors is listed in parenthesis after each species. Twenty-four to twenty-six species have been recorded up to now only from western Timor and eight species only from eastern Timor. This list will undoubtedly be reduced with the better exploration of the island.

SPECIES KNOWN ONLY FROM WESTERN TIMOR

Hieraaëtus fasciatus renschi (1), *Excalfactoria chinensis lineatula* (1), *Gallinula tenebrosa frontata* (1), *Irediparra g. gallinacea* (2), *?Ptilinopus regina flavicollis* (6) [*?Wallace*, eastern Timor], *Macropygia ruficeps orientalis* (1), *Gallicolumba hoedtii* (1), *Tanygnathus megal. hellmayri* (2), *Cuculus poliocephalus lepidus* (2), *Caprimulgus macrurus* subsp. (1), *Alcedo atthis floresiana* (3), *Pitta brachyura elegans* (2), *Hirundo striolata rothschildiana* (1), *Geokichla dohertyi* (1), *Zoothera andromedae* (1), *Brachypteryx l. leucophrys* (2), *Pnoepyga pusilla timorensis* (1), *Urosphena s. subulata* (3), *Cettia montana everetti* (4), *Seicercus montis paulinae* (1), *Dicaeum sanguinolentum hanieli* (2), *Zosterops montana steini* (1), *Pseudozosterops mülleri* (4), *Lonchura molucca propinqua* (3), and *?Erythrura tricolor* (5) [*?Wallace*, east Timor].

SPECIES KNOWN ONLY FROM EASTERN TIMOR

Circus assimilis rogersi (1), *Rallus philippensis chandleri* (3), *Poliolimnas c. cinereus* (3), *Merops philippinus javanicus* (3), *Mirafra javanica timorensis* (1), *Hirundo tahitica frontalis* (3), *Megalurys t. timoriensis* (1), and *Acrocephalus arundinaceus sumbae* (1).

STEIN'S ITINERARY

Unfortunately, Stein has published no report on his Timor and Sumba expeditions. Since he cannot be reached at the present time and since there is not even a manuscript report available, it becomes necessary to re-

construct his itinerary from the meager data on the labels. He arrived in Kupang, Netherlands Timor, apparently about December 20, 1931, and began almost immediately to study the lowland fauna of western Timor. He collected at Kupang from December 21 to 31, at Tjamplong (160 meters) from January 5 to 29, and at Noilmina (300 meters) from January 30 to February 10. From here the highest mountain of western Timor, Mt. Mutis, was climbed, and a camp was established between February 20 and March 8 at about 2000 meters altitude. Some collections were also made at medium altitudes, such as Bonleo (1100 meters, February 22, 28) and Soë (February 15, March 23). The end of March was spent at Supul and Niki Niki (720 meters, March 26-31). In April the expedition proceeded to Portuguese Timor, where collections were made at the coast near Dilly (April 16-25) and on Mt. Ramelan (2600 meters, April 30, May 1-6). Much was expected from the previously unexplored high mountains of eastern Timor, but the result was disappointing. Villages occur up to an altitude of 2300 meters, and the forests have, therefore, entirely disappeared from the mountains. Stein found only open eucalyptus groves without undergrowth. This explains why so many of the characteristic mountain birds of western Timor seem to be entirely lacking in the mountains of Portuguese Timor as, for example, *Ducula cineracea*, *Geokichla dohertyi*, *Brachypteryx leucophrys*, *Pnoepyga pusilla*, *Bradypterus montis*, *Urosphena subulata*, *Seicercus montis*, and *Dicaeum sanguinolentum*.

The complete lack of field notes unfortunately makes it impossible to study the ecology of Timor birds in connection with the climate and the vegetational types of the island. To make such an analysis will well reward future students of Timor. Particularly interesting will be to study what species are associated with the Australian flora (*Eucalyptus* and other genera) and what influence the long dry season has on the habits of birds.

ANNOTATED LIST OF STEIN'S TIMOR COLLECTION

The taxonomic and faunistic knowledge of birds has reached a level at which it is no longer justifiable to publish expensive lists

containing all the details of every single one of the collected specimens. To present merely a skeleton list of the contents of the col-

lection, followed by a detailed discussion of the more interesting species, is much more economical and permits the recording of a scientifically equivalent amount of data. This course has been followed in the working out of G. Stein's collections. Every single specimen was studied, measured, and compared with the other museum material. These findings were recorded, however, only in those cases in which they added to our previous knowledge. Many of these discussions refer to species which occur jointly on Timor and Sumba, and in order to avoid repetition the material on both islands was combined in a separate section.

* = See taxonomic notes on Timor and Sumba birds (p. 144).

† = First record for Timor.

[] = Species recorded from Timor by other collectors, but not obtained by Stein.

Podiceps ruficollis vulcanorum Rensch

4 ♂ ad., 1 ♀ ad., 8 downy young of various sizes, Supul (Niki Niki) (March 26–31). The eggs were described by Schönwetter (1934, p. 41).

† *Podiceps novaehollandiae timorensis* Mayr

1 ♂ ad., Supul (March 30). See Mayr, 1943, Emu, vol. 43, p. 7.

[*Phalacrocorax m. melanoleucos* (Vieillot).

Obtained by S. Müller and Wallace]

Notophox n. novaehollandiae (Latham)

1 ♂, Noilmina; 2 ♂, Supul. See Amadon, 1942, Amer. Mus. Novitates, no. 1175, pp. 2–3.

Butorides striatus steini Mayr

1 ♂ ad., Dilly. See Mayr, 1943, Emu, vol. 43, p. 10.

[*Bubulcus ibis coromandus* Boddaert. Obtained by Wallace and Carvalho]

[*Cosmerodius albus modestus* (Gray).

Collected by Lesueur and Wallace]

Demigretta sacra sacra (Gmelin)

1 ♂ subad., Noilmina (gray phase).

[*Egretta garzetta nigripes* Temminck.

Collected by Wallace]

Nycticorax caledonicus hilli Mathews

1 ♂ imm., Noilmina.

† *Ixobrychus sinensis sinensis* (Gmelin)

2 ♂ ad., Dilly (April 17, 18).

Dupetor flavicollis australis (Lesson)

1 ♀, Noilmina.

Platalea leucorodia regia Gould

1 ♂ ad., 1 ♀ ad., Dilly (April 17).

[*Dendrocygna arcuata* (Horsfield).

Obtained by Wallace]

Anas superciliosa rogersi Mathews

1 ♂, Supul; 1 ♀, Nenas. The eggs were described by Schönwetter (1934, p. 41).

Anas g. gibberifrons Müller

2 ♂, Dilly.

Aviceda subcristata timorlaoensis Meyer

1 ♀ nestling, Noilmina.

Milvus migrans affinis Gould

1 ♂, Niki Niki.

Haliastur indus intermedius Blyth

1 ♂ ad., Dilly; 1 ♀ ad., Bonleo; 1 ♀ imm., Tjamplong.

[*Accipiter virgatus gularis* (Temminck and Schlegel). Collected by Wallace. Migrant]

Accipiter fasciatus hellmayri Stresemann

2 ♂ ad., 1 ♀ ad., Tjamplong; 1 ♂ ad., Kupang; 1 ♂ ad., 1 ♀ ad., Niki Niki.

[*Haliaeetus leucogaster* (Gmelin).

Collected by Everett]

† *Hieraaetus fasciatus renschi* Stresemann

1 ♂ ad., Noilmina. See Mayr, 1941, Ornith. Monatsber., vol. 49, p. 43.

† *Circus assimilis rogersi* Mathews

1 ♀ [= ♂] imm., Dilly (April 17). See Amadon, 1941, Emu, vol. 40, p. 374.

† *Circaetus gallicus* subspecies

1 ♀ ad., Tjamplong (Jan. 10). See Mayr, 1941, Ornith. Monatsber., vol. 49, p. 43.

[*Falco longipennis hanieli* Hellmayr.

Obtained by several collectors]

Falco moluccensis timorensis Mayr

1 ♂, Noilmina; 2 ♂, 2 ♀, Tjamplong; 1 ♀, Niki Niki; 1 ♀, Mt. Ramelan; 1 ♀, Dilly. See Mayr, *tom. cit.*, pp. 46–47.

* *Synoicus ypsilophorus raaltenii* Müller

12 ♂ ad., 2 ♂ subad., 8 ♀ ad., Noilmina; 2 ♂ imm., 1 ♂ chick, Tjamplong (Jan. 14); 3 small chicks, Niki Niki (March 28).

* *Synoicus ypsilophorus* subspecies

3 ♂ ad., 2 ♀ ad., Dilly.

[*Excalfactoria chinensis lineatula* Rensch.

Collected by Péron and Maugé]

Gallus gallus gallus Linnaeus

1 ♂ chick, Bonleo.

**Turnix maculosa maculosa* (Temminck)

2 ♂, 1 ♀, Noilmina; 1 ♂, Tjamplong.

**Rallus philippensis chandleri* (Mathews)

1 ♂ ad., 3 ♀, Dilly. The eggs were described by Schönwetter (1934, p. 40).

Poliolimnas c. cinereus (Vieillot)

3 ♂, 2 ♀, Dilly.

Amaurornis phoenicurus leucomelas (S. Müller)

1 ♂, Noilmina; 2 ♂, 1 ♀, Tjamplong.

†*Gallinula tenebrosa frontata* Wallace

2 ♂, 3 ♀, Supul.

Porphyrio porphyrio melanopterus Bonaparte

1 ♂ ad., 2 ♂ imm., 2 ♀ ad., 1 ♀ imm., 1 chick Supul (March 30). For a description of the eggs, see Schönwetter (1934, p. 41).

[*Irediparra g. gallinacea* (Temminck).

Obtained by several collectors]

†*Squatarola¹ squatarola* (Linnaeus)

1 unsexed, Dilly (April 18).

Pluvialis dominica fulva (Gmelin)

1 ♂, 1 ♀, Bonleo (Feb. 27, 28); 1 ♀, Dilly (April 18).

†*Charadrius alexandrinus ruficapilla*
Temminck

2 ♂, 3 ♀, Dilly (April 17, 18). Wing, male, 100.5, 101.5, female, 99, 102, 102.5; tail, male, 39, 40, female, 38, 39, 39; tarsus, male, 26, 28, female, 25, 27, 28. There are no differences of size or coloration between the present series and a series of Australian birds. The species is probably only a winter visitor on Timor.

†*Charadrius mongolus stegmanni*
Stresemann

1 ♂, 1 ♀, Dilly (April 18). Both birds are in breeding dress and share with specimens from the Commander and Bering Islands the characters which Stegmann ascribes to this race. See Stresemann, 1940, Ornith. Monatsber., vol. 48, p. 55.

Tringa glareola Linnaeus

1 ♀, Supul (March 30).

Actitis hypoleucos (Linnaeus)

1 ♀, Dilly (April 16).

¹ Additional migratory shore birds obtained on Timor Island by earlier collectors but not encountered by Stein are: *Charadrius leschenaultii* Lesson, *Charadrius veredus* Gould, *Numenius phaeopus variegatus* (Scopoli), *Heteroscelus incanus brevipes* (Vieillot), *Capella megala* (Swinhoe), *Erolia acuminata* (Horsfield), *Siltia isabella* (Vieillot), and *Glareola maldivarum* Forster. See Hellmayr (1914, pp. 105–106).

†*Erolia ruficollis* (Pallas)

1 ♂, 2 ♀, Dilly (April 18).

Himantopus himantopus leucocephalus Gould

1 ♀ ad., 1 ♀ imm., Dilly (April 13). See Mayr, 1938, Amer. Mus. Novitates, no. 1007, p. 14.

**Treron psittacea* (Temminck)

3 ♂, 3 ♀ ad., 2 ♀ imm., Tjamplong; 1 ♀, Dilly.

Ptilinopus cinctus cinctus (Temminck)

7 ♂, 3 ♀, Tjamplong; 1 ♂, Bonleo; 1 ♀, Noilmina; 2 ♀, Nenas (1200 meters).

Ptilinopus regina flavicollis Bonaparte

1 ♂, 1 ♀, Kupang; 1 ♀ imm., Tjamplong.

**Ducula c. cineracea* (Temminck)

1 ♂, 3 ♀, 1 ♀ juv., Mt. Mutis (1200–2100 meters).

Ducula rosacea (Temminck)

3 ♂, 2 ♀, Noilmina; 1 ♂, Bonleo. A widespread pigeon without geographic variation, mainly found on small islands. The description of Oberholser's *amydrus* (Solombo Besar) indicates that it is based on the characters of grease-stained specimens.

Columba vitiensis metallica Temminck

1 ♂, 1 ♀, Tjamplong; 1 ♂ imm., Mt. Mutis (2100 meters).

Turacoena modesta (Temminck)

2 ♂ ad., 1 ♂ juv., Bonleo; 5 ♂ ad., 1 ♂ juv., 1 ♀, Tjamplong.

[*Macropygia ruficeps orientalis* Hartert.
Collected by Haniell]

**Macropygia phasianella magna* Wallace

4 ♂, Tjamplong.

Streptopelia chinensis tigrina (Temminck)

1 ♀, Kupang, 2 ♂, Tjamplong; 1 ♂, Noilmina; 1 ♂, Nenas; 2 ♂, Dilly; 1 ♂, Mt. Ramelan.

Streptopelia b. bitorquata Temminck

1 ♂, Tjamplong.

**Geopelia striata maugea* (Temminck)

3 ♂ ad., 1 ♂ imm., 3 ♀, Tjamplong; 3 ♂, Noilmina; 2 ♀, Kupang; 1 ♀, Bonleo; 4 ♂, 2 ♀, Dilly.

Chalcophaps indica timorensis Bonaparte

5 ♂, 1 ♀, Tjamplong; 1 ♀, Niki Niki; 1 chick, Supul; 1 ♂, 1 ♀, Dilly.

†*Gallilolumba hoedtii* Schlegel

1 ♂ imm., Tjamplong.

Trichoglossus haematodus capistratus
Bechstein

7 ♂, 6 ♀, Tjamplong. Belongs to the Lesser Sunda Islands group of races.

Trichoglossus euteles (Temminck)

♂, ♀, Mt. Mutis, Soë, Mt. Ramelan, Dilly; found up to 2300 meters. There is a slight difference between birds from the western (Alor, Lomblen, Pantar, Timor) and eastern (all other islands) part of the range of this species. Western adult males have the crown purer golden yellow, the back yellower, and the blue green band across the throat less pronounced. There is, however, too much overlap, and the difference is too slight to justify a new name.

Trichoglossus (Psittuteutes) iris iris
(Temminck)

2 ♂, 1 ♀, Noilmina; 1 ♀, Tjamplong; 3 ♂, 1 ♀, Soë; 2 ♂, 5 ♀, Nenas; 1 ♂, Mt. Mutis (1500 meters). All these western Timor birds belong to typical *iris*.

[Trichoglossus (Psittuteutes) iris rubripileum
(Salvadori)]

Cacatua sulphurea parvula (Bonaparte)

1 ♂, 2 ♀, Noilmina; 2 ♂, 2 ♀, Tjamplong.

Geoffroyus geoffroyi geoffroyi (Bechstein)

5 ♂ ad., 1 ♀ ad., 5 ♀ imm., Tjamplong; 1 ♀ ad., Niki Niki; 1 ♂ juv., 1 ♀ imm., Kupang. The throat is slightly more bluish green in females from Timor, more brownish olive in females from Wetar.

†*Tanygnathus megalorhynchus hellmayri*,
new subspecies

1 ♂, 1 ♀, Noilmina; 1 ♀, Tjamplong.

Aprosmictus j. jonquillaceus (Vieillot)

5 ♂, 4 ♀, Tjamplong; 1 ♀, Noilmina; 1 ♂, Mt. Mutis; 2 ♂, Dilly; 2 ♀, Mt. Ramelan.

[Cuculus canorus telephonus Heine.
Perhaps collected by S. Müller]

Cuculus saturatus horsfieldi Moore

3 ♂, Noilmina; 2 ♀, Tjamplong; 2 ♂, Mt. Mutis (1600–1800 meters). A reëxamination of Solomon Müller's types in the Leiden Museum must decide whether *canoroides* is not really the oldest name of this race and perhaps of the species. Names cannot be rejected merely because they are based on a composite type series. It will be the task of a first reviser who has access to the type series to restrict the name to one of the components.

Cuculus poliocephalus lepidus Müller

2 ♂, Tjamplong.

**Cacomantis variolosus tymbonomus* Müller

1 ♂ ad., 1 ♂ imm., 1 ♀ ad., 1 ♀ imm., Tjamplong; 1 ♂ imm., Noilmina; 1 ♂ ad., 1 ♀, Dilly.

[*Chalcites malayanus* subspecies]

**Eudynamis scolopacea everetti* Hartert

1 ♂ ad., 5 ♂ imm., 5 ♀ ad., Tjamplong.

Centropus bengalensis sarasinorum Stresemann

2 ♂, 3 ♀, Tjamplong; 2 ♂, Dilly.

**Tyto alba delicatula* (Gould)

2 ♀, Noilmina; 2 ♀, Tjamplong.

Ninox novaeseelandiae fusca (Vieillot)

4 ♀, Noilmina; 4 ♂, 6 ♀, Tjamplong; 1 ♂, Niki Niki; 1 ♂, Nenas (1200 meters); 2 ♂, 1 ♀, Mt. Mutis (2000–2300 meters); 1 ♀, Dilly; 1 ♀, Mt. Ramelan. See Mayr, 1943, Emu, vol. 43, p. 13.

†*Caprimulgus macrurus* subspecies

1 ♀ juv., Tjamplong. The single juvenal is inadequate for the subspecific identification of the Timor population.

**Caprimulgus affinis timorensis*,
new subspecies

2 ♂, Noilmina; 1 ♂, 1 ♀, Supul; 1 ♀, Niki Niki; 2 ♂, 1 ♀, Dilly.

Collocalia inexpectata micans Stresemann

5 ♂, 2 ♀, Tjamplong; 2 ♂, 1 ♀, Nenas (1200 meters); 1 ♀, Mt. Ramelan (2000 meters).

**Collocalia esculenta neglecta* Gray

6 ♂, 3 ♀, Mt. Mutis; 1 ♀, Tjamplong; 4 ♂, 1 ♀, Bonleo; 1 ♂, 2 ♀, Niki Niki.

Halcyon chloris chloris (Boddaert)

1 ♂, 2 ♀, Kupang; 1 ♂, Tjamplong; 2 ♂, 1 ♀, Dilly; 1 ♂, Mt. Ramelan (2000 meters).

[*Halcyon s. sancta* Vigors and Horsfield.
Found by Everett]

Halcyon a. australasia (Vieillot)

2 ♂ ad., 6 ♂ juv., Tjamplong; 1 ♂ ad., 1 ♂ juv., Noilmina; 1 ♂ ad., Niki Niki. *H. a. tringorum* Hellmayr is an extremely variable hybrid race. One of the specimens is indistinguishable from Timor birds.

Alcedo atthis floresiana Sharpe

1 ♂, Kupang; 2 ♂, Noilmina.

Merops ornatus Latham

1 ♂ ad. (Jan. 7, gonads large), 1 ♀ imm., Tjamplong; 1 ♂ imm., Niki Niki.

Merops philippinus javanicus Horsfield

1 ♀ ad., 2 ♀ imm., Dilly.

Eurystomus orientalis connectens Stresemann

1 ♀ ad., 1 ♀ imm., Tjamplong. The immature bird (Jan. 18, 1932) has all of its primaries still in their sheaths and confirms the breeding of the race *connectens* on Timor Island. Its similarity

with *pacificus* proves that the latter must have reached Australia from Timor.

**Pitta brachyura elegans* Temminck

1 ♂ ad., Kupang; ♂ ad., ♀ ad., ♂ imm., Tjamplong; 1 ♀ ad., Noilmina.

**†Mirafra javanica timorensis*,
new subspecies

8 ♂, 4 ♀, Dilly.

Hirundo tahitica frontalis Quoy
and Gaimard

2 ♂, Dilly.

†Hirundo striolata rothschildiana Rensch

2 ♂, 1 ♀, Tjamplong; 1 ♂, Nenas (1200 meters).

Hirundo (Petrochelidon) nigricans
timoriensis Sharpe

♂, Noilmina; ♂ ♀, Tjamplong; 1 ♂, Soë; 1 ♂, Niki Niki; ♂ ♀, Dilly.

Coracina novaehollandiae personata
(S. Müller)

1 ♂ ad., 2 ♂ imm., 2 ♀ ad., Noilmina; 1 ♂ ad., 3 ♀ imm., Tjamplong; 2 ♂ ad., 1 ♀, Mt. Mutis (2000 meters); 1 ♂, 2 ♀, Mt. Ramelan (2200 meters). For a distribution map of the species, see Ripley, 1941, Auk, vol. 58, p. 385.

[Coracina novaehollandiae didima Mathews]

Edolisoma tenuirostre timoriense Sharpe

1 ♂, Noilmina.

Lalage sueurii sueurii (Vieillot)

1 ♂, Kupang; 2 ♂, 1 ♀, Tjamplong; 1 ♂, Soë; 1 ♂, Dilly.

Anthus novaeseelandiae medius Wallace

1 ♂, Kupang; 1 ♀ juv., Tjamplong; 1 ♀, Niki Niki; 1 ♀, Nenas (1200 meters); 1 ♂, Mt. Mutis (1500 meters); 3 ♂, 1 unsexed, Dilly; 2 ♂, 2 ♀, Mt. Ramelan (2000–2300 meters).

[Anthus gustavi Swinhoe. Collected
by Wallace]

†Motacilla cinerea caspica (Gmelin)

1 ♂, Soë; 2 ♀, Nenas (1200 meters) (March 6–23).

Motacilla flava simillima Hartert

2 ♂ ad., 1 ♀ ad., Dilly (April 17). These specimens in fresh adult plumage agree perfectly with typical birds from Bering Island, etc.

**†Geokichla doherityi* Hartert

7 ♂, 5 ♀, 3 pull., Mt. Mutis (1600–2300 meters).

**Geokichla peronii peronii* (Vieillot)

1 ♂, 1 ♀, Kupang; 6 ♂ ad., 2 ♂ imm., 4 ♀, Tjamplong; 1 ♂, Noilmina; 1 ♀ imm., Nenas (1200 meters).

**Geokichla peronii audacis* Hartert

1 ♂, Dilly.

[Zoothera andromedae (Temminck)]

Turdus poliocephalus schlegelii Sclater

8 ♂, 6 ♀, 7 juv., Mt. Mutis (1600–2000 meters).

**†Turdus poliocephalus sterlingi*,
new subspecies

6 ♂ ad., Mt. Ramelan (2300–2600 meters).

Rhodophila g. gutturalis (Vieillot)

1 ♂, 1 ♀, Kupang; 1 ♂, 1 ♀, Noilmina; 3 ♂ ad., 4 ♂ imm., 2 ♀, Tjamplong; 4 ♂, 1 ♀ imm., Nenas (1200 meters). For the generic nomenclature of this species, formerly known as *Oreicola melano-leuca*, see under *Siphia timorensis*. The name *gutturalis* (description of female) has page priority over *melanoleuca* (description of male).

**Saxicola caprata pyrrhonota* (Vieillot)

1 ♂, Kupang; 1 ♂, 1 ♀ juv., Tjamplong; 2 ♀, 2 juv., Mt. Mutis (2000 meters); 1 ♂, 1 ♀, Dilly.

**Brachypteryx l. leucophrys* (Temminck)

1 ♂ ad., 1 ♂ juv., 4 ♀ ad., 1 ♀ juv., Mt. Mutis (1800–2100 meters).

**†Pnoepyga pusilla timorensis*,
new subspecies

A series of ♂ and ♀, Mt. Mutis (1800–2000 meters).

**Büttikofarella bivittata* (Bonaparte)

2 ♀, Kupang; 1 ♀, Noilmina; 9 ♂, 4 ♀, Tjamplong; 1 ♀, Supul.

[Megalurus timoriensis timoriensis Wallace]

Cisticola juncidis fuscicapilla Wallace

1 ♂ ad. (summer dress), 1 ♀, Noilmina (Feb. 1); 4 ♂ ad. (summer), Dilly (April 16–18). Wing, male ad., 49–49.5, female, 45; tail, male, 34–37, female, 37.

Cisticola exilis lineocapilla Gould

1 ♂ ad., Kupang; 3 ♂, Tjamplong; 3 ♂, 1 ♀, Noilmina; 1 ♂, Niki Niki; 1 ♀, Nenas (1200 meters). This series agrees in size and in the coloration of the upper parts with birds from Melville Island. However, the Melville Island birds have middle of throat, breast, and belly white and only the flanks ochre, while the entire under parts are washed with ochre in the Timor birds. The same dark coloration of the under parts is found in birds from the Lesser Sunda Islands, particularly from Flores and Bali. This difference might justify the resurrection of the name *delicatula* Blyth (Java), if the latter name has nomenclatorial standing.

†*Acrocephalus arundinaceus orientalis*
(Temminck and Schlegel)

3 ♀, Dilly (April 15–19). The plumage, including wing and tail, is badly worn, in spite of the early date.

†*Acrocephalus arundinaceus sumbae*
Hartert

2 ♂, 1 ♀, Dilly (April 17–20). The three specimens, which are badly worn and molting, cannot with certainty be separated from *sumbae*. They seem equally small (wing, about 66, 67, 69), and the wing formula seems also similar, as far as can be determined from this material in poor condition (3>4>5>6>2>7).

*†*Bradypterus montis timorensis*,
new subspecies

1 ♂, 1 ♀, Mt. Mutis (1800 meters).

Urosphena s. subulata (Sharpe)

1 ♂, 1 ♀, Nenas (1200 meters). Tail index of 4 males, 3 females, 46.3–50.4 (48.1).

Cettia (Horeites) montana
everetti Hartert

1 ♂, 1 ♀, Tjamplong (150 meters); 1 ♀, Supul; 2 ♂, 1 ♀, Nenas (1200 meters); 3 ♂, 8 ♀, Mt. Mutis (1500–2300 meters).

**Phylloscopus (trivirgatus) presbytes* (Blyth)

3 ♂, Noilmina (up to 300 meters); 4 ♂, 5 ♀, Mt. Mutis (1800–2300 meters); 3 ♂, 1 ♀, Mt. Ramelan (2000–2300 meters). The three Noilmina specimens are extremely worn and beginning to molt (Feb. 2–5). The Mutis birds (Feb. 20, etc.) have almost completed their molt.

[*Phylloscopus b. borealis* (Blasius)]

*†*Seicercus montis paulinae*,
new subspecies

3 ♂ ad., 6 ♀ ad., 3 ♂ imm., 4 ♀ imm., Mt. Mutis (1500–2300 meters).

**Gerygone inornata inornata* Wallace

3 ♂ ad., 1 ♂ imm., 2 ♀ ad., 1 ♀ juv., Tjamplong; 2 ♂ ad., 2 ♂ imm., 2 ♀ Noilmina; 1 ♀ ad., Nenas (1200 meters); 3 ♂ ad., 2 ♂ imm., 2 ♀, Mt. Mutis (2000–2300 meters); 3 ♂ ad., 1 ♀ ad., Mt. Ramelan (2000–2500 meters).

Cyornis h. hyacinthina (Temminck)

1 ♂, 1 ♀, Kupang; 2 ♂ ad., 2 ♂ juv., 2 ♀, Tjamplong; 1 ♂ ad., 2 ♂ juv., 1 ♀, Noilmina; 1 ♂ ad., 3 ♂ juv., 1 ♀, Nenas (1200 meters); 1 ♂ juv., 1 ♀ juv., Mt. Mutis (2000 meters); 5 ♂ ad., 2 ♀ ad., Mt. Ramelan (1800–2000 meters). This is a rather isolated species, but it seems to have been derived from the Philippine *herioti* (Luzon) via *sanfordi* and *hoevelli* (Celebes). This group of

species has no close relatives, but the Asiatic *vivida* may be distantly related. The Wetar Island subspecies (*C. hyacinthina kühni* Hartert) is very distinct.

*†*Dendrobiastes hyperythrus timorensis*,
new subspecies

Series ♂ and ♀, Mt. Mutis (1800–2200 meters); 1 ♂ ad., Mt. Ramelan (2200 meters).

**Siphia timorensis* (Hellmayr)

3 ♂, 6 ♀, Tjamplong; 3 ♂, 1 ♀, Nenas (1200 meters).

**Muscicapula melanoleuca* subspecies

1 ♂ ad., 1 ♂ juv., 2 ♀ juv., Nenas (1200 meters); 1 ♂ ad., 1 ♀ juv., Soë; 1 ♂ juv., Mt. Mutis (1500 meters); 3 ♂ ad., 1 ♀ ad., Mt. Ramelan (2000–2300 meters).

**Rhipidura rufifrons semicollaris* Müller

1 ♂, 1 ♀, Kupang; 1 ♂, Tjamplong; 2 ♂, Mt. Mutis (1700–2000 meters); 1 ♂, Dilly; 1 ♂, Mt. Ramelan (2000 meters).

Rhipidura r. rufiventris (Vieillot)

2 ♂, 1 ♀, Kupang; 1 ♂, Noilmina; 1 ♂, 1 ♀, Dilly; 2 ♂, 2 ♀, Mt. Ramelan (2000 meters).

Myiagra r. ruficollis (Vieillot)

1 ♂, Noilmina; 1 ♂ juv., Tjamplong; 3 juv., Nenas (1200 meters); 1 ♂ imm., Mt. Mutis (1400 meters). I cannot recognize *colonus* Hartert. The narrowness of the bill of some of the Djampea specimens is obviously caused by the tight binding of the bill.

**Monarcha t. trivirgatus* (Temminck)

3 ♂, 1 ♀, Kupang; 5 ♂, 3 ♀, Tjamplong; 1 ♂, Noilmina; 1 ♀, Dilly.

**Monarcha c. cinerascens* (Temminck)

1 ♂ ad., Kupang; 6 ♂ ad., 1 ♀ ad., Tjamplong. Wing, male ad., 81.5, 82, 82, 84, 84, 84.5, 84.5, female, 80; tail, male, 69, 70, 70, 70, 71, 71, 71, female, 68.

Pachycephala pectoralis calliope Bonaparte

3 ♂, 3 ♀, Kupang; 6 ♂, Tjamplong; 1 ♂, Noilmina; 1 ♂, Niki Niki; 1 ♂, 1 ♀, Mt. Mutis (2000–2100 meters).

**Pachycephala orpheus orpheus* Jardine

4 ♂, 5 ♀, Kupang; 3 ♂, 5 ♀, Tjamplong; 1 ♂, 3 ♀, Noilmina; 1 ♂, Nenas (1200 meters); 1 ♂, 3 ♀, Dilly.

**Lanius schach bentet* Horsfield

1 ♂ imm., Tjamplong; 1 ♀, Kupang; 1 ♀, Mt. Ramelan (1800 meters).

Artamus leucorhynchus albiventer (Lesson)

1 ♂, Kupang; 1 ♂, 1 ♀, Tjamplong; 3 ♂, Mt.

Mutis (2000–2100 meters); 1 ♀, Dilly. North Celebes birds with a wing of 138–147 are so distinctly larger than Timor birds (128–137) that it seems justifiable to separate them as *celebensis*. Birds from southern Celebes (131–141), from Sumba (134–140), and from the Lesser Sunda Islands (133–143) are intermediate in size. It will be a matter of convenience which of these populations to associate with *albiventer* and which with *celebensis*.

Artamus cinereus cinereus Vieillot

1 ♂, 2 ♀, Kupang; 3 ♂, 2 ♀, Tjamplong; 1 ♂, Noilmina; 1 ♂, 2 ♀ Dilly. There are no differences between Letti, Sermatta, and Timor specimens. The Australian *melanops* is conspecific with *cinereus*.

Aplonis minor minor (Bonaparte)

3 ♂, 3 ♀, Tjamplong; 2 ♀, Nenas (1200 meters).

**Oriolus v. viridifuscus* (Heine)

1 ♂ imm., Kupang; 1 ♂ imm., 1 ♀ imm., Noilmina; 1 pull. (Jan. 9), 1 ♀ imm., Tjamplong; 2 ♂ imm., Dilly.

Sphecotheres viridis Vieillot

3 ♂, 1 ♀, Kupang; 2 ♂ ad., 2 ♂ imm., 3 ♀, Tjamplong; 2 ♂, 2 ♀, Dilly. Dilly birds (wing, male ad., 133, 134, female ad., 127, 132; tail, male, 100, 103.5, female, 100, 104) average larger than western Timor birds (wing, male, ad., 126, 127, 128, 130, female, 127, 127, 130; tail, male, 95, 96, 98, female, 96, 98, 103). Three adult males from Atapupu are intermediate (wing, 130, 130.5; tail, 97, 101, 105). Dilly specimens also seem to be of a colder, grayer green than the citrine green birds from western Timor. Females from Dilly also seem to be lighter and less heavily streaked. *Sphecotheres hypoleucos* (Wetar) and *flaviventris* (Australia) belong to the same superspecies, but are too different to be regarded as merely subspecifically different.

Dicrurus (bracteatus) densus Bonaparte

1 ♂, 2 ♀, Tjamplong; 1 ♀, Noilmina; 1 ♂, 1 ♀, Nenas (1200 meters).

Corvus macrorhynchus timorensis Bonaparte

1 ♂, Mt. Mutis (2000 meters); 1 ♀, Kupang; 1 ♀, Tjamplong; 1 ♀, Soë; 1 ♀, Niki Niki.

**Cinnyris s. solaris* (Temminck)

2 ♂, Kupang; 3 ♂, Noilmina; 5 ♂, Tjamplong; 1 ♀, Niki Niki; 9 ♂, 4 ♀, Dilly. All except one of the males are adult.

**Philemon b. buceroides* (Swainson)

1 ♂, Kupang; 2 ♀, Noilmina; 1 ♂, 4 ♀, Tjamplong; 2 ♂ ad., 6 ♂ imm., 2 ♀, Dilly.

**Philemon i. inornatus* (Gray)

1 ♂, Kupang; 6 ♂, Noilmina; 4 ♂, 5 ♀, Tjamplong; 1 ♀, Soë.

**Philemon inornatus robustus*, new subspecies

11 ♂, 8 ♀, Dilly; 5 ♂, 1 ♀, Mt. Ramelan (2000–2400 meters).

Meliphaga reticulata Temminck

4 ♂, 6 ♀, Kupang; 2 ♂, 2 ♀, Tjamplong; 1 ♂, Niki Niki; 4 ♂, 3 ♀, Dilly. "A few also at Nenas (1200 m.)." Wing, male ad., 77–82 (79.6), female, 72–76 (74.3); tail, male, 65–73 (68.9), female, 63–68 (65.3). This species seems to have no close relatives. It is probably distantly related to one of the Australian or Papuan *Meliphaga* or else to a species like *Xanthotis polygramma*. Mathews omitted this species from the "Systema avium Australasianarum."

Lichmera flavicans (Vieillot)

[= *Stigmatops maculata* (Temminck)]

3 ♂, Tjamplong; 4 ♂, 1 ♀, Soë (800 meters); 2 ♂, 1 ♀, Mt. Ramelan (2000 meters).

Lichmera indistincta limbata (Müller)

1 ♂, Kupang; 6 ♂, Tjamplong; 2 ♂, 1 ♀, Dilly.

Myzomela vulnerata (Müller)

2 ♂, Kupang; 1 ♂, 2 ♀, Tjamplong; 2 ♂, 1 ♀, Nenas (1200 meters); 1 ♂, Dilly.

Dicaeum maugei maugei Lesson

3 ♂, 1 ♀, Tjamplong; 1 ♂ Soë; 1 ♀, Niki Niki; 3 ♂, 2 ♀, Nenas (1200 meters); 1 ♂, Dilly.

Dicaeum sanguinolentum hanieli Hellmayr

2 ♂ ad., Nenas (1200 meters). Wing, 54, 56.5; tail, 27, 29.

**Piprisoma obsoletum obsoletum* (Müller)

2 ♂ imm., 1 ♀, Kupang; 8 ♂, Tjamplong; 1 ♂, Dilly.

**Zosterops lutea citrinella* Bonaparte

3 ♂, 3 ♀, Tjamplong; 6 ♂, Noilmina; 2 ♂, 2 ♀, Niki Niki; 1 ♂, Nenas (1200 meters).

*†*Zosterops montana steini*,
new subspecies

Series, Mt. Mutis (1800–2300 meters); series, Mt. Ramelan (1800–2600 meters).

Pseudozosterops mülleri (Hartlaub)

1 unsexed, Kupang; 4 ♂, 2 ♀, 2 juv., Tjamplong.

Amandava amandava flaviventris (Wallace)

1 ♂, Nenas (1200 meters); 3 ♂, Dilly. For a discussion and distribution map, see Delacour, 1935, L'Oiseau, vol. 5, pp. 377–388.

Taeniopygia g. guttata (Vieillot)

3 ♂, 2 ♀, Kupang; 1 ♂, 2 ♀, Tjamplong; 1 ♀, Noilmina; 3 ♂, 2 ♀, Nenas (1200 meters); 1 ♂, 1 ♀, Dilly; 3 ♂, Mt. Ramelan (2000–2300 meters). This species is conspecific with *castanotis* (Australia).

Lonchura quinticolor (Vieillot)

5 ♂, 5 ♀, Tjamplong; 1 ♂, 1 ♀, Noilmina; 1 ♀, Nenas (1200 meters); 1 ♀, Dilly.

**Lonchura punctulata blasii* Stresemann

1 ♂, 1 ♀, Kupang; 2 ♀, Tjamplong; 2 ♀, Dilly;

3 ♂, Mt. Ramelan (2300 meters).

Lonchura molucca propinqua (Sharpe)

2 ♂, 1 ♀, Tjamplong; 1 ♂, Noilmina; 1 ♀, Nenas (1200 meters).

Padda fuscata (Vieillot)

4 ♂, 2 ♀, Kupang; 5 ♂, 1 ♀, Tjamplong.

Erythrura tricolor (Vieillot)

10 ♂, 5 ♀, Tjamplong; 1 ♂, Nenas (1200 meters).

THE BIRDS OF SUMBA

HISTORY OF EXPLORATION

SUMBA WAS ONE of the last islands of the Malay Archipelago to be explored zoologically. Even though two endemic Sumba parrots, *Lorius roratus cornelia* Bonaparte (1853) and *Cacatua sulphurea citrinocristata* Fraser (1844), had already been made known to science through aviary specimens of uncertain origin, the first collection of birds was made on the island by Riedel in 1880. Meyer records 40 species from this collection. During the following 18 years, ten Kate and the veteran collectors William Doherty and Alfred Everett visited the island and raised the number of species and subspecies to 103. It was generally conceded that these experienced collectors had left little to be discovered, and it came as a great surprise when Dammerman found 14 additional forms during his 1925 expedition (together with P. Franck). This included such striking novelties as *Alseonax segregata*, *Erythromyias harterti*, *Rhinomyias stresemanni*, and *Myzomela erythrocephala dammermani*. H. C. Siebers and B. Rensch described no fewer than three valid species and seven new subspecies from this collection. Many of these forms were known only from single specimens, and it seemed very desirable to obtain additional material. Stein was completely successful in this endeavor, and at the same time he succeeded in obtaining excellent series of other rare species such as *Treron teysmannii*, *Ptilinopus dohertyi*, *Lorius roratus cornelia*, *Rhyticeros everetti*, *Edolisoma dohertyi*, *Terpsiphone paradisi sumbaensis*, *Cinnyris buettikoferi*, and *Dicaeum wilhelminae*. Furthermore, he added the following species to the list of Sumba birds: *Podiceps ruficollis vulcanorum*, *Porzana fusca*, *Poliolimnas c. cinereus*, *Limosa lapponica baueri*, *Crocethia alba*, *Thalasseus bergii cristatus*, *Columba vitiensis metallica*, *Macropygia phasianella emiliana*, *Macropygia ruficeps orientalis*, *Chalcites lucidus plagosus*, *Caprimulgus macrurus* subsp., *Halcyon sancta sancta*, and *Coracina novaehollandiae didima*. The fact that at least five of these 13 species are merely winter visitors and not one of them endemic on Sumba indicates that the faunistic exploration of Sumba Island can be considered as nearly completed, as far as

birds are concerned. The study of Stein's material resulted in the description of two new subspecies.

Dammerman's researches had increased the list of Sumba birds to 116. With Stein's 13 additions it has now reached a total of 129. Except for additional migrants I do not expect this total to be raised materially. Deducting 21 migrant visitors from this total leaves 108 for the breeding species. Definite breeding records for some of these species are desirable; they are possibly only visitors. This is particularly true for five species: *Bubulcus ibis coromandus*, *Dendrocygna arcuata*, *Circus assimilis rogersi*, *Merops ornatus*, and *Ariamus c. cinereus*.

The following publications comprise the most important ornithological literature on Sumba:

- BUETTIKOFER, J.
1892. On a collection of birds from the islands of Flores, Sumba and Rotti. Notes Leyden Mus., vol. 14, pp. 193-206.
- DAMMERMAN, K. W.
1926. Een tocht naar Soemba. Natuurk. Tijdschr. Nederlandsch Indië, vol. 86, pp. 27-122.
- HARTERT, E.
1896. An account of the collections of birds made by Mr. William Doherty in the Eastern Archipelago. VII. Sumba. Novit. Zool., vol. 3, pp. 576-590.
1898. Account of the birds collected in Sumba by Alfred Everett and his native hunters. *Ibid.*, vol. 5, pp. 466-476.
- MEYER, A. B.
1882. Ueber Vögel von einigen der südöstlichen Inseln des malayischen Archipels, insbesondere über diejenigen Sumbas. Verhandl. Zool.-Bot. Gesellsch. Wien, vol. 31, pp. 759-774.
- RENSCH, B.
1931. Ueber die von Dr. Dammerman im Jahre 1925 auf Sumba gesammelten Vögel. Treubia, vol. 13, pp. 371-390.

Additional smaller papers are recorded in the above-listed publications.

STEIN'S ITINERARY

Stein collected on Sumba between May 15 and July 9, 1932. Again, as with Timor, no report on the course of the expedition is

available. To judge by the labels, his collecting stations were as follows: Waingapu, May 15–21; Langgaliru (western Sumba, ca. 500 meters), May 18–June 1; Mao Marru, June 7–12; Melolo (eastern Sumba, coast), June 15–June 19.

Sumba is a very arid island, although it has

patches of monsoon forest. The physiography of the island is described by Dammerman in the above-mentioned publication. Additional notes on the natural history of Sumba have been published by van Heurn (1932, *Natuurk. Tijdschr. Nederlandsch Indië*, vol. 92, pp. 64–84).

ANNOTATED LIST OF STEIN'S SUMBA COLLECTION

* = See taxonomic notes on Timor and Sumba birds.

† = First record for Sumba.

[] = Species recorded from Sumba by Rensch (1931) but not obtained by Stein.

† *Podiceps ruficollis vulcanorum* Rensch

2 ♀, Mao Marru; 1 ♂, Melolo.

[*Phalacrocorax m. melanoleucos* (Vieillot)]

Notophox n. novaehollandiae (Latham)

1 ♂, 2 ♀, Waingapu; 1 ♀, Melolo.

Butorides striatus steini Mayr

1 ♂, 1 ♀, 1 juv., Melolo. See Mayr, 1943, *Emu*, vol. 43, p. 10.

[*Ardeola sp. speciosa* (Horsfield)]

[*Bubulcus ibis coromanda* (Boddaert)]

[*Egretta i. intermedia* (Wagler)]

[*Egretta garzetta nigripes* (Temminck)]

Demigretta sacra sacra (Gmelin)

1 ♂, 1 ♀, Melolo (both white phase).

[*Ixobrychus sinensis* (Gmelin)]

[*Dendrocygna arcuata* (Horsfield)]

Anas superciliosa rogersi Mathews

1 ♀, Langgaliru.

[*Anas g. gibberifrons* S. Müller]

[*Elanus caeruleus hypoleucus* Gould]

Aviceda subcristata timorlaoensis Meyer

1 ♂ juv., Mao Marru.

Milvus migrans affinis Gould

1 ♂ imm., Waingapu.

Haliastur indus intermedius Blyth

1 ♂ ad., 1 [♀] juv., Mao Marru.

Accipiter fasciatus tjendanae Stresemann

2 ♂ ad., 1 ♂ subad., 1 ♂ imm., 1 ♀ ad., 1 ♀ imm., Melolo; 1 ♀ ad., Langgaliru.

[*Haliaeetus leucogaster* (Gmelin)]

Circus assimilis rogersi Mathews

1 ♀ ad., Melolo.

[*Pandion haliaetus melvillensis* Mathews]

[*Falco peregrinus ernesti* Sharpe]

Falco moluccensis renschi Siebers

1 ♂, Mao Marru; 2 ♀, Waingapu; 2 ♀, Melolo.

Megapodius freycinet reinwardti Dumont

2 ♂ ad., 1 ♂ imm., 1 ♀ imm., Langgaliru; 2 nestlings, Mao Marru.

* *Synoicus ypsilophorus pallidior* Hartert

10 ♂ ad., 1 ♂ imm., 6 ♀, Melolo.

[*Excalfactoria chinensis lineatula* Rensch]

[*Gallus varius* (Shaw)]

[*Turnix everetti* Hartert]

*† *Porzana fusca fusca* (Linnaeus)

1 ♂ ad., Langgaliru.

† *Poliolimnas cinereus cinereus* Vieillot

1 ♂ ad., 1 ♀ ad., Mao Marru.

Amaurornis phoenicurus leucomelas
(S. Müller)

1 ♂, 2 ♀, Langgaliru.

[*Gallinula tenebrosa frontata* Wallace]

[*Irediparra g. gallinacea* (Temminck)]

[*Pluvialis¹ dominica fulva* (Gmelin)]

* *Charadrius peronii* Schlegel

7 ♂, 6 ♀, 1 chick, Melolo.

Charadrius leschenaultii Lesson

1 ♀, Melolo (June 14).

† *Limosa lapponica baueri* Naumann

1 ♀, Waingapu (May 17).

¹ Additional migrant shore birds previously recorded from Sumba but not obtained by Stein are: *Numenius phaeopus variegatus* (Scopoli), *Numenius madagascariensis* (Linnaeus), *Tringa glareola* (Linnaeus), and *Actitis hypoleucos* (Linnaeus).

Arenaria interpres interpres (Linnaeus)

2 ♂, Melolo (June 14).

†*Crocethia alba* (Pallas)

2 ♂, Melolo (June 14).

Erolia ruficollis (Pallas)

1 ♀, Melolo (June 14).

†*Thalasseus bergii cristatus* (Stephens)

1 ♀, Melolo (June 17).

**Treron teysmannii* Schlegel

4 ♂, 1 ♀, Langgaliru; 1 ♂, 1 ♀, Mao Marru; 1 ♀, Melolo.

Ptilinopus doherityi (Rothschild)

3 ♂, 4 ♀, Langgaliru; 1 ♀, Mao Marru. In spite of its aberrant features, which clearly justify its specific status, this species is nothing but a geographic representative of *P. cinctus*, and there is no reason for recognizing the "genus" *Mezotreron* Sharpe. The sexual dimorphism is limited to size and to the darker color of the upper parts of the male. Wing, male, 179, 181, 183, female, 166, 166, 171, 171, 173.

Ptilinopus melanospilus melanauchen (Salvadori)

7 ♂, 2 ♀, Langgaliru; 1 ♂, 1 ♀, Waingapu; 2 ♂, Melolo. Sumba birds have gular spot and crissum paler, more sulphur yellow than specimens from Java and Sumbawa; the difference is not sufficiently marked to justify the recognition of another subspecies in this badly over-split species.

**Ducula aenea aenea* (Linnaeus)

2 ♂, 3 ♀, Langgaliru; 2 ♂, 3 ♀, Mao Marru; 1 ♂, Melolo.

†*Columba vitiensis metallica* Temminck

1 ♂, Mao Marru; 1 ♀, Langgaliru.

†*Macropygia phasianella emiliana* Bonaparte

1 ♂, Langgaliru; 4 ♂, 2 ♀, Melolo.

†*Macropygia ruficeps orientalis* Hartert

1 ♀, Langgaliru.

Streptopelia chinensis tigrina (Temminck)

1 ♂, 1 ♀, Waingapu; 2 ♂, Melolo; 1 ♀, Langgaliru.

**Geopelia striata maugea* (Temminck)

2 ♂, Waingapu; 1 ♂, Mao Marru; 3 ♂ ad., 1 ♀ ad., 2 ♀ imm., Melolo; 1 ♀ ad., Langgaliru.

Chalcophaps indica indica (Linnaeus)

3 ♂, Mao Marru; 1 ♂, Melolo; 1 ♂, Waingapu.

Trichoglossus haematodus fortis Hartert

1 ♂, 4 ♀, Langgaliru; 1 ♂, 3 ♀, Mao Marru; 1 ♂, 1 ♀, Melolo.

Cacatua sulphurea citrino-cristata (Fraser)

1 ♂, 2 ♀, Waingapu; 1 ♂, 1 ♀, Mao Marru; 1 ♀, Langgaliru.

Larius rostratus cornelia (Bonaparte)

1 ♂, Melolo; 4 ♀, Mao Marru; 2 ♀, Langgaliru.

Geoffroyus geoffroyi tjindanae Meyer

3 ♂, 1 ♀, Langgaliru; 1 ♂, 2 ♀, Mao Marru; 1 ♂, 2 ♀, Melolo.

Tanygnathus megalorhynchus sumbensis Meyer

2 ♂, 1 ♀, Langgaliru; 1 ♀, Mao Marru.

[*Cuculus saturatus horsfieldi* Moore]*Cacomantis variolosus sepulcralis* Müller

3 ♂, 3 ♀, Langgaliru; 2 ♂, Mao Marru; 1 ♂, Melolo.

†*Chalcites lucidus plagosus* (Latham)

2 ♂, 1 ♀, Langgaliru (May 25, 26); 1 ♀, Waingapu (May 21).

**Eudynamis scolopacea everetti* Hartert

1 ♂ ad., Melolo.

Centropus bengalensis sarasinorum Stresemann

2 juv., Melolo.

Tyto alba sumbaensis (Hartert)

1 ♂, Melolo.

Ninox novaeseelandiae rudolfi Meyer

1 ♂, Langgaliru.

†*Caprimulgus macrurus* subspecies

1 ♂, Mao Marru. Wing, 169; tail, 128. This single adult male is wholly insufficient for the determination of the subspecific status of the Sumba population.

**Caprimulgus affinis kasuidori* Hachisuka

1 ♂, 3 ♀, Melolo.

Collocalia inexpectata micans Stresemann

1 ♂, Mao Marru; 1 ♀, Langgaliru.

**Collocalia esculenta sumbawae* Stresemann

2 ♂, 1 unsexed, Langgaliru; 6 ♂, 7 ♀, 3 unsexed, Mao Marru.

[*Alcedo atthis floresiana* (Sharpe)][*Ceyx r. rufidorsus* Strickland]*Halcyon chloris chloris* (Boddaert)

1 ♂, 1 ♀, Melolo; 1 ♀, Waingapu.

†*Halcyon sancta sancta* Vigors and Horsfield

1 ♂, 1 ♀, Melolo (June 17).

Halcyon australasia australasia (Vieillot)

2 ♂, Langgaliru; 1 ♂, Mao Marru.

Merops ornatus Latham

1 ♂ ad., Waingapu; 1 ♀ ad., Langgaliru; 1 ♀ ad., Melolo.

[Merops philippinus javanicus Horsfield]*Eurystomus orientalis connectens* Stresemann

1 ♀, Melolo.

Rhyticeros everetti Rothschild

3 ♂ ad., 1 ♂ imm., Langgaliru; 1 ♂ ad., Mao Marru; 1 ♂ imm., Melolo.

Pitta elegans maria Hartert

2 ♂ juv., Mao Marru.

**Mirafrja javanica parva* Swinhoe

1 ♂ ad., 1 ♀ ad., 1 ♀ juv., Waingapu; 2 ♂ juv., 2 ♀ juv., Melolo.

[Hirundo rustica gutturalis Scopoli]*Hirundo tahitica frontalis* Quoy
and Gaimard

1 ♀, Langgaliru; 1 ♂, 1 ♀, Melolo.

[Hirundo striolata rothschildiana Rensch]*Coracina novaehollandiae sumbensis* (Meyer)

1 ♂ ad., Langgaliru; 2 ♂, 1 ♀, 1 juv., Mao Marru.

†*Coracina novaehollandiae didima*
(Mathews)

1 ♀ juv., Waingapu (May 18); 1 ♂, 1 ♀, Melolo (June 18–19). The Australian migrants have a shorter tail (72.2–75.9% of wing, against 85.4–89.3%) and a longer wing tip (33.5, 34.8% of wing, against 29.0–29.7%) than *sumbensis*. *C. n. didima* (= *kühni* Hartert) differs from *melanops* only in its slightly paler color.

Edolisoma dohertyi Hartert

7 ♂, 5 ♀, Langgaliru; 2 ♂, 2 ♀, Mao Marru. Wing, male, 122–130 (125.8), female, 119–126 (122.8). *E. dohertyi* belongs undoubtedly to the *morio* assemblage, as grouped by Stresemann (1939, Ornith. Monatsber., vol. 47, p. 124). The coloration of its female, however, agrees with none of the three female plumage types distinguished by Stresemann, and it seems preferable to consider *dohertyi* a separate species of the super-species *morio*.

Lalage sueurii sueurii (Vieillot)

1 ♂, 1 ♀, Waingapu; 1 ♀, Langgaliru; 1 ♂, Melolo.

**Anthus novaeseelandiae* subspecies

1 ♂, 2 ♀, Waingapu; 2 ♂, 3 ♀, Mao Marru.

[Anthus gustavi Swinhoe]*[Motacilla flava simillima* Hartert]**Geokichla dohertyi* Hartert

1 ♀, 1 unsexed, Langgaliru; 1 ♀, 2 pull., Mao Marru (June 9–10).

**Saxicola caprata francki* Rensch

1 ♀, Waingapu; 1 ♂, 1 ♀, Langgaliru; 4 ♂, 1 ♀, Mao Marru; 2 ♂, Melolo.

Megalurus timoriensis inquirendus Siebers

1 ♂ ad., 1 ♀ imm., Langgaliru. The single adult male (tail molting) differs from a series of Australian *alisteri* by the stronger spotting of the breast and of the crown. The entire coloration of the upper parts seems to be darker and more rufous. Wing, male ad., 68, female imm., 60; tail, female, 77.

Cisticola juncidis fuscicapilla Wallace

2 ♂ (winter), Langgaliru; 2 ♀, Waingapu. Wing, male, 46+, 47+, female, 43.5, 47.5; tail, male, 44, female, 34, 39.

Acrocephalus arundinaceus sumbae Hartert

1 ♂ ad., Langgaliru. Wing, 72; tail, 67.5. The wing is about to complete its molt (June 2), and the second primary, though nearly up to the length of the sixth, is still in the sheath. As Rensch pointed out (1931, Treubia, vol. 13, p. 381), the race *sumbae* is much larger than was indicated in the original description.

[Phylloscopus borealis examinandus
Stresemann]*Culicicapa ceylonensis connectens* Rensch

5 ♂, 3 ♀, Langgaliru. Wing, male, 58–62 (60.8), female, 57–58.5; tail, male, 45.5–49.5 (48.3), female, 46.5, 46.5, 49.

Muscicapa (latirostris) segregata Siebers

1 ♀, Waingapu; 1 ♂, Langgaliru.

**Siphia harterti* Siebers

2 ♂, 1 ♀, Langgaliru; 2 ♂, Mao Marru.

**Rhipidura rufifrons sumbensis* Hartert

4 ♂, 1 ♀, Waingapu; 1 ♂ imm., 1 ♀, Langgaliru; 3 ♂, 2 ♀, Mao Marru.

Myiagra ruficollis ruficollis (Vieillot)

4 ♂, 1 ♀, Waingapu; 1 ♂, Langgaliru; 1 ♂, Mao Marru.

**Monarcha t. trivirgatus* (Temminck)

5 ♂, Langgaliru.

Terpsiphone paradisi sumbaensis Meyer

2 ♂, 2 ♀, Waingapu; 1 ♂, Langgaliru; 3 ♂, Mao Marru; 4 ♂, 1 ♀, Melolo. The longest tail-feathers of seven adult males measure: 356, 367, 371, 375,

393, 401, 491. The last-listed specimen (wing, 101) has a tail which is much longer than any other tail measurement recorded in the literature. In specimen 4770 the tail is almost entirely brown; a similar bird is in the Rothschild Collection. Rensch (*tom. cit.*, p. 379) also records a partly brownish specimen of this subspecies.

Rhinomyias (oscillans) stresemanni Siebers

4 ♂, 7 ♀, Langgaliru. Wing, male, 82, 83, 85, 86, female, 78.5–82.5 (80.2); tail, male, 60, 60, 63, 63.5, female, 56–60 (58.0). This form is unquestionably closely related to *Rhinomyias oscillans* of Flores. It is a matter of taste whether or not to consider the two forms as conspecific.

Pachycephala pectoralis fulviventris
Hartert

1 ♀, Waingapu; 9 ♂, 6 ♀, Langgaliru; 2 ♂, 1 ♀, Mao Marru.

Lanius cristatus superciliosus Latham]

Artamus leucorhynchus celebensis Brueggemann

3 ♂, 3 ♀, Melolo. Wing, male, 136, 138, 140, female, 139, 140.

[*Artamus cinereus cinereus* Vieillot]

Aplonis minor minor (Bonaparte)

2 ♂, 2 ♀, Langgaliru; 2 ♂, 2 ♀, Melolo. Hellmayr (1914, p. 43) suggested that Sumba birds might be smaller than typical *minor* (wing, Sumba, 94–97, *minor*, 100–104; tail, Sumba, 55–62, *minor*, 62–67). The present measurements of Sumba birds indicate a considerable overlap (wing, male, 95, 99, 101, female, 96; tail, male, 56, 58, 59, 59, female, 52, 54, 55, 55). The difference is not sufficient for subspecific separation. This species is closely related to *A. metallica*.

Oriolus chinensis broderipi Bonaparte

1 ♂, Langgaliru; 2 ♂, 2 ♀, Mao Marru; 1 ♂, Melolo.

Dicrurus hottentottus sumbae Rensch

2 ♂, 1 ♀, Langgaliru; 4 ♂, 2 ♀, Mao Marru; 1 ♀, Melolo. Wing, male ad., 144, 146, 154, male imm., 141.5, 144, female ad., 139.5, 141, female imm., 140; tail, male ad., 137, 145, 146, 152, male imm., 137, 140, female ad., 137, 144, female imm., 141; tail index, male ad., 98.7 99.3, 101.3, male imm., 96.8, 97.2, female ad., 97.2, 103.2, female imm., 100.6. The relative tail length of *vicinus* is 86–88 and of *bimaensis* about 81–92. The tail of *densus* is longer; tail index, male ad., 108.8, 113.4, female ad., 108.7, 110.0, 110.2, female imm., 104.8.

Corvus macrorhynchus timorensis Bonaparte

2 ♂, 2 ♀, Langgaliru; 1 ♂, Mao Marru.

Parus major cinereus Vieillot

2 ♂, Waingapu; 2 ♂, Langgaliru; 2 ♂, Melolo.

Cinnyris buettikoferi Hartert

2 ♀, Waingapu; 3 ♂, 4 ♀, Langgaliru; 1 ♂, 3 ♀, Mao Marru; 4 ♂, 1 ♀, Melolo.

**Anthreptes malacensis rubrigena* Rensch

2 ♂, 2 ♀, Waingapu; 1 ♀, Langgaliru; 6 ♂, 3 ♀, Melolo.

Philemon buceroides sumbanus Rensch

2 ♂, Waingapu; 2 ♂, 1 ♀, Langgaliru; 2 ♀, Mao Marru; 2 ♂, 1 ♀, Melolo.

Lichmera indistincta limbata (Müller)

3 ♂, 3 ♀, Waingapu; 1 ♂, Mao Marru; 6 ♂, 1 ♀, Melolo.

Myzomela erythrocephala dammermani
Siebers

1 ♂ ad., Langgaliru. Much darker than the Australian *erythrocephala*. The black on the back is deeper, and the breast band is much wider.

Dicaeum wilhelminae Buettikofer

6 ♂, 3 ♀, Langgaliru; 2 ♂, Mao Marru; 1 ♂, Melolo. It is impossible to decide, without a revision of the whole genus, whether *wilhelminae* is closer to *maugei* or to *sanguinolentum*. It is, therefore, advisable to treat it in the meantime as a full species.

**Piprisoma obsoletum tinctum*, new subspecies

5 ♂, 1 ♀, Waingapu; 1 ♀, Langgaliru; 1 ♀, 1 juv., Melolo.

**Zosterops lutea citrinella* Bonaparte

6 ♂, 3 ♀, Waingapu; 3 ♂, 1 ♀, Langgaliru; 2 ♂, Mao Marru; 1 ♀, Melolo.

Zosterops wallacei Finsch

7 ♂, 2 ♀, Langgaliru; 3 ♂, 2 ♀, Mao Marru; 1 ♂, Melolo. Iris "yellow brown, light brown, reddish brown."

Amandava amandava flavidiventris (Wallace)

1 ♂, Waingapu; 2 ♀, Langgaliru.

Taeniopygia guttata guttata (Vieillot)

3 ♂, Waingapu; 5 ♂, 2 ♀, Melolo.

Lonchura quincticolor (Vieillot)

1 ♂ juv., Waingapu; 1 ♂, 1 ♀, Langgaliru; 6 ♂, 3 ♀, Melolo. This is a very isolated species. Its closest relative seems to be *ferruginosa*, which occurs on Celebes, Java, and Bali.

**Lonchura punctulata sumbae*, new subspecies

1 ♂ juv., 1 ♀ ad., Mao Marru; 2 ♂, Melolo.

Lonchura molucca propinqua (Sharpe)

1 ♂ juv., Langgaliru; 1 ♂ ad., 2 ♀ ad., 1 ♀ juv., Mao Marru; 3 ♂ ad., 2 ♀ ad., 3 juv., Melolo.

TAXONOMIC NOTES ON THE BIRDS OF TIMOR AND SUMBA

IN THE COURSE OF working out Stein's collection it became necessary not only to describe a number of new subspecies, but also to make complete revisions of certain genera and species. Instead of inserting these discussions in the annotated list of the collection it was thought more convenient to gather them in a separate section. Many of the discussed species occur both on Timor and Sumba, and in order to avoid repetition it was decided to combine the notes on the birds from the two islands. Reports on parts of the Stein collection are incorporated in the following two publications:

MAYR, ERNST

1941. Ueber einige Raubvögel der Kleinen Sunda Inseln. Ornith. Monatsber., vol. 49, pp. 42-47.
1943. Notes on Australian Birds. II. Emu, vol. 43, pp. 3-17.

THE RACES OF *Synoicus ypsilophorus* IN THE LESSER SUNDA ISLANDS

According to Hartert (1897), who has been followed by Hellmayr, Peters, and all other recent authors, this species has two subspecies in the Lesser Sunda Islands, *pallidior* on Sumba and Savu, and *raalteni* on all the other islands on which the species occurs. Stein's material shows that this arrangement is not correct. A fine series (including 13 adult males) from Noilmina (western Dutch Timor), not far from Pariti, the type locality of *raalteni*, shows that *raalteni* is a pale bird. In fact, it is as pale underneath as *pallidior*, but without its gray wash on breast and flanks. True *raalteni* (Noilmina series) are of a very uniform color above, with hardly an indication of shaft-streaks or black marks. On the back the gray is more extensive than the rufous chestnut. The pale central streak on the crown is very inconspicuous. The sides of the crown are brown without distinct black marks.

Hartert was misled into considering *raalteni* a dark and very rufous form, because his material consisted of specimens from the islands north of Timor (see below), of three adult males from Atapupu (eastern Timor), and of Wallace's material in the British

Museum, which apparently also came from eastern Timor. These birds from eastern Timor, of which I have seen three additional adult males collected by Stein at Dilly, are decidedly darker and more rufous than typical *raalteni*. They are intermediate with an undescribed race from the islands north of Timor, the characters of which seem to be most pronounced on Alor and Wetar. Flores birds should also belong to this subspecies, but no specimens have been available for examination.

Synoicus ypsilophorus castaneus, new subspecies

TYPE: A.M.N.H. No. 542299; Rothschild Coll.; ♂ ad.; Alor Island, Lesser Sunda Islands; April, 1897; A. Everett.

ADULT MALE: Similar to *raalteni* (western Timor), but darker and more rufous chestnut; under parts tawny chestnut, with the pale shaft-streaks and tips to the feathers much reduced or absent; even center of throat washed with rufous; upper parts much darker than in *raalteni*; gray tones reduced to the extent that they comprise only about one-third of the colors, while in *raalteni* more than 50 per cent of the upper parts is gray.

ADULT FEMALE: Similar to *raalteni*, but distinctly more rufous brown above and below.

There is much individual variation in this race as in the other subspecies of this species. Some females are very "feminine" with heavy black vermiculation of the under parts and coarse black blotches of the upper parts. Other females can be told from males only by the more pronounced white shaft-streaks above and below, by the more conspicuous central white streak on the crown, and by the somewhat heavier and darker vermiculation of the flanks. The majority of the specimens are intermediate between these two extremes. It is probable that most of this variation is non-genetic and depends rather on the hormonal level of the female during the period of the molt.

WING: Male adult, 92-97 (94.6), female adult, 92-101 (96.5), against male adult, 93-101 (96.2), female adult, 93-98 (96.5) in

raalteni. *S. y. pallidior* Hartert is of the same size.

RANGE: Flores, Alor, Wetar, Kisser, Letti, Moa, and Luang Islands, Lesser Sunda Islands.

Specimens from Wetar are very slightly, and those from Kisser and the other islands east of Timor are distinctly, less rufous than the Alor birds. However, all of them are closer to Alor specimens than to the series of *raalteni* from western Timor.

The new material permits a redescription of *pallidior* which was characterized by Hartert merely as being paler than *raalteni*.

***Synoicus ypsilophorus pallidior* Hartert**

Synoicus raalteni pallidior HARTERT, 1897, Novit. Zool., vol. 4, p. 271.—Savu Island, Lesser Sunda Islands.

ADULT MALE: Similar to *raalteni*, but under parts generally washed with grayish; dark vermiculation of flanks more pronounced; light shaft-streaks more conspicuous; crown strongly contrasting with back, blackish brown with a pronounced pale buff central line; back also much darker and more variegated; all feathers with narrow or conspicuous white shaft-streaks and with smaller or larger blackish spots or bars, particularly on the inner vanes.

ADULT FEMALE: Similar to *raalteni*, but under parts with broader and more conspicuous shaft-streaks; black vermiculation of flanks not so coarse; upper parts very similar, but of a colder color, patterns more clearly defined.

WING: Male adult, 91–101 (95.0), female adult, 93–98 (95.5).

RANGE: Sumba and Savu Islands.

S. y. pallidior was compared by Hartert in his original description with specimens of what is now called *castaneus*. It is actually a darker bird than *raalteni*. There seem to be no differences between Sumba and Savu birds.

It is very doubtful whether *Synoicus* and *Excalfactoria* can be upheld as generically distinct from *Coturnix*. The slight differences in color pattern, number of tail-feathers, and shape of axillaries do not seem to be of more than specific, or at best subgeneric, value. *Synoicus* of current authors is monotypic; *Excalfactoria* has two geographically repre-

sentative species, while *Coturnix* has five species, most of which represent each other.

***Turnix maculosa maculosa* Temminck**

The button quails are among the most difficult genera of birds, not only on account of the rarity of specimens, but also because individual variation of most species is considerable. Hellmayr (1914, p. 95) emphasizes this in regard to *maculosa* and considers it impossible for this reason to separate the Lesser Sunda Islands birds from specimens from Australia. Examination of our material reveals that the under parts are much more richly colored in the Lesser Sunda Islands series, with even throat and belly washed with golden ochre in all but one or two specimens. These parts are pale ochraceous or whitish in Australian birds. Hellmayr's description of the type specimen of *maculosa* leaves little doubt that it came from Timor Island, and subsequent authors were, therefore, right to restrict the type locality to that island. I pointed out in a previous paper (Mayr, 1938, Amer. Mus. Novitates, no. 1007, p. 1) that *melanota* was the correct name of the Australian race and stated its taxonomic characters. In the meantime I have been informed by Mr. Bryant that the type locality of *melanota* is not Tasmania, as stated by Gould in the original description, but Moreton Bay, Queensland. The species apparently does not occur on Tasmania at all.

***Rallus philippensis chandleri* (Mathews)**

The Timor specimens are very close to, and subspecifically indistinguishable from, *chandleri* (Celebes). They tend to be blacker above with bigger and more conspicuous white spots. As far as the lower parts are concerned, the present series is about the most variable one of this species I have seen from a single locality. Two birds (♀) are without breast band, two birds with it. One specimen (♀) is very pale underneath with the black bars almost obsolete in the middle of breast and upper belly; two specimens are intermediate, and one is dark with the breast dark gray.

The single available skin from southern Flores (the type of *wilkinsoni* is removed) is dark, and below rather similar to the darkest of the Timor skins, but less blackish above.

Its large size, however, makes it impossible to regard *wilkinsoni* a synonym of *chandleri*. Rensch records a Flores bird with the small wing of 145.

MEASUREMENTS: Wing, male adult, 144, three females, 139, 143, 144; culmen (from feathering), male, 27.5, female, 25.5, 27, 27; tarsus, male, 45, female, 41, 41, 41. The wing of the *wilkinsoni* female measures 158.

On Gunung Api lives a dwarf race (*xerophilus*) with a wing of 131–132 (van Bemmelen and Hoogerwerf, 1940, Treubia, vol. 17, p. 470).

Porzana fusca fusca (Linnaeus)

Hartert (1921, "Die Vögel der paläarktischen Fauna," p. 1836) thought that Flores birds (I measure wing, 100, 102) might belong to a larger race. The present Sumba male has a wing of 98.5. One Luzon bird, however, measures equally large (wing, 100) and two others 95 and 98. Birds from Java, Sumatra, and the Malay Peninsula generally measure smaller (wing, about 90–95). The Malayan population would have to be called *rubiginosa* Temminck, 1825 (Java), if its smaller size should be substantiated by better material. There is no color difference.

Charadrius peronii Schlegel

WING: Sumba, seven males, 93–101.5 (97.0), six females, 98–102 (100.1).

This species shows much individual and little geographic variation. The black band across the breast is interrupted in all the males, while it is closed in several Philippine birds. These latter birds have a heavy black ante-ocular (malar) stripe which is rather inconspicuous and interrupted with white in the present series. In two males from Kangean the region in front of the eye is pure white and the pectoral band is broadly interrupted.

THE SPECIES OF THE *Treron curvirostra-pompadora* GROUP

The classification of the *Treron curvirostra-pompadora* group of fruit pigeons is one of the most controversial subjects of East Indian bird taxonomy. This group includes about 28 forms which are rather similar to each other and quite distinct from any other species of the genus *Treron*. It is very probable that they would all be combined into a single

polytypic species, if it was not for the unfortunate fact that at various localities two forms of this group co-exist without any signs of interbreeding. This is true for extensive areas on the Asiatic mainland (*nipalensis* and *phayrei*), Mindoro Island in the Philippines (*axillaris* and *erimacra*), and possibly south Sumatra and the islands in Sunda Strait (*smicra-curvirostra* and *pulverulenta*). It was consequently evident that at least two species would have to be admitted, but many of the island forms are so distinct that arguments arose with which of the two mainland species (*curvirostra* and *pompadora*) they should be associated. Hartert (1927, Novit. Zool., vol. 34, pp. 1–3) and Stresemann (1934, Ornith. Monatsber., vol. 42, pp. 148–149), for example, included the *griseicauda* and *psittacea* groups with *pompadora*, while Siebers (1930, Treubia, vol. 7, suppl., pp. 177–179) and Rensch (1931, Mitt. Zool. Mus. Berlin, vol. 17, pp. 483–484) associated them with *curvirostra*. The correct association of these forms is of great importance to the zoogeographer who wants to determine the history of the various island faunas, and it seemed worth while to analyze the situation once again. I have tabulated all the conspicuous characters by which the various forms differ and have found that the following seven groups can be distinguished:

1. *curvirostra* group, with *nipalensis*, *hainana*, *curvirostra*, *harterti*, *haliploa*, *pega*, *smicra*, *hy-pothapsina*, *nasica*, and *erimacra*.

Rhamphotheca always meeting feathers of forehead; laterally exposed cere yellowish (red in life); gray of crown always reaching eye; throat greenish; under tail-coverts cinnamon; mantle maroon; wing-bend maroon; always an indication of an ochre or vinaceous wash on the entire breast, but no localized spots; black bar on tail variable, little or no greenish olive wash on lateral tail-feathers.

2. *griseicauda* group, with *pulverulenta*, *vordermani*, *griseicauda*, *pallidior*, *ada*, *goodsoni*, and *sangirensis*.

Rhamphotheca not quite meeting feathers of forehead; cere blackish; gray of crown not only reaching eye, but extending to cheeks and sides of throat; throat grayish or grayish green; under tail-coverts cinnamon; mantle maroon; wing-bend often gray; an ochre-vinaceous spot on either side of the throat; black tail-bar usually fairly broad; little or no olive wash on lateral tail-feathers.

3. *floris*: Lesser Sunda Islands, Lombok to Alor.

Like the *griseicauda* group, but mantle and wing-bend dull olive, under tail-coverts white; throat yellowish, no ochre-vinaceous spots on sides of throat; tail-bar narrow, a considerable amount of olive wash on some of the lateral tail-feathers.

4. *teysmannii*: Sumba.

Rhamphotheca meets feathers of forehead; laterally exposed cere black; no gray on crown; forehead and throat yellowish olive; under tail-coverts white; mantle maroon; no ochre-vinaceous wash or spots on breast or throat; tail-bar narrow, some olive wash on the lateral tail-feathers; wing-bend gray and olive; rhamphotheca grayish green.

5. *psittacea*: Timor.

Rhamphotheca does not meet feathers of forehead; cere blue black; no gray on crown; throat yellowish; under tail-coverts white; mantle green; no ochre-vinaceous wash or spots on breast or throat; tail-bar narrow, little or no green wash on lateral tail-feathers.

6. *pompadora* group, with *pompadora*, *affinis*, *phayrei*, *axillaris*, *everetti*, *aromatica*.

Cere exposed, rhamphotheca never in contact with feathers of forehead; crown gray, but forehead yellow green in *pompadora*; sides of head yellowish olive, gray of crown not in contact with eye; throat usually bright yellow; under tail-coverts white or cinnamon (*affinis*, *phayrei*); mantle more or less maroon; wing-bend like mantle, except in *aromatica*, where it is gray; throat yellowish olive, *phayrei* only has a central ochraceous spot; tail-bar narrow or broad; lateral tail-feathers usually with a generous olive wash.

7. *chloroptera*: Nicobars-Andamans.

Similar to the *pompadora* group, but duller; throat greenish, wing-bend olive and gray; under tail-coverts white; tail-bar narrow, lateral tail-feathers washed with olive.

This tabulation shows that each of the groups (1-7) has certain characters or character combinations which do not occur in the others. Are they of sufficient importance to justify species rank for each of these groups? Stresemann (1941, Jour. Ornith., vol. 89, p. 50) has recently suggested ending the wholesale lumping of forms in this assemblage and regarding at least *psittacea*, *teysmannii*, and *aromatica* as full species. However, it seems to me that *griseicauda* is at least as different from *pompadora*, and *floris* from *griseicauda*, as is *teysmannii* from *psittacea*, while on the other hand *aromatica* seems hardly sufficiently distinct from *axillaris* to justify its recognition as a separate species.

It is a remarkable fact that such obviously closely related species as *psittacea* (Timor) and *teysmannii* (Sumba) should differ by such striking characters: *T. psittacea*, cere naked, back green; *T. teysmannii*, cere feathered, back maroon.

The importance of this revised classification is mainly zoogeographical. It is obvious, for example, that Buru (*aromatica*) cannot have been colonized from Celebes or from the Lesser Sunda Islands, but must have received its stock directly from the Philippines. The clear recognition of the *griseicauda* group adds another species to the joint Celebes-Java fauna. The strong differences between *psittacea*, *teysmannii*, *floris*, and *griseicauda* indicate that the Lesser Sunda Islands have been inhabited by these pigeons for a long period. Still they were unable to enter either the Papuan or the Australian regions.

NOTES ON *Ducula aenea*

The geographic variation within this species has been insufficiently studied, as I have mentioned on earlier occasions (1938, Bull. Raffles Mus., Singapore, vol. 14, p. 11; 1938, Ibis, p. 316). Specimens from Sumba and the Lesser Sunda Islands (including Flores) differ from a Borneo series by more vinaceous coloration. The gray breast contrasts more with the vinaceous abdomen; the under tail-coverts are brighter chestnut; even the entire head is suffused with vinaceous; the white frontal band is inconspicuous or absent; the upper throat is buffy vinaceous, not white, and there is no circle of white feathers around the eye; the size is larger.

The bronze, greenish, or bluish gloss of the green feathers of back, wings, and tail depends entirely on wear and soiling with grease. I have not been able to discover geographic variation in this character. The vinaceous colors on head and under parts are likewise much more conspicuous in greasy specimens than in clean, powdery ones. Great care should, therefore, be taken to compare only specimens in equivalent plumage condition.

What the names of the various races of *aenea* on the Sunda Islands should be remains to be determined. The population from the Lesser Sunda Islands must be considered as typical *aenea*, since this name was restricted

to the Flores Island population (Hartert and Goodson, 1918). Later restrictions by Oberholser, Stresemann, and others are not valid. The Palawan race is quite distinct from the Borneo race; Natuna birds ("*diatropurus*" Oberholser) are indistinguishable from Borneo birds. I have not seen either Java or Sumatra birds, but they are reported to be like Borneo birds.

Sumba birds average larger than specimens from Lombok, Sumbawa, and Flores. The difference is, however, insufficient for subspecific separation.

WING: Sumba, male, 244, 245, 246, 250, 250, 252, 256, 258, female, 242, 243, 246, 247, 248, 258; Flores, male, 242, 243; Sumbawa, male, 244, 244; Lombok, male, 244, 250.

It seems convenient to describe on this occasion a new subspecies which for years has been so labeled in the collections of the American Museum.

***Ducula aenea pallidinucha*,**
new subspecies

TYPE: A.M.N.H. No. 110835; ♂ ad.; Tobea Island, Buton Strait, southeastern Celebes; December 14, 1909; R. C. Andrews.

Similar to *paulina*, but nape paler, ochre or almost straw colored, not fox red or maroon; entire under parts averaging paler; size averaging larger.

RANGE: Southeastern Celebes. Known only from one male and one female from the type locality and from two males collected by Heinrich at Lalolei (one examined by me).

Stresemann comments (1941, Jour. Ornith., vol. 89, p. 57) on the large size of the two Lalolei specimens (wing, 229, 235). The wings of the two Tobea birds measure: male, 225, female, 235. Males from northern Celebes measure 216–229 (225.6). Meyer and Wiglesworth (1898, "Birds of Celebes," vol. 2, p. 618) also comment on the larger size of south Celebes birds. The Muna birds of the Elbert expedition (Stresemann, *loc. cit.*) should also belong to the new race.

The type of *paulina* Bonaparte is of unknown origin, but Temminck's plate depicts a bird with maroon-colored nape which is described in the text as "roussâtre foncé." Since this is the typical character of north Celebes birds, it seems justifiable to restrict the type locality of *paulina* to Menado, north Celebes.

ON *Ducula cineracea* TEMMINCK

The fine series of this extremely rare pigeon is particularly valuable for comparison with the Wetar Island series in the Rothschild Collection. It shows that the latter belongs to an undescribed race:

***Ducula cineracea schistacea*,**
new subspecies

TYPE: A.M.N.H. No. 611397; Rothschild Coll.; ♀ ad.; Wetar Island, South West Islands; September 29, 1902; H. Kühn coll.

Similar to *cineracea* (Timor), but grayer below; pinkish vinaceous area in center of throat restricted; vinaceous of breast more strongly washed with gray.

WING: Female adult, 229, immature, 216, 219, 222, 222, 227, against male adult, 222, female adult, 220, 221, 224, female immature, 205, in *cineracea*.

RANGE: Wetar Island.

There is only a single adult from Wetar in the collection, but the immatures have a more or less adult body plumage, even though wing and tail are immature. Both adults and immatures agree in the reduction of vinaceous in the center of the throat.

This species seems to have no close relatives, unless it be *D. pickeringi* from the Philippines. The *latrans-bakeri-brenchleyi* group from western Polynesia is, however, very similar. Is this similarity due to convergence or does it indicate close relationship?

THE CLASSIFICATION OF THE GENUS
Macropygia (FIG. 1)

The arrangement of species within the genus *Macropygia* still leaves much to be desired. Peters (1937, "Check-list of birds of the world," vol. 3, pp. 75–81), following the lead of earlier authors, recognizes a species *M. phasianella* consisting of the Australian *phasianella* group, the Philippine *tenuirostris* group, and the Malayan *emiliana* group. This gives a rather absurd distributional picture until we fill in the gaps with the closely related forms *magna* (South East and South West Islands, Timor, south Celebes) and *rufipennis* (Andamans and Nicobars). In fact, even the *amboinensis* group, which is completely allopatric with the *magna-phasianella* group (except for a doubtful overlap in the Macassar district of south Celebes), belongs

at least to the same superspecies. Siebers (1930, Treubia, vol. 7, suppl., pp. 189–191) was much impressed by the similarity between *ruficeps* and *amboinensis*, but it seems to me that it is clearly indicated not only by the morphological characters but also by the distribution that the *amboinensis* group is closer to *phasianella* than to *ruficeps*. Whatever is done with *amboinensis*, so much is certain that it is illogical to unite *emiliana* and *phasianella* in one species, but to omit *magna* and *rufipennis* from it. This whole group of forms would make a favorable subject for a study in character geography and speciation.

***Geopelia striata maugea* (Temminck)**

Birds from Sumbawa (wing, male adult, 101–107, mean, 103.3) and from Sumba (wing, male adult, 101–106, mean, 102.8) are paler gray on throat and forehead, tend to smaller size and to narrower bars on throat and neck than typical *maugea* from Timor (wing, male adult, 103–109, mean, 105.9), but the difference is too slight to deserve subspecific recognition. Timor birds are intermediate between Sumba-Sumbawa birds on one side and *audacis* (Tenimber) on the other.

***Tanygnathus megalorhynchus hellmayri*,
new subspecies**

TYPE: A.M.N.H. No. 307979; ♂ ad.; Noilmina, Dutch Timor; February 8, 1932; Georg Stein coll.

MALE: Similar to *T. m. affinis* from the Moluccas, but feathers of back without conspicuous blue margins; wing-bend green, not blue; yellow edges of lesser and median upper wing-coverts narrower and paler, greenish yellow, not golden yellow; head yellowish green, not blue green, and not contrasting with color of hind neck; under parts and under wing very similar. Differs from *subaffinis* and *sumbensis* in the yellow axillaries and under wing-coverts, and from *viridipennis* in smaller size, in the green upper back, and in the almost complete absence of black from the upper wing-coverts and tertials.

FEMALE: Extremely similar to *affinis*, but with the wing (greater and median wing-coverts) more greenish, with the wing-bend greenish blue instead of pure blue, and with the amount of black on the lesser upper wing-coverts reduced.

MEASUREMENTS: Wing, male, 237, female, 227, 229; tail, male, 153, female, 135; culmen, male, 44, female, 40, 42. Of *affinis*: wing, male, 238, 240, 240, 246, 252, female, 228, 231, 233, 235, 240; tail, male, 134, 137, 141, 142, 145, female, 133, 134, 134, 135, 135, 135; culmen, male, 45, 47, 47, 48, 48, female, 41, 42, 43, 43, 43, 46.

RANGE: Semaui and westernmost Timor.

This race was known, up to the present, only from two males from Semaui, which were described by Hellmayr (1914, "Die Avifauna von Timor," p. 81). The single male collected by Stein has the same characters which Hellmayr reports for the Semaui specimens. The characters of this race seem sufficiently strongly established in the five known specimens to justify subspecific recognition.

The similarity with *affinis* is so striking that closest relationship must be assumed. *T. m. subaffinis* of the Tenimber and Babar Islands, on the other hand, differs by so many characters (bluish under wing, absence of black on lesser wing-coverts, reduction of blue on lower back, etc.) that its relationship must be assumed to be rather distant. The map of this species, published by Stresemann (1939, Jour. Ornith., vol. 87, p. 364, fig. 16), should be emended accordingly. The fact that *Tanygnathus megalorhynchus* breaks up into six well-marked races (mostly with small, isolated ranges) in the eastern Lesser Sunda Islands and the islands south of Celebes indicates that this is the ancestral home of the species and that it has since spread into the northern Moluccas, Sangir Islands, and western Papuan Islands where the race *megalorhynchus* covers a wide area. This uniformity may be partly due to the recent arrival of the race or to the fact that this population still possesses a high colonizing potential which expresses itself in frequent inter-island wanderings and resulting mingling of local populations.

***Cacomantis variolosus tymbonomus*
S. Müller**

It has been assumed by recent writers, for some curious reason, that no resident race of this cuckoo occurs on Timor Island and that the name *tymbonomus* was a synonym of *variolosus* or at best an earlier name for *dumetorum* from western Australia. Stein's

specimens prove that there is an endemic race of this species on Timor, as might be expected from the general distribution of the species, and that the name *tymbonomus* is, therefore, not applicable to western Australian birds.

Two adult males from Timor differ from a series of ten adult males from the East Kimberley district, Western Australia, by being not plain brown gray on the mantle, but by having narrow rufous edges to the feathers of back, scapulars, and lesser upper wing-coverts; the tail bars are entirely rufous, not white or rufous white, only the tip of each tail-feather is white; the under parts, particularly crissum and under tail-coverts, have much less rufous ochre wash; breast and flanks are finely variegated with gray; the under tail-coverts are barred; the crown seems to be darker gray.

The five immatures are even more different from a large series of immatures from both eastern and western Australia. The barring of the under and upper parts is much finer, and the bars on the tail are deeper rufous.

WING: Male adult, 125, 131, male immature, 121, 125, female, 123, 124, 125.

The Australian races of this species have not yet been worked out carefully, but in addition to *dumetorum* a small, grayish form on Cape York may have to be recognized.

Eudynamis scolopacea everetti Hartert

ADULT FEMALE: Extremely variable. The crown is either uniform blue black, or with a few brown feathers on the forehead or entirely streaked with brown, a condition which is shown by three adult females (Manuwoko [Goram Islands], Alor, and Timor). The throat is either entirely black, or irregularly variegated black and rufous ochre, or two broad black malar stripes are separated by a rufous stripe along the middle of the throat. Breast, belly, and flanks are broadly or finely barred with brown black. Two specimens are unbarred below, except for some vermiculation on lower flanks and under tail-coverts. The relative width of black and brown bars on the tail is also variable.

MEASUREMENTS: Male adult, 199, 203, female adult, 194–210 (201.0); tail, male, 187, 206, female, 177–200 (183.8).

Adult females of *cyanocéphala* and sub-

cyanocéphala differ by the pure white or almost pure white spots and bars on back, wings, and tail, by the paler color and the narrower and more regular barring of the under parts.

Hartert described *everetti* (1900, Novit. Zool., vol. 7, p. 231) merely as smaller than *cyanocéphala*. There are, however, the above-described color differences. It is still undecided whether or not all the eastern *Eudynamis* belong to one species. The question has last been discussed by Siebers (1930, Treubia, vol. 7, suppl., pp. 377–380) and by Rand (1941, Amer. Mus. Novitates, no. 1102, pp. 8–9), both of whom favor the recognition of several species. The available material is still insufficient for a final decision.

Tyto alba delicatula (Gould)

Tyto alba kuehni HARTERT, 1929, Novit. Zool., vol. 35, p. 99.—Kisser Island.

Tyto alba everetti HARTERT, 1929, *loc. cit.*—Savu Island.

Hartert described in 1929 two subspecies which, according to him, were indistinguishable from *delicatula* in coloration, but which differed in measurements. I have been able to confirm the absence of color differences, but the alleged size differences require additional discussion.

Including the four females collected by Stein on Timor, the measurements of "*kuehni*" are: wing, Kisser, male, 292, 300, unsexed, 288; Timor, male, 292, female, 289, 295, 298, 300; tail, Kisser, male, 116, 118, unsexed, 118; Timor, male, 118, female, 114, 117, 122, 123.

This compares with wing (♂ ♀), 273–291, tail, 109–120 in 29 Australian skins of *delicatula*. The size difference is thus obvious, but is it significant and sufficient for subspecific separation? In our sample of eight specimens of *kuehni* the mean is 294.25 and the standard deviation 4.77; in the series of 29 specimens of *delicatula* the mean is 284.10 and the standard deviation is 4.65. This means (without repeating all the calculations on which this statement is based) that about 86 per cent of the Sunda Islands birds are different from about 86 per cent of the Australian birds, but that less than 20 per cent of the birds of either district are different from 99.9 per cent of the birds of the other popula-

tion. This large overlap is obvious even in our small samples. The zone of overlap is from 288 to 291 and it includes 11 of the 37 available specimens, that is, 30 per cent. The linear range of overlap would be even greater, as theoretical calculations prove, if larger samples were available. The recognition of *kuehni* is, therefore, inadvisable.

The recognition of *everetti* is even less defensible. Mr. Dean Amadon, who examined this form in connection with his work on the Polynesian barn owls, writes about it as follows (Amadon MS): "Hartert based his description of *everetti* on a series of nine skins taken on Savu Island in August, 1896. He noticed that they showed much molt but decided that four specimens could be measured, listing them as: ♂ 247, 253, ♀ 265, 283. In examining this series I find that eight of the nine have the bases of the primaries and rectrices still in the sheaths and are obviously not fully grown; perhaps a large brood of young just out of the nest! The one adult is worn and I measure its wing as 282 (Hartert records it as 283). It is sexed as a male, but Dr. Hartert wrote on the label 'must be a female.' As a matter of fact the sexual dimorphism in size in this species is too uncertain to justify this assertion and we must accept the original sex determination. There is thus only a single specimen from Savu available which is comparable with material from other localities, and this bird, a male with a wing of 282 mm., is indistinguishable from Australian *delicatula*. *Tyto alba everetti* must therefore be considered a synonym." My own careful examination of the material leads me to agree fully with Mr. Amadon's conclusions.

GEOGRAPHIC VARIATION IN *Caprimulgus affinis* (FIG. 2)

Peters (1940, "Check-list of birds of the world," vol. 4, p. 213) calls attention to the unsatisfactory condition of the taxonomy of this species. He includes birds from the Lesser Sunda Islands with the dark Java race *affinis*, while Hachisuka (1932, Bull. Brit. Ornith. Club, vol. 52, p. 81) associates the same populations with *propinquus*, the pale Celebes race. A study of considerable material, including the fine new series collected by Stein on Sumba and Timor, proves that neither ar-

rangement is correct. I am grateful to the authorities of the United States National Museum (through H. Deignan), of the Academy of Natural Sciences of Philadelphia (through R. M. de Schauensee), and of the Museum of Comparative Zoölogy (through J. L. Peters) for the loan of much valuable material.

The following races can be recognized in the Malay Archipelago (excluding the Philippine Islands).

Caprimulgus affinis propinquus Riley

Similar to *affinis* (Java), but considerably lighter; the blackish bars on the tail narrower and the black spots on scapulars and crown much reduced in size; on the other hand the pale marks on forehead, nape, scapulars, upper wing-coverts, and breast are larger and buffier, less rufous-ochre; lower belly unbarred. A very distinct form.

MEASUREMENTS: Wing, male, 170, female, 164; tail, male, 101, female, 96.

RANGE: North-central Celebes (Parigi, Tawaya).

Two specimens (female adult, male immature) from Tawaya are quite similar to the type from Parigi, which I was able to examine owing to the kindness of the authorities of the United States National Museum. The Tawaya female is even paler and more coarsely spotted than the male type. The type, on the other hand, has the spots on the breast more whitish; otherwise the agreement between the three skins is very close.

A single male from Macassar (weight, 162; tail, 98) has not the slightest resemblance to the series from north-central Celebes. It is as dark on the upper parts as typical *affinis* from Java and indeed very similar to that form. The crown is even blacker, and the black bars on the tail are broader. The pale spots on the upper parts and the general color of the lower parts seem to be deeper rufous ochraceous. The barring of throat and breast is much coarser and more clearly defined. Additional material might prove the existence of an endemic race in southern Celebes.

Caprimulgus affinis affinis Horsfield

A very dark race with broad bars across the tail and with the black area on the crown rather extensive, particularly in the male.

The barring of breast and upper flanks is medium fine; the spots on throat and breast are fairly well developed.

A series from Java measures: wing, male, 159.5, 160, 163, 164, 164.5, female, 156, 157, 159, 165; tail, male, 91, 95, 97, 98, 99, female, 97, 97, 97.

RANGE: Sumatra, Nias, Billiton, Borneo, Java (type locality), Bali, and Lombok.

A series from Bali is definitely lighter on the upper parts than Java birds; the black marks are reduced and the pale ones more conspicuous; the population is, however, still much darker than *propinquus*.

MEASUREMENTS: Wing, male, 159, 168, female, 162, 163, 166; tail, male, 98, 103, female, 93, 94, 94, 97.

A series from Deli, Sumatra, is very close to Java birds, equally dark, with quite a bit of a rufous brown wash and with prominent black marks, particularly on the center of the crown.

MEASUREMENTS: Wing, male, 165, 165.5, female, 162, 167, 169, 170; tail, male, 100.5, female, 95, 98, 99, 102.

A few specimens from western Sumatra (from the Padang district to Atjeh) are much lighter and grayer. They agree in general coloration with the Bali series, but are more finely vermiculated on the back and show less of the coarse spotting on the scapulars (specimens examined from Pasir Gantang, Padang, and Koetatjane).

MEASUREMENTS: Wing, male, 162, female, 163, 164; tail, male, 93, 94, female, 85, 91. A single skin (male) from the Atjeh highlands (Blangedjeren, 3000 feet) is darker and larger (wing, 167; tail, 100).

Three skins from eastern and southeastern Borneo form the darkest series of the species. Individual skins are, however, not any darker than the darkest Java specimens.

MEASUREMENTS: Wing, male, 172, female, 169; tail, male, 102, female, 94, 103. The large size of two of the three specimens is probably due to altitudinal variation. They were collected at Tanggaroeng, Mahakkam River (H. Raven).

LOMBOK (ONE MALE, ONE FEMALE): On the upper parts slightly lighter than Java birds, particularly the female. Under parts as in typical *affinis*.

MEASUREMENTS: Wing, male, 166, female, 156; tail, male, 100, female, 92.

The fact that this variation is irregular and that the differences between the light and the dark populations are not very striking makes it seem inadvisable to recognize additional subspecies. Names are available for the west Sumatra and for the Bornean populations.

Considering the strong geographic variation on Sundaland (Sumatra, Borneo, Java), it is not surprising that nearly every island east of the Wallace line has a slightly different population. The following populations and subspecies can be recognized:

***Caprimulgus affinis undulatus*,**
new subspecies

TYPE: A.M.N.H. No. 633166; Rothschild Coll.; ♀ ad.; Flores, Lesser Sunda Islands; November 15, 1896; A. Everett.

Similar to *affinis* in the coloration of the upper parts, but tending to be lighter, more evenly colored, and more finely vermiculated; breast and belly are more closely barred and the barring extends farther down along the flanks.

MEASUREMENTS: Wing, male, 166, 168; female, 159, 163, 164; tail, male, 98, 100, female, 89, 94, 99.

RANGE: Sumbawa and Flores.

***Caprimulgus affinis kasuidori* Hachisuka**

A very pale, gray, and boldly patterned form. The barring of the breast is coarse and does not extend far down along the flanks.

Sumba specimens are more coarsely patterned than those from Savu (type locality) and have heavier black spots on the upper parts.

MEASUREMENTS: Wing, male, Sumba, 163, Savu, 161 (immature), 169, female, Sumba, 162, 163, 163, 163.5, Savu, 165, 165; tail, male, Sumba, 97, Savu, 91 (immature), 97, female, Sumba, 96, 98, Savu, 95, 96.

RANGE: Savu and Sumba.

Savu specimens are somewhat intermediate between the Sumba and the Timor populations, but closer to the former.

***Caprimulgus affinis timorensis*,**
new subspecies

TYPE: A.M.N.H. No. 307984; ♂ ad.; Noilmina, Timor Island; February 8, 1932; G. Stein coll.

Similar to *kasuidori*, but less grayish, upper parts light, pattern finer and sandier; all light spots and marks ochre, not whitish buff; the

black pattern much reduced; entire under parts deeper ochraceous; barring of throat, breast, and flanks as much reduced as in the Savu race.

By convergence this form is quite similar to *propinquus* from central Celebes, but it differs by less pronounced marking of breast and throat, by a less faded pattern of the upper parts, and by broader dark tail-bars and bolder black marks on the upper parts; the tail averages longer.

MEASUREMENTS: Wing, male, 160, 160, 161, 163, 164, female, 159, 159, 162; tail, male, 99, 99, 100, 101, 102, female, 95, 95, 99.

RANGE: Timor Island.

A single female from Alor is very close to *timorensis* except for being slightly darker and definitely richer ochraceous; it has the scarce and coarse barring of the under parts typical for *timorensis* and shows in this respect no approach whatsoever to *undulatus*.

A series from Kisser Island is puzzling. Above, it is not unlike *timorensis*, although somewhat darker and less ochraceous; below, it is definitely paler ochraceous, and throat and breast are densely covered with fine barring, almost as in *undulatus*, although this barring does not reach so low on the flanks. It might be best to include this population, for the time being, with *timorensis*.

The two "species" *affinis* and *monticola* are perfectly connected by the subspecies *griseatus* (Luzon) and *stictomus* (Formosa). I agree, therefore, with Stresemann's proposal (1927, Novit. Zool., vol. 33, p. 398) to consider all these forms as conspecific. The name *affinis* Horsfield, 1821, has ten years priority over *monticola* Franklin, 1831, and the continental races will have to be called, therefore, *Caprimulgus affinis monticola*, *Caprimulgus affinis burmanicus*, etc.

NOTES ON *Collocalia esculenta*

The receipt of an excellent series of specimens of *neglecta* has permitted a revision of the *esculenta* forms of the islands east of the Lesser Sunda Islands, resulting in a considerable change of the currently accepted arrangement (1941, Peters, "Check-list of the birds of the world," vol. 4, p. 230).

The subspecies *neglecta*, which incidentally is strikingly different from all other *esculenta* races, is restricted to the island of Timor. It is

characterized by a greenish gray back, almost devoid of gloss. The scapulars have pale margins, and the feathers of the rump are usually margined with white. The throat is very light, since the grayish feathers have broad white tips; it is not sharply set off against the white lower breast and belly.

A series of adults from Mt. Mutis measures: wing, male, 96, 97.5, 99, 99.5, 101, female, 98.5, 101.5, 105; tail, male, 41, 41, 42, 43, 44, female, 40, 42.5, 44. Three adults from Niki Niki measure: wing, male, 95, 97, female, 93; tail, male, 44, 44.5, female, 40.

This pale and grayish race is connected by a series of intermediate populations with the brilliantly glossy races of the *esculenta* group (in the narrower sense) which ranges from Celebes to the Papuan region. These intermediate populations are best arranged in two races, more or less determined by their distance both to *esculenta* and to *neglecta*.

The less glossy of the two races may be named:

Collocalia esculenta perneglecta, new subspecies

TYPE: A.M.N.H. No. 634549; Rothschild Coll.; ♀; Wetar Island, South West Islands; October 6, 1902; H. Kühn coll.

Intermediate between *neglecta* and *sumbawae*. Differs from *neglecta* by being more glossy on the upper parts, and not grayish but greenish; scapulars of adults without pale margins; throat darker, feathers with shorter white tips; dark throat and breast rather sharply set off against whitish abdomen.

MEASUREMENTS: Wing, male, 91–97 (94.7), female, 90–96 (94.2); tail, 40–43.

RANGE: Alor, Wetar, Romah, and Kisser. Also Savu (subsp.), and Damar (subsp.).

Specimens from Wetar, Romah, and Kisser are very much alike and almost exactly intermediate between *neglecta* and *sumbawae*. Individual variability is slight, and the populations cannot, therefore, be considered as of hybrid origin. The Savu population is slightly closer to *neglecta*, while the Alor birds begin to approach *sumbawae* by being darker and glossier. A series of birds from Woeloer, Damar Islands, is even darker and glossier and is about as close to *sumbawae* as to *perneglecta*. In view of its distribution it will be more convenient to include this population with *perneglecta*.

***Collocalia esculenta sumbawae* Stresemann**

The glossier of the two races is *sumbawae*, which is found not only on Sumbawa, but also on Sumba and Flores.

A series from Sumba measures: wing, male, 91–96 (94.0), female, 91.5–96 (93.8); tail, male and female, 40–42.5 (41.1); tail index, 43.8–45.4 (44.5).

***Pitta brachyura elegans* Temminck**

The fine series which Stein obtained of this rare pitta permits the accurate determination of the characters of typical *elegans*, but lack of comparative material prevents the working out of possible geographic variation.

MEASUREMENTS: Wing, male adult, 115–119.5 (117.9), female adult, 116–123 (119.1); culmen, male, 26.5–28.5 (27.5), female, 27–29 (28.0).

Back solid green, black streaks absent in all of the males, but vaguely indicated in two of the 11 females; black chin spot triangular, not elongated in a tongue-like shape; white spot on first primary usually rather large, but absent in one female and small in two or three others; red on upper part of abdominal spot more somber and of a distinctly different tint than on crissum and under tail-coverts (Timor series).

SULA-MANGOLI: A single female has the back prominently streaked with blackish; white spot on first primary absent; black chin spot elongated in a tongue-like shape; abdominal spot as in Timor birds; ochre of under parts as in darkest of Timor birds. Wing, 116; culmen, 27.

BURU (MT. MADA): A single male has the back and wing spot very prominently streaked with black; no white spot on first primary; chin spot rather tongue-shaped; under parts rather deep ochre; bill large. Wing, 122; culmen, 30. A single female has the back vaguely marked with black streaks; big white spot on first primary; chin spot tongue-shaped; under parts rather pale, bill medium. Wing, 116; culmen, 27.

The name *crassirostris* Wallace is available for the Sula Islands population, but so far no characters have been found which clearly separate it from typical Timor birds.

***Mirafra javanica timorensis*, new subspecies**

TYPE: A.M.N.H. No. 307999; ♂ ad.; Dilly, Timor Island; April 22, 1932; Georg Stein coll.

Similar to *M. j. parva* (Flores), but more sandy rufous throughout; blackish pattern of upper parts similar, but streaking of breast apparently somewhat reduced; entire under parts prominently washed with sandy ochre, this color is deeper on breast, flanks, and thighs; superciliary, sides of face, and ear-coverts also washed with rufous ochre; entire upper parts not more or less pure grayish, but with a warm buffy ochre wash; edges of scapulars and tertials broader and more ochraceous; edges of upper wing-coverts and of wing-feathers broader and more tawny rufous. Rather similar to *javanica* in general coloration, but slightly paler ochraceous underneath and of smaller size, bill much less heavy. Very distinct from *halli*, *rufescens*, *soderbergi*, and the other Australian races of the species.

MEASUREMENTS: Wing, male, 72–77 (73.9), female, 69–73 (71.4); tail, male, 46–50, female, 45–48.

RANGE: Timor and Savu Islands.

This lark has obviously a very localized distribution. Stein is the first collector to encounter it on Timor, where he found it only at a single locality (Dilly). His series (collected in April) consists of worn specimens with one or two birds molting into fresh plumage. As far as can be seen, these specimens agree perfectly with a series of four freshly molted birds from Savu Island.

The general distributional picture is rather puzzling. *M. j. timorensis* is separated from the similar *javanica* by the very pale and grayish *parva*. A series of specimens from Sumba Island, including three adults in fresh plumage, was compared with two topotypical adults in fresh plumage from Flores Island, and no difference could be detected. A single bird from Sumbawa is slightly, and one from Lombok is distinctly, more ochraceous. The Lombok bird, in fact, agrees better with *javanica* than with *parva*.

***Anthus novaeseelandiae albidus* Stresemann**

Sumba birds are, as a series, of a distinctly colder and grayer color than specimens from Bali, Lombok, and Sumbawa. The type of *albidus* (Flores) agrees well with the Sumba series. This gray population in the east is the extreme of a graded series of populations beginning with the brownish *malayensis* on the

Malay Peninsula, through a somewhat paler population on Java, a still less sandy-colored one on Bali, Lombok, and Sumbawa, and ending in the very gray birds of Sumba. The differences between the various populations are not very striking and it is, therefore, advisable, as has been done heretofore, to unite the Java birds with *malayensis* and the Bali-Lombok-Sumbawa population with *albidus*.

THE EAST INDIAN *Geokichla* (FIG. 3)

The six species *dumasi*, *schistacea*, *peronii*, *dohertyi*, *erythronota*, and *interpres* form a group of closely allied forms which still largely represent each other geographically. Overlaps occur on Timor between *peronii* and *dohertyi* and on Lombok, Sumbawa, Flores between *dohertyi* and *interpres*. Rensch (1931), Stresemann (1940, Jour. Ornith., vol. 88, p. 92), and others have speculated on the probable origin and interrelationship of the species of this group, but without tangible success. The differences between these six species are quite striking, and it must be assumed, at least for *schistacea* and *peronii*, that they are old endemics. The closest relatives seem to be two isolated species, *everetti* on Kina Balu and *wardi* on Ceylon. The African *Geokichla* group (*gurneyi*, etc.) seems to be closer to the East Indian group than are *G. sibirica* and *citrina*.

The nearest relative of *peronii* is apparently *dohertyi*, and we must assume that the occurrence of both species on Timor is the result of a double invasion, with *dohertyi* being the recent arrival. If this is the case (and there are a number of points which support this hypothesis) we have one of the few situations in which the earlier immigrant is a lowland bird and the more recent arrival is restricted to the mountains.

Geokichla dohertyi Hartert

There is a slight amount of geographical variation within the range of *dohertyi*, but it is not sufficient for the recognition of any subspecies. The population of Timor shows the largest measurements, those of Sumba and Sumbawa the smallest, while those of Lombok and Flores are intermediate. Sumba birds have less white on the upper throat than birds from the other islands. The back is darkest chestnut in birds from Timor and

Sumba, lightest (most tawny) in Lombok birds, while those from Sumbawa and Flores are intermediate.

MEASUREMENTS (THOSE OF RENSCH, 1931, P. 570, IN ITALICS): Wing, males: Lombok, 108, Sumbawa, 99–105 (102), Flores, 107, 104, 105, Sumba 104, Timor, 106, 109, 111, 111, 113, 114, 115; females: Lombok, 105, 108, Sumbawa, 101, 103, 107, Flores, 106, 106, Sumba, 100, 102, 106, 107, Timor, 105, 108, 108, 108, 110. Tail, males: Lombok, 74, Sumbawa, 66–72 (69.5), Flores, 75, 67, 74, Sumba, 70, Timor, 72, 77, 77, 78, 78, 80, 80; females: Lombok, 74, 75, Sumbawa, 69, 71, 73, Flores, 76, 73, Sumba, 65, 65, 66, 67, Timor, 73, 76, 76, 76, 77.

Geokichla peronii Vieillot

All the birds from Dutch Timor belong to typical *peronii*, the type locality of which I restrict to Kupang. To this race belong also four specimens in the Rothschild Collection from Atapupu. A single male from Dilly is much darker and more rufous. It is indistinguishable from a series of *audacis*. The range of this form includes probably all eastern Timor.

Turdus poliocephalus sterlingi, new subspecies

TYPE: A.M.N.H. No. 308001; ♂ ad.; Mt. Ramelan (2600 meters); Portuguese Timor; May 1, 1932; Georg Stein coll.

Very similar to *schlegelii* from western Timor and apparently indistinguishable in the color of the upper parts; sides of head, throat, and upper breast darker, sootier gray; abdomen deeper chestnut brown, less fallow.

MEASUREMENTS: Wing, male adult, 116, 120, 124, 124, 124, 125; tail, male adult, 96, 96, 99, 100, 101, 105.

RANGE: Mt. Ramelan, eastern Timor.

Stein's series is the first record of this thrush from eastern Timor. All the specimens (collected in May) are in fine, fresh plumage. A large series from Mt. Mutis (collected in February) is rather worn and faded. However, there are a few specimens in comparable plumage condition. Furthermore, the Rothschild Collection contains a single male from Mt. Mutis which was collected by Haniel on June 11, 1911 (Hellmayr, 1914), and which is in excellent fresh plumage. This

bird agrees with the best of Stein's skins from Mt. Mutis in the paler throat and abdomen. The Mt. Ramelan birds are very similar in the coloration of the under parts to *T. p. hygroscopus* from central Celebes. The greenish gray, instead of sooty black, upper parts distinguish the two forms at once.

It gives me great pleasure to name this newly discovered form in honor of Mr. Sterling Rockefeller whose interest was responsible for Stein's expedition to Timor.

NOTES ON *Saxicola caprata*

The distributional history of this species is very puzzling. Stresemann (1939, pp. 321, 325) made it quite certain that the species must have arrived in the Lesser Sunda Islands via Philippines and Celebes, but he did not show how the birds could have reached eastern New Guinea and New Britain. If the birds had used Australia or south New Guinea as stepping stones, we would expect to find them still in this area, but they are absent. On the other hand, the colonization of north New Guinea directly from the Philippines would necessitate a single jump of almost 2000 kilometers, since all the intervening country is unsuitable for this species. It is not impossible that such a jump has actually occurred, since there are many instances of avian distribution in the Pacific area which cannot be explained except by assuming jumps of similar or even greater size. A study of the distribution of *Lanius schach* and other species of similar distributional patterns might help to solve this puzzle.

As material of this species accumulates, it becomes increasingly evident that this species is composed of a great number of more or less isolated colonies. This pattern of distribution is to be expected since the grasslands, which are the habitat of this species, show an equally spotty distribution. The question to the taxonomist is how to arrange these local populations into subspecies. The main outlines of Stresemann's revision (1912, Novit. Zool., vol. 19, pp. 319-322) are still valid today, although a few additional races have since been named. Stresemann points out that within the *pyrrhonota* (= *fruticola*) group there is a certain amount of geographical variation both of size and coloration

of the females. Rensch (1931, Treubia, vol. 13, p. 380) took up this clue and described the Sumba population as *francki*. There are, however, at least two other unrecognized races, as already indicated by Stresemann (*loc. cit.*).

Saxicola caprata cognata, new subspecies

TYPE: A.M.N.H. No. 582409; Rothschild Coll.; ♀ ad.; Tapa, Babar Islands; August 29, 1905; H. Kühn coll.

Similar to *francki* (Sumba), but apparently slightly smaller; rump of females white, but body color very dark, fuscous rather than grayish; shaft streaks very pronounced (even when allowing for wear). Differs from *aethiops* by averaging smaller size and apparently by darker coloration of upper parts in females.

MEASUREMENTS: Wing, male, 72.5, female, 66.5, 66.5; tail, male, 55, female, 50, 52.

RANGE: Known only from Tapa, Babar Island.

Saxicola caprata fruticola Horsfield

Similar to *pyrrhonota* (Timor), but averaging larger. Adult males indistinguishable in coloration from *pyrrhonota*. Adult females distinctly grayer; under tail-coverts whitish, not rufous, in 12 of 14 specimens; rump usually buffy ochraceous, not rufous tawny; no white on basis of inner greater upper wing-coverts.

WING: Male adult, usually 72-77, occasionally as low as 70.

RANGE: Java and Lesser Sunda chain, eastward as far as Lomblen.

The 14 adult females are by no means a very uniform series, although all conform better to the diagnosis of *fruticola* than to *pyrrhonota*.

JAVA: Specimens from Mt. Tosari, 5000 feet (wing, male, 77, 77, female, 70, 74) are much larger than a series collected in the lowlands (male, 71, 72, 72, female, 69).

BALI: Three females are rufous.

SUMBAWA: Four females are very gray, with hardly a trace of rufous in the plumage, except on the rump. The under parts of the fourth bird are quite generously washed with rufous ochre.

FLORES: A single female is very dark and grayish.

LOMBLEN: Two females are quite dark and with a distinct rufous ochre wash on the under parts.

For the sake of comparison, a short diagnosis of *pyrrhonota* will be added.

***Saxicola caprata pyrrhonota* (Vieillot)**

Adult females rather pale and with a pronounced rufous tone. Among 10 females the under tail-coverts are white in only two (Savu, Kisser). The basal part of the inner greater upper wing-coverts is white in the females from Savu (1), Wetar (2), and Kisser (2), but not in the five females from Timor; the rump is rather deep rufous in all the females, but it is pale ochraceous in the single Savu bird. The size is small, except in the birds from Wetar and from the mountains of Timor.

WING (ADULTS): Savu, male, 69, female, 66.5; Timor, male, 67, 68.5, 69, 70.5, female, 67, 68, 70, 73 (the two large females from Mt. Mutis); Wetar, male, 72, 74, 74, 76, female, 70, 70; Kisser, male, 70, 70, 72, female, 68, 69.

RANGE: Savu, Timor, Kisser, and Wetar.

***Brachypteryx leucophrys leucophrys*
Temminck**

Specimens, assigned to this subspecies, may be either olive brown or rufous brown. In order to demonstrate this variation graphically and to translate it into numerical terms, I have applied a method which I have described on an earlier occasion (1938, Bull. Raffles Mus., Singapore, vol. 14, p. 13). I combined all the 23 adult birds from the Malayan islands in a single series and arranged them according to their hue of coloration. The most rufous bird is listed first, the most olive bird last. (S=Sumatra, J=Java, B=Bali, Sb=Sumbawa, L=Lombok, T=Timor.) S, S, Sb, S, B, Sb, Sb, S, T, T, T, T, J, T, J, Sb, Sb, L, L, J, L, L, L. Average rank: Sumatra, 1, 2, 4, 8 (3.75); Bali, 5; Sumbawa, 3, 6, 7, 16, 17 (9.8); Timor, 9, 10, 11, 12, 14 (11.2); Java, 13, 15, 20 (16.0); Lombok, 18, 19, 21, 22, 23 (20.6). This tabulation indicates that there are definite differences between the populations from the various islands. Sumatra birds are the most rufous, and Lombok birds the most olive. This difference is striking, if the five Lombok birds are placed beside the four Sumatra

skins. The difficulty is that the series from some of the islands (Java, Sumbawa) are quite variable and, furthermore, that the trend is irregular. The two most olive-colored populations (Java, Lombok) are sandwiched in between more or less rufous ones. Furthermore, I have before me material from only a single mountain in Java (Mt. Gedeh), and there is no assurance that the populations on the other isolated peaks are not much more rufous or more olive. In view of these objections it seems best not to recognize any races in the island range of *Brachypteryx leucophrys*. The species is most likely a rather recent arrival over most of this range. *Brachypteryx montanus floris* Hartert (Flores) is no more closely related to the present species than any of the other races of *montanus*.

***Pnoepyga pusilla timorensis*, new subspecies**

TYPE: A.M.N.H. No. 308002; ♂ ad.; Mt. Mutis (2000 meters), Timor; February 22, 1932; Georg Stein coll.

Similar to *rufa* (Java) and to *everetti*, but duller and paler. Upper parts paler and grayer, without a pronounced rufous tawny tone; sides of face buffy gray; upper and under parts more uniform, with the scaly pattern much reduced; light spots on upper parts paler, more buff. Sexual dimorphism slight, but females tend to have the under parts washed with buff.

WING: 52–55.

RANGE: Mt. Mutis (1800–2000 meters), Timor Island.

Most of the specimens (collected in February) are very worn. This, together with the more grayish coloration, indicates that the habitat of the species is considerably more arid on Timor than in the more western parts of the range. Stein did not encounter the species on Mt. Ramelan.

The immature plumage is very distinct. It lacks the scaly pattern of the under parts and the pale spots of the upper parts. Chin, upper throat, and center of the belly are whitish. The rest of the under parts is dark gray, more or less mixed with fuscous brown, particularly on the flanks. There is an indication of light streaking on the upper breast.

The discovery by Stein of this species on Timor is not entirely unexpected, since it also

occurs on Flores (*everetti* Rothschild). It is a typical member of the recently immigrated Malayan mountain fauna.

THE GENUS *Büttikoferella*

The position of this genus is not yet understood. In many respects it resembles the babbler genera *Dumetia* and *Pellorneum*, and this is where it is customarily placed by bird taxonomists. On the other hand, the genus is similar to many of the grass warblers. It resembles several genera in the Australian region, such as *Eremiornis*, *Megalurulus*, *Cichlornis*, and *Ortygocichla*. Further study must show whether these genera should be placed with the Timaliinae or the Sylviinae.

The immature plumage is, on the whole, similar to the adult dress, but lacks the rufous and ochraceous tones almost entirely. The under parts are dirty white, with many feathers, particularly on the breast showing earth brown or fuscous tips. The crown is snuff brown, the superciliary dirty brown.

There is no sexual dimorphism of coloration, but males are considerably larger than females.

MEASUREMENTS: Wing, male adult, 67.5–72 (69.9), female adult, 62–64.5 (63.5); tail, male, 76–83 (78.7), female, 66–76 (72.2).

The name *Büttikoferella* Stresemann (1928, Ornith. Monatsber., vol. 36, p. 40) was omitted not only from the "Zoological record," but even from the index of the periodical in which it was published.

Bradypterus montis timorensis, new subspecies

TYPE: A.M.N.H. No. 308007; ♂ ad.; Mt. Mutis (1800 meters), Timor; March 1, 1932; Georg Stein coll.

MALE: Similar to *montis* (Java) but lighter underneath. Chin and uppermost throat almost pure white; blackish fuscous spots on lower throat and breast much smaller; breast paler, less smoky gray; white on lores more pronounced; upper parts more cinnamon, less rufous; bill shorter.

FEMALE: Very similar to that of *montis* but paler; upper parts more cinnamon, less rufous; bill shorter.

MEASUREMENTS: Wing, male, 54, female, 58; tail, 63 (m.), female, 66.

Iris chocolate brown, bill brownish black, feet pale horn-colored.

RANGE: Known only from the type locality.

Until now the species *montis* was known only from the eastern half of Java. Its nearest relatives are listed by Delacour (1943, Ibis, vol. 85, p. 36).

THE SYSTEMATIC POSITION OF *Phylloscopus presbytes*

All the previous authors, without exception, who studied the systematic position of this species, came to the conclusion that it was closely related to *sarasinorum* from Celebes and more distantly to the whole *Phylloscopus trivirgatus* group. It came, therefore, as rather a surprise when Ticehurst in his "Review of the genus *Phylloscopus*" (1938, British Museum) declared categorically that *presbytes* had nothing to do with the *trivirgatus* group, and that it was entirely isolated with the nearest relatives "to be found no nearer than S. Annam." A renewed study of the relationship of this species leads me to disagree entirely with Ticehurst's startling conclusion. Proportions, tail pattern, and general coloration indicate that *presbytes* is really quite closely related to *sarasinorum*, as correctly maintained by the earlier authors (Hellmayr, Hartert, Stresemann, Rensch, etc.). As Stresemann (1940, Jour. Ornith., vol. 88, p. 106) has pointed out, *P. presbytes* is not particularly closely related to *trivirgatus*, which extends eastward in the Lesser Sunda Islands chain as far as Lombok and Sumbawa. On the other hand, the similarity with *sarasinorum* from south Celebes is so striking that the closest relationship must be assumed. It is very probable that *presbytes* (Flores and Timor) is the southernmost member of a chain of races beginning with *nigrorum* in the Philippines and including all the Celebes races.

Ticehurst's reasons (*op. cit.*, pp. 5–9) for excluding the "*Cryptigata*" group of species from *Phylloscopus* become entirely invalid, as soon as the close relationship of *presbytes* with *sarasinorum* is acknowledged. Furthermore, most of his criteria of the "genus" *Cryptigata* are not valid, if examined more closely. Ticehurst, for example, places particular emphasis on the tail-wing ratio, which is supposed to be 73–80 in the *Acanthopneuste* section of *Phylloscopus* and 64–71 in "*Cryp-*

tigata." This may have been his principal reason for associating *presbytes* with *Phylloscopus*. The tail ratio of subspecies *presbytes* is: male, 76.3, 76.9, 78.9, 80.0, 80.7, female, 73.6, 73.7, 75.0, 76.9, 77.1, 83.3; in *floris* it is 73.4, 75.4, 75.5. In two races of the *Cryptigata* group the ratios are as follows: *sarasinorum*, 70.4, 71.1, 71.8, 72.2, and *nigrorum*, 71.2, 72.6, 73.7, 75.8. These figures show that there is no gap between *Phylloscopus* and "*Cryptigata*." The *Phylloscopus*-like features of *presbytes* (narrow bill, long tail, pale color) are probably due to the arid climate of Flores and particularly of Timor. It favors morphological characters which are quite similar to those of temperate zone (dry climate) *Phylloscopi* and different from the habitus of the species that live in the humid tropics. The adaptive plasticity of bill, tail, and wing shape in these tropical *Phylloscopi* makes it at once apparent that it is impossible to retain a genus *Cryptigata*. How the various forms of the *trivirgatus* group should be arranged into species can be determined only in the course of a revision of the whole group.

It is possible that *presbytes* varies geographically on Timor. The Mt. Ramelan birds (collected in May) seem to have less yellow and more gray in the plumage than the Mt. Mutis series. Mt. Mutis birds (collected in February) have the crown olive brown and the back olive citrine-green. In Mt. Ramelan birds the crown is much grayer and the back a colder green with a grayish tone. The under parts are much paler yellow than in Mt. Mutis birds. The Mt. Ramelan

birds show evidence of some wear, and the specimens with the greatest wear show also the mentioned characters most pronounced. Two females from Atapupu (collected in August) show slight wear and are about intermediate in characters.

There is definite altitudinal variation of size in this species.

There is not even an overlap of size between the birds from the lowland and the high altitude localities. The tail-wing ratios of the lowland birds (male, 75.0, 77.4, female, 75.3, 76.7) are similar to those of the highland birds as listed above.

***Seicercus montis paulinae*, new subspecies**

TYPE: A.M.N.H. No. 308004; ♂ ad.; Mt. Mutis (1800 meters), Timor; February 26, 1932; Georg Stein coll.

Similar to *S. m. floris* Hartert, but larger; fuscous stripes on sides of crown still further reduced; brown of crown brighter and lighter, more golden ochre; color of back brighter and purer green, more warbler green than olive; brown on ear-coverts and sides of throat more mixed with yellow; yellow on rump more conspicuous.

MEASUREMENTS: Wing, male adult, 53.5, 54.5 (50–52¹), female adult, 51, 51, 52 (47–49); tail, male adult, 44, 44 (39–42), female adult, 40–41 (37–39).

RANGE: Mt. Mutis (1800–2300 meters), Timor Island.

Most specimens (February 24–March 2, 1932) are in molt, but several have practically completed it. This is a most interesting

¹ Measurements of *floris* in parentheses.

ALTITUDINAL VARIATION IN <i>Phylloscopus presbytes</i>	MALE		FEMALE	
	Wing	Tail	Wing	Tail
Atapupu lowlands			47.0, 50.5	36, 38
Noilmina 300 meters	53, 54, 56	41, 41, 42		
Mt. Mutis 1800–2300 meters	57, 58, 58	45, 46	52, 53, 54, 54.5, 56, 59	39, 40, 42, 43.5, 45
Mt. Ramelan 2000–2300 meters	58.5, 59, 60	45, 45, 48	56	42

eastward extension of the range of this species.

The new form is named in honor of Mrs. J. Sterling Rockefeller.

Gerygone inornata

Meise in his monograph of the genus *Gerygone* (1931, Novit. Zool., vol. 36, pp. 358–374) united no fewer than 20 forms in the species *fusca*. There is little doubt of the intimate relationship of these forms; on the other hand, within the "species" *fusca* of Meise one can distinguish a number of subdivisions which seem to deserve specific rank. The ranges of these specific groups approach each other very closely without any signs of intermediacy. I suggest, therefore, recognizing a superspecies *fusca* with the four species *fusca*, *laevigaster*, *inornata*, and *sulphurea*. I include the *cantatrix* and *pallida* groups with *laevigaster* and the *dorsalis* group with *inornata*. Stresemann (1939, Jour. Ornith., vol. 87, p. 360) suggests accepting *dorsalis* as a good species and uniting *inornata* with *sulphurea*, but it seems to me that *inornata* is much closer to *dorsalis* than to *sulphurea* both in regard to color pattern of the head and general coloration. In regard to the coloration of the tail, *sulphurea* is even farther away from *inornata* than is *dorsalis*. The closest relative of the *Gerygone fusca* group is *Gerygone ruficollis* from the mountains of New Guinea; in fact it may even be considered a member of the same superspecies. Its song is a descending achromatic scale exactly like that of *Gerygone sulphurea flaveola*, as described by Heinrich (1940, Jour. Ornith., vol. 88, p. 88).

***Dendrobiastes hyperythrus clarae*,
new subspecies**

TYPE: A.M.N.H. No. 308006; ♂ ad.; Mt. Mutis (2000 meters), Timor; February 26, 1932; Georg Stein coll.

ADULT MALE: In size similar to *vulcani*, but under parts lighter, more orange buff, less deep ochre; upper parts lighter blue-gray, less sooty; white stripe on both sides of the forehead narrower; differs from *audacis* by the paler under parts.

ADULT FEMALE: Differs from that of *audacis* by having a smaller bill, by having the under parts more orange buff, instead of ochraceous buff, by having the back much

more olivaceous (less grayish), and by having the edges of the wing-feathers more olive brown, less rufous; lesser upper wing-coverts olive gray. Differs from *vulcani* by the much paler color of the under parts, with the abdomen and under tail-coverts whitish; by the olive gray, instead of rufous brown edges of the wing-feathers, by the olive blue-gray, instead of olive brown back, by the white or buffy white forehead and superciliary (which is orange ochre in *vulcani*) and by the grayish, not brownish, tail.

MEASUREMENTS: Wing, male, 61–65, female, 61; tail, male, 45–47, female, 43.

RANGE: Timor (Mt. Mutis and Mt. Ramealan, 1800–2300 meters).

This form is close to *audacis*, but differs by the mentioned characters. I can find no differences between specimens of *vulcani* from Java, Bali, Lombok, and Sumbawa. Two males from Flores have the back unusually pale gray, but their subspecific association will remain doubtful until females can be examined. This interesting new form is named in honor of Mrs. Georg Stein, who personally prepared a considerable part of the skins of the Timor collection and who contributed in many other ways to the success of the expedition.

The two Celebes forms *jugosae* and *analisae* belong definitely to the Malayan group of *Dendrobiastes hyperythrus* and are in fact very close to *vulcani*, *mjöbergi*, and *malayanus*. They are not in the least similar to the Philippine forms *montigena*, *nigrorum*, *luzoniensis*, etc. It can, therefore, be assumed that *Dendrobiastes hyperythrus* colonized Celebes from the south and west, rather than from the Philippines as assumed by Stresemann (1940, Jour. Ornith., vol. 88, p. 80). This does not require the postulation of any land bridges, since the ability of *D. hyperythrus* to jump water gaps is well known (see settlement of Batjan, Babar, Buru, Seran, etc.).

***Siphia timorensis* (Hellmayr)**

This species was known, until a few years ago, as *Erythromyias pyrrhonota* (Müller). Müller, however, had described the species originally (1843) in the genus *Saxicola* and since there was an earlier *Saxicola pyrrhonota* (Vieillot, 1818) the Timor species had to be

renamed, which was done by Hellmayr (*Erythromyias timorensis*, 1918). The generic question is equally involved. Bonaparte (1854) created a genus *Oreicola* for "the three oceanic chats" of his "Conspectus avium." Two of these were true chats, but the third one (*pyrrhonota* Müller) was a fly-catcher. Gray (1855, p. 143), unfortunately, selected this third species as the type of the "chat" genus *Oreicola*. This selection was done strictly according to the rules of nomenclature, and *Erythromyias* Sharpe (1879) becomes, therefore, a synonym of *Oreicola* Bonaparte (1854). Furthermore, the chats (*ferrea*, *jerdoni*, and *gutturalis*) that until recently have been listed under *Oreicola* must now be referred to the genus *Rhodophila* Jerdon (1863). It might be mentioned in this connection that *Rhodophila melanoleuca* Jerdon (1863), which is used by Stuart Baker, Ticehurst, and other recent writers, is pre-occupied by *Oenanthe* (= *Rhodophila*) *melanoleuca* (= *gutturalis*) Vieillot (1818) and must be replaced by *Rhodophila jerdoni*. So much for the nomenclature of this species. Another difficulty concerning this species is its place in the system.

Zoogeographically it is a member of the group which represents the "old Malayan stock" in the Timor fauna. Taxonomically it is not very far removed from "*Erythromyias*" *buruensis* and *dumetoria*, but it also seems to be related to some Asiatic species, including "*Ochromela*" *nigrorufa* from the Indian Peninsula. Instead of recognizing many monotypic or oligotypic genera, it seems best to accept a collective genus *Siphia*.

Siphia harterti Siebers

Most welcome are Stein's five specimens of this Sumba species which up to now was known only from the unique female type. The discovery of the male has not facilitated very much the search for the correct systematic placement of this species. Sexual dimorphism of coloration is completely lacking; the female differs from the male only by being slightly smaller. The present specimens agree well with Siebers' original description (1928, *Treubia*, vol. 10, p. 402), except that I would describe the throat as "dirty white" with a faint grayish wash, rather than "with a rust-colored wash." The rufous cinnamon of the

side of the breast protrudes as a small triangle on the lower breast, suggesting a broadly interrupted pectoral band. The flanks are white.

The species is sufficiently distinct from *dumetoria* (Lombok, Sumbawa, Flores, Tenimber), from *buruensis* (Buru, Seran, Kei), and from *timorensis* (Timor), not to be considered as particularly closely related to them. All four species seem to constitute an old Malayan element, which spread to the Lesser Sunda Islands, the Timor group, and the southern Moluccas, but is curiously absent from the Celebes group and from the Philippines.

MEASUREMENTS: Wing, male, 67, 67.5, 68, 70, female, 64.5; tail, male, 49, 50, 50.5, 52, female, 46.5; tail index, male, 72.1, 74.3, 74.7, 74.8, female, 72.2.

Muscicapula melanoleuca subspecies

This is a strongly heterogynic species. Geographical variation is, as far as I know, restricted to the female plumage. Females always seem to be in the minority of the collections, and this makes the working out of the variation in this species rather difficult. Well characterized races are: (1) typical *melanoleuca* of the Himalayas and Assam, in which the back of females is very brownish gray; (2) *westermanni* (Malay Peninsula, Borneo), in which crown and upper back of females are of a pure dark blue gray; (3) *hasselti* (Java, Bali, Lombok, Sumbawa), in which the back of the females is olive gray, while upper tail-coverts and tail are rich russet brown. All the other populations are somewhat intermediate, the back is more or less olive gray, the upper tail-coverts vary from olive-gray brown to rufous. This includes birds from Burma, Yunnan, Indo-China, Philippines, Celebes, Moluccas, and the Timor group. So far only one valid name seems to have been proposed within this assemblage, *langbianis* Kloss (1927, *Bull. Brit. Ornith. Club*, vol. 47, p. 145, Langbian Massif, south Annam). This race is characterized as follows: "Annam females differ [from *melanoleuca*] in being greyer, much less brown, above. They are also paler and greyer, less bluish, above than Malayan birds [*westermanni*] and slightly tinged with ochraceous on the rump." This description

fits almost literally a series of three adult females from Wetar and Timor. They differ from *hasselti* (Java, etc.) by having tail and upper tail-coverts grayish olive ochre, instead of rufous, and from *westermanni* by having crown and upper back pale slate gray and lower back and rump olive gray. There are no obvious differences in a comparison with a single adult female of *langbianis*. It may be necessary to use the name *langbianis* collectively for all the above-mentioned intermediate populations.

Rhipidura rufifrons

The subspecies *sumbensis*, the validity of which was questioned by Hellmayr (1914, p. 32), averages not only larger, but differs also by some color characters. The black breast band is wider and more scaly on its posterior margin. The rufous of the back is darker and reaches higher up on the upper back. Birds from Wetar are indistinguishable from Timor birds; specimens from Savu, Flores, and Alor agree with Timor birds in coloration, but average larger. They are probably best referred to *semicollaris*.

MEASUREMENTS: Timor, wing, male, 67.5, 70, 70.5, 70.5, 72, female, 69.5; tail, male, 87, 88, 90, 90, female, 87. Sumba, wing, male, 71.5, 73.5, 74, 75, 75, 76, 76, female, 68.5, 70, 71; tail, male, 89, 91, 92.5, 92.5, 93.5, 95, female, 88, 88.5, 91.

The northwest Australian *dryas* is very similar to *sumbensis* and *semicollaris*, and closest relationship must be assumed. There is a high probability that *dryas* descended from *semicollaris*, but the opposite possibility cannot be ruled out until a close study of the whole *rufifrons* group has been made.

Monarcha trivirgatus AND ITS RELATIVES

The fact that *Monarcha leucurus*, *loricatus*, and *everetti* replace *Monarcha trivirgatus* (and subspecies) geographically has caused Meise recently to include them with this species (1930, Jour. Ornith., vol. 78, p. 459). This is, in my opinion, another instance of an ill-advised application of the principle of geographical representation. The three mentioned forms are apparently not even very close to *trivirgatus*. They belong to the *manadensis-barbatus-verticalis-menckei-infelix-brehmii* section of the genus, while *trivirgatus* is related to

"*Heteranax*" *mundus* (Tenimber, Damar) and to *Monarcha guttula* (New Guinea, etc.). The differences are manifold and consist not merely in the absence of rufous color in the adult plumage, as Meise implies. In the *leucurus* group, the tail is more extensively white, the back is blue black instead of gray, the black pattern on face and throat is different, and there are differences of size and proportion. On the whole the *leucurus* group can be considered as much older than *trivirgatus* since its few isolated subspecies are very distinct from each other, while all the forms of *trivirgatus* (at least the western ones) are quite similar.

There is a remarkable break in the range of *trivirgatus* between *wellsi* (Seranlaut to Kisui) and *albiventris* (Cape York, Queensland, and ?South New Guinea). This gap can perhaps be explained if we assume *guttula* to be related. The two species overlap, however, in the Louisiades (Misima and Tagula). Whether or not the presence of *leucurus loricatus* on Buru and of *leucurus leucurus* on the Kei Islands prevented colonization by *trivirgatus* is hard to decide. A representative of *trivirgatus* might be expected on both islands but is not found. *Monarcha mundus* is, in spite of its peculiar bill, a close relative of *Monarcha trivirgatus*. The two species overlap, however, on Damar Island.

Monarcha cinerascens cinerascens Temminck

Stein's topotypical specimens from Timor are extremely valuable since only very few typical specimens of this subspecies are known. Meise had seen none when he wrote his revision (1929, Jour. Ornith., vol. 77, pp. 455-458), and this deficiency led him somewhat astray. Typical Timor *cinerascens* are very pale gray on crown, throat, and back, but the abdomen is not so deep chestnut as claimed by Meise. It is, in fact, only slightly darker than in *disjunctus*. In this character there is a cline beginning with the Banda Islands, which is the home of the darkest population, over "*kisserensis*" and *cinerascens* to *disjunctus*. Very disconcerting is the fact that *harterti* (Ternate and Buru) is not sufficiently paler brown on the abdomen, compared with Timor *cinerascens*, to be recognizable.

A certain amount of variability remains in this species, even if all immatures are eliminated and after the sexes are segregated. Thus, among six adult males from Tjamplong (Timor), one individual is strikingly darker gray, as dark as *disjunctus* or *jacobii*. The series from the Kei Islands is extremely variable both in regard to the color of the abdomen and the back. A single individual from Great Banda is paler brown on the abdomen than the others; the same bird is darker gray on the back. This individual variation is probably caused by the occasional wandering of individuals from one island to the other.

The subspecies *cinerascens*, as delimited by recent workers (Meise, Hartert, Stresemann), includes the populations from the Timor group, the South West Islands, the South East Islands, Tenimber Islands, Kei Islands, and Banda group. Actually this is a rather heterogeneous assemblage of forms. They all agree in the paleness of the gray, but in regard to the color of the abdomen a cline is represented with Banda birds at the darkest (deepest chestnut) extreme and Timor birds at the palest end. Birds from Kisser Island, which lies in the immediate vicinity of Timor, are interesting because this island is the type locality of *kisserensis* A. B. Meyer. These birds are intermediate between Timor and Banda birds, but on the whole closer to Timor birds, exactly as one would expect from the geographical position of Kisser. No name is available up to the present for the dark-bellied Banda population.

***Monarcha cinerascens brunneus*,
new subspecies**

TYPE: A.M.N.H. No. 654010; Rothschild Coll.; ♂ ad.; Great Banda Island; August 21, 1898; H. Kühn coll.

Similar to *cinerascens* (and "*kisserensis*"), but abdomen of a deeper chestnut brown. This is particularly apparent on the under tail-coverts and in the middle of the abdomen. Gray of upper parts and throat darker, more bluish. Size averaging slightly larger. Differs from *intercedens* by being paler in the gray parts and darker brown on the abdomen.

MEASUREMENTS: Wing, male, 85, 85.5, 86, 87, female, 83; tail, male, 71, 72, 72.5, 77, female, 70.

RANGE: Great Banda.

A single male from Great Banda has a much paler abdomen and darker upper parts. It is also smaller (wing, 82; tail, 71), but seems fully adult. A single male from Maar Island, Seranlaut, is as dark as Banda birds (wing, 83.5; tail, 68), and should also be referred to *brunneus*.

The question remains, what to do with the populations from all the intermediate islands.

Two males from Teor and one male from Manawoka, Goram Islands, are distinctly lighter brown underneath. The same is true for three of four birds from the Tual, Little Kei Islands. A fourth bird is as dark as the darkest *brunneus*. There is little difference between series from Kisser, Moa, Damar, and the Tenimber Islands. All are intermediate between *cinerascens* and *brunneus* and agree approximately with the three lighter Kei Island birds. The name *kisserensis* is available for these intermediate populations, and it might be convenient to use it for this assemblage of forms.

Pachycephala orpheus

The relationship of this species is still rather obscure. Its geographical representative on Roma, Letti, and Moa, *Pachycephala par*, is so similar that it might well be considered merely a subspecies. The species *Pachycephala sulfuriventer* and *P. simplex-griseiceps* are related, but only distantly. The females of the *Pachycephala pectoralis* races from the Lesser Sunda Islands and the Timor group are so similar to *orpheus* that close relationship is indicated. It is possible that *P. orpheus* originated as a hen-feathered island race of *P. pectoralis*, in the same manner as the Rennell and Norfolk Island races of this species. The immature plumage, however, with its absence of rufous tones and the strong streaking of the breast, is quite different from that of *pectoralis*.

***Lanius schach bentet* Horsfield**

Two "new" races have recently been described from the range of *bentet*. Both are based on characters which vary individually more than geographically. *L. s. tosariensis* Kuroda (east Java) is supposed to differ from *bentet* by having the entire crown black. Actually this character is very variable. The color of the crown in specimens before me is

as follows (g=crown gray, except forehead; i=crown intermediate; b=crown black): Sumatra, 5g, 2i; west Java, 4g, 1i; east Java, 3g, 5i, 4b; Bali, 4g, 3i; Lombok, 5g, 1i; Sumbawa, 4g, 2i, 2b; Kisser, Wetar, Timor, Alor, 10g, 6i, 1b. This tabulation indicates that the color of the crown is subject to a slight degree of geographical variation, but it is equally obvious that this variation is too irregular and too indefinite to be used for sub-specific description.

In regard to size, there is a definite trend with western birds largest and eastern birds smallest. A series of eastern birds (Kisser to Alor) measures as follows: wing, six males, 86–90 (88.5), eight females, 85–89.5 (87.2); tail, two male adults, 120, 123, seven females, 116–119 (117.1). The wing of western birds reaches 95, but there is too much overlap to justify the recognition of a larger subspecies (Rensch, 1931, p. 581). In regard to the color of the lower back and rump, eastern birds are darker than Sumatra birds, as Stresemann pointed out (1913, Novit. Zool., vol. 20, p. 356), but Java birds are as pale as Sumatra birds, and Neumann's race *sumatrae* is, therefore, untenable (see also de Schauensee and Ripley, 1939, Proc. Acad. Nat. Sci. Philadelphia, vol. 91, p. 360). In fact the difference between eastern and western birds is not sufficiently strong to justify the recognition of a separate race.

The isolated occurrence of this species in eastern New Guinea is a zoogeographical puzzle. *L. s. stresemanni* Mertens is so different from the two geographically nearest subspecies, *bentlei* (Timor, etc.) and *nasutus* (Philippines), that it cannot be said with which one it might be more closely related.

Oriolus viridifuscus (Heine)

If this species is considered a subspecies of *O. bourouensis*, as was done by Meinertzhagen (1923, Ibis, p. 89), such a species should also include four or five other forms which were given specific rank by Meinertzhagen. The actual relationship of all these forms can be expressed in a more nearly correct way by accepting a large superspecies which also includes *phaeochromus* (Halmahera) and *forsteri* (Seran). *O. viridifuscus* is best considered a separate species with *finshi* (Wetar) its only other subspecies. The nearest relative

is *sagittatus* of Australia which seems to have descended from *viridifuscus*. The importance of the Timor species is that it forms the link between the *bourouensis-phaeochromus* and the *sagittatus* groups.

Cinnyris solaris

This species presents an interesting case of recently completed speciation, as Rensch (1931, p. 613) has pointed out. *C. solaris* is almost entirely allopatric with *C. jugularis*, but both species overlap on the islands Sumbawa, Flores, and Lomblen. The Sumba form *buettikoferi* is intermediate between both species to such an extent that it could equally well be considered as belonging to either species. The male resembles that of *jugularis*, the female that of *solaris*. Furthermore, *C. solaris* occupies that curious "white spot" in the distribution of *jugularis* in the Timor region (see Stresemann, 1939, map 17, p. 407). As Rensch (*loc. cit.*) says, there can be no doubt that *solaris* is a descendant of *jugularis*. "I assume that *solaris* evolved from *jugularis* during the end of the Tertiary when the island of Sumbawa was submerged. By the time when Sumbawa rose again above sea-level and came into close proximity with the neighboring islands, the two forms had diverged to such a degree that sexual affinity had disappeared. *C. jugularis pectoralis* was now able to spread from the west to Sumbawa, Flores and Lomblen, without mixing with *solaris*." I fully agree with this interpretation of the distributional data.

Anthreptes malacensis

The Sumba form *rubrigena*, which is characterized by the absence of the maroon red scapulars and edges of the greater upper wing-coverts, is strikingly different from the neighboring races. In regard to the color of the cheeks, I find little difference between *rubrigena*, *convergens* (Lesser Sunda Islands), and *celebensis*, which conflicts with Rensch's remarks on this character. The island of Celebes seems to have been colonized both from the Lesser Sunda Islands (*convergens*) and from the Philippines (*chorigaster*), both of which are very similar to *celebensis*. The occurrence on Sumba and on many of the small islands of the Philippines proves the excellent colonizing faculties of this species.

There is evidence for a considerable amount of recent speciation in the *malacensis* group. The two species *rhodolaema* and *griseigularis* are so similar to *malacensis* that they would undoubtedly be considered conspecific if their ranges were not overlapped by *malacensis*. They were probably geographical representatives of *malacensis*, prior to the recent range expansion of the latter species.

Philemon buceroides

The Wetar race *pallidiceps* is very slight. Most specimens of Stein's Timor series are unfortunately either immature (11 of 18 birds) or very worn. Adult birds in fresh plumage measure as follows: wing, male, 157, 157, female, 153; tail, male, 136, 136, female, 133; bill, male, 45, 46, 47, female, 41, 43, 44. For Wetar birds I measure: wing, male, 156, 157, 160, 160, female, 149, 150; tail, male, 133, 133, 134, 136, 137, female, 130, 134; bill, male, 46, 47, 47, 47, 50, female, 44, 45. The paler crown of Wetar birds, however, seems to hold, although it is partially due to wear. Savu birds are slightly smaller: wing, male, 153, female, 142; tail, male, 129, female, 126; bill, male, 46, female, 43.5. The Alor and Lomblen race (*plesseni*) is much darker and slightly smaller. The Sumba race (*sumbanus* Rensch) is much darker than typical *buceroides*, but about of the same size. Wing, male adult, 156, 157, 158, 162, 162, female, 146, 149, 149; tail, male adult, 133, 133, 139, 140, 145, female, 127, 129, 136; culmen, male, 44, 44, 45, 46, 48, female, 42, 43, 43 (Stein series).

Philemon inornatus inornatus Gray

There has been some doubt as to the application of the name *cineraceus* Bonaparte ("Timor, ex S. Müller"). The original description is insufficient, but Finsch made the claim (1901, Notes Leyden Mus., vol. 22, p. 272) that the type was a specimen of *kisserensis*. Hellmayr (1914, p. 49) corrected this, however, and showed that there were in the Leiden Museum actually two specimens labeled as type. One of these is a typical adult male of the Timor species *inornatus*; the other specimen is a young female of *kisserensis*. The original labels exist no longer, but it is known that S. Müller never visited Kisser, Letti, or Moa, the only three islands

on which *kisserensis* occurs. It is, therefore, very likely that the Kisser specimen was labeled as type by mistake, unless one wants to accept the far-fetched possibility that Müller obtained *kisserensis* as a cage bird on Timor Island. It is thus probable that the *inornatus* specimen is actually the holotype of *cineraceus*. However, in order to eliminate all doubts, I hereby select the above-mentioned adult male from Timor in the Leiden Museum as the lectotype of *cineraceus* and, furthermore, I restrict the type locality of *cineraceus* to Pariti, western Timor Island. The *inornatus* specimen thereby becomes the virtual type of *cineraceus*, which is important in case anyone considers the two Leiden specimens as cotypes. Our action conforms with Bonaparte's statement that Timor was the type locality of *cineraceus*. *P. cineraceus* thus becomes an unambiguous synonym of *inornatus*, and the nomenclature, as it has been accepted by most authors during the past 60 years, becomes permanently fixed.

Philemon inornatus robustus, new subspecies

TYPE: A.M.N.H. No. 308000, ♀ ad.; Mt. Ramelan (2400 meters), eastern Timor; May 2, 1932; Georg Stein coll.

In coloration indistinguishable from *inornatus* (western Timor) but considerably larger.

MEASUREMENTS: Wing, male adult, 124–130.5 (127.4), male immature, 122–127 (124.9), female adult, 117, 118, 120, 124, female immature, 112, 112; tail, male adult, 104–115 (109.4), male immature, 112, 112, 120, female adult, 101–110 (103.8), female immature, 99, 100; culmen, male adult, 29–32. The measurements of typical *inornatus* are: wing, male adult, 115–122, male immature, 110.5, 116, 116.5, female adult, 109, 113, female immature, 107; tail, male adult, 96–105 (99.6), male immature, 99, 99, 103, female adult, 92, 95, 96, 96, female immature, 98; culmen, male adult, 29–32.

RANGE: Eastern Timor (Dilly, Mt. Ramelan).

Many specimens of the Stein series, particularly from western Timor, are either badly worn or molting. It was, therefore, possible to use the measurements of only about half the entire series of 42 specimens. A new series

of *inornatus* in fine plumage condition may show that the above-listed measurements will have to be revised. Two males and two females from Atapupu (Rothschild Collection) are about halfway in size between the two forms. This is to be expected in view of the intermediate position of this locality (wing, male adult, 120, 122.5, female, 113, 113.5; tail, male, 104, 107, female, 104, 107). In their wing measurements, these specimens are closer to *inornatus* and should probably be referred to this race. There is little indication of altitudinal variation in *robustus*. Two adult males from Mt. Ramelan (2000 meters) fall inside the range of variability of a Dilly series, but their wing is in molt, and the longest primary may not yet be fully grown. A single adult female from Mt. Ramelan (2400 meters) is larger (wing, 124; tail, 110) than the largest female in a small series from Dilly (wing, 120; tail, 108). I have chosen Mt. Ramelan as the type locality, since its population is apparently the largest one in a clinal series of populations with the small-sized western Timor population at the other extreme.

Hellmayr (1914, p. 48) made the statement that this species had up to that time been recorded with certainty only for eastern Timor. This statement is literally correct, since there are no exact localities on the labels of specimens collected prior to Wallace's visit. However, we know that all the collecting of the "Voyage au Pôles Sud" was done at Kupang and that the type of *inornatus* must, therefore, have come from that locality. It is equally true that S. Müller did all his work at or near Pariti (Pritti) and that the type of *cineraceus* must have come from the neighborhood of that locality. (The length of the wing, male adult, 118 mm., confirms this allocation of this specimen.) It is, therefore, obvious that two names were available for the western Timor form, but that the large eastern Timor form was still without a name.

NOTES ON THE GENUS *Philemon*

The friar-birds, which are united by progressive ornithologists in the genus *Philemon*, are scattered by Mathews (1930, "Systema avium Australasianarum," pp. 801-806) over six genera, five of which seem unnecessary.

There might be some excuse for this splitting if Mathews had included in each of these genera a single group of closely related species, but this is by no means the case. The *moluccensis* group, to which *moluccensis*, *bucerooides*, *novaeguineae*, *eichhorni*, and other species belong, is split into no fewer than four genera; *Philemon inornatus* and *kisserensis* are generically separated from *citreogularis*, their closest relative, and so forth. The need for a more natural arrangement is apparent, and this is the reason for the present study. Questions of nomenclature have not been examined. The genus has had its share of nomenclatorial upheavals during the past 25 years: *P. lessoni* was synonymized with *diemenensis*, and *bucerooides* was transferred from the Australian to the Timor bird, with *timoriensis* as synonym (Hellmayr, 1916).

There is much circumstantial evidence to indicate that the origin of the genus *Philemon* is to be looked for in the Papuan region. New Guinea is the home of the most primitive species (*meyeri*), and the most closely related genera (*Pycnopygius*, *Melitograis*) are Papuan or Moluccan. All the Australian species, except *argenteiceps*, occur also on New Guinea (although two of them, *citreogularis* and *corniculatus*, only in southern New Guinea).

The known 12 or 14 species of *Philemon* can be arranged naturally into four groups. The species within each of these groups are still largely allopatric. These groups are (in each case the name of the earliest-named species has been adopted as the group name):

- (1) *meyeri*
- (2) *citreogularis* group
 - brassi*
 - citreogularis*, including *kisserensis*
 - inornatus*
- (3) *moluccensis* group
 - fuscicapillus*
 - subcorniculatus*
 - moluccensis*, including *timorlaoensis* and *plumigenis*
 - bucerooides*
 - novaeguineae*, including *yorki*, *jobiensis*, and *cockerelli*
 - eichhorni*
 - albitorques*
 - argenteiceps*
- (4) *corniculatus* group
 - corniculatus*
 - diemenensis* (= *lessoni*)

The relationship of these four groups of species is as follows: *P. meyeri*, which is restricted to New Guinea, is by far the most primitive species. It stands alone but connects the genus *Philemon* with the other Meliphagidae, as, for example, with *Pycnopygius*. The *Philemon citreogularis* group consists of three species, of which the Papuan *brassi* Rand is the most distinct. *Philemon c. kisserensis* from Kisser, Letti, and Moa Islands is so similar to *citreogularis* that it must be considered a subspecies, while the Timorese *inornatus* may be regarded a full species. Still, it is clearly a descendant of *citreogularis*.

The *moluccensis* and the *corniculatus* groups seem to be distantly related to one another. It is probable that *corniculatus* descended from the Australian and *moluccensis* from the Papuan-Moluccan branch of a formerly uniform population. The *moluccensis* branch has become much diversified since then and has split up into a number of species. It is largely a matter of taste which forms of this group are called species and which subspecies. The species *buceroideus* and *novaeguineae* are so similar to *moluccensis* that all three could well be considered as conspecific. On the other hand, the representative island forms *fuscicapillus* (Morotai, Halmahera, Batjan), *subcorniculatus* (Seran), *eichhorni* (New Ireland), and *albitorques* (Admiralty Islands) are sufficiently distinct to be considered separate species of the superspecies *moluccensis*.

The Australian species *argenteiceps* offers a most interesting example of speciation. It is still so similar to *buceroideus* that if this species were restricted to an island and if no other member of the *moluccensis* group were found on such an island, few ornithologists would hesitate to include *argenteiceps* in the species *buceroideus* or *novaeguineae*. Actually it lives side by side with *novaeguineae yorki* over most of northern Australia without any signs of interbreeding. This proves beyond doubt that *P. argenteiceps* is a good species. The best way to explain this distributional overlap is to assume a double invasion of Australia. *P. argenteiceps* comprises the descendants of the first stock of colonizers, while *P. novaeguineae yorki* is the result of a second colonization which probably took place rather recently, namely, when Cape York was joined to south

New Guinea during the late Pleistocene. When the second group of colonizers arrived in Australia, *argenteiceps* had already developed sufficient distinctness not to interbreed any longer.

The *corniculatus* group consists of only two species, *P. corniculatus* from Australia and south New Guinea and *P. diemenensis* (= *lessoni*) of New Caledonia and the Loyalty Islands. The latter is a very distinct species, but a number of characters, such as the gray on the wing and the feather structure on throat and breast, suggest descent from a *corniculatus*-like stock.

***Piprisoma obsoletum tinctum*, new subspecies**

TYPE: A.M.N.H. No. 308003; ♂ ad.; Waingapu, Sumba; May 15, 1932; Georg Stein coll.

Similar to *obsoletum*, but entire under parts tinted with pale buffy yellow, not pure chalk white; grayish streaking on breast much more conspicuous, sides of breast gray; upper parts with a more pronounced greenish wash, dark olive gray, not olive brown; size smaller.

MEASUREMENTS: Wing, male adult, 57–60 (58.5), female, 55, 55, 57; tail, male, 29–31 (29.6), female, 27, 27.5, 28. A series of *obsoletum* measures: wing, nine male adults, 59.5–63 (61.4), female, 57; tail, male, 30–34 (31.4), female, 26.

RANGE: Sumba, Sumbawa, Flores, and Alor.

Single specimens from Flores and Alor (juvenile) agree well with the Sumba series.

Stein's fine Timor series of this rare species is very important for the study of this genus. It shows that typical *obsoletum* are almost immaculate white below and are also characterized by a reduction of the lipochrome contents of the upper parts. The new subspecies, however, connects this striking Timor race with the striated forms of Malaysia. There is no doubt that *modestum* and *finschii* are to be considered races of *obsoletum*, but it is still undecided whether or not the whole group is not conspecific with *agile*. To me they seem closer to *agile* than the *sordidum-everetti* group which Kloss and Chasen associate with *agile*. The validity and the limits of the genera of Dicaeidae are other doubtful issues and cannot be decided without a revision of the whole family.

Zosterops lutea citrinella Bonaparte

Figure 4

Hellmayr (1914, p. 52) stated that Sumba and Savu specimens were indistinguishable from Timor birds and united, as Hartert had done previously, all three populations under the name *citrinella*. Stresemann (1931, Mitt. Zool. Mus. Berlin, vol. 17, p. 217) described the Sumba birds as a separate race (*intercalata*), as having upper parts, ear-coverts, and throat more yellowish (less greenish) than *citrinella*. I cannot confirm these findings. Stein's series from western Timor (Tjamplong, Noilmina, Niki Niki) is slightly, but unquestionably, yellower than the specimens of the Sumba series. Of the Savu birds one is rather yellowish, the other three more greenish. Similar differences exist also among Sumba birds. Specimens collected by Doherty (in December, 1896) are considerably more yellow than Stein's recent series (May, 1932). The two most greenish birds are two females from Atapupu, Timor (July, 1897), collected by A. Everett. Very greenish with restricted yellow on the throat is a specimen from Nenas (1200 meters), Timor, but this bird is immature and hardly greener than other immatures. This evidence can be summarized as follows:

There is much individual, seasonal, and age (of skin) variation in the degree of yellowness in the plumage of *citrinella*. Sumba and Savu birds are not distinguishable from typical Timor birds, nor is there a difference of size.

The white-eyes related to *citrinella* were reviewed by Stresemann in a number of contributions (1931, Mitt. Zool. Mus. Berlin, vol. 17, pp. 201-238; 1939, Jour. Ornith., vol. 87, pp. 156-164). It seems to me, however, that the last word on these birds has not yet been said. The fact that Stein discovered a mountain species on Timor, which is undoubtedly close to the *montana-neglecta* group induces Stresemann to remove *citrinella* (+subsp.) from the *montana* (= *chlorates*) relationship and to join it with the *palpebrosa* group. It appears to me that this arrangement (1939) is less natural than the earlier one (1931) in which *citrinella* is considered a good species, related to *montana* and geographically representative of *chloris*.

The fact is that both of the Timor white-eyes (the mountain and the lowland species) are more similar to the *montana-neglecta* group, than either one is to "*palpebrosa*" *melanura* (+subsp.). Stresemann realized that *citrinella* was a member of a more widely distributed group and that it had to be a yellow-bellied species, since it occurred on Timor together with a form of *montana*, the only white-bellied species of the region. He decided that "*palpebrosa*" *melanura* was the searched-for relative. This seems not correct. The *melanura* group differs from *citrinella* by such an array of characters that I consider the two groups as not even closely related. In *citrinella* the bill is heavier and straighter, bill and feet are lighter, wings and tail are not so blackish, the belly is white, not greenish, the plumage is softer and duller, the size is larger, and the tail proportionately much larger (index, 69.5-75.2, as against 62.0-64.5 in *gallio* and *unica*). In each of these characters *Z. citrinella* is closer to the *montana-neglecta* group than to the *melanura* group. It is apparently only a single character in which *citrinella* agrees with *melanura*—the light brown iris. In *montana* it is supposed to be white or light gray. This is true for *montana florensis*, although the labels indicate brownish white as iris color in some instances. In a series from Mt. Korinchi the iris is recorded as "hazel" or "brown" and in the Timor series as "ivory" or "greenish yellow." In addition to this difference in the iris color, all the *montana* forms live in the mountains.

The conclusion we can draw is that *citrinella* does not belong to the "*palpebrosa*" *melanura* group. But what is it related to? The similarity to *montana* is too striking to be altogether accidental; a distant relationship must be assumed. However, there are two other species that are even closer to *citrinella* (1850), in fact, that must be considered conspecific: *chloris* (1850) and *lutea* (1843). Stresemann was, thus, correct in considering *citrinella* a geographical representative of a yellow-bellied form, only it is not *melanura*, but *lutea*! This solution at once removes not only the morphological difficulties but also the ecological ones. The species *lutea* (+*chloris*+*citrinella*) is, in its entire range, an inhabitant of the mangrove, of small

islands, and of second-growth formations in the lowlands of the larger islands. It ascends occasionally up to 1300 meters, but its principal range is below 500 meters. *Zosterops "palpebrosa" melanura*, however, is a form that seems to be partial to true forest, particularly in the mountains.

The new classification also clears up a zoogeographical puzzle: the distribution of *Zosterops "chloris."* This "species" occurs as a common lowland bird, according to Stresemann's arrangement, from Java and Bali in the west as far east as Flores, where it stops abruptly. Much farther east it is found again in the Banda and some of the Kei Islands. All the islands in the extensive intervening area are inhabited by a group of equally common forms ("*citrinella*" and subspecies) which curiously enough trespass nowhere on the domain of *chloris*, even though ecological or geographical barriers are absent. The solution is, of course, that *chloris* and *citrinella* are conspecific and that both in turn are members of the species *lutea*. *Zosterops griseotincta* of the Louisiades seems to be a member of the same species, or at least super-species.

The occurrence of yellow-bellied and white-bellied forms in the same species is of common occurrence in the genus *Zosterops*. Stresemann (1939, Jour. Ornith., vol. 87, pp. 156-164) reports it for the following species (the yellow-bellied forms are listed in parenthesis):

- (1) *lutea-citrinella* (*lutea*, *chloris*)
- (2) *montana-neglecta* (*montana*, Seran, Batjan, Ternate)
- (3) *palpebrosa* (*siamensis*, *melanura*)
- (4) *atriceps* (*buruensis*)
- (5) *minor* (*hypoxantha*)
- (6) *rendovae* (all except *tetiparia* and *vella-vella*)

The discovery of the mutability of white belly to yellow belly has led to a considerable simplification of the classification of the genus *Zosterops*.

Zosterops montana steini, new subspecies

TYPE: A.M.N.H. No. 308005; ♂ ad.; Mt. Ramelan (2600 meters), eastern Timor; May 1, 1932; Georg Stein coll.

Similar to *neglecta* (Lombok-Sumbawa) and *florensis* (Flores), but much more yellowish citrine above; rump very yellowish; yellow region of forehead more clearly yellow and more extensive, covering anterior third of crown; yellow wash on the "white" parts of the abdomen more pronounced; size larger. Differs from *lutea citrinella* (Timor lowlands) by the yellower upper tail-coverts and forehead, by the less blackish lores, by the greater extent of the yellow throat patch, by the brownish wash of the flanks and by the yellowish gray (or whitish or greenish), not light brown iris.

MEASUREMENTS: Wing, male adult, 58.5-62.5 (60.0), female adult, 57.0-61.0 (59.2); tail, male adult, 41-43 (41.9), female adult, 40-44 (41.3); tail index, 10 male adults, 67.8-71.7 (70.2), 12 female adults, 68.7-72.1 (69.9).

RANGE: Mountains of Timor (Mt. Mutis, 1800-2300 meters; Mt. Ramelan, 1800-2600 meters).

Lonchura punctulata sumbae, new subspecies

TYPE: A.M.N.H. No. 720819; Rothschild Coll.; [♂] ad.; February, 1896; W. Doherty coll.

Similar to *blasii* (Timor), but U-shaped bars of under parts rufous brown, not blackish brown as in *blasii*, or rufous as in *particeps* or *fortior*; white area on each feather of under parts narrower, brown vermiculation more irregular; under tail-coverts more heavily barred; differs from *fortior* (Lombok, Sumbawa) by smaller size and darker under parts.

MEASUREMENTS: Wing, male, 49-52, female, 48-50; tail, male, 32-40, female, 31-37.

RANGE: Sumba Island.

Savu and Flores birds have the blackish brown bars of *blasii*.

ALTITUDINAL VARIATION ON TIMOR

AS RAND (1936) and others have demonstrated, many birds show altitudinal variation, that is, the populations of lower altitudes differ in size or coloration from those of higher altitudes. The series of most of the species collected by Stein on Timor are not large enough to prove altitudinal variation; furthermore, if there are large series, as for example, some from Tjamplong or from Mt. Mutis, they are not paralleled by equally large series of the same species from other altitudes. Still, in a dozen or more species, Stein's specimens give an indication of the existence of altitudinal variation, as is evident from the tables of measurements listed below. Future collectors on Timor might want to pay special attention to the securing of specimens of these species. In all cases it involves an increase of size with altitude. In the case of a few species, like *Trichoglossus euteles*, *Aprosmictus jonquillaceus*, *Ninox novaeseelandiae fusca*, *Rhodophila g. gutturalis*, and *Cisticola exilis lineocapilla*, there is sufficient material available to indicate the absence of altitudinal variation. The figures of the tabulation are those of wing length in millimeters; the altitude is given in meters.

<i>Ptilinopus cinctus</i>	
Females	160 m. = 158, 160 300 m. = 160 1200 m. = 167
<i>Turacoena modesta</i>	
Males	160 m. = 198, 202, 205 1100 m. = 207, 208
<i>Geopelia striata maugea</i>	
Males	Sea level = 103, 106, 106, 107 160 m. = 104, 106, 106 300 m. = 105, 107, 109
Females	Sea level = 99, 100, 101, 102 160 m. = 101, 106 1100 m. = 106
<i>Trichoglossus iris rubripileum</i>	
Males	300 m. = 115, 117 800 m. = 118, 118, 120 1200 m. = 121, 121
Females	160-300 m. = 111, 114 800 m. = 118 1200 m. = 117, 117, 118, 119, 122

<i>Collocalia esculenta neglecta</i>	
Males	720 m. = 93 800 m. = 96 1100 m. = 99 1800-2100 m. = 96, 97.5, 99, 99.5, 101
Females	720 m. = 95, 97 1800-2100 m. = 98.5, 101.5, 105
<i>Halcyon a. australasia</i>	
Males	160 m. = 82.5, 82.5 300 m. = 84.5 720 m. = 86
<i>Hirundo striolata rothschildiana</i>	
Males	160 m. = 122.5, 123.5 1200 m. = 126
<i>Phylloscopus presbytes</i>	
Males	300 m. = 53, 54, 56 2000-2300 m. = 57, 58, 58, 59 2300 m. = 58.5, 59, 60
<i>Gerygone inornata inornata</i>	
Male	160 m. = 48, 52.2 300 m. = 51.5, 52, 53 2000 m. = 54, 54.5, 55.5 2000-2300 m. = 55, 55.5, 56
Females	160 m. = 47.5, 50.5 300 m. = 51 1200 m. = 52 2000 m. = 51 2500 m. = 53
<i>Cyornis h. hyacinthina</i>	
Ad. males	0-1200 m. = 89, 89, 89, 91, 91, 93 2000 m. = 92, 93, 96, 96, 96, 96
Imm. males	0-1200 m. = 88.5-91 2000 m. = 97
Ad. females	0-300 m. = 86.5, 89, 89, 89 1200 m. = 92 2000 m. = 95.5
<i>Meliphaga reticulata</i>	
Males	Sea level = 77, 78, 78.5, 80, 80, 80, 81 160 m. = 79, 80.5 720 m. = 82
<i>Lichmera flavicans</i>	
Males	160 m. = 72, 72.5, 73 800 m. = 72, 73, 74, 75 2000 m. = 71.5, 74
<i>Dicaeum maugei maugei</i>	
Males	0-160 m. = 54, 56, 56 800 m. = 56.5 1100-1200 m. = 55, 57, 57.5, 58

NOTES ON THE ZOOGEOGRAPHY OF TIMOR AND SUMBA

GEOLOGIC AND OCEANOGRAPHIC researches have shown that Sumba and Timor are situated on the same submarine ridge, the so-called outer Banda arc, together with some of the South West Islands, Timorlaut, possibly Kei, Seranlaut, and Seran. This chain of islands is separated by a deep trench from the inner Banda arc, which consists of the island chain, Java-Flores-Wetar-Damar-Banda. The Sumba-Timor-Timorlaut chain is also separated by deep water from the Australo-Papuan Sahul shelf.

These geological facts are of significance to the zoogeographer only if correlated with the data on the distribution of the animal life of these islands. The final aim of such an investigation is to determine *when, from where, and*

by what means every one of the species reached each island. However, such conclusions on the dynamics of animal distribution can be drawn, if at all, only after sufficient descriptive material has been gathered. It is, therefore, the first task of the zoogeographer to determine the place of origin, the faunal history, and the ecological requirements of every species, before he can decide whether or not it needed a land bridge in order to reach a given island. Stresemann (1939) has demonstrated the usefulness of this method in his admirable zoogeographic analysis of the bird fauna of Celebes. I shall attempt to apply similar methods to an analysis of the bird fauna of Timor.

THE FAUNAL COMPONENTS OF THE BIRD FAUNA OF TIMOR

Timor birds can be divided roughly into three groups, a western (Indo-Malayan and Palearctic), an eastern (Australo-Papuan), and an indeterminate element. However, a close study of the ranges of these species has convinced me that the point of origin of most of them can be determined much more accurately. Stresemann (1939) has shown that nearly all the western species reached Celebes, the Moluccas, and Lesser Sunda Islands on two major invasion routes, one from Burma through Sundaland (Malay Peninsula, Borneo, Sumatra, and Java), and the other from South China through Formosa, the Philippines, and Celebes. Following this suggestion, I have tried whenever possible to divide the western species into these two elements. Likewise the eastern species consist of a Papuan, usually humid tropical, and an Australian, often semi-arid, element. Most Timor species of eastern origin, except some old endemics and some widespread species, can be separated easily into these two components. On the basis of these considerations I have arranged the 137 species of native resident land birds of Timor into the following 15 classes:

1. Endemic, probably of western origin. *Büttikoferella bivittata*.

2. Widespread species of unknown origin.

Dupetor flavicollis, Haliastur indus, Hirundo tahitica.

3. Widespread species, apparently of western origin. *Egretta garzetta, Butorides striatus, Platalea leucorodia, Haliaeetus leucogaster, Falco moluccensis, Porphyrio porphyrio, Collocalia esculenta*.

4. Widespread species, probably of eastern origin. *Poliolimnas cinereus*.

5. Old western element, reached Timor probably via Sundaland. *Treron psittacea, Pitta brachyura, Lalage sueurii, Geokichla peronii, Geokichla dohertyi, Zoothera andromedae, Rhodophila gutturalis, Urosphena subulata, Siphia timorensis, Oriolus viridifuscus, Cinnerys solaris, Dicaeum maugei, Dicrurus bracteatus, Lonchura molucca, Lonchura quincticolor, Padda fuscata*.

6. Recent western element (either Malaysian or Celebesian). *Podiceps ruficollis, Ardeola ibis, Amaurornis phoenicurus, Centropus bengalensis, Caprimulgus macrurus, Eurystomus orientalis, Muscicapula melanoleuca, Lonchura punctulata*.

7. Recent western element (via Malaysia). *Macropygia ruficeps, Streptopelia chinensis, Cuculus poliocephalus, Tyto alba, Collocalia inexpectata, Anthus novaeseelandiae, Brachypteryx leucophrys, Pnoepyga pusilla, Cisticola juncidis, Cettia montana, Seicercus montis, Dendrobiastes hyperythrus, Lanius schach, Corvus macrorhynchus, Dicaeum sanguinolentum, Piprisoma obsoletum, Amandava amandava*.

8. Recent western element (via Philippines, Celebes). *Milvus migrans, Hieraaetus fasciatus,*

Excalfactoria chinensis, *Turnix maculosa*, *Caprimulgus affinis*, *Alcedo atthis*, *Merops philippinus*, *Mirafra javanica*, *Hirundo striolata*, *Saxicola caprata*, *Cisticola exilis*, *Acrocephalus arundinaceus*.

9. Old western element (via Philippines, Celebes). *Streptopelia bitorquata*, *Turdus poliocephalus*, *Bradypterus montis*, *Phylloscopus (trivirgatus) presbytes*, *Cyornis hyacinthina*.

10. Banda Sea element (originally eastern or western). *Macropygia magna*, *Tanygnathus megalorhynchus*, *Coracina novaehollandiae*, *Pseudozosterops mülleri*.

11. Secondarily eastern species, of western superspecies or generic groups (A = Australian, P = Papuan, AP = Australo-Papuan). *Podiceps novaehollandiae* (AP), *Demigretta sacra* (P), *Nycticorax caledonicus* (AP), *Anas superciliosa* (A), *Dendrocygna arcuata* (AP), *Aviceda subcristata* (P), *Circus assimilis* (A), *Falco longipennis* (A), *Synoiacus ypsilophorus* (A), *Irediparra gallinacea* (AP), *Rallus philippensis* (P), *Gallinula tenebrosa* (AP), *Columba vitiensis* (P), *Merops ornatus* (A), *Hirundo nigricans* (A).

12. Banda Sea element (of eastern origin). *Ptilinopus cinctus*, *Ptilinopus regina*, *Ducula cineracea*, *Ducula rosacea*, *Turacoena modesta*, *Gallicolumba hoedtii*, *Trichoglossus euteles*, *Trichoglossus iris*, *Chalcides malayanus*, *Halcyon australasia*, *Rhipidura rufifrons*, *Monarcha trivirgatus*, *Pachycephala orpheus*, *Philemon buceroides*, *Meliphaga reticulata*, *Lichmera flavicans*, *Myzomela vulnerata*, *Zosterops montana*, *Zosterops lutea*, *Erythrura tricolor*.

13. Papuan element. *Geoffroyus geoffroyi*, *Eudynamis scolopacea*, *Cacomantis variolosus*, *Halcyon chloris*, *Rhipidura rufiventris*, *Monarcha cinerascens*, *Aplonis minor*.

14. Eastern element (Papuan or Australian). *Phalacrocorax melanoleucus*, *Anas gibberifrons*, *Trichoglossus haematodus*, *Cacatua sulphurea*, *Edolisoma tenuirostre*, *Gerygone inornata*, *Pachycephala pectoralis*.

15. Australian element. *Notophox novaehollandiae*, *Accipiter fasciatus*, *Geopelia striata*, *Chalcophaps indica*, *Aprosmicus jonquillaceus*, *Ninox novaeseelandiae*, *Megalurus timoriensis*, *Myiagra ruficollis*, *Artamus leucorhynchus*, *Artamus cinereus*, *Sphecotheres viridis*, *Philemon inornatus*, *Lichmera indistincta*, *Taeniopygia guttata*.

It can be seen from a close study of these 15 classes that I have deviated to a considerable extent from the recently proposed classifications of Rensch (1936) and Stresemann (1939). Rensch eliminates a high proportion of the fauna from consideration either as being "widespread" or as being a special

"Zwischengebietselement." This leaves him among the Timor birds only 54 species (26 western and 28 eastern species), as against 129 species of the above-given classification. Stresemann, in his analysis of the Celebes bird fauna, applies very much the same principles as chosen by me, except that he also leaves a greater number of species unclassified. It seems to me, however, that both authors fail to carry their analysis to the last possible end.

In order to indicate the criteria used to arrive at the above classification, my method will be illustrated by a few examples. Class 3 consists of seven widespread species, apparently of western origin: The genus *Egretta* is widespread in Asia and Africa and even reaches the Americas. Only one subspecies of the species *E. garzetta* reaches the Australian region. *Butorides* is a monotypic genus, but it is widespread in Africa and the Americas, and the pattern of distribution in the Australian region (absence from the Bismarck Archipelago) is proof for the western origin of this species. Similar considerations are true for *Platalea leucorodia*, *Haliaeetus leucogaster*, *Falco moluccensis*, and *Porphyrio porphyrio*. These four species belong to widespread western groups which reach the Australian region only in a single species or subspecies. *Collocalia esculenta* is the most difficult species of this group to place. Its absence from Australia and from most of Polynesia indicates a western origin. The *linchi* group of Malaysia has all the characters of a primitive group and the eastern *esculenta-leucopygialis* group those of a specialized descendant.

As far as the species in classes 5, 6, and 7 are concerned, there is hardly any other interpretation possible. All are clearly western elements, and if there is any doubt, it is merely on which of the two major invasion routes they reached Timor, via Malay Peninsula-Java, or via Philippines-Celebes. In class 8 those species of the recent western element have been grouped that seem to have reached Timor via Philippines-Celebes. There is no doubt concerning the inclusion in this group of *Excalfactoria chinensis*, *Turnix maculosa*, *Merops philippinus*, *Cisticola exilis*, *Saxicola caprata*, and *Acrocephalus arundinaceus*. Stresemann (1939, p. 325) has already listed these species as users of the

Philippines-Celebes route. The other six species require some discussion. *Milvus migrans affinis* has at the present a range which is widely separated from that of the other subspecies in Asia. The species is entirely absent from the Malay Peninsula, from the Greater Sunda Islands, and from the Philippines, but it is much more probable that this species of savannas and open country passed through the Philippines rather than through the heavily wooded humid tropical Sundaland. The present range of *Milvus migrans* is very much like that of the *Falco tinnunculus-moluccensis-cenchroides* group, and a similar history can be assumed. *Hieraaetus fasciatus renschi* has a very isolated range on Sumbawa, Timor, Luang, and Wetar. Since this is a species of open, semi-arid country, it is much more likely to have passed through the semi-arid corridor of the Philippines-Celebes route than through Sundaland. We must rely on inferences in these species with wide gaps in their breeding ranges. *Caprimulgus affinis* is so clearly connected with the Asiatic mainland *monticolus* group through intermediate races on Formosa and Luzon that no doubt can exist about the immigration route. This is another case in which an advance in the taxonomy has helped to clear up a zoogeographical problem. The Flores-Timor race of *Alcedo atthis* is nearer to the Celebes race (*hispidoides*) than to the Malayan race (*benghalensis*). This, in conjunction with the fact that the species seems to be absent from Java as a breeding bird, is proof for the use of the Philippines-Celebes route by this species. Even though *Mirafra javanica* and *Hirundo striolata* are absent from Celebes today, there is strong circumstantial evidence that both species used Celebes as stepping stones to reach the Lesser Sunda Islands. They are entirely absent from humid Malaysia and apparently reached Java from the Lesser Sunda Islands, as did *Acrocephalus arundinaceus*, *Cisticola exilis*, *Saxicola caprata*, *Falco moluccensis*, *Caprimulgus affinis*, *Excalfactoria chinensis*, *Merops philippinus*, *Turdus poliocephalus*, and other members of the Philippines-Celebes fauna.

It would lead too far if I were to relate in detail all the evidence which caused me to classify the remaining species of Timor birds in classes 1, 2, 4, 9-15. The criteria were

always the same, namely, the geographical distribution of the nearest relatives of each subspecies and a study of the ecological requirements of each species. The position of hypothetical former land bridges was completely disregarded. This is the more possible since there is hardly a spot in the Malay Archipelago which has not been covered by a land bridge by one author or another. I hope I have been able to show that sufficient evidence is available on which to base conclusions, although inferences have to be used wherever the present ranges are discontinuous.

The grouping of the breeding birds of Timor into 15 classes provides the raw material for further analysis. The first question that can be answered is whether ornithologically Timor belongs to the Oriental or to the Australian region. There are 129 species left after eliminating the eight species of the doubtful classes, 1, 2, and 10. Of these the classes 3, 5, 6, 7, 8, and 9 are clearly western, and the classes 4, 12, 13, 14, and 15 are clearly eastern. This adds up to 65 western and 49 eastern species. This leaves the 15 species of class 11 to be classified. There is little doubt that all of them reached Timor from the east, either from Australia or from Papua. Still, they belong so obviously to western (=Oriental or Holarctic) genera or generic groups that they must be considered as having been derived from the Oriental-Holarctic fauna. To include these species with the Australian element of Timor would be a serious zoogeographical error.

The total of the species of the western element on Timor is, therefore, to be increased from 65 to 80 (=62 per cent) as against only 49 (=30 per cent) Australo-Papuan species. On the basis of the composition of its avifauna, Timor is thus to be included in the Oriental region. The analysis of other groups of animals leads to the same conclusion (Rensch, 1936). If the zoogeographic classification of the Timor bird fauna were based on families instead of species and genera, the proportion of the Australian element would be even smaller. Such species as *Chalcites malayanus*, *Eudynamis scolopacea*, *Notophox novaehollandiae*, *Accipiter fasciatus*, *Ninox novaeseelandiae*, *Halcyon australasia*, *Halcyon chloris*, *Cacomantis variolosus*, *Edoli-*

soma tenuirostre, *Aplonis minor*, *Megalurus timoriensis*, *Zosterops montana*, *Zosterops lutea*, *Erythrura tricolor*, and *Taeniopygia guttata* would then have to be excluded from the truly Australian element. The colonization of Australo-Papua by Asiatic elements, continuing throughout the Tertiary, makes the decision very difficult as to which species should be considered as "already" Australian and which as "still" Asiatic.

ENDEMISM ON TIMOR

In view of the fact that geologists consider Timor a very old island, the endemism in its avifauna is surprisingly small. There is only a single endemic genus (*Büttikoferella*) which is hardly separable from *Megalurulus* (New Caledonia) and which does not seem very far from *Dumetia*. Among the 137 resident bird species 22 (=16 per cent) are endemic on Timor or in the Timor group, but at least 8 of these are members of more widespread superspecies. The "old" endemism on Timor is thus very small. The subspecific endemism is much greater; there are 67 endemic subspecies on Timor (=47.5 per cent).

The reason for the small number of old endemics on Timor is twofold. One is that in early Pleistocene most of Timor seems to have been submerged, and only the highest mountains remained exposed as small islands in the sea. The fauna of the remaining parts of Timor was completely exterminated at that time. The other reason is that Timor was very insufficiently isolated from the other neighboring island groups and from Australia during late Tertiary and Pleistocene. This facilitated faunal exchange and inhibited the development of endemic forms.

The much younger and much less isolated chain of the Lesser Sunda Islands (from Lombok to Alor) has about 14 good endemic species and a few additional ones which might have to be considered subspecies: *Turnix (susciator) powelli*, *Treron floris*, *Otus sylvicola*, *Otus alfredi*, *Halcyon fulgidus*, *Rhipidura (rufiventris) diluta*, *Rhinomyias oscillans*, *Pericrocotus lansbergi*, *Coracina (novaehollandiae) floris*, [*Edolisoma (morio) dohertyi*], *Orthnocichla everetti*, *Pachycephala nudigula*, *Corvus florensis*, *Gracula (religiosa) venerata*, *Meliphaga lombokia*, *Acmonorhynchus annae*, *Oreosterops superciliosa*, *Oreosterops dohertyi*,

and *Pseudozosterops crassirostris*. This number of endemics is not as much smaller than that of Timor as one would expect. Stresemann (1939, p. 313) has recorded some interesting facts on endemism which are worth quoting. On Celebes, for example, there are 84 endemic species among 220 species (=38.2 per cent) and no fewer than 16 endemic genera. On Java, on the other hand, there are 16 (=4.8 per cent) endemic species among 337 breeding species. Of New Caledonia's 68 species, 19 (=27.9 per cent) are endemic, including five endemic genera.

There are 11 endemic species of birds that are restricted to Timor Island (including Semau): *Treron psittacea*, *Rhodophila gutturalis*, *Büttikoferella bivittata*, *Siphia timorensis*, *Sphecotheres viridis*, *Philemon inornatus*, *Meliphaga reticulata*, *Lichmera flavicans*, *Myzomela vulnerata*, *Pseudozosterops mülleri*, and *Padda fuscata*.

It seems zoogeographically justifiable to include among the Timor endemics also those species which have spread to Wetar and the South West Islands. This adds the following 11 species to the list: *Ducula cineracea* (Wetar), *Turacoena modesta* (Wetar), *Gallinolumba hoedtii* (Wetar), *Trichoglossus euteles* (Lomblen to South West Islands), *Trichoglossus iris* (Wetar), *Aprosmictus jonquillaceus* (Wetar), *Geokichla peronii* (Wetar and South West), *Urosphena subulata* (Babar), *Cyornis hyacinthina* (Wetar), *Pachycephala orpheus* (Wetar, Saleyer), and *Oriolus viridifuscus* (Wetar). In view of Timor's greater geological antiquity, it seems justifiable to assume that Timor was the original home of these species.

As original endemics of the Timor group, are possibly also to be regarded *Halcyon australasia* (including Lesser Sunda Islands), *Cinnyris solaris* (west to Sumbawa), and *Erythrura tricolor* (east to Timorlaut), but they have now a fairly wide distribution.

Omitting the three last-mentioned species from our consideration we have 22 species endemic in the Timor group. Among these, *Pseudozosterops mülleri* is hard to place, but of the other 21 species, 12 (=57 per cent) are of eastern origin, and nine of western origin. This figure means that in the old Timor bird fauna, that is, among the earliest colonizers, the eastern element is slightly stronger than the western. Timor was, thus, in pre-Pleisto-

cene, or early Pleistocene, times as accessible to the Australo-Papuan fauna as it was to the Oriental fauna, or even more accessible. The bearing of this fact on Wegener's theory will be discussed subsequently.

The nine western endemics belong to the following above-listed classes: class 1 (*Bütikoferella*), class 5 (*Treron*, *Geokichla*, *Rhodophila*, *Urosphena*, *Siphia*, *Oriolus*, *Padda*), and class 9 (*Cyornis*). Nearly all of these species are either so distinct that the nearest relative cannot be determined, or else they (or the species group to which they belong) are so isolated that it cannot be decided how they reached Timor. It seems more probable that the region of Sundaland rather than Celebes and the Philippines served as stepping stone for most of the species. More knowledge of the position and extent of the pre-Pleistocene islands of the Malay Archipelago is needed before anything further can be stated. The 12 eastern endemics belong to the following classes: nine to class 12 (*Ducula cineracea*, *Turacoena modesta*, *Gallicolumba hoedtii*, *Trichoglossus euteles*, *Trichoglossus iris*, *Pachycephala orpheus*, *Meliphaga reticulata*, *Lichmera flavicans*, *Myzomela vulnerata*), and three to class 15 (*Aprosmictus jonquillaceus*, *Sphecothebes viridis*, *Philemon inornatus*). Since class 12 contains a majority of Papuan elements, it can be concluded that the Papuan element predominates among the eastern endemics. However, it is important to emphasize that the three species of class 15 are of clearly Australian origin and indicate that Timor has been accessible to Australian colonists for a considerable period. All three belong to Australian superspecies.

THE COLONIZATION OF TIMOR BY BIRDS

The raw data tabulated in the preceding section present an opportunity to determine how the various species of birds arrived on Timor. Actually this is only a small portion of the more extensive problem of the colonization of the island belt between the Sunda and Sahul shelves. There is no other region in the world for which so many land bridges have been "constructed" to explain certain distributional phenomena. Rensch (1936) is a typical representative of the school of land bridge "builders." He postulates "a former

connection of Timor with Roti-Savu, with Sumba, with Wetar, and with Alor," also "the former existence of a land-bridge between Timor and Timorlaut, which probably included Moa-Babar. . . . We can assume that this connection was interrupted in the most recent past. . . . We can also assume that the Sunda arc was connected with northern Australia by dry land during the recent geological past." In the same manner he connects every island of the Malay Archipelago by land bridges with nearly all other neighboring islands. The Sarasins (1901) and, to a lesser extent, De Beaufort (1926) and other authors, have been equally generous in the postulation of land bridges. It will be shown in a later section that the conception of most of these bridges is based on faulty reasoning, and in particular on an under-rating of the natural dispersal faculties of animals. It will be the task of the present section to examine carefully the evidence on which some of these land bridges were established. Stresemann (1939) has already shown that land bridges to Java and to Saleyer-Flores are not needed to explain the colonization of Celebes by birds. It seems that the time has come to reexamine closely all the previously proposed land bridges in the light of the new facts on passive chance dispersal. I am afraid very few of these bridges will stand up under such a critical analysis. Hypothetical bridges in the Malay Archipelago that I am sure will not survive are: (1) the Flores-Saleyer-Celebes bridge, (2) the Alor-Timor bridge, (3) the Sumba-Timor bridge, (4) the Wetar-Timor bridge, (5) the Timor-Australia bridge, (6) the Babar-Damar bridge (in fact, any bridge between the inner and the outer Banda arc), (7) the Kei-Aru bridge, (8) the Seran-New Guinea bridge, (9) the Seran-Buru bridge, (10) the North Moluccas-Seran bridge, and (11) the Sula-Buru bridge.

It would lead too far in the present paper to test the validity of all these land bridges. I shall limit myself to an analysis of only those bridges that were proposed by Rensch to explain the composition of the Timor fauna. Such an analysis will have to be preliminary, since the time has not yet come to include a full evaluation of ecological factors. Not all faunal differences can be expressed

entirely in terms of geographical accessibility, a point which is well illustrated by the faunal difference between humid western and dry eastern Java. A low island like Sumba cannot have a mountain fauna, and it will always differ in this respect from a mountainous island, even if the two had been connected recently by a land bridge. Furthermore, there are always random faunal differences between distant localities, even though they may be permanently connected. The ecological and historical factors that cause such differences are frequently obscure. It is obvious for the reasons just mentioned that all zoogeographic interpretations should be treated with some caution.

TIMOR AND SUMBA

The islands of Sumba and Timor are situated on the same geanticline and of all the possible land bridges leading to and from Timor, the Sumba-Timor bridge has the best geological basis. A drop of the sea level by 1160 meters (or a rise of the island chain by the same amount) would establish a complete dry land connection between the two islands. The distance between Timor and Sumba is about 300 kilometers, but Roti and Savu Islands narrow the gap and serve as possible stepping stones, reducing the largest jumps to less than 100 kilometers in Savu Strait and to 75 kilometers in Dao Strait.

A comparison of the avifaunas of the two islands yields the following facts. Eighty-one (= 59.2 per cent) of the 137 species of breeding birds of Timor occur also on Sumba. This suggests a rather close relationship of the two faunas, but actually 77 of these species are widespread and are common residents on one or several of the islands of the Lombok-Alor group of the parallel chain of the Lesser Sunda Islands. The four exceptions are the following:

1. *Dendrocygna arcuata*: A species widespread west, north, and east of the Lesser Sunda Islands. It occurs on Java and Bali on the inner Banda arc, and has been able to colonize New Caledonia, Fiji, and other oceanic islands. The species may yet be found on the Lombok-Alor chain. At any rate, such a widespread species cannot be listed as evidence for a Sumba-Timor bridge.

2. *Circus assimilis*: Amadon (1941, Emu,

vol. 40, pp. 372-375) has shown that Sumba-Timor birds belong to the north Australian race *rogersi*. The species has also jumped across to Celebes. Rensch (1931) suggests that the species is only a non-breeding visitor to Sumba and Timor, but it is likely that it is still to be found on Wetar, Alor, or other islands in the grassland belt. The total range of the genus *Circus* makes it seem possible that Celebes is the point of origin of the species *assimilis* and that it has spread from there via Lesser Sunda Islands to Australia rather than vice versa. The wide distribution of the species *assimilis* indicates that the absence on the Lombok-Alor group is insignificant.

3. *Megalurus timoriensis*: The species (map, see Stresemann, 1939, Jour. Ornith., vol. 87, p. 344) has a distribution very much like *Circus assimilis*, except that it settled also on Amboina and in the New Guinea area. The Sumba race *inquirendus* is closer to the Australian race *alisteri* than to the Timor population. This indicates independent colonization from Australia. *Turnix everetti* (Sumba), a descendant of *T. pyrrhorothonax* (Australia), is another case of an Australian colonization of Sumba, independent of Timor. A third one is found in the genus *Myzomela*. The Sumba form *dammermani* is a subspecies of the Australian species *erythrocephala*, while Timor is inhabited by *Myzomela vulnerata*, which is related to the Banda group of *annabellae*, *boiei*, *batjanensis*, *chloroptera*, etc. None of the three cases (*Megalurus*, *Turnix*, and *Myzomela*) supports a former land connection between Sumba and Timor.

4. *Artamus cinereus*: A species widespread in the Timor group (Semaui, Timor, Letti, Sermatta), but apparently found only once on Sumba. Since it has not been found by Doherty, Everett, Dammerman, or Stein, it is possibly listed from Sumba by mistake. Its colonization of Timor from Australia proves the ability of this species to jump water barriers, and it would not be unexpected to see the species continue its spread to Sumba. Such a spread, however, requires no land connection.

This analysis shows that the assumption of a Sumba-Timor land bridge is not required to explain the distribution of a single species of birds. On the contrary, the faunal relation-

ships of each of these two islands of the outer Banda arc are with its nearest neighbor on the inner Banda arc, Timor with Wetar and Sumba with Flores, from which they are separated by deep sea trenches (for details, see below). This distribution pattern is in conflict with the land bridge theory but is in excellent agreement with the hypothesis of chance dispersal across water gaps.

TIMOR AND WETAR

The bird fauna of Wetar is probably still insufficiently known, since only about 80 breeding species are known. The previous explorers (Hoedt, Riedel, Schädler, and Kühn) were faced by many difficulties, and no bird collection has been made since 1902. The mountains are not only lower (they rise to only 1500 meters) but also more arid than those of Timor; in fact, Wetar seems to be one of the driest islands of the Sunda arc. Aridity, lack of high mountains, and geologically young age (most of Wetar is volcanic) combined account for the small number of breeding species. Those that are present are Timor elements. Aside from *Megapodius* and *Falco peregrinus*, which may yet be discovered on Timor, Wetar has only a single species of bird (*Otus scops tempestatis*) of which a geographical representative is not found on Timor. The Wetar bird fauna can thus be described as poorer than that of Timor (only 57 per cent as many species) but otherwise practically identical with it.

This is a purely zoogeographic identity. Taxonomically there is a considerable degree of difference between many of the geographical representatives on the two islands. In fact in two species pairs, *Myzomela vulnerata* (Timor) and *kuehni* (Wetar), and *Lichmera flavicans* (Timor) and *notabilis* (Wetar), the difference is so striking that perhaps no immediate relationship exists. *Sphecotheres hypoleucus* (Wetar) is a good species but clearly a geographical representative of *S. viridis* (Timor). In 18 species the Wetar subspecies is different from the Timor form; this includes such typical members of the Timor fauna as *Ducula cineracea*, *Turacoena modesta*, *Trichoglossus iris*, *Aprosmictus jonquillaceus*, *Cyornis hyacinthina*, and *Oriolus viridifuscus*, six species which are restricted to Timor and Wetar and are not found anywhere else in the

South West Islands or Lesser Sunda Islands.

How is the faunal relationship of the two islands to be interpreted? The distance between Wetar and Timor is merely 50 kilometers; in fact, if Kambing Island, which lies between them, has served as a stepping stone, the width of the greatest gap is reduced to 25 kilometers. In contrast to these very favorable conditions for transoceanic dispersal is the configuration of the ocean bottom. There is a deep trench between Timor and Wetar which reaches a depth of more than 2000 meters between Kambing and Timor and of more than 3000 meters between Wetar and Timor. This is surely not the place to look for a land bridge. The extreme similarity of the Wetar fauna to that of Timor, together with the well-developed endemism on Wetar, indicates to me that Wetar is a fairly old island which has always been in close proximity to Timor. There is no need for a land bridge which would be in conflict with the geological findings.

TIMOR AND THE SOUTH WEST ISLANDS

The faunal relationship between Timor and the South West Islands (other than Wetar) is simple to describe. These islands have a typical, but badly depleted, Timor fauna, lacking most of the endemics of the Timor group. The fauna is mainly composed of widespread elements. Very important is the point that neighboring islands are faunally most closely related, whether they are on the inner or on the outer Banda arc. Thus the fauna of Damar is closer to that of Babar than to that of Roma. Kisser, which is not connected with either arc, has a fauna which is similar to that of the neighboring island of Letti on the outer Banda arc.

On the islands that are nearer to Timorlaut, a slight Timorlaut element is noticeable. This consists of the following species and subspecies (D = Damar, B = Babar): *Accipiter novaehollandiae polionotus* (D), *Rallina tricolor victa* (D), *Ducula concinna* (B, D), *Ptilinopus wallacei* (B), *Tanygnathus megalorhynchos subaffinis* (B), *Pitta brachyura vigorsii* (B, D), *Edolisoma tenuirostre dispar* (D, Roma), *Monarcha (Heteranax) mundus* (B, D), *Myzomela boiei annabellae* (B), and *Aplonis metallica circumscripta* (D). The most peculiar bird of the South West Islands is the

endemic genus *Dammeria henrici*, restricted to Damar, the relationship of which is still obscure but which is apparently close to, if not congeneric with, *Dendrobiastes*.

All the species which are found on the South West Islands are excellent transoceanic colonizers. There is no evidence in the fauna of the South West Islands of a land connection either with Timor or with Timorlaut and the Moluccas. It is interesting to note that the inner chain of islands (Roma, Damar) has as high or higher a Papuan admixture than the outer chain (Letti-Babar). The faunal composition of each of these islands is determined by the availability of the source of immigration and not by the course of the submarine mountain ridges on which it is situated.

TIMOR AND CELEBES

It has never been claimed that Timor and Celebes were ever directly connected by a land bridge which did not include any other islands of the region. This is an obvious impossibility, since Flores is directly in the path of such a connection, and Flores has, therefore, been included in the Timor-Celebes land bridge by those who favor such a connection. The weakest part of this bridge is that between Flores and Celebes. Rensch (1936) lists among birds, *Tanygnathus megalorhynchos*, *Loriculus flosculus*, and *Phylloscopus presbytes*, as proofs for such a bridge. However, each one of these three species has a different distributional history, and all three (or the genera to which they belong) are well known for their ability to spread from island to island. Rensch also quotes the distribution of the genera *Monachalcyon* and *Myza* as proof for a Flores-Celebes bridge, but this claim is based on faulty taxonomy (both genera *sensu* Rensch are artificial). It is for these and other reasons that Stresemann (1939, p. 338) rejects a Celebes-Flores land bridge. He points out that the faunas of the Lesser Sunda Islands and of south Celebes are much too different and, furthermore, that the fauna of the intervening Kalao group does not indicate any former continental connection with Celebes. I agree entirely with this conclusion. He then analyzes the list of species which colonized Celebes from the Lesser Sunda Islands and vice versa (*ibid.*, pp. 318, 325)

and comes to the conclusion that this colonization must have been very recent because all these species are racially identical on both sides of Flores Sea, or at least only very slightly differentiated. This is true for the species listed by Stresemann, but I notice that he omits from his list the five species of my class 9 of Timor birds [*Streptopelia bitorquata*, *Turdus poliocephalus*, *Bradypterus montis*, *Phylloscopus (trivirgatus) presbytes*, and *Cyornis hyacinthinus*]. Admittedly, the immigration route Philippines-Celebes-Lesser Sunda Islands is not proved for some of these species, but it is more probable than any other. It is certain for *Turdus* and for *Phylloscopus*, but even though both of these species are mountain birds, they cannot be considered proof for a land bridge. *Turdus poliocephalus* is a notable transoceanic colonizer, and *Phylloscopus (trivirgatus)* has been able to reach San Cristobal as well as such isolated places as Biak and San Matthias. Neither species requires land bridges to explain its present range. This is even more true for the more recent element (classes 6 and 8 of my tabulation). All the species contained in these classes indicate by wide ranges and by their occurrence on many oceanic islands that they have no difficulties in overcoming water gaps. Significant is the point, emphasized by Stresemann, that ecological factors have been most important in determining what species crossed Flores Sea (from Celebes to the Sunda chain and vice versa). All the species of class 8 are inhabitants of grasslands or of the open country in the lowlands. The same is true for nearly all of the species of class 6. It can thus be stated that, at least among birds, the ecological requirements of a species are as important in determining whether it can cross from one island to the next, as the presence or absence of land bridges. In the more or less arid zone of southern Celebes and the Lesser Sunda Islands, birds of arid habitats are the most successful transoceanic colonizers.

TIMOR AND AUSTRALIA

Wallace, in his "Malay Archipelago," notes that Timor is separated from Australia by nearly 300 miles of open sea, while it is connected with Java and the other Sunda Islands by an unbroken chain of islands,

separated from one another merely by narrow straits. He states that it is, therefore, surprising that the Australian element is almost as strong on Timor as the Oriental fauna, and explains it as follows: "To account for the present state of things, we should naturally suppose that Australia was once much more closely connected with Timor than it is at present, and that this was the case is rendered highly probable by the fact of a submarine bank extending along all the north and west coast of Australia, and at one place approaching within twenty miles of the coast of Timor. This indicates a recent subsidence of North Australia, which probably once extended as far as the edge of this bank, between which and Timor there is an unfathomed depth of ocean.

"I do not think that Timor was ever actually connected with Australia, because such a large number of very abundant and characteristic groups of Australian birds are quite absent and not a single Australian mammal has entered Timor; which would certainly not have been the case had the land been actually united. . . . Neither do any of the most characteristic groups of Australian insects occur in Timor, so that everything combines to indicate that a strait of the sea has always separated it from Australia, but that at one period this strait was reduced to a width of about 20 miles."

My own conclusions are in substantial agreement with those of Wallace, published almost 75 years ago (1869). The former proximity of Timor and Australia, which Wallace postulated to explain the similarities of the faunas, has been substantiated in the meantime by geologists. It was the lowering of the ocean level during the Pleistocene glaciation that exposed the shallow Sahul shelf and reduced the width of Timor Strait from 300 to 45 miles. This gap of about 45 miles, however, never disappeared entirely. All the zoogeographic facts contradict, as Wallace states correctly, the existence of a former land connection with Australia. The few authors, like Rensch (1936, p. 191), who believe in such a land bridge, vastly underrate the dispersal faculties of the animals that have passed from Australia to Timor or vice versa.

Stresemann (1939) has pointed out recently that Timor was an important stepping stone

during the Pleistocene faunal "migration" along the Asia-Philippines-Celebes-Flores-Timor-Australia grassland corridor. I am discussing this phenomenon in more detail in a different publication (Mayr, in press), but I might mention that at least the following species of birds seem to have reached Australia via this stepping stone: *Milvus migrans*, *Falco cenchroides*, *Excalfactoria chinensis*, *Ptilinopus cinctus*, *Macropygia phasianella*, *Cacomantis variolosus*, *Eudynamis scolopacea*, *Tyto alba*, *Tyto longimembris*, *Halcyon sancta*, *Eurystomus orientalis*, *Pitta brachyura*, *Mirafra javanica*, *Coracina novaehollandiae*, *Lalage sueurii*, *Anthus novaeseelandiae*, *Cisticola exilis*, *Cisticola juncidis*, *Acrocephalus arundinaceus*, *Rhipidura rufifrons*, and *Oriolus sagittatus*.

This list is, of course, only a minimum number. It does not include all the widespread herons, like *Ardea sumatrana*, *Egretta garzetta*, *E. intermedia*, *Cosmerodius albus*, *Demigretta sacra*, *Butorides striatus*, *Ixobrychus minutus*, *Botaurus poeciloptilus*, etc., which might have reached Australia via Timor, but for which the evidence is not conclusive. It would be easy to compile similar lists for hawks, ducks, rails, and many other orders and families. The importance of Timor for the colonization of Australia by avian immigrants has, up to the present, been considerably underrated.

Among the 137 species of breeding birds of Timor no fewer than 76 (=55.5 per cent) occur also in Australia or are represented by a member of the same superspecies. For 61 species, however, Timor Strait is an effective distributional barrier. This group includes primarily inhabitants of mountain or monsoon forest, for which the ecological conditions in northwestern Australia are not suitable, for example, *Pnoepyga*, *Geokichla*, *Zoothera*, *Turdus*, *Brachypteryx*, *Urosphena*, *Horeites*, *Phylloscopus*, and many others. However, this class contains also a few inhabitants of grasslands or open country which should have been able to reach Australia. This is true for *Hirundo striolata*, *Rhodophila gutturalis*, *Saxicola caprata*, *Lanius schach*, *Amandava amandava*, *Padda fuscata*, *Lonchura quincolor*, *L. punctulata*, and *L. molucca*. It is not clear whether it is accident or some special ecological require-

ments which have prevented these species from reaching Australia.

In contrast with the species which reached Australia via Timor are the 14 species of class 15, which came to Timor from Australia, and the 22 species of classes 11 and 14, of which at least some came from Australia.

SUMMARY OF THE ZOOGEOGRAPHY OF TIMOR

I can do no better than to introduce my summary on the zoogeographic position of Timor with a quotation from Wallace (1869): "I have dwelt at some length on the origin of the Timorese fauna, because it appears to me a most interesting and instructive problem. It is very seldom that we can trace the animals of a district so clearly as we can in this case, to two definite sources [Asia and Australo-Papua]; and still more rarely that they furnish such decisive evidence of the time, and the manner, and the proportions of their introduction. We have here a group of Oceanic Islands in miniature—*islands which have never formed part of the adjacent lands, although so closely approaching them; and their productions have the characteristics of some Oceanic Islands. . . . It has been objected to Mr. Darwin's theory,—of Oceanic Islands having never been connected with the mainland,—that this would imply that their animal population was a matter of chance; it has been termed the 'flotsam and jetsam theory.'* . . . But in the case which I have here described, we have the most positive evidence that such *has* been the mode of peopling the islands. Their productions *are* of that miscellaneous character which we should expect from such an origin."

There is little that can be added to this masterful analysis by the pioneer of the

The Pleistocene proximity to Australia has thus influenced the composition of the Timor fauna considerably, although not quite so much as indicated by Wallace, who seems to have underestimated the Papuan and Banda Sea element.

science of zoogeography. Many land bridges have been proposed since Wallace to account for the present composition of the animal life of Timor, but, as I believe I have shown above, a careful analysis does not support a single one of them. This is true for birds, and I am confident that it will be confirmed for other animals as soon as proper criteria are applied.

1. Of the 137 species of breeding land birds of Timor Island, eight are of uncertain origin. Of the remaining species, 65 (= 50.4 per cent) came from the west, and 64 species came from Australo-Papua. If the eastern species of western genera are added to the western element, its percentage rises to 62 per cent. Timor must, therefore, be included with the Oriental region.

2. Timor lies on the same submarine bank as Sumba, Timorlaut, and Seran, but is separated from Wetar by a deep channel. Faunistically, or at least ornithologically, it is most closely related to Wetar.

3. The drying up of most of Sahul shelf at the height of Pleistocene glaciation narrowed the width of Timor Strait from 300 miles to 45 miles and facilitated a considerable faunal exchange between Australia and the Malay Archipelago, with Timor serving as stepping stone.

THE ZOOGEOGRAPHY OF THE SUMBA BIRD FAUNA

The composition of the bird fauna of Sumba reflects very accurately both the geographical position and the ecological conditions of this island. Being situated merely 40 kilometers south of Flores, it has on the main a fauna which is very similar to that of Flores. But being much more arid and without high elevation, it lacks all the species that are restricted to rain or to mountain forest.

As a consequence, its bird fauna is much poorer than that of Flores, consisting of only 103 species as against 140 species of breeding land birds in Flores.

ENDEMISM

The endemism on Sumba is very slight. No genus of birds is endemic; there are eight endemic species and 26 endemic subspecies, a

total of 34 endemic forms, which is 33 per cent of the bird fauna. These are the endemic species: *Turnix everetti*, *Treron teysmanii*, *Ptilinopus dohertyi*, *Rhyticeros everetti*, *Siphia harterti*, *Rhinomyias stresemanni*, *Cinnyris buettikoferi*, and *Dicaeum wilhelminae*. However, seven of these are clearly geographical representatives of other species, and most of them could almost equally well be considered subspecies. *Siphia harterti* is the only endemic species on Sumba which is not member of a more widespread superspecies, and even this species is evidently related to *Siphia timoriensis* and *S. dumetoria*. This lack of pronounced endemism indicates either that Sumba is a young island, or that it has had a continued active faunal exchange with neighboring islands, or both.

THE ORIGIN OF THE SUMBA AVIFAUNA

Nearly all the 103 species of breeding Sumba birds are also represented on the Lombok-Alor chain and can be considered as having been derived from there. The only exceptions are the following species: (1) *Dendrocygna arcuata*, (2) *Circus assimilis*, (3) *Turnix everetti*, (4) *Larus roratus*, (5)

Rhyticeros everetti, (6) *Megalurus timoriensis*, (7) *Muscicapa (latirostris) segregata*, (8) *Artamus cinereus*, and (9) *Myzomela erythrocephala*. These nine species illustrate the flotsam-jetsam principle very nicely. Species 1 is probably still to be recorded from the Lesser Sunda chain. Species 2, 3, 6, and 9 seem to have immigrated directly from Australia (see p. 176). Species 4 and 5 seem to have come from the Moluccas, species 8 from Timor, and species 7 from the Palaearctic. The faunal composition of Sumba makes it unnecessary to postulate any land bridge. Rensch (1936) quotes *Tanygnathus megalorhynchus*, *Rhinomyias*, *Culicicapa*, and *Acmonorhynchus annae* as proof for a former Flores-Sumba bridge. He overlooks the fact that each of these species has a different faunal history. The only joint attribute of these four species is that they do not occur on any of the other Lesser Sunda Islands. If the 103 breeding species are divided into eastern and western species, the following composition of the bird fauna is found: 57 species are western (56.5 per cent), 44 species are eastern (43.5 per cent), while two are uncertain. Sumba clearly belongs to the Oriental region.

REGIONAL ZOOGEOGRAPHY, LAND BRIDGES, AND DISPERSAL FACULTIES

The zoogeographers of island regions belong to two rather well-defined schools. The one, which I like to call (with a bit of humor) the "naive" school, takes it for granted that two islands or other disconnected land masses must have been united previously by a land bridge if parts of their faunas of flightless animals are identical or closely related. This concept provided a great stimulus to faunistic research, since it implied that a careful analysis of faunal differences and relationships would permit the reconstruction of palaeogeographic maps showing the distribution of land and sea in former ages. Conversely, it was assumed that a knowledge of former land connections, as provided by geology, would explain the phenomena of present distribution.

In recent years an ever increasing body of facts has accumulated proving that this simple hypothesis is not correct. In this, geologists and biologists have cooperated.

Land bridges are now readily admitted only for such islands as Britain, the Greater Sunda Islands, the Aru Islands, and Formosa, which prove by their well-balanced faunas that they once must have been part of a continent. The zoogeographical evidence is well supported by geological data in all the cases mentioned. However, the existence of former land bridges must be questioned in the case of all islands with an impoverished or unbalanced fauna. These new findings and interpretations effected a considerable change of opinion among zoogeographers; in fact they resulted in the development of a new school. The proponents of this school of zoogeography point out that the dispersal faculties of island animals have been vastly underrated in the past (Gulick, 1932; Darlington, 1938; Mayr, 1941; Zimmerman, 1942). This is true not only of flying animals, like bats, birds, and most insects, but of nearly all groups. There is ample evidence that even Anura and true fresh-water fish can

occasionally overcome ocean gaps. It has been found that even strictly oceanic islands in the Pacific may have rather rich faunas of snails, flightless insects, lizards, and other animals which were formerly believed to be able to spread only with help of land bridges. The geological evidence against land bridges is so unequivocal and convincing in these instances that no doubt remains that these species must have been deposited on these islands by hurricanes or marine currents or by any other means except land bridges. If gaps of 2000 and 3000 kilometers can be spanned, how much more potent must be the factor of passive dispersal where gaps of only 20 or 100 kilometers are involved! The importance of rafts for this dispersal has been stressed by Matthew (1915), M. A. Smith (1943), and others. Dispersal through the air seems to be even more important, particularly for those organisms and their eggs which are unable to withstand long exposure to salt water.

Birds, bats, and Lepidoptera, being flying animals, have always been credited with a considerable ability to cross water barriers. However, it has been pointed out by Stressemann (1927-1934, 1939), by Rensch (1936), by Mayr (1941), and others that birds, for example, are as useful as zoogeographic indicators as are strictly terrestrial groups. The most successful colonizers among the beetle fauna of eastern Polynesia are small flightless species that breed in dead twigs. Some of the small species of land snails seem to be particularly adapted to inter-island transport. The factors that promote such colonization, like rafts and hurricanes, have been discussed by so many recent authors (Gulick, 1932; Darlington, 1938; Zimmerman, 1942) that nothing more needs to be said.

Why certain species and genera are so successful in overcoming water barriers and others are not, is a point about which we require considerably more information. The relative dispersal faculty of various bird species and genera has been discussed by me repeatedly (Mayr and de Schauensee, 1939; Mayr, 1941). Nearly all the species that are found in the Malay Archipelago in the island belt between Sunda and Sahul shelves are good colonizers. Parrots, pigeons, honeyeaters, starlings, and white-eyes have been par-

ticularly successful colonizers in Polynesia, and the reason seems to be that they all travel occasionally in flocks. If such a flock is blown out to sea, it has an infinitely better chance of establishing itself on a previously unoccupied island than a single individual. Woodpeckers, on the other hand, are among the most solitary of the birds. This may account for the fact that they have made so little progress in colonizing the Malay Archipelago. They got into the Philippines, two species reached Celebes, and one the Lesser Sunda Islands (east to Alor). This compares with 18 species on Borneo and more than 20 on Sumatra.

Mammals are, on the whole, poor colonizers of islands. Simpson (1940a) points out how few successful colonizations of Madagascar and the West Indian Islands have been made. The very impoverished mammal fauna of Celebes and of the Lesser Sunda Islands shows that the same is true of the Malay Archipelago. The factors that control the distribution of a particular genus are often rather complex. The marsupials of the genus *Phalanger* have unusually well-developed dispersal faculties. They reached the Solomon Islands, the Admiralty Islands, the Timor group, the Moluccas, and Celebes. Yet they have been unable to jump the small gap between Celebes and Borneo. It seems likely to me that this gap was actually bridged repeatedly, but that the numerous predators on Borneo have prevented the establishment of *Phalanger*.

The fact that even mammals can cross water gaps is demonstrated particularly well by the mammals of the Kei Islands. A land bridge between the Kei Islands and New Guinea has frequently been postulated because there are six species of marsupials on the Kei Islands. They are:

1. *Phalanger orientalis*: This is an extremely successful colonizer which has spread from western New Guinea to the Kei Islands, to Timor and Wetar, to the Moluccas. Offshoots of it have even reached the Celebes group (*celebensis*) and the Solomon Islands (*breviceps*). The population from western New Guinea, the Kei Islands, the southern Moluccas (Buru and Amboina), and the Timor group (Timor, Wetar) has not yet broken up into distinct subspecies. This in-

dicates the recent date of much of this colonization.

2. *Phalanger maculatus*: Also a highly successful over-the-water colonist, which has managed to get even to the well-isolated Admiralty Islands. It is widespread in the Moluccas and has reached even the Celebes group. There is little subspecific differentiation over most of the range of the species.

3. *Petaurus papuanus*: The little flying phalanger has spread from the New Guinea area to New Britain, the Kei Islands, and northern Moluccas. This range indicates over-the-sea dispersal but does not actually prove it. Still, the species cannot be taken as proof for a former land bridge. The same is true for the fourth species.

4. *Echymipera doreyana*: Known only from islands on the New Guinea shelf and from the Kei Islands.

5. *Thylogale brunii brunii*: Known from the Aru and Kei Islands, while, according to Tate and Archbold (1937, Bull. Amer. Mus. Nat. Hist., vol. 73, p. 415), *Th. b. lauterbachii* is the race of southern New Guinea. The fact that south New Guinea and the Aru Islands have different subspecies, even though they were connected by land only some 10,000 to 20,000 years ago, while the same subspecies occurs on the Aru and Kei Islands, which are separated by an oceanic deep, indicates clearly that *Th. brunii* must have been carried by an oceanic current from Aru to Kei. This colonization must have taken place very recently, since the Kei Island population has not yet developed into a separate race.

6. *Dendrolagus ursinus keiensis*: The Kei Islands are the only place off the Australo-Papuan shelf where a *Dendrolagus* occurs.

The Kei Islands, with six species, have a very poor marsupial fauna, compared to New Guinea with 50 to 100 species. However, the Kei Islands fauna is rich compared to that of Halmahera (only *Phalanger* and *Petaurus*) and the southern Moluccas (only *Phalanger* and the endemic *Rhynchomeles prattorum*). Noticeable also is the slight degree of endemism among the six species of Kei Islands marsupials. The answer is presumably ecological. The Kei Islands are only 100 kilometers distant from the shore of Pleistocene Sahul-land and near the place where the large

rivers that drain the Snow Mountains must have entered the sea. These rivers, which probably compared favorably in size with present-day Fly, Sepik, and Mamberano rivers, must have been a great source of tree rafts, and this may be an explanation for the rich mammalian fauna of the Kei Islands. Halmahera and Seran, on the other hand, although they are in distance closer to New Guinea, are situated opposite a mountainous coast, along which only small streams enter the sea. There was much less opportunity for colonization by rafts.

Some additional evidence regarding a land bridge between the Kei Islands and New Guinea can thus be summarized as follows: All the geological data are in conflict with the theory of a former land bridge (at least during geologically recent times). The composition of the fresh-water fish fauna is also opposed to such an explanation. There is not a single primary fresh-water fish to be found on Kei, and the secondary fresh-water fish show a greater affinity with the Indian than with the Australian fauna. It is for all these reasons that it is to be concluded that no late Tertiary or Pleistocene land bridge existed between Aru and Kei Islands and that the six species of marsupials reached the Kei Islands on rafts. The slight or absent racial differentiation indicates that this colonization took place quite recently, possibly while the edge of Sahul shelf was near the Kei Islands during the height of the Pleistocene glaciations.

Different dispersal factors must be taken into consideration for each island and for each group of animals. It is quite possible, for example, that it will be shown eventually by comparative studies that the Kei Islands have a particularly high Papuan element in all groups that depend on rafts for dispersal, while Halmahera has a particularly high Papuan element in the groups that are carried through the air. More faunistic and taxonomic work needs, however, to be done before such studies can be undertaken.

Amphibians are another group of animals which are frequently considered as incontrovertible proof of former land bridges. This also has become very doubtful in recent years. Most amphibians, whether as eggs, larvae, or adults, are very susceptible to injury by salt

water. It is improbable that they would survive lengthy oceanic voyages on rafts. Therefore, if frogs are found on islands with otherwise oceanic faunas, like the Fijis or the Caribbean Islands, one must assume that they were transported there by hurricanes, clinging to palm fronds or other wind-borne vegetation. In the island region of the Malay Archipelago the species of the arboreal genus *Rhacophorus* (in particular *leucomystax*) have a much wider distribution than the terrestrial, i.e., aquatic, species. Of about 35 species of Java frogs and toads, only nine or ten reached Lombok, and only two Timor. For most frogs even narrow ocean straits are dispersal barriers of considerable magnitude; still, the Australian species *Hyla rubella* managed to reach both Timor and Timorlaut. These fragmentary notes are offered merely because dispersal faculties in amphibians have never been critically analyzed.

The dispersal faculties of fresh-water fish also have been underestimated. To begin with, there are many genera and families of so-called fresh-water fish which are, in fact, modified ocean fish and which still have the ability to live in salt water. Such fish are *a priori* disqualified as evidence for or against former land bridges. This leaves the true primary fresh-water fish (Myers, 1938). These are indeed excellent indicators of former continental connections. But there is some evidence that even such species may jump small water gaps under exceptional circumstances (Darlington, 1938). There is well-substantiated evidence for transportation of fish in waterspouts. Furthermore, floods sometimes cover the ocean near the coast with a thin sheet of fresh water and this may serve as a stepping stone between two neighboring islands. If, for example, a single species of Cyprinidae, of the widespread genus *Rasbora*, has succeeded in colonizing Lombok and Sumbawa, this does not necessarily prove the existence of a former land connection between Java-Bali and Lombok. The fact that the other 54 Java species of Cyprinidae were left behind suggests colonization by accident or unusual dispersal faculties for the single species.

It cannot be my task in the present paper to provide a comparative treatment of dispersal faculties in various groups of animals.

The time for this has not yet come. But possibly these remarks will stimulate specialists of various groups to correlate the ecological characteristics of each species with its distributional pattern.

The mammalian fauna of the Kei Islands represents a single specific instance only, in which the hypothesis of transoceanic chance dispersal is more successful in explaining the facts than is the assumption of a former land bridge. It seems necessary, in view of the widespread belief in land bridges, to cite additional evidence in favor of transoceanic colonization. Distribution patterns in the Malay Archipelago supply such evidence. There are, for example, four sets of phenomena which have puzzled the land bridge builders and which fit exactly the hypothesis of chance dispersal.

1. Faunal relationships within the Malay Archipelago are independent of the submarine contours (below the 200-meter line) but are closely correlated with the distances of the islands from each other.

It has already been pointed out above that Timor is zoogeographically very close to Wetar, although both islands are separated by an oceanic deep. Equally, the faunal relationship with Sumba is not very great, although both islands are on the same submarine ridge. Good zoogeographic connections also exist between Aru-Kei, between Seran-New Guinea, and between Seran-northern Moluccas, although in all these cases there are no submarine banks that might be interpreted as drowned land bridges. This is supplemented by the surprisingly small zoogeographical relationship of some islands which are situated on the same submarine ridge, such as Sumba-Timor, Alor-Wetar, Timor-Timorlaut-Seran. It can be stated, and there are only few exceptions to this rule, that the fauna of each island of the Indo-Malayan island belt (except on the continental shelves) is the direct product of its accessibility to over-the-water immigrants from other neighboring islands, providing age, size, and ecology are comparable. Islands that are separated by straits of less than 200 meters in depth may have been in continental connection during recent glaciations and as a result may show greater faunal affinity.

2. Slight faunal affinities exist even between geologically unrelated regions.

De Beaufort (1926, pp. 160–161) is rather puzzled about the faunal connections between northern Celebes and Halmahera, between the Philippines and Halmahera, and between the Philippines and New Guinea. The geologist finds no possibility for a land connection between these islands during the late Tertiary or the Pleistocene, which is the period when the faunal exchange must have taken place. It is now obvious that the animals that occur jointly on the island groups mentioned have the ability to cross water gaps of considerable width.

3. The small percentage of endemic species.

If each island or group of islands received its fauna by one or a few land bridges and was then completely isolated, one would expect that most of the species would evolve into endemics during this isolation. It is found, however, that with the exception of a few old islands the number of endemics is rather low. Rensch (1936, pp. 261–262) is perplexed by the fact that so few of the animals of Flores, Wetar, Timor, or other of the eastern Sunda Islands are restricted in their distribution to the Sunda arc. This is true for only 17.5 per cent of the Flores species, for 27 of 297 (=9.1 per cent) of the analyzed Timor species, and for seven of 161 (=4.3 per cent) of the Wetar species. If there had been a continuous land bridge along the inner Banda arc, the percentage should be much higher. What these figures really indicate is that any species that can jump the water gaps of Lombok Strait and of the strait between Alor and Wetar is equally likely to get across to Celebes, to the Moluccas, to Timorlaut, or to Australia. As soon as this happens it will, of course, no longer be restricted to the Sunda arc. The low percentage of species that are widespread on the Sunda arc, but restricted to it, proves the superior dispersal faculty of the species of which the fauna of the Lesser Sunda Islands is composed.

4. The spread of discontinuously distributed mountain animals can be understood only if a great ability to overcome topographical barriers is assumed.

Stresemann (1939, pp. 379–384) points out in his study of the birds of Celebes that many of the species of the mountain forest have an

unexpected ability not only to cross stretches of lowland of considerable extent, but even to embark on lengthy transoceanic flights. Such species as *Muscicapula melanoleuca*, *Zosterops montana*, *Dendrobastes hyperythrus*, *Eumyias panayensis*, *Turdus poliocephalus*, *Phyllergates cucullatus*, *Phylloscopus trivirgatus*, *Bradypterus montis*, *Urosphena subulata*, *Seicercus montis*, and *Dicaeum sanguinolentum* must have made large jumps to get from one mountain top to the next one. Wallace and Rensch have attempted to explain the discontinuous distribution of mountain animals by assuming that the habitats of these species had been continuous during the climatic depression of the Pleistocene. Palaeobotanical and palaeoclimatic research indicates, however, that the drop of the mean temperature in the tropical belt during the glaciation cannot have amounted to more than 1° or 2° C., and this could not have anywhere nearly accomplished a junction of the various mountain forests (Steenis, 1934–1935, pp. 391 ff.). Not even the most liberal construction of land bridges could overcome this difficulty. The same is true of the spread of all animals that are in one way or another narrowly adapted to a discontinuous habitat. Stresemann (*loc. cit.*) calls attention to the fact that there is a considerable variability in the dispersal faculty of mountain birds. Some seem to be poorly endowed with it, and this is particularly true of the mountain species of old islands (like Celebes); others have it highly developed (like most of the above-listed species).

CRITERIA FOR LAND BRIDGES

The above-quoted evidence, in addition to the data accumulated by Gulick (1932), Darlington (1938), and Zimmerman (1942), makes it apparent that a good deal of historical zoogeography will have to be rewritten. Land bridges have been erected in the past with such utter disregard for geological, ecological, and phylogenetic data that almost any land bridge is now under suspicion. The only safe method seems to be to reject any land bridge that does not satisfy a number of basic conditions. The following are some of the criteria which have been developed by recent authors (Stresemann, 1939; Simpson, 1940a; and Mayr, 1941).

1. No species can be quoted as evidence for a former land bridge which occurs also on islands known to be oceanic.

2. All land bridges are temporary, hence all the species that arrived on a certain island by the same land bridge must have the same age. Strikingly different degrees of speciation indicate colonization at different ages, provided all other factors are equivalent. This is well demonstrated by the bird faunas of the Hawaiian Islands, of the Galápagos, of Biak, of New Caledonia, and other islands.

3. A land bridge must have been utilized by a high percentage of the fauna to which it was available. In cases where only a small part of a fauna has used a possible connection, it seems more logical to assume chance dispersal across incomplete barriers rather than to postulate a highly selective land bridge.

4. There are facile transoceanic colonizers in nearly every group of land animals, and others that need true land bridges for dispersal. Each case must be treated on its own merits.

The validity of every land bridge must be tested not only by these four criteria, but it must also be subjected to the additional considerations made by Simpson (1940a).

The evidence on land bridges can be summarized as follows. The majority of the land bridges postulated during the past 50 years are to be rejected for three reasons. First, because they are in conflict with the facts of geology. Second, because they cause more difficulties to the zoogeographer than they explain. The observed distribution patterns are not those that one would expect on the basis of the postulated land bridges. The third reason is that these land bridges are unnecessary, because the existing patterns of distribution can be well explained without them. This is obvious as soon as one realizes the enormous dispersal faculties of most animals as well as the fact that extinction in intermediate areas is the reason for most of the now existing discontinuities.

RESULTS OF THE NEW ZOOGEOGRAPHIC METHOD

The decline of the land bridge concept results in a changed attitude towards many zoogeographic problems. This will be illus-

trated only by a single instance. Ever since Wallace and the Sarasins showed that Macassar Strait indicates a sharp faunal break between Borneo and Celebes and since the geologists found that this faunal break coincides with an ancient geological break, it was taken for granted that all the western elements reached Celebes either via a Java bridge or via a Philippine bridge. It was Stresemann (1939, p. 329) who showed that many of these species, including many flightless ones, could have reached Celebes without a land bridge. As soon as this is admitted, it becomes obvious that Borneo, which is closer to Celebes than either Java or the Philippines, is probably the original home of many of these species. This consideration, incidentally, weakens the Java-Celebes and Philippines-Celebes land bridges, because it drastically reduces the list of the species which "must" have come to Celebes over these two postulated bridges.

Similar considerations can be applied to the colonization of many of the other islands. It results in some instances in the emergence of a completely new distributional picture.

DIFFERENT DISTRIBUTION PATTERNS IN EACH GROUP OF ORGANISMS

It has now become increasingly apparent that the patterns of distribution in island regions depend more on dispersal faculties and ecological requirements of the involved species than on former land connections (particularly where there never have been any). This means that birds, butterflies, and lizards, three groups containing many facile colonizers, will have a different distribution pattern than snakes, mammals or anurans, which are severely handicapped by oceanic gaps, or urodeles and true fresh-water fish, which cross ocean straits only in exceptional cases. Most plants seem to have still greater dispersal faculties than even birds or butterflies. Plants, on the other hand, have much more rigid ecological requirements than most animals. It is for this reason that phytogeographic regions seem to coincide rather closely with climatic regions, while zoogeographic regions, at least in insular districts, tend to be identical with areas of former continental connections, or at least of accessibility.

THE FINDINGS OF THE ZOOGEOGRAPHER

In a way, it has been a great disappointment to the zoogeographer to realize how extensive the dispersal faculties of animals and particularly of flightless animals are. Since it has become obvious that the present distribution of animals is only a poor clue in the analysis of former land connections, it might even be asked whether regional zoogeography can contribute anything at all to facilitate palaeogeographic reconstructions. The answer is, fortunately, yes. There are first the well-balanced continental faunas of islands like Formosa, Borneo, or New Guinea, which prove that these islands have been in recent connection with continents. In all these cases the geological evidence is so strong that it hardly requires confirmation by the biogeographer. Occasionally the zoogeographer can contribute valuable observations to the past history even of well-isolated islands. This is based on the principle of accessibility. Whenever the faunal composition of an island deviates seriously from that which one would expect on the basis of its position in relation to other islands or mainlands, it might give a clue to a change in the geographical configuration. This will be demonstrated with the help of two examples:

1. THE FAUNAL RELATIONSHIP OF ALOR TO TIMOR

Alor Island is only 32 kilometers distant from Timor and is thus actually nearer than Wetar (50 kilometers). (See above.) Like Wetar it is separated from Timor by a channel having a depth of more than 3000 meters. The two islands, Alor and Wetar, are of similar size, their geological structure (recent volcanic) seems to be similar, they seem to lie on the same geanticline, and seem to have a very similar climate. Zoogeographically, the two islands are very different as Rensch (1936, p. 162) has shown. Wetar has an impoverished Timor fauna; Alor has an impoverished Flores fauna. The two islands are about 70 kilometers distant, but Kambing Island narrows the distance to 40 kilometers. The greatest depth on the submarine ridge between the islands is about 1260 meters. It is rather mysterious, in view of these facts, why there should be such a striking zoo-

geographic difference between the two islands. It may be worth while to analyze this contrast a little further.

Among the 78 species of birds which Wetar and Timor have in common, 34 (=43.5 per cent) are not known from the Alor group. On the other hand, such widespread species as *Parus major*, *Acmonorhynchus annae*, *Antheptes malacensis*, *Lonchura pallida*, *Gracula religiosa*, *Oriolus chinensis*, *Terpsiphone paradisi*, *Hypothymis azurea*, *Dryobates grandis*, *Treron floris*, *Ducula aenea*, *Ptilinopus melanospila*, and *Turnix (suscitator) powelli* find their eastern limit on Alor and do not expand to Wetar or Timor.

Faunistically there is thus a strong contrast between Alor on one hand and Timor and Wetar on the other. Geographically and geologically Alor and Wetar are in one class and Timor in a different one. This discrepancy is not easily explained. It seems possible, however, that Wetar is a much older island than Alor, even though both are situated on the same geanticline. If this were true, a continuous faunal exchange between closely neighboring Wetar and Timor could have taken place while Flores was rather distant and inaccessible. As Adonara, Lomblen, Pantar, and Alor emerged gradually and successively from the ocean, these islands were populated from Flores, with which island they are in almost complete contact. Thus they acquired an almost pure Flores avifauna. The recent age of Alor is also indicated by the small degree of endemism (only eight slight subspecies among about 75 species of breeding birds). It will be the task of the geologist to prove or disprove this working hypothesis. The only point which I tried to make is that a zoogeographical analysis can yield data of considerable importance to the geologist even if they are not used for the construction of a land bridge.

2. WEGENER'S THEORY AND THE POSITION OF AUSTRALIA

All continents and continental islands are, according to Wegener, pieces of a single land mass which broke apart, and the pieces of which eventually drifted into their present position. This is a purely geological theory and it cannot be the task of the zoogeographer to prove or to disprove it. According to

Wegener, Australia, Antarctica, and South America broke off from India-Africa in the early Mesozoic (or late Palaeozoic) and the three continents stayed together until late Tertiary. It is only during the Pleistocene that Australia (including New Guinea) broke off from Antarctica and drifted into the vicinity of the Malay Archipelago. The pros and cons of Wegener's theory of continental drift as applied to the Malay Archipelago have been discussed by Kuenen (1935, pp. 98-109) from the geological point of view and by Rensch (1936, pp. 283-300) from that of the zoogeographer. The foremost geologists of the region (Molengraaff, Umbgrove, Kuenen) have come unanimously to the conclusion "that the Asiatic and the Australian continents at one time [until the late Mesozoic] formed a more or less continuous mass." Kuenen points out that even if continental drift could be proved for other parts of the earth, Australia could not have taken part in this movement, except possibly for a slight counterclockwise rotation around the East Indian Archipelago. Even this event cannot have taken place any later than early Tertiary. The acceptance of such a slight drift would not affect the thesis of the basic stability of the position of the Asiatic and Australian continents to one another. However, according to Wegener, Australia was separated from Asia until Pleistocene by an oceanic gap of 3000 or 4000 kilometers. The zoogeographer is able to test which one of the theories fits the zoogeographic evidence better. According to Wegener, Australia received its fauna from South America (via Antarctica) and established only a very recent contact with the Malay Archipelago and its Asiatic fauna. Accordingly, Australia should be composed of an old Americo-Australian and a very recent Asiatic element. In contradistinction, Australia has always been within reach of transoceanic immigrants from Asia, according to the orthodox geological theory, although this colonization became slowly but steadily accelerated during the period when one after the other of the islands of the Malay Archipelago emerged from the sea. This faunal exchange reached a climax during the Pleistocene glaciations when the continental shelves were largely dry land. The zoogeographic data are in com-

plete agreement with this second alternative and are thus the exact opposite of what one would expect on the basis of Wegener's hypothesis.

The test must be made with groups of animals which have a fair ability of crossing oceanic gaps. Mammals are, therefore, ruled out. As Simpson (1940b) has shown, there is good reason to believe that the ancestors of both the Australo-Papuan marsupials and of the rodents have reached their present home by rafting. This involves only two or possibly three separate colonizations, which is too small a number to test the above-made hypothesis. Birds, on the other hand, are well suited for this purpose. If there had been throughout the Tertiary a continuous series of colonizations of Australia from Asia, one would expect that the earliest colonizers had changed to separate families or subfamilies, later ones to separate genera, still later ones to separate species, and the most recent arrivals to separate subspecies. This is exactly what we find when we examine the bird fauna of Australia. First there are some old endemic families and subfamilies, of which the nearest relatives are uncertain. This includes the Dromaiidae, Casuariidae, Megapodiidae, Loriinae, Cacatuinae, Platycercinae, Podargidae, Menuridae, Atrichornithidae, Grallinidae, Artamidae, Neosittidae, Meliphagidae, Struthideinae, Ptilonorhynchidae, and Cracticidae. Important is the point that not a single one of these families is more closely related to a South American family than to an Old World family. There is thus no evidence among the old Australian bird element for a former connection with South America.

The next oldest element is composed of a number of families and subfamilies which probably reached Australo-Papua during early or middle Tertiary and which are plainly related to Old World families. This includes the Pedionomidae, Ptilinopinae, Pachycephalinae, Sphecotheridae, Cinclosomatinae, Acanthizinae, Pardalotinae, and Paradisaeidae.

The third group consists of the genera which are endemic in Australo-Papua, but which are clearly related to Asiatic genera. This group may include some Miocene arrivals but is probably composed mainly of Pliocene colonists. It would lead too far

to give the full list and I shall content myself in listing only a selection: *Synoicus*, *Geopelia*, *Irediparra*, *Notophox*, *Dupetor*, *Erythrotriorchis*, *Uroaetus*, *Lophoictinia*, *Ieracidea*, *Syma*, *Dacelo*, *Tanysiptera*, *Cacomantis*, *Misocalius*, *Chalcites*, *Eudynamis*, *Rhipidura*, *Myiagra*, *Machaerirhynchus*, *Seisura*, *Arses*, *Monarcha*, *Microeca*, the *Poecilodryas* group, *Pteropodocys*, *Climacteris*, *Zonaeginthus*, *Erythrura*, *Aplonis*, *Corcorax*, and others.

Even more recent are those colonists which diverged only specifically, since they arrived in Australo-Papua late in the Pliocene or early in Pleistocene. The exact time of arrival is, of course, uncertain in view of the absence of fossils and with the probability of different speed of evolution in different lineages. This list includes the following species:

Coturnix pectoralis
Turnix (6 species)
Columba norfolkiensis
Rallus pectoralis
Rallus philippensis
Porzana fluminea
Podiceps novaehollandiae
Podiceps poliocephalus
Eupodotis australis
Grus rubicunda
Platalea flavipes
Nycticorax caledonicus
Botaurus poiciloptilus
Circus assimilis
Circus approximans
Accipiter novaehollandiae
Accipiter fasciatus
Accipiter cirrhocephalus
Hieraaëtus morphnoides
Elanus axillaris
Elanus scriptus
Aviceda subcristata
Falco longipennis
Falco hypoleucus
Falco cenchroides
Tyto novaehollandiae
Tyto tenebricosa
Ceyx azurea
Ceyx pusilla
Halcyon (4 species)
Merops ornatus
Eurostopodus (2 species)
Collocalia spodiopygia
Collocalia vanikorensis
Cuculus pallidus
Centropus phasianinus
Hirundo tahitica
Hirundo nigricans

Hirundo ariel
Coracina papuensis
Coracina robusta
Coracina lineata
Edolisoma tenuirostre
Megalurus gramineus
Megalurus timoriensis
Zosterops lateralis
Zosterops lutea
Lonchura castaneothorax
Lonchura flaviprymna
Oriolus sagittatus
Oriolus flavocinctus
Corvus coronoides
Corvus bennetti

Finally there is a group of about 40 species which reached Australia so recently that only subspecific differentiation has occurred.

The zoogeographic data are thus in striking accord with the assumption of orthodox geology that the relative position of Asia and Australia has not changed materially since the Mesozoic, and that tectonic processes have been responsible first, for the isolation of the two continents by sea, and second, for the establishment of a connecting island belt. The accessibility of Australo-Papua to Tertiary colonizers from Asia becomes even more apparent if we compare the fauna and flora of New Guinea rather than of Australia with that of Malaysia.

There are additional objections to the application of Wegener's drift theory to the Australo-Papuan region. The Solomon Islands and the Bismarck Archipelago, for example, are, according to Wegener, parts of the Moluccas-Sunda Islands chain which split off when the Australo-Papuan block "crashed" into this chain of islands. According to Wegener, the fauna of the islands east and west of New Guinea should have a Malayan character as against an "Australian" fauna on New Guinea. Actually the fauna of the Solomon Islands and of New Britain is strictly an impoverished Papuan fauna, except for a few endemics of uncertain relationship. This constitutes another objection to Wegener's hypothesis.

The main theme of the present discussion is not to disprove Wegener's theory. Rather it is to show that zoogeography is a very useful and illuminating science, even if stripped of all its land bridge building tendencies. Zoogeographic data can be applied to the solution

of many palaeogeographic problems. In fact, an unsuspected wealth of material is available to the comparative biogeographer. The investigation presented above gives some hints on certain lines of approach which might yield valuable results to other students. The

distribution of mammals, reptiles, amphibians, and invertebrates will have to be subjected to an analysis similar to that which I have applied to birds before we can hope for a balanced picture of the history of colonization of the Malay Archipelago.

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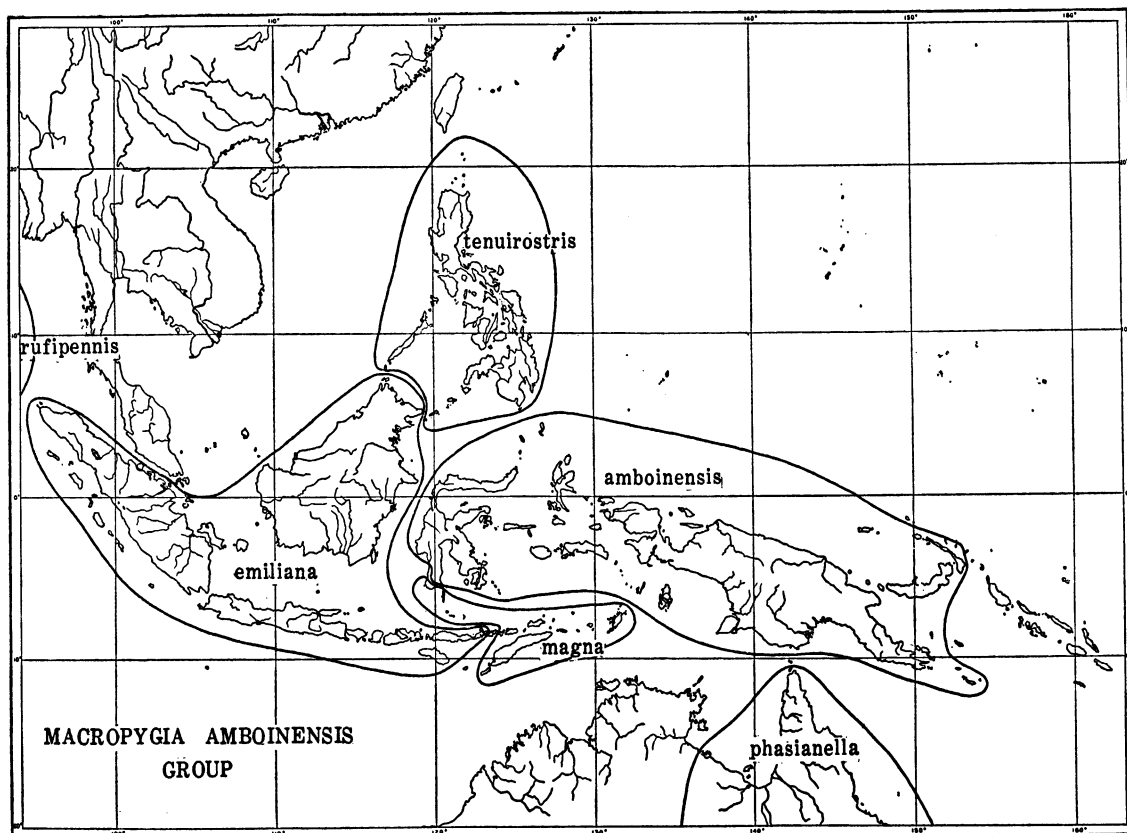


FIG. 1. The distribution of the *Macropygia amboinensis* group. The six subgroups represent each other geographically. There is no overlap even in south Celebes, where *magna* is restricted to the more or less arid lowlands, while *amboinensis* is found in the more humid hill country.

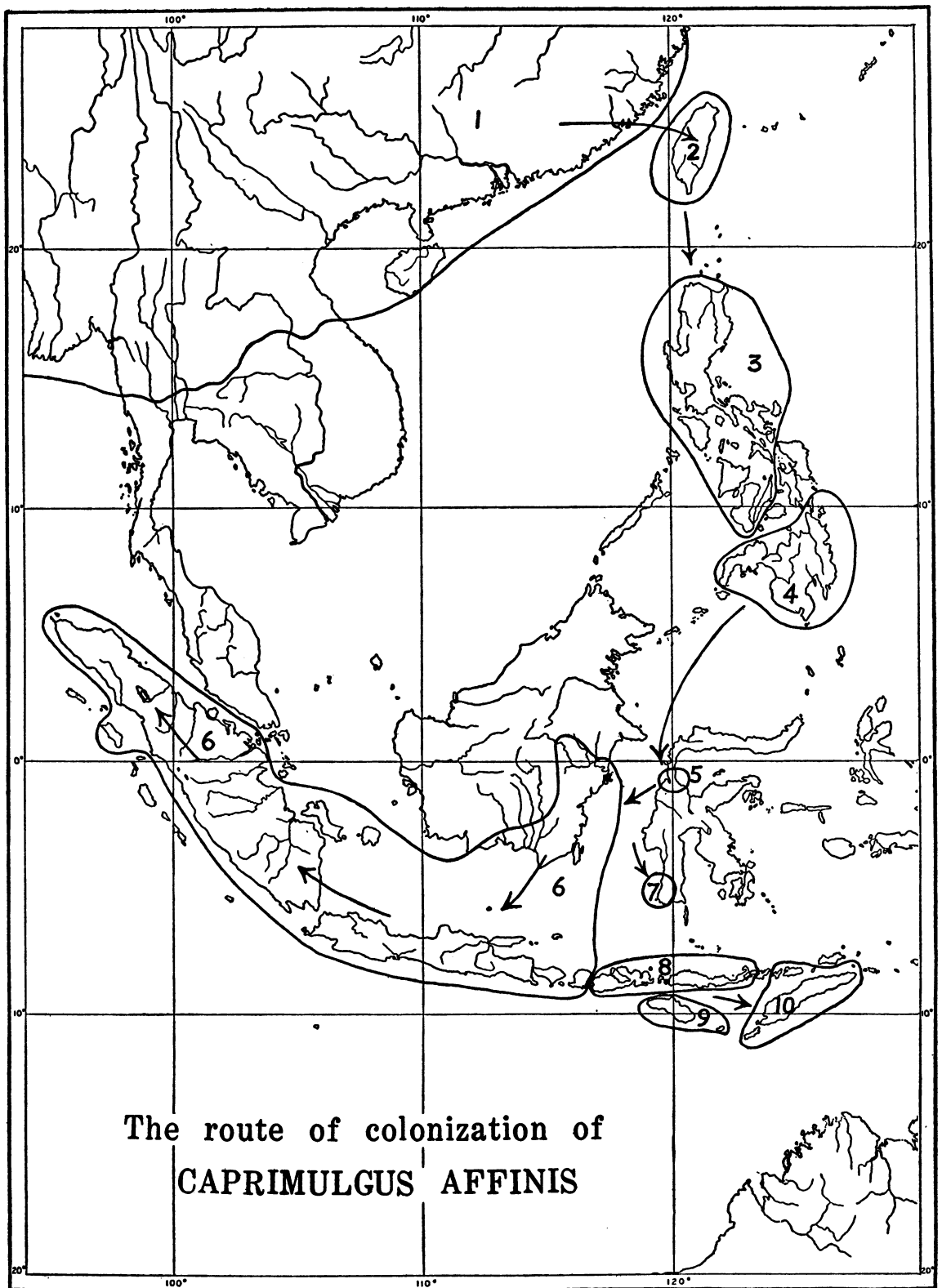


FIG. 2. *Caprimulgus affinis* entered the Malay Archipelago via Philippines and Celebes. It has not succeeded in reaching Australia across Timor Strait, like *Cisticola exilis* or many other grassland species with a similar distribution pattern. 1, Continental races of the *monticolus* group; 2, *stictomus*; 3, *griseatus*; 4, *mindanensis*; 5, *propinquus*; 6, *affinis*; 7, subspecies, near *affinis*; 8, *undulatus*; 9, *kasuidori*; 10, *timorensis*.

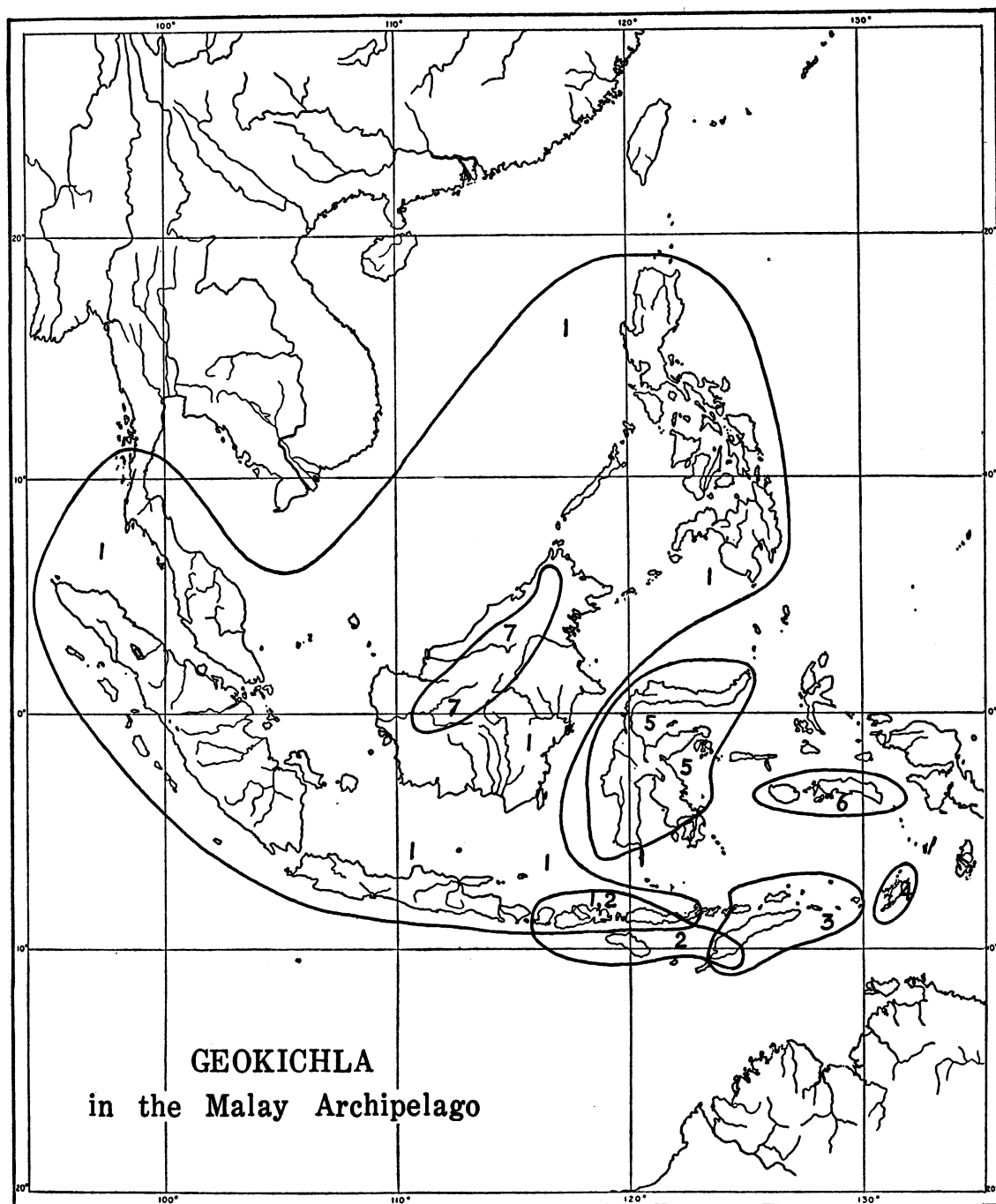


FIG. 3. The *Geokichla* species in the Malay Archipelago. 1, *Interpres*; 2, *dohertyi*; 3, *peronii*; 4, *schistacea*; 5, *erythronota*; 6, *dumasi-joiceyi*; 7, *everetti*. The first six of these are closely related and are still largely geographical representatives. Overlaps occur between *interpres* and *dohertyi* on Lombok, Sumbawa, and Flores, and between *dohertyi* and *peronii* on Timor.

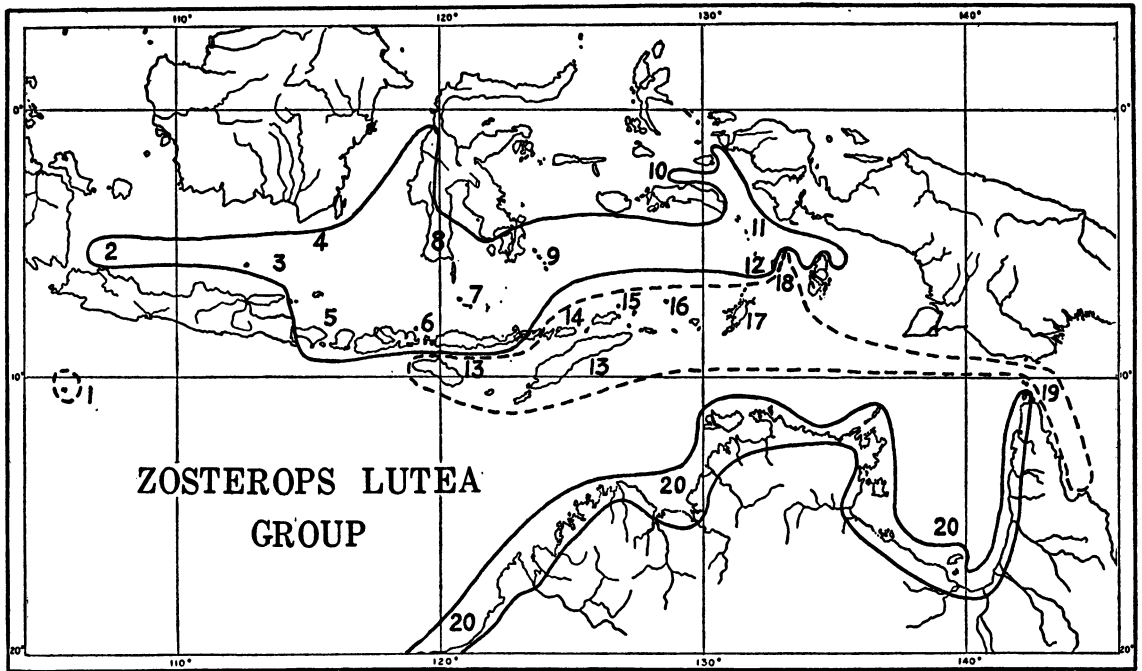


FIG. 4. The distribution of the *Zosterops lutea* group. 1, The white-bellied *natalis*. 2-12, The yellow-bellied *chloris* subgroup: 2, *maxi*; 3, *solombensis*; 4, *zachlora*; 5, *periplecta*; 6, *sumbawensis*; 7, *kalaotuae*; 8, *intermedia*; 9, *flavissima*; 10, *tudjuensis*; 11, *chloris*; 12, *uropygialis*. 13-19, The white-bellied *citrinella* subgroup: 13, *citrinella*; 14, *harterti*; 15, *lettiensis*; 16, *bassetti*; 17, *griseiventris*; 18, *grayi*; 19, *albiventris*. 20, The yellow-bellied *lutea* subgroup. Closely related species to the east are *griseotincta*, *rennelliana*, and the *rendovae* subgroup.

