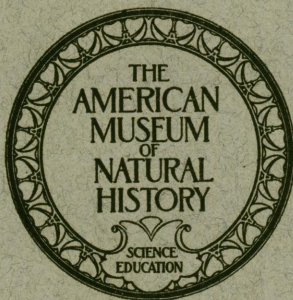


RESULTS OF THE ARCHBOLD
EXPEDITIONS. No. 35

A REVIEW OF THE GENUS *HIPPOSIDEROS*
WITH SPECIAL REFERENCE TO
INDO-AUSTRALIAN SPECIES

BY G. H. H. TATE



BULLETIN
OF
THE AMERICAN MUSEUM OF NATURAL HISTORY

VOL. LXXVIII, ART. V, pp. 353-393

New York

Issued August 19, 1941

Article V.—RESULTS OF THE ARCHBOLD EXPEDITIONS. NO. 35

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FIGURES 1 TO 5

	PAGE
INTRODUCTION.....	353
TAXONOMIC HISTORY.....	354
CRITERIA USED IN CLASSIFICATION.....	355
TWO NEW FORMS OF <i>Hipposideros</i>	357
LIST OF NAMED FORMS, UNDER GROUPS.....	358
SUBGENERIC GROUPS OF <i>Hipposideros</i>	360
ANNOTATED LIST OF NAMED FORMS OF <i>Hipposideros</i>	380
<i>Hipposideros</i> MATERIAL IN THE ARCHBOLD COLLECTIONS.....	391
<i>Hipposideros</i> OF THE NEW GUINEA REGION.....	392

INTRODUCTION

Preparation of the reports on the mammals of the Archbold collections has shown the need for a review of the relationships of the bats of the genus *Hipposideros* Gray. The material available for accomplishing this undertaking, though ample, is not inclusive enough to warrant a complete revision of the genus. Besides the collections in the American Museum and the considerable series assembled by Richard Archbold, the collections at Washington, Philadelphia, Chicago, Pittsburgh and Cambridge have been accessible through the generous co-operation of their respective curators. In addition, photographs of the skulls of the majority of the type specimens in European museums and detailed notes on the same, made in the summer of 1937, have been of great value to supplement the literature on many species not represented in the American collections.

African species of *Hipposideros* have been studied only in order to learn their relationships to Oriental species. No study has been made of sub-relationships within African groups, such as *caffer* and its allies.

The Hipposiderinae are currently separated from the Rhinolophinae through reduction by coalescence of the number of pedal phalanges from three to two. According to that classification the subfamily Hipposiderinae includes, besides *Hipposideros*, *Triaenops*, *Rhinonycteris*, *Clootis*,

Coelops, *Asellia* and *Anthops*. Most of those genera appear to represent specialized types with many characters of *Hipposideros*. In *Triaenops*, *Rhinonycteris* and *Asellia* the transverse noseleaf is subdivided and the tooththrows are subparallel; in *Clootis*, *Asellia* and *Rhinonycteris* p^2 is eliminated; in *Anthops* and *Coelops* the length of the tail has been greatly reduced. But indications of the same kinds of specialization are observable also in groups still currently placed within the genus *Hipposideros*: The tail is much shortened in *H. commersonii*; the upper premolar¹ is stated to be absent in *H. sabanus*; nearly parallel tooththrows occur in *H. muscinus*. The bats which students now separate generically from those still retained in *Hipposideros* seem mainly to be members of "groups" which began specializing fast and early.

In spite of the large number of names, approximately 126, which have been proposed for bats of this genus, close study of their structure has resulted in their tentative classification into only eleven major groups totaling about 30 species, leaving a remnant of names of uncertain position, due to inadequate description in the literature, inaccessibility of type specimens, or uncertain relationships morphologically.

¹ Miller, 1907, is followed for the terminology of the two upper and two lower premolars, namely, p_2^2 and p_4^2 .

TAXONOMIC HISTORY

Hipposideros has long been known to be divisible into a number of species-groups. Gray¹ in 1866 proposed a number of names under brief diagnoses of possible subgeneric value:

Macronycteris: type, *gigas*

Gloionycteris: type, armiger

*Rhinophylla*²: type, *labuanensis*

Speorifera: type, *vulgaris*

Chrysonycteris: type, *fulva*

Phyllorhina: examples, *nobilis* and *pygmaea*

Peters,³ five years later, grouped a number of species and synonyms under Gray's names and himself set up six more subgenera, as follows:

Doryrhina Peters:
type, *cyclops* Temminck

Phyllorhina Gray: *diadema* { *diadema* Geoffroy
 nobilis Horsfield
examples, *griseus* Meyen
 lankadia Kelaart
 ? *galerita* Cantor
 ? *pygmaea* Waterhouse

Gloionycteris Gray: *armiger* Hodgson
examples, *swinhoei* Peters

Macronycteris Gray: *commersonii* Geoffroy
examples, *gigas* Wagner
 vittata Peters

		<i>larvatus</i> Horsfield <i>vulgaris</i> Horsfield <i>deformis</i> Horsfield <i>insignis</i> Horsfield
<i>Rhinophylla</i> Gray and <i>Speorifera</i> Gray: examples,	<i>speoris</i> three leaflets	<i>crumeniferus</i> Peron ? <i>marsupialis</i> Geoffroy ? <i>dukkhunensis</i> Sykes <i>apiculatus</i> Gray <i>pennicillatus</i> Gray <i>templetoni</i> Kelaart <i>aureus</i> Kelaart <i>taitiensis</i> Zeebor
	<i>labuanensis</i> Tomes <i>cervinus</i> two leaflets	<i>cervinus</i> Gould <i>albanensis</i> Gray
	<i>longicauda</i> Peters	

Chrysonycteris Gray:
examples,

<i>fulva</i>	<i>fulva</i> Gray
	<i>murinus</i> Gray
	<i>atratus</i> Kelaart
	<i>cineraceus</i> Blyth
	<i>aruensis</i> Gray
	<i>aurita</i> Tomes
<i>bicolor</i>	<i>bicolor</i> Temminck
	<i>atricolora</i> Peters
	<i>amboinensis</i> Peters ⁴

Sideroderma Peters:
type, *fuliginosa* Temminck

Ptychorhina Peters: examples, *caffa* { *caffa* Sundevall
gracilis Peters
bicornis Heuglin

Cyclorhina Peters:
type, *obscura* Peters
doriae Peters

Thyreorhina Peters:
type, *coronata* Peters

Syndesmotis Peters:
type, *megalotis* Heuglin

Dobson⁵ treated the subgeneric groups of Gray and Peters as synonyms of *Phyllorhina* = *Hipposideros*. His work extended the revisional treatment by Peters. Andersen⁶ in 1905, 1906 and 1907, reviewed the *diadema*, *armiger*, *commersonii* and *caffer*

⁴ New name for Temminck's *bicolor* from Amboina, thus restricting the type locality of *bicolor* to "Java and Timor."

⁵ Dobson, 1876, Monogr. Asiatic Chiroptera, London, pp. 58-73; 1878, Cat. Chiropt. Brit. Mus., London, pp. 127-152.

⁶ Anderson, 1905, *Ann. Mag. Nat. Hist.*, (7) XVI, pp. 497-507; *op. cit.*, 1906, (7) XVII, pp. 35-48, 269-283; 1907, *Ann. Mus. Civ. Storia Nat.*, Genova, (3) III, pp. 18-20.

¹ Gray, 1866, Proc. Zool. Soc. London, p. 82.

² Homonym of *Rhinophylla* Peters, 1865, Monatsber. Akad. Wiss. Berlin, p. 520.

³ Peters, 1871, Monatsber. Akad. Wiss. Berlin, pp. 312-330.

groups. In 1918¹ a superficial excerpt from what was probably a detailed revision in manuscript was published under his name, in which a number of new forms were briefly sketched. That revision was never printed.

Though later writers have offered im-

portant contributions in the shape of descriptions of new forms and added descriptive matter relating to known species, none has attempted work aiming at synthetic treatment of the genus as a unit or of more of its subgeneric divisions.

CRITERIA USED IN CLASSIFICATION

The morphological evidence indicating distinct evolutionary trends within the genus *Hipposideros* is perplexing and often contradictory. Such characters as: progressive simplification of the upper incisors or reduction of the anterior premolars, widening of the rostral region or increase in the number of leaflets lateral to the horse-shoe, seldom combine to indicate clearly recognizable evolutionary trends. Instead, those characters behave as independent tendencies latent perhaps in all species, active in some species, quiescent in others. The student tries to discriminate between characters representing basic divergence and those indicating only parallelism or convergence.

Retention of the anterior upper premolar in the primitive dental alignment remains occasionally in several groups of species, particularly in the *bicolor* group (*sensu stricto*) and the *calcaratus* group. Even in those groups the tendency for the teeth to be displaced laterally outward from the toothrows can be discerned. In other groups the anterior premolars usually become excluded and the posterior premolars and canines attain virtual or total contact. Concomitant with such changes in the teeth of the upper jaw, the lower anterior premolars become modified. With movement of p^2 out of the toothrow, p_2 becomes progressively smaller, both by shortening of the cingulum and by reduction of the

height of the cusp from $2/3$ or $3/4$ (in *bicolor* and *calcaratus*) to $1/2$ the height of p_4 , while in *cyclops*, *semoni* and *sabanus*, in which p^2 has become vestigial² the height of the cusp of p_2 is less than $1/3$ that of p_4 . The tooththrows become shorter in proportion to the palatal width.

The second character mentioned, modification of the incisors, varies to only a limited degree. Typically no occlusion occurs between upper and lower incisors, the mandible being strongly undershot. The single pair of upper incisors, their tips convergent except in the *commersonii* group, is formed of bilobate teeth usually well separated, and with the outer lobe obsolescent to a degree varying with the species group. The two pairs of lower incisors are trilobate, the median teeth outwardly overlapping the lateral ones except in *muscinus*, by the extent of one lobe. The crown dimension of the outer tooth varies from sub-equal (in *muscinus*, *cyclops*, *calcaratus*, *gigas*, *galeritus* and *bicolor* groups) to twice the thickness and one and a half times the width of the inner tooth (in *speoris*, *pratti*, *armiger*, *commersonii*, *diadema* groups). In these latter groups the upper incisors retain most of the external lobe, are stouter, and become nearly contiguous (except *commersonii*); in the former the outer lobe is obsolescent and the teeth are weaker and spaced more widely. Posterior canine cusps are present in *abae*, *commersonii*, *calcaratus* and *galeritus*

¹ Anderson, 1918, Ann. Mag. Nat. Hist., (9) II, pp. 379-383.

² Thomas believed it absent in *sabanus*.

groups. They are developed also in other genera such as *Triaeonops* and *Coelops*.

A tendency is evident for the W pattern of m^3 (and the talonid of m_3) to be incomplete; the posterior cusp and commissure fail to develop and the antero-posterior length of the tooth is reduced. In the *muscinus* group m_3^3 remain virtually perfect. Elsewhere more or less reduction appears. Partial reduction is seen in *galeritus*, *caffer*, *bicolor*, *cyclops*, *larvatus*, *armiger* and *pratti*. And marked reduction shows in *commersonii*, *diadema* and *calcaratus* groups.

The rostral area exhibits fundamentally a double rounding or swelling, anterior to the ante-orbital region, in combination with a varying degree of lateral expansion; and, secondarily, in the *armiger* group, a marked flattening of the entire top of the rostrum, coupled with a greater degree of ossification. In *commersonii* group the rostrum is very high; in *pratti* it is elongated. Minimal lateral expansion of the rostrum is seen in the *calcaratus* group; maximal expansion is reached in such species-groups as *armiger*, *pratti*, *diadema*, *cyclops*, *semoni*, *speoris*. Intermediate conditions are seen in *bicolor*, *cervinus*, *caffer*, *sabanus*.

Normally the interorbital area shows a decided constriction between the rostral expansion and the braincase. In the *calcaratus* group and in *coxi* this condition is less marked. Because of its scarcely expanded rostrum, the ratio

$\frac{\text{least interorbital width}}{\text{width across rostrum}}$ in *calcaratus* may

rise above 65 per cent.

The width across the squamosal roots of the zygomata exceeds the greatest width at the mastoid level in all groups except the *bicolor* group and part of *calcaratus*. In the *bicolor* group the zygomata are peculiarly narrow and the braincase is well inflated.

Important modifications appear in the delicate premaxillary bones. In the *bicolor* group they are narrowly oblong, and, taken together, form a wedge-shaped contact with the palate. Their lateral edges are deeply notched to form, with the maxillae,

the incisive foramina. About the center of the anterior edge of each premaxilla is the alveolus of the incisor tooth. But this pattern is strikingly modified in certain groups: In some the posterior V is rounded to a U. And the foraminal openings may become narrowly slit-like as in *cervinus* or oval as in *calcaratus*, or the anterior enclosing processes may fail to reach the maxillaries as in *armiger* and *speoris*; or again they may become enlarged, encircle the foramina, and unite with the posterior processes (*pratti*, *cyclops*, *gigas*), thus excluding the maxillary bones from margining any part of the incisive foramina. In the *muscinus* group a special condition is seen: the foramina are large, and oval; the premaxillae (paired) reach the front of the palate by a narrow, spatulate process and the sides by two smaller lateral spatulate processes. The position of the incisive alveoli is at the middle of the anterior edge of the premaxilla in most species. In *muscinus* and *gigas* they are placed at the outer corners of the anterior edge.

The cochleae in the majority of groups are small. They are wider than their distance apart in *bicolor*, *muscinus* (greatly so), *cyclops* and *gigas* groups. In *galeritus*, *armiger* and *diadema* groups they are subequal to their width apart, and in *pratti* they are distinctly smaller.

Skin characters in most species have been studied with care by many former students. The structure of the noseleaves presents great variation. The foremost character¹ to claim attention is the development of two club-like processes one behind the other in the African species *cyclops* and the New Guinea-Australian *muscinus* groups, unique in *Hipposideros*, although homologous structures are seen in some other *Hipposiderine* genera.

The transverse leaf (posterior) is relatively simple and small in the *bicolor* and *galeritus* groups. It may have one or three vertical supporting ridges which divide it into two or four shallow cells. In the *armiger* and *pratti* groups it tends to be trilobate, and to differ in size according to the sex of the animal bearing it. A secondary

¹ Except perhaps the united ears in *megalotis*.

transverse ridge is present in the *caffer* subgroup, rising behind from the base of the primary leaf. Its crest is serrate. A similar but probably not strictly homologous secondary transverse ridge was described by Thomas and Doria for *wollastoni*.

The number of leaflets lateral to the horseshoe is significant in certain groups: No lateral leaflets occur in the *bicolor* group. In *calcaratus* none (to one, incipient). In *galeritus* and *pratti* groups two.¹ In *speoris* group three. In *diadema* three or sometimes four. In *armiger* four. Among the African species *caffer* has two, *gigas* and *abae* three. *Cyclops* and *muscinus* have each two, the outer one extending back to the rear of the transverse leaf.

The frontal sac, which is usually developed, may be related to sex. Present in males, it may be reduced or absent in females. It is entirely absent in the *diadema* group and in *lankadiva* and allies and approaches obsolescence in females of the *speoris* group (including *abae*). Other species whose females lack the frontal sac are *papua*, *pygmaeus* and *coxi*.

The ear in both the *calcaratus* and *bicolor* groups is quite large and obtuse to round-pointed. Such bats exhibit what Temminck called "un pli interne," or internal fold in the position of the absent anti-tragus. This fold bears rarely a distinct tubercle or papilla—the "kleinen kegel-

förmigen Anhang" (Schneider) of *speoris*. In the *bicolor* and *calcaratus* groups the same fold becomes a distinct pocket. In *cyclops*, *gigas* and *muscinus* which have elongate, acutely pointed ears, it is absent.

In *speoris*, *galeritus*, *diadema*, *armiger* and *pratti* groups the ears are large, broad, pointed, emarginate at outer edge near the tip. The distal half of the pinna of all except *galeritus* is naked. In *sabanus* the ear is similar, though proportionally smaller. The *galeritus* group, with ears also of similar general shape, can be further recognized from the fact that body fur extends outward over more than three-quarters of the surface of the pinna.

H. (Syndesmotis) megalotis, in which the ears are united at the base, is still inadequately known. It may not be truly referable to *Hipposideros*. The united condition of the ears suggests relationship to the Megadermidae.

A vestigial tragus can be seen in the case of *muscinus*.

Color has not been employed to any appreciable extent in this paper to aid in classification. Many of the species dealt with appear in both red and gray phases. In such cases color cannot aid the classifier. So far as is known bats without alternating color phases occur in the groups *muscinus* and *cyclops*.

TWO NEW FORMS OF HIPPOSIDEROS

Hipposideros bicolor macrobullatus, new subspecies

TYPE.—No. 102367, Amer. Mus. Nat. Hist.; adult ♂; Talassa (Maros), South Celebes; 300 meters; collector, G. Heinrich, Nov. 9, 1931. Type, a skin with skull, in good condition.

GENERAL CHARACTERS.—A "*bicolor*" bat, distinguished by its proportionally larger ears and horseshoe, wide internasal septum (1 mm.), very large bullae, back of palate rounded and extended beyond the back of m^3 .

DESCRIPTION OF TYPE.—Skin brownish gray above, the bases of the hairs whitish, as in all *bicolor*; underparts slightly paler; ears of "*bicolor*" type, quite large; tail about one and one-half as long as tibia; thumb with the elongate metacarpal and short basal phalanx of the group.

Skull with braincase slightly wider than in other *bicolor* from Celebes, but chiefly noteworthy on account of the enlarged bullae.

MEASUREMENTS.—Head and body, 52 mm.²; tail, 33; hind foot, 7; ear, 23. The ear, dry, now measures 20 mm. from crown and 17 mm. wide. Forearm, 42 mm.; tibia, 17; calcar, 8.5. Skull: occipito-canine length, 17 mm.; zygomatic width, 8.2; mastoid width, 9.0; rostral width, 4.8; least intertemporal width, 2.4; width of cochlea, 2.5; width of bulla, 3.1; length, $c-m^3$, 5.6; m^1-m^3 , 3.3.

Unfortunately the type specimen is the only one in the collection. The type of *macrobullatus* was compared with material representing *bicolor* from Roeroekan, N. Celebes, from Peleng Island, Halmahera,

¹ Exceptions occur: see *sabanus*, *dyacorum*.

² Measured in the field by Heinrich.

and another skull from Talassa. It diverged in the same manner from all.

Hipposideros breviceps, new species

TYPE.—No. 103335, Amer. Mus. Nat. Hist.; adult ♂; North Pagi, Mentawi Islands, lowlands; collector, J. J. Menden, Jan. 31, 1935. Type, skin with skull, in fair condition.

GENERAL CHARACTERS.—Member of *galeritus* group, externally very similar to *schneideri* but smaller (forearm only 43 mm.); skull with much shorter rostrum—resembling *dyacorum*, but horseshoe with 2 lateral leaflets instead of none.

DESCRIPTION OF TYPE.—Pelage with tips very dark, almost fuscous, the bases grayish white; underparts pale brownish gray, bases even paler. Membranes and ears blackish. Horseshoe small, provided with two lateral leaflets, the outer much the smaller.

Skull with short, broad outline much resembling that of *dyacorum* of Borneo. Rostral swellings distinct, individually inflated; premaxillae not exceeding fronts of canines; jugal eminence rising abruptly; palate rounded be-

hind, its posterior edge level with m^3-3 ; cochlea moderate, larger than their distance apart.

Canines with small cusp posteriorly, near the cingulum; p^2 much reduced; W-pattern of m^3 incomplete; p_2 very small, the length of its cingulum to that of p_4 as 0.5 mm. : 0.9 mm.

MEASUREMENTS.—Head and body, 42 mm.¹; tail, 23; ear, 15; hind foot, 7; forearm, 43. Skull: occipito-canine length, 16.9; zygomatic breadth, 9.5; mastoid width, 8.9; rostral width, 5.2; least intertemporal width, 3.2; cochlea 2.5; distance apart of cochlea, 1.9; $c-m^3$, 5.8; cingulum length of p^2 , 0.3, of p^4 , 1.1, of p_2 , 0.45, of p_4 , 0.9.

This new species is represented in our collections by a series of 37 specimens, all paratypes. *Breviceps* appears to represent a half-way stage in the line of evolution from an *insolens*-like form to the specialized *dyacorum*. The skull and teeth, although not so small, have already attained the condition of *dyacorum*; the lateral leaflets, on the other hand, are unreduced.

LIST OF NAMED FORMS

List of the named forms of *Hipposideros* (*tricuspidatus* and allies omitted), arranged geographically under groups.

NAMED FORMS	TYPE REGION, OR TYPE LOCALITY		
<i>bicolor</i> group	Indo-Australian region	<i>saevus</i> Andersen	Kei Island, New Guinea
<i>micropus</i> Peters	Simla, India	<i>aruensis</i> Gray	Aru Island, New Guinea
<i>cineraceus</i> Blyth	Punjab, India	<i>albanensis</i> Gray	Cape York, N. E. Australia
<i>murinus</i> Gray	India	<i>calcaratus</i> group	Papuan (also Philippine ?)
<i>fulgens</i> Elliot	Mahratta, India	<i>calcaratus</i> Dobson	Duke-of-York Island
<i>auritus</i> Tomes	India	<i>cupidus</i> Andersen	Papua
<i>fulvus</i> Gray	Madras, India	? <i>coronatus</i> Peters	Mindanao, Philippines
<i>pallidus</i> Andersen	Kathiawar, India	<i>commersonii</i> group ²	African and Mascarene
<i>pomona</i> Andersen	Coorg, India	<i>marungensis</i> Noack	West Tanganyika
<i>atratus</i> Kelaart	Ceylon	synonym <i>mostellum</i> Thomas	Kenya
<i>nicobarulae</i> Miller	Nicobar Island	<i>thomensis</i> Bocage	St. Thomé Island
<i>gentilis</i> Andersen	Burma	<i>gigas</i> Wagner	Angola
<i>sinensis</i> Andersen	Fukien, China	syn. <i>vittata</i> Peters	Ibo Island, Mozambique
<i>nequam</i> Andersen	Selangor, Malaya	<i>gambiensis</i> Andersen	Gambia
<i>atrox</i> Andersen	Selangor, Malaya	<i>niangarae</i> J. A. Allen	Belgian Congo
<i>major</i> Andersen	Engano Island, Sumatra	<i>commersonii</i> Geoffroy	Madagascar
<i>ridleyi</i> Robinson and Kloss	Singapore, Malaya	<i>pratti</i> group	Indo-Chinese
<i>bicolor</i> Temminck	N. W. Java	<i>lylei</i> Thomas	Northern Siam
<i>javanicus</i> Sody	Java	<i>pratti</i> Thomas	Szechwan, China
<i>doriae</i> Peters	Sarawak, Borneo	<i>galeritus</i> group	Indo-Australian; Oceanic
<i>antricola</i> Peters	Luzon, Philippines	<i>brachyotus</i> Dobson	Central India; Ceylon (Phillips)
<i>wrighti</i> Taylor	Luzon, Philippines	<i>aureus</i> Kelaart	Ceylon
<i>erigens</i> Lawrence	Mindoro, Philippines		
<i>toala</i> Shamel	Celebes		
<i>macrobullatus</i> Tate	S. Celebes		
<i>amboinensis</i> Peters	Amboina		

¹ Field measurements by Menden.

² Interrelationships not studied.

<i>galeritus</i> Cantor	Penang, Malaya	<i>nobilis</i> Horsfield	Java
<i>labuanensis</i> Tomes	Labuan, Borneo	<i>speculator</i> Andersen	S. Celebes
<i>insolens</i> Lyon	S. E. Borneo	<i>pelingensis</i> Shamel	Peleng Island, Celebes
<i>celebensis</i> Sody	S. Celebes		
<i>crumeniferus</i> Peron	Timor Island	<i>diadema</i> Geoffroy	Timor Island
<i>batchianus</i> Matschie	Batjan Island	<i>euotis</i> Andersen	Batchian Island
<i>cervinus</i> Gould	N. Queensland; its range extending to Santa Cruz Islands	<i>custos</i> Andersen	Kei Island
		<i>pullatus</i> Andersen	Papua
		<i>reginae</i> Troughton	N. Queensland
		<i>trobrius</i> Troughton	Trobriand Islands, New Guinea
<i>galeritus</i> group derivatives	Sunda to Philippines	<i>mirandus</i> Thomas	Admiralty Islands
<i>sabanus</i> Thomas	N. Borneo	<i>dinops</i> Andersen	Rubiana, Solomon Islands
<i>schneideri</i> Thomas	Sumatra		
<i>dyacorum</i> Thomas	Borneo	<i>oceanitis</i> Andersen	Guadalcanar, Solomon Islands
<i>breviceps</i> Tate	N. Pagi Island, Sumatra	<i>demissus</i> Andersen	San Christobal, Solomon Islands
<i>longicauda</i> Peters	Java		
<i>pygmaeus</i> Waterhouse	Philippines		
<i>galeritus</i> group derivatives ¹	Wholly African	Mainland offshoot of <i>diadema</i> group	Indian; reported to reach Burma
<i>caffer</i> Sundevall	Natal	<i>lankadiva</i> Kelaart	Ceylon
<i>gracilis</i> Peters	Mozambique	<i>indus</i> Andersen	Kanara, India
<i>bicornis</i> Heuglin	Eritrea	<i>mixtus</i> Andersen	E. Mysore, India
<i>angolensis</i> Sebra	Angola	<i>unitus</i> Andersen	Saugore, India
<i>centralis</i> Andersen	Uganda	<i>schistaceus</i> Andersen	Bellary, India
<i>guineensis</i> Andersen	Gaboon		
<i>niapu</i> J. A. Allen	Belgian Congo	<i>speoris</i> group	Chinese-Burmese-Sunda
<i>tephrus</i> Cabrera	Morocco	<i>larvatus</i> Horsfield	Java
<i>beatus</i> Andersen	Cameroons	<i>insignis</i> Horsfield	Java
<i>fuliginosus</i> Temminck	"Coast of Guinea"	<i>deformis</i> Horsfield	Java
<i>nanus</i> J. A. Allen	Belgian Congo	<i>leptophylla</i> Dobson	Khasia Hills, Assam
<i>ruber</i> Noack	Tanganyika	<i>grandis</i> G. M. Allen	Chindwin, Burma
<i>curtus</i> G. M. Allen	Cameroons	<i>neglectus</i> Sody	C. Borneo
		<i>vulgaris</i> Horsfield	Java
		<i>barbensis</i> Miller	St. Barbe Island
		<i>poutensis</i> J. A. Allen	Hainan Island, China
Derived from base of <i>speoris</i> - <i>galeritus</i> stem. (?) Not closely related to each other		<i>speoris</i> Schneider	Peninsular India, Ceylon and Africa
<i>coxi</i> Shelford	Sarawak, Borneo	<i>speoris</i> Schneider	Tranquebar, S. India
<i>obscurus</i> Peters	Luzon, Philippines	<i>dukhunensis</i> Sykes	Dekkan, India
<i>papua</i> Thomas and Doria	Misori Island, Dutch New Guinea	<i>templetoni</i> Kelaart	Ceylon
<i>armiger</i> group	Indo-Chinese	<i>aureus</i> Kelaart	Ceylon
<i>armiger</i> Hodgson	Nepal, India	<i>taitiensis</i> Fitzinger	Tahiti ?
<i>debilis</i> Andersen	Malay Peninsula	<i>apiculatus</i> Gray	Madras, India
<i>swinhoei</i> Peters	Amoy, China	<i>penicillatus</i> Gray	
<i>terasensis</i> Kishida	Formosa	<i>abae</i> J. A. Allen	Congo
<i>turpis</i> Bangs	Liu Kiu Islands		
<i>pendleburyi</i> Chasen	Peninsular Siam	<i>muscinus</i> group	Torresian
		<i>muscinus</i> Thomas	Fly River, Papua
		<i>semoni</i> Matchie	Cooktown, N. Australia
<i>diadema</i> group	Primarily Insular, to Australia and Solomon Islands, but also Burmese-Chinese	<i>stenotis</i> Thomas	Mary R., N. Australia
<i>nicobarensis</i> Dobson	Nicobar Island	<i>wollastoni</i> Thomas	S. W. Dutch New Guinea
<i>masoni</i> Dobson	Moulmein, Burma		
<i>enganus</i> Andersen	Engano Island, Sumatra	<i>cyclops</i> group ²	Central African
<i>vicarius</i> Andersen	Sarawak, Borneo	<i>cyclops</i> Temminck	"Coast of Guinea"
<i>natunensis</i> Chasen	Natuna Island	synonym <i>micaceus</i> de Winton	Gaboon
<i>griseus</i> Meyen	Luzon, Philippines	synonym <i>langi</i> J. A. Allen	Belgian Congo
<i>anderseni</i> Taylor	Philippines		
		<i>megalotis</i> group ²	East African
		<i>megalotis</i> Heuglin	Eritrea

¹ List of named forms. Interrelationships not studied.² Not studied.

SUBGENERIC GROUPS OF *HIPPOSIDEROS*

The eleven major species-groups which can be recognized in the genus are listed synoptically:

- | | | |
|------------------------------|--|---|
| 1.— <i>bicolor</i> group | India to North Australia | 4.—Transverse leaf greatly enlarged in males, lateral leaflets 2, skull with anteriorly prolonged rostrum. Size large. <i>pratti</i> group. |
| 2.— <i>calcaratus</i> group | New Guinea and Solomon Islands | Transverse leaf not specially enlarged in males, rostrum otherwise. 5. |
| 3.— <i>commersonii</i> group | African and Madagascar | 5.—Two lateral leaflets or less, size medium to small. <i>galeritus</i> group. |
| 4.— <i>pratti</i> group | Southeastern Asia | Three or four lateral leaflets, size medium to large. 6. |
| 5.— <i>galeritus</i> group | India to Australia, New Hebrides, Africa | 6.—Frontal sac absent in both sexes; rostrum rounded, with paired inflations variously developed. Size large. <i>diadema</i> group. |
| 6.— <i>armiger</i> group | India to Formosa, Liu Kiu Islands | Frontal sac present in both sexes, or absent in ♀; rostrum rounded, size medium. |
| 7.— <i>diadema</i> group | Burma and Siam to Australia and Solomon Islands | <i>speoris</i> group. |
| 8.— <i>speoris</i> group | India to China, Borneo, Java; and Central Africa (<i>abae</i>) | 7.—Tail very short. Skull with toothrows anteriorly convergent. M ³ with W-pattern reduced. Size large. <i>cyclops</i> group. |
| 9.— <i>muscinus</i> group | New Guinea, North Australia | Tail unshortened. Skull with toothrows almost parallel. M ³ with W-pattern complete. Size small. <i>muscinus</i> group. |
| 10.— <i>cyclops</i> group | Africa | 8.—Ears united by frontal band. <i>megalotis</i> group. |
| 11.— <i>megalotis</i> group | East Africa | |

Three of these groups, *bicolor*, *galeritus* and *diadema*, are widespread and abundant through the Indo-Australian region. Two, *calcaratus* and *muscinus*, are Papuan and Australian; two, *pratti*, *armiger*, are continental (S. E. Asia); and three, *commersonii*, *cyclops*, *megalotis*, are African.

Muscinus and *cyclops* come from a common but remote origin. *Megalotis*, known only from the type, is perhaps not strictly referable to *Hipposideros*. *Triaenops* (*tricuspidata*, etc.) have been omitted. A simple, partly artificial key to the main groups is offered.

- 1.—Without two longitudinally placed club-shaped processes on sella and transverse process. 2.
With two such processes. 7.
- 2.—Ears not united by frontal band. 3.
Ears united by frontal band. 8.
- 3.—Ears large, the outer edge not emarginate, skull with mastoid width exceeding zygomatic width, size small. *bicolor* group.
Ears large, sub-triangular, outer edge not emarginate, skull with zygomatic width exceeding mastoid, intertemporal constriction only slightly less than rostral width. Size medium. *calcaratus* group.
Ears narrow, elongate, acute. Skull with rostrum almost as high as braincase, upper incisors placed at outer corners of premaxillae. Tail much shortened. Size large. *commersonii* group.
Ears medium to large, triangular, the outer edge emarginate. 4

Hipposideros bicolor group

Ears large, the antitragal lobe provided with a distinct "internal fold" (Temminck), the outer edge of the ear not emarginate. Horseshoe moderate (width about 15 per cent of forearm); transverse leaf thin, supported by three weak ribs which divide it into four "cells"; no lateral leaflets. Frontal sac present in both sexes. (Phillips states it is obsolescent in *atratus*.) Joints of thumb of the southeastern forms proportioned as in *calcaratus* group (in *gentilis* and allies basal phalanx is longer). Length of tibia 40 per cent of forearm; calcar 20 per cent; tail 70 per cent of forearm; part of terminal joint often exceeding patagium.

Skulls of species of this group are recognizable by the enlarged braincase and narrowed zygomata, combined with their elongate, tapered outlines. The only other bats at all resembling them—bats of the *calcaratus* group—have similarly tapered skulls, but widened inter-orbital area, less broadened braincase, smaller cochlea. They are considerably larger.

Upper incisor with outer lobe obsolescent; canine without posterior cusp; p² still usually included in tooththrow; outer lower incisor unenlarged but overlapped by i₁; crown of p₂ 1/2 to 3/4 of height of crown p₄ (reduced in *atratus*, *nequam*); the W-pattern of m³ reduced.

H. bicolor was described by Temminck as coming from "Java, Amboina and Timor." Temminck continued, "specimens from Amboina (subsequently named by Peters *amboinensis*) have dimensions a little less than those from Java." He had before him "ten females and four males." Of the length of the forearm he wrote, "antibrachium 1 inch 3 lines [32 mm.] . . . The adult from Java . . . antibrachium 1 inch 8 lines [42 mm.]."

Fifty years later Jentink listed¹: Skulls "a" and "b" adults. Amboina. Types of *Rhinolophus bicolor* Temminck; and specimens "a"—"s," most of which bear dates showing they were collected later than Temminck's type series. Of them, only "a," "b," "c," "d," "f," "g," "i," "p," "q" could have been examined by Temminck. Possibly Dobson's (1878, p. 151) "specimen e," from Leyden Museum, represents another, obtained by exchange. Of the foregoing, skins "a," "b" and "c" (from Sumatra) can be eliminated. Skins "d" and alcoholics "p" and "q" as well as Dobson's specimens are from Java, and "f" and "g" (from Amboina) were not found. No skulls had been extracted from others of the series. Dr. Junge in 1937 very kindly had the skull of the Javanese "specimen d" extracted and cleaned, so that I might study and photograph it.

The type locality (and consequently the geographical race) of *H. bicolor* seems yet to be unrestricted. I now propose to restrict the type locality of "côte d'Anjer" in the extreme northwest of Java where Van Hasselt collected specimen "d," and to make specimen "d" lectotype of Temminck's type series (which included specimens of *amboinensis*). From my notes I quote:

Specimen "d" (lectotype): sex ?; ear broad, squarish in outline; dorsal color now light brown with whitish bases, underparts with chest and throat now white, posteriorly brownish buff with paler bases. Skull broken in occipital region, elongate; nasal eminence slight; rather pronounced posterior interparietal swelling. Anterior pre-molar only slightly out of line with p^4 and c.

Lower p_2 three-fourths of height of crown of p_4 . Significant measurements: Forearm, 47; zygomatic breadth, 9.1; greatest mastoid breadth, 9.4; least inter-orbital width, 3.0; $c-m^3$, 6.5; m^1-3 , 3.9.

From Temminck's description of the coloring "roux marron" tips and white bases, the Javanese specimen "d" must have represented the reddish-brown phase of *bicolor*, and the 47-mm. forearm indicates it was one of the larger species of its group.

Further study of bats of the *bicolor* group from Java and surrounding territories suggests that two, and possibly three, distinct species may be present on the island. Besides the genotype (specimen "d" of Jentink from Anjer), with which *javanicus* is very probably synonymous, I have examined M.C.Z. 12798, ♂, from Soekaboemi, West Java, which has the forearm only 39 mm. and $c-m^3$, 5.6 mm. This bat is structurally indistinguishable from our series from Bali, the island immediately adjoining Java on the east, except that its infra-orbital foramen is large and slit-like. It appears to be very close to *nicobarulae* and *atricola* (of Lawrence), both of which have the same forearm and tooththrow measurements.

The series from Bali has forearm 39–41 mm., $c-m^3$, 5.3. With one exception these bats have the pelage a lustrous, golden color quite unlike the majority of species, which have brown or fuscous-tipped hairs with whitish bases.

This leaves in the Indo-Malaysian region the *fulvus-gentilis* bats, to which perhaps *erigens* is related, *cineraceus* with forearm only 34 and $c-m^3$ but 5.1 mm., and *atratus* with forearm 36 and $c-m^3$, 5.4.

H. gentilis sinensis has the forearm 41 and the tooththrow 6.1 mm. It is approached quite closely by *erigens* of the Philippines but has the subterminal joint of the thumb decidedly longer (2.6:2.1). I suggest, too, that true *gentilis* may be very nearly related to *fulvus* of peninsular India.

There remain to be considered the representatives of the group in Celebes, New Guinea and adjoining areas. *Toala* Shamel, whose type has been recently examined, has the forearm 39 mm., $c-m^3$, 5.5.

¹ Jentink, 1887, Cat. Osteologique, pp. 272–273; 1888, Cat. Syst., pp. 168–169.

It appears thus to be related to our specimens from Bali and M.C.Z. 12798 from Java. A.M.N.H. 109104 from Peleng Island is not to be distinguished from Celebes material. A.M.N.H. 102364 from Halmahera is likewise identical to the specimen from Java. *Macrobullatus* is easily distinguished through its large bullae.

Papuan material, of which we have ample, is a little smaller: forearm 37 mm., c-m³, 5.4. Specimens from the Fly River have the slit-like infra-orbital foramen mentioned above, elongated to 1.6 mm.; those from Idenburg River less so. Both show greater deepening of the posterior third of the zygoma than appears in material from any of the more westerly localities. Such posterior processes on the zygomata are present normally in most groups of *Hipposideros*. They are highly developed in *Asellia* and other genera, and therefore characteristic of the family. They tend toward obsolescence in all members of the *bicolor* group except those from New Guinea.

There is good reason to believe that *micropus* belongs with *cineraceus*, but the affinities of *doriae* must yet be proved.

H. nequam Andersen has not been allocated in the group. Its greatly reduced p_2 separates it from true *bicolor*, with which the size of its forearm would otherwise place it. I have failed to observe more than a moderate degree of reduction in p_2 of *atratus* (specimens in M.C.Z. obtained from W. W. A. Phillips), which was so strongly emphasized by Andersen. In M.C.Z. 27500 the cingulum length of p_2 : $p_2 = 0.6:0.75$. In a form in which p_2 is "comparatively large" (Andersen, 1918), the cingulum length of $p_2:p_4 = 0.8:0.8$. *Nicobarulae*, *atratus* and *antricola* have skulls which are virtually indistinguishable, and they are almost identical in size.

Hipposideros calcaratus group

Ear broad, triangular, obtuse, its outer margin not concave. Horseshoe area simple: horseshoe medium in size (width about 12 per cent of forearm); posterior leaf simple, unwidened, with one supporting ridge (two lateral ones absent or weak); no

lateral leaflets. Frontal sac present in both sexes. Thumb strongly developed, the metacarpal equaling or slightly exceeding the basal phalanx. Length of tibia 50 per cent of forearm. Calcar elongate (30 per cent of forearm). Tail 70 to 75 per cent of forearm, its terminal joint not exceeding uropatagium.

Skull unspecialized; inter-orbital region unconstricted (attaining 70 per cent of width of rostrum); rostrum scarcely expanded, skull tapering anteriorly. Premaxillae (from below) elongate (3.2 mm.), narrow (1.0 mm.), the elliptical openings of the incisive foramina closed extero-posteriorly by the maxillae. Palate in front with U-shaped opening for reception of maxillae, behind not extending beyond m³. Vomer projecting far back into mesopterygoid fossa, thickened at its lower margin. Cochleae about as wide as their distance apart. Mandible with strong coronoid process and a heavy knob-like angular process. Upper incisors simplified, their crowns with only trace of outer lobes, their tips inclining inward but separated by the thickness of one incisor. Canine proödont, with high posterior cusp. Second premolar, though very much reduced, still retained in toothrow. Main cusp of p^4 higher than molar cusp line. W-pattern of third molar reduced in conformity with the characters by which Miller separated *Hipposideros* and *Rhinolophus*. Outer lower incisor slightly enlarged. Crown of p_2 about 3/4 height of p_4 .

So far as known the *calcaratus* group is restricted to the New Guinea region (see map, figure 5). *Coronatus* Peters from Mindanao (type of *Thyreorhina*, subgenus) had characters which agreed substantially with those of *calcaratus*.

Our *calcaratus* material from the island of New Guinea and outliers, falls into two readily separable groups:

- 1.—Smaller bats with forearm 47–50 mm.; posterior canine cusp descending only 1/3 of length of tooth; c-m³, 7.0–7.5; openings, separating the alisphenoid areas from the posterior pterygoid area, relatively large (1 mm. wide); the sphenoid "bridge" narrow (1.3 mm.) and the sphenoidal depression weakly developed.
- 2.—Larger bats with forearm 51–55 mm.; pos-

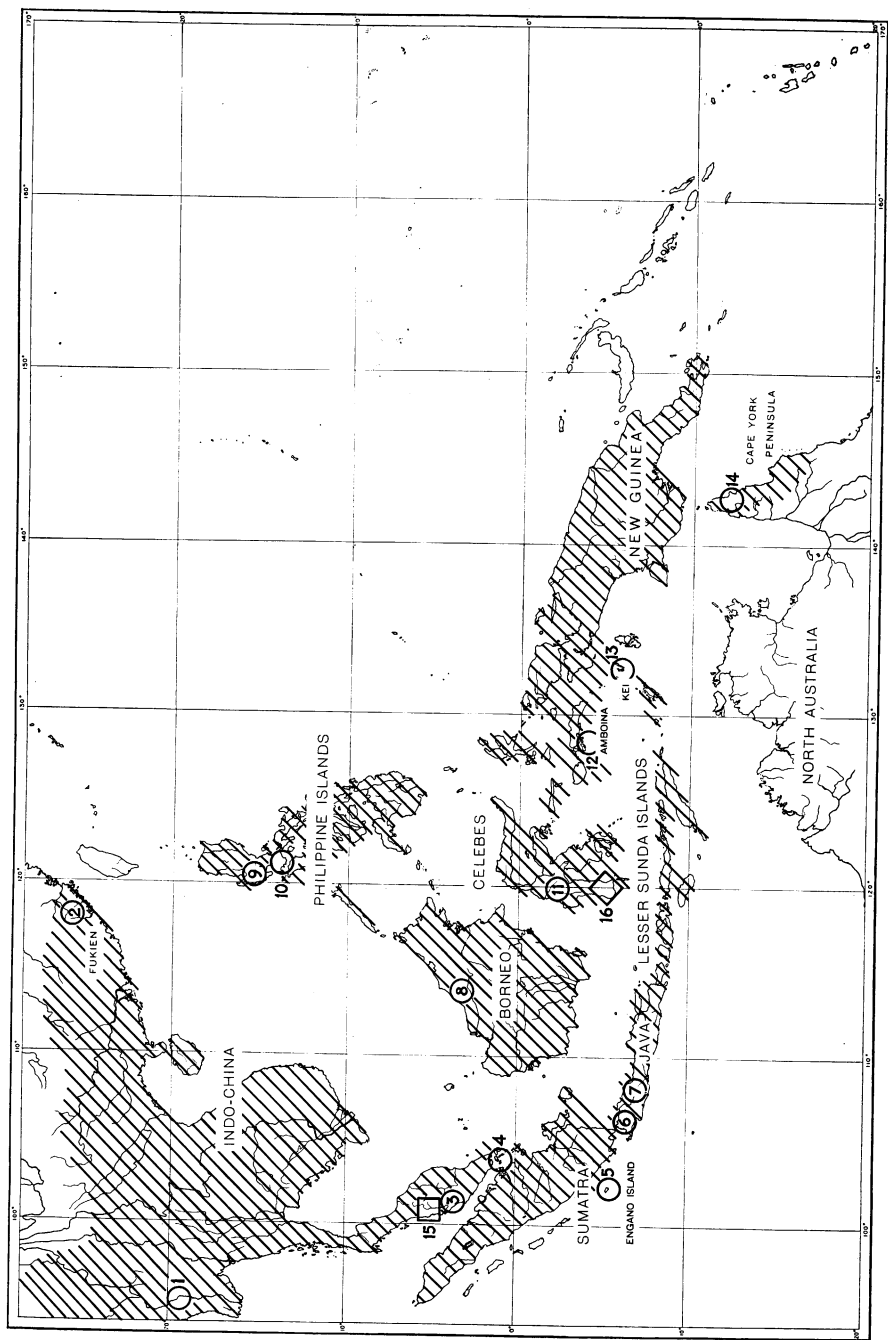


Fig. 1. *Hipposideros bicolor* group.
 In circles: 1, *H. bicolor gentilis*; 2, *H. b. sinensis*; 3, *H. b. atrox*; 4, *H. b. ridleyi*; 5, *H. b. major*; 6, *H. b. bicolor*; 7, *H. b. javanicus*; 8, *H. b. doriae*; 9, *H. b. antricola*; 10, *H. b. erigens*; 11, *H. b. toala*; 12, *H. b. amboinensis*; 13, *H. b. saevus*; 14, *H. b. albanensis*.
 In square: 15, *H. nequam*.
 In diamond: 16, *H. macrobullatus*.

terior canine cusp descending nearly half-way down tooth, the tooth proportionately more massive; $c-m^3$, 8.0 to 8.6; openings adjoining pterygoid "bridge" small (0.7 mm.), partly concealed by "bridge," which is wide (1.8); sphenoidal depression relatively well defined.

There is no character in Dobson's description of *calcaratus* to indicate to which of these groups it is related. But Andersen's brief comparison made when he proposed *cupidus* would appear to settle the matter—*cupidus* the smaller, *calcaratus* the larger.

Both species appear to be widely distributed. Probably they have been confused with each other in literature. But when the skulls are compared they are easily distinguishable. The skins, apart from their decided differences in size (which applies to the absolute sizes of feet, phalanges and claws of thumbs, etc.), appear not to differ.

The bright rufous phase of *calcaratus*, represented by four bats from the upper Fly River, is noteworthy.

U.S.N.M. 18480 from Jobi is a specimen of *H. cupidus*.

The *commersonii* group (*Macronycteris*, subgenus)

Large species of African and Madagascar, first distinguished by the "longitudinal"¹ opening of the frontal sac (present in both sexes). Horseshoe entire in front, with three to four lateral leaflets; transverse leaf with median septum. Ear acute, emarginate, not broadened. Thumb with basal phalanx equaling or exceeding the metacarpal. Tail shorter than tibia.

Skull with moderately inflated and broadened but high rostrum—almost as high as braincase minus sagittal crest. Sagittal and lambdoidal crests strongly developed. Premaxillae enclosing incisive foramina. Angular process of mandible but little flexed outward; coronoid high. Symphysis strong and deep.

Upper incisors weakly bilobed, divergent. Canine with high though weak posterior cusp. Anterior premolar excluded, much reduced. Outer lower incisors but slightly enlarged. Anterior lower premolar reduced—its crown only 1/3 the height of p_4 .

¹ Nearly circular.

Hipposideros pratti group

The forms *pratti* and *lylei*, though they resemble the *armiger* group superficially in color and size, have developed independently from well down the *Hipposideros* stem.

They are characterized by the enormous development of their lobate transverse noseleaves² in males, by a supplementary transverse structure, probably the homologue of the sella in *Rhinolophus*, and by the notching of the median anterior edge of the horseshoe (as in *larvatus*). No supporting septa appear on the face of the transverse leaf, which is quite thick. The horseshoe is margined by only two lateral leaflets (as in *cervinus*). Frontal sac present. Ear broad, pointed, slightly emarginate.

Skull with rostral area low and markedly widened, but differing from condition in *armiger* group by possession of well-developed frontal depression and by greater forward extension of the canine-bearing portions of the maxillae. Premaxillae wholly enclosing incisive foramina; roofs of narial and mesopterygoid canals showing step-like discontinuity, described in *armiger* group.

Upper dentition much as in *armiger*: outer lobe of i weak but distinct; outer lower incisor half as thick again as inner. Lower anterior p with crown height 1/2 that of p_4 . Molars less heavy. Upper third molar with W-pattern reduced. See distribution map, figure 4.

Hipposideros galeritus group

The range of this group of bats (*s.s.*) is rather more restricted than that of the *bicolor* group. It extends from India (*brachyotus*) through the Malay Peninsula, Sunda Islands, Borneo and Celebes to New Guinea, northern Australia and New Hebrides. In typical form it has not yet been recorded from Indo-China and China. *Pygmaeus* represents it in the Philippine Islands. Inclusion of the *caffer* subgroup extends the range to most of Africa.

All typical species possess two lateral leaflets. Many—perhaps all—can further

² See illustration in Osgood, 1932, Field Mus. Nat. Hist., Zool., XVIII, p. 223.

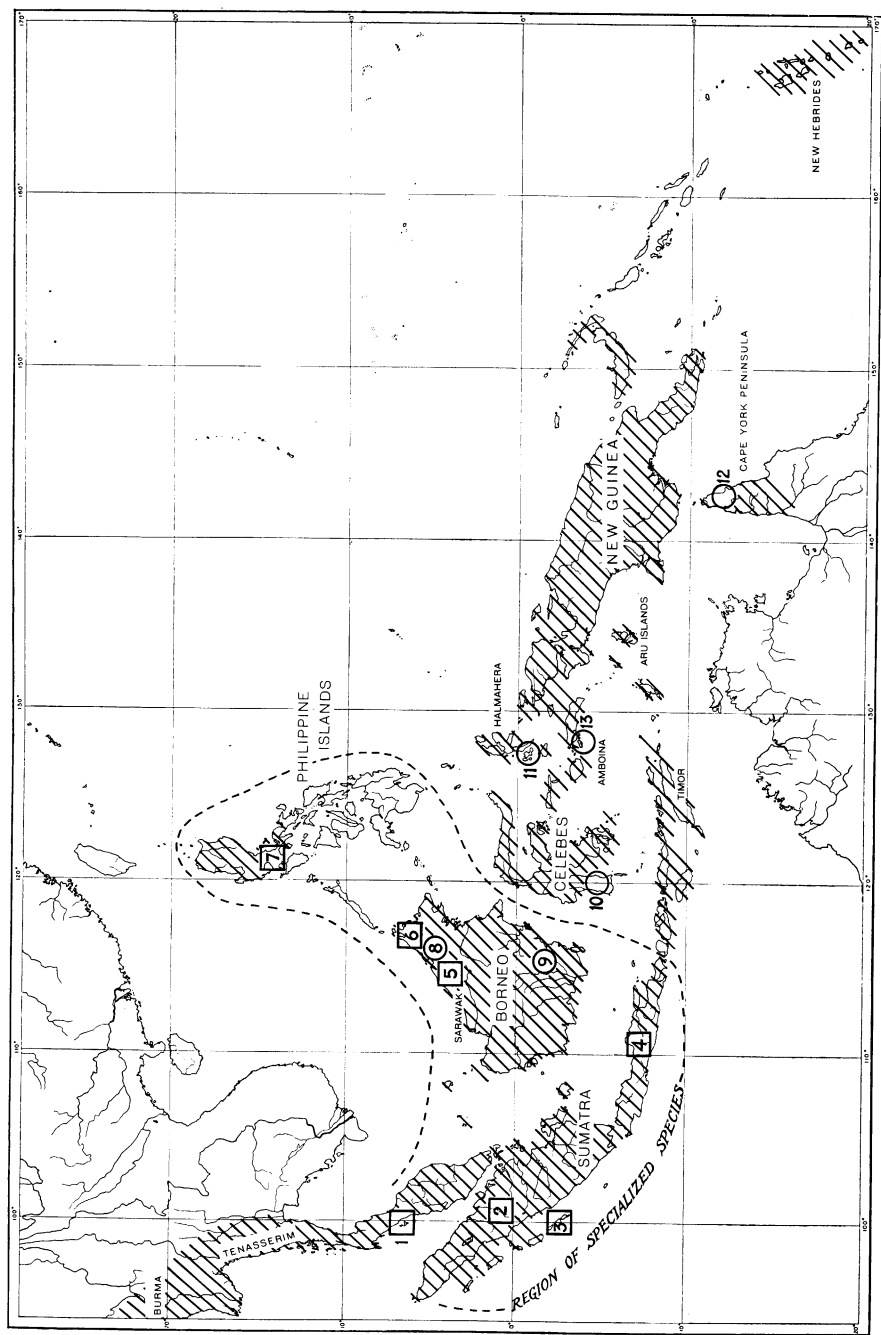


Fig. 2. *Hipposideros galeritus* group.
 In squares (more specialized): 1, *H. galeritus galeritus*; 2, *H. g. schneideri*; 3, *H. breviceps*; 4, *H. longicauda*; 5, *H. dyacorum*; 6, *H. sabanus*; 7, *H. pugnax*.
 In circles (less specialized): 8, *H. labuanensis*; 9, *H. cervinus insolens*; 10, *H. c. celebensis*; 11, *H. c. batchianus*; 12, *H. c. cervinus*.

be recognized by absence of pigmentation of the narial portions of the horseshoe, in *galeritus* and *cervinus* extending to almost the whole horseshoe.

Transverse leaf four-celled, simple: the "sella" portion of the nasal region full and cushion-like; horseshoe proper simple, with its anterior margin unnotched (except *sabanus*).

Ears not enlarged, broad, pointed, with body fur on three-fourths of their outer surface, somewhat emarginate along the outer margin just below the tip. Tail moderate (to very long, if *longicauda* can be referred here).

Skulls shorter and broader than those of either the *bicolor* group or the *calcaratus* group. Rostral area moderately full, rounded, with incipient post-orbital eminences, its width about 50 per cent of zygomatic breadth, which last is greater than greatest mastoid width. Least inter-temporal width about 50 per cent of rostral width. Palate broad and short. Incisive foramina in premaxillae large, broadly oval, their extero-posterior margins formed by the maxillae.

Incisors with only a trace of the external lobes. Canine width variously developed posterior cusp. Anterior upper premolar partially excluded. Hypocone better developed in m^1 than in m^2 . Lower outer incisor scarcely or not at all thicker than inner one. Crown of p_2 typically $2/3$ of height of crown of p_4 .

Here may be included as characteristic *cervinus*, *batchianus*, *celebensis* and *insolens*. But a more specialized series is found in the Malay area, and the Sunda Islands, in which reduction of p_2^2 has been carried a stage farther, so that the crown of p_2 remains only from $1/2$ to $1/3$ the height of the crown of p_4 . Such are *schneideri* and probably *galeritus*. Whether *brachyotus* (India) and *aureus* (Ceylon) show this greater dental specialization I do not yet know. In the Philippines area a specialized derivation of the *cervinus* group is found: *pygmaeus* has become greatly reduced in size and its frontal sac is obsolete (? perhaps only in females).

Certain bats, *sabanus* and others, apparently derived from the *galeritus* group ap-

pear partly intermediate between the *cervinus* and *bicolor* groups. Horseshoe small, its front edge notched, without lateral leaflets; transverse leaf without vertical septa; frontal sac present in both sexes. Skull rather short. Zygomatic width slightly exceeding mastoid width. Rostral swelling moderate, 57 per cent of width of braincase. Incisors weak, outer lobe obsolescent. Canine without cusps, less proödont than in *cervinus* or *bicolor* groups. Lower anterior premolar less than half the height of crown of p_4 .

H. sabanus from North Borneo appears to be allied to *H. dyacorum* from Sarawak. *Dyacorum* has the frontal gland present in both sexes, lacks lateral leaflets, but has ears substantially like those of *cervinus*. The forearm is exceptionally strongly arched. The skull is shortened as in *sabanus*, but p^2 though extremely minute is still present. In the lower jaw p_2 is reduced in size as in *sabanus*. *H. schneideri* of Sumatra appears also to be specialized by considerable reduction of p_2^2 . *Breviceps* resembles *dyacorum* in skull and dentition but retains the two pairs of lateral leaflets.

Hipposideros caffer and allies (*Ptychotherma*, subgenus) apparently constitute the African offshoot from the stem leading to *galeritus* group. Frontal sac usually present in both sexes.¹ Horseshoe entire in front, provided with two lateral leaflets, as in *galeritus* group. Transverse leaf without the three septa; at most two-celled; specialized by development of a serrated secondary transverse leaf from its posterior face.

Skull much as in *galeritus*, slightly lower. Outer lobe of incisor similarly much reduced; p^2 only partly displaced. Slight enlargement of outer lower incisor discernible; height of crown of p_2 , $1/3$ to $2/3$ that of p_4 .

Allen² has listed six geographical races under *caffer*. It seems, too, that *fuliginosus* (*Sideroderma*, subgenus) should be at least associated with the group. *H.*

¹ In females I have examined the frontal sac, though small, is present. In *fuliginosus* it is said to be absent.

² Allen, G. M., 1939, Bull. Mus. Comp. Zool., XXXVIII, pp. 79-81.

nanus is closely allied to *caffer* (I have examined the type); *curtus* and *ruber* also.

Note on the type of *H. galeritus*

Dobson (1878, p. 142) wrote of *galeritus* "the nasal membranes in the type specimens . . . appear much larger than in specimens from other localities." (With *galeritus* he had synonymized *labuanensis*, *longicauda* and *brachyotis*.) His remarks on the spacing out of *c*, *p*² and *p*⁴, if observed from the type specimen, would be significant. But one cannot be sure of this, as he had before him specimens from Singapore, Sarawak, Ceylon and Dekkan. The only forearm measurement given by him was 1.75 inches (44.4 mm.). He showed exactly the same length of forearm in his next species—*cervinus*—from Australia and New Guinea.

The type of *galeritus* Cantor raises a difficulty not often met with. There is some question in my mind whether the skin and skull are not mismatched. The specimen (in alcohol ?) was the true basis of Cantor's description which follows, in abbreviated form:

" . . . flesh-colored nasal appendage simple but large . . . horseshoe . . . covers the short . . . muzzle, which has two leaves on either side . . . the ears . . . broader than long . . . pyriform, narrowing toward the apex . . . more than 2/3 of the back of the ear is covered with fur . . . differs [from *speoris*, which has the frontal sac present only in males] in the absence of the frontal pore . . . a solitary male was captured in the valley of Pinang." Consequently, if it can be shown that the skull now marked "type" is that of a different species, the specimen, not the skull, becomes the object to which the name *galeritus* will be restricted.

The specimen, as seen from Cantor's writings, clearly had affinities with *cervinus* and allied bats with which for years students have associated it. But the skull of which I have photographs (with type label attached and clearly legible) appears to be a skull of a member of the *bicolor* group. Its greatest mastoid width and greatest zygomatic width (measured on the picture and checked against a millimeter rule included

in the picture) are, respectively, 9.0 mm. and 8.2 mm. The rostral width is 4.9 and *c-m*³, 5.6. The skull may therefore belong with *major*, *atrox* and *ridleyi* of the *bicolor* group.

This state of affairs, if true, might upset the whole classification of the group which depends upon the status of the type of *galeritus*. To prevent such an occurrence the body of the type, not the skull bearing a similar number, must be regarded as Cantor's type specimen. The forearm of the type measures 45.5 mm. (1937).

It is customary for authors to assume that *galeritus* extends through Sumatra, Java, Borneo to Celebes. Without evidence to the contrary this assumption must continue, but then for the sake of consistency *galeritus* must be extended to include the almost similar *cervinus* of New Guinea and Australia.¹ Provisionally it is suggested that all members of the group having two lateral leaflets, the frontal sac present in both sexes, and the anterior upper and lower premolars not extremely reduced, be placed within a single species *galeritus*.² We shall then have, as more or less valid subspecific forms, *brachyotus*, *labuanensis*, *insolens*, *celebensis*, *batchianus*, *cervinus*, *H. sabanus*, *schneideri*, *longicauda* and *dyacorum*, with their respective specializations, appear to be derived species; *pygmaeus* seems to be a derivative of more remote origin; and *papua*, *incertae sedis*, but probably from the source stem of *speoris* and *galeritus*.

Separation of *dyacorum* and *breviceps* (and probably *sabanus*) from the races with less reduced premolars is warranted by actual measurement: cingulum length of *p*₂² in all of the larger-toothed forms varies only from $\frac{0.4-0.5 \text{ mm.}}{0.8-0.9 \text{ mm.}}$; the same

teeth in *dyacorum* from North Borneo and in *breviceps* from N. Pagi (which however has the braincase longer) measures $\frac{0.2-0.3 \text{ mm.}}{0.4-0.5 \text{ mm.}}$.

The reduced size of the lower tooth is es-

¹ Thomas, 1894, Ann. Mus. Civ. Storia Nat., Genova, (2) XIV, p. 108.

² It can only be determined by discovery of the type or collecting of topotypes whether *crumeniferus* should displace *galeritus*.

pecially striking. In *dyacorum* there is even indication of some displacement outward from the lower tooththrow.

From photographs it is possible to note that p_2 of *labuanensis* has a cingulum length of approximately 1 mm. *Schneideri*, to which part of our material from Pagi is referable, shows p_2 only 0.5 mm. long, but the occipital part of the braincase is considerably more produced than is the case in *dyacorum*. It is a larger animal.

The present group, like the *bicolor* group, has begun in certain species to reduce the size of p_2^2 , particularly in the region of the Greater Sunda Islands. Thus in the two species *labuanensis* (forearm 48 mm.) and *schneideri* (forearm about 44–46 mm.) cingulum lengths of p_2^2 measure longitudinally $\frac{0.4}{0.8}$ and $\frac{0.2}{0.4}$, respectively. And for the reasons given earlier I cannot decide whether the type of *galeritus* is large-toothed or small-toothed. On geographical grounds based upon our specimens from Pagi and upon borrowed material from Sumatra it should have small premolars. In fact *schneideri* may well be *galeritus* renamed. It is desirable that topotypes of *galeritus* from Penang be secured and their teeth minutely described. All of our material with long forearms from Sumatra and Pagi appears to be referable to *schneideri*.

From Borneo we have two members of the group in which p_2^2 are unreduced: a larger (*labuanensis*) and a smaller (*insolens*). Our *labuanensis*, from Landak in N. W. Borneo, match the photos of the type specimen very closely, both in dimensions and in structure; details include the infra-orbital foramen, which is small but elongate (0.8); the back of the palate level with back of m_2 , provided with blunt post-palatal spine; the form of p_2 , seen from above, rounded, not elongate; $c-m^3$, about 6.7 mm. Our specimens must be virtually topotypes of *labuanensis*. *Insolens* is represented by Lyon's original material from the upper Pasir River. In it the foramen is almost pore-like; the back of palate extends a little behind m^2 and lacks a spine; p_2 is more elongate than wide (1.0×0.8),

and $c-m^3$, 6.2. Further, the W-pattern of m^3 is less reduced, and the dorsal prominence of the zygoma rises abruptly instead of gradually, as in *labuanensis*. A few specimens of *insolens* were collected at Perboewa as well as our series of *labuanensis*.

Specimens from Banka (e.g., U.S.N.M. 124834) agree wholly with *labuanensis*. A large series in our collection from Talassa (Maros), South Celebes (*celebensis*), agrees in most of the characters with *insolens*, as do a few individuals from Bantimoerang, South Celebes. In Celebes specimens, which are rather smaller, m^3 has been shortened antero-posteriorly and its cusp-pattern is incomplete, as in *labuanensis*. Individuals in U.S.N.M. from Peleng Island exactly resemble *celebensis*. Material from Jobi Island in Geelvink Bay; Weyland Mountains, Dutch New Guinea; Hollandia, Dutch New Guinea; Aru Islands is still much as *insolens*. But in material from New Guinea mainland the enlarged, slit-like infra-orbital foramina reappear and, in the Fly River area at least, the animals are larger (forearm 50–52 mm.). New Hebrides specimens are like those of South New Guinea. Both still have considerably smaller teeth and differently shaped p_2 from those of *labuanensis*. The zygomatic eminence in material from Fly River, Aru and New Hebrides (*cervinus*) rises less abruptly than that of *insolens* but more suddenly than in the case of *labuanensis*. A small but distinct depression (perhaps individual) between the rostral swellings is developed in the three last mentioned.

In none of the material reviewed (except *schneideri* of Sumatra) are p_2^2 much reduced. Of the more specialized offshoots of the *galeritus* group the collection contains a small series of *dyacorum* from Perboewa, Landak, North Borneo, thus nearly topotypical. Compared with the widely distributed *insolens-celebensis-cervinus* type, the skulls are at once much smaller and their palates are much shorter ($c-m^3 = 5.4$ mm.). The zygomatic eminence is small and is placed far back. The infra-orbital foramen is large and slit-like. The premaxillae scarcely extend beyond the ca-

nines. The cingulum lengths $p_2^2 = \frac{0.3 \text{ mm.}}{0.4 \text{ mm.}}$, the reduction of the lower tooth being especially remarkable. The bats are notable for possessing no lateral leaflets.

Pygmaeus, the only member of the entire group thus far recorded from the Philippine Islands (the status of the type of *obscurus* remains undetermined, in spite of Taylor's assumption that he had re-collected the species), is also one of the most peculiar. It possesses two lateral leaflets, the inner ones almost continuous beneath the front of the horseshoe, three septa down the front of the transverse leaf, emarginate ears, and a frontal sac in males only. It is almost as small as *cineraceus* of the *bicolor* group, even though the forearm is longer (39–40 mm.).

Skull with large paired rostral swellings (4.0 mm.); zygomatic and mastoid widths sub-equal (6.8); a weak jugal eminence; cochleae 2.1 broad and 1.8 apart. Lower incisors unthickened; c with strong posterior cusp; p_2^2 unreduced; m^3 with W-pattern not greatly reduced; $c-m^3$, 4.8; m^1-m^3 , 2.8 mm.

Brachyotus is unrepresented in our material. The forearm of specimens from Ceylon is given by Phillips as 48 to 51 mm. Therefore, it is probably allied either to the small-toothed *schneideri* or the large-toothed *labuanensis*. *Longicauda*, too, which Sody discussed, requires for certain allocation in this survey re-study of the type. Our collections contain no material from Java, but from the geographical disposition of the forms in surrounding territory, no less than three forms must be looked for there.

H. coxi, *obscurus*, *crumeniferus* and *papua* are discussed in the annotated list. They must remain provisionally *incertae sedis*.

The systematic arrangement of the oriental members of the group must remain uncertain pending determination of the exact status of the two old names, *crumeniferus* and *galeritus*. There appears to be no doubt that *cervinus*, *batchianus*, *celebensis* and *insolens* are conspecific; *labuanensis*, *schneideri*, *dyacorum*, *breviceps*, *sabanus* and *pygmaeus* are good species; but doubt remains as to the relationship of the remaining named forms.

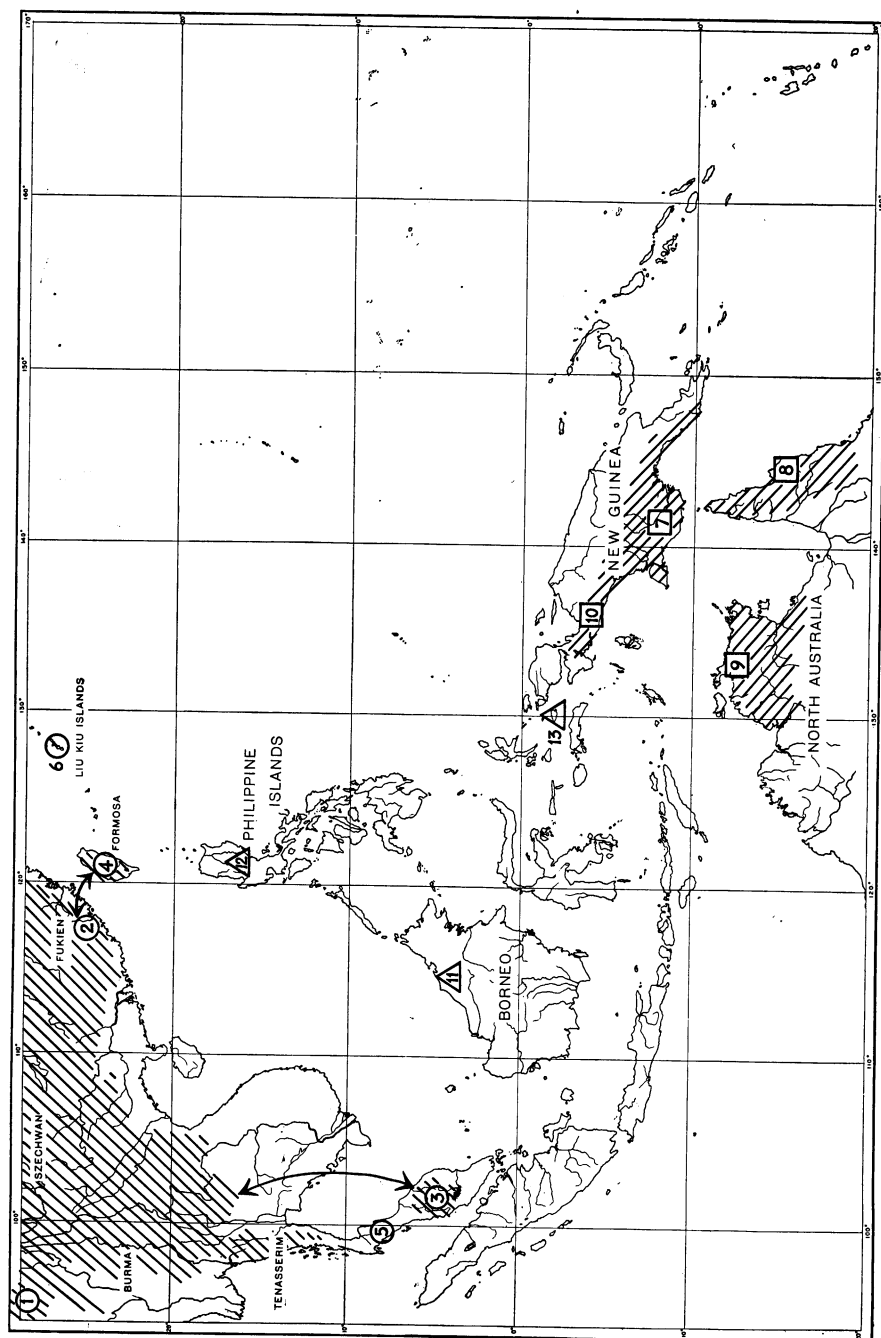


Fig. 3. *Hipposideros armiger* group. In circles: 1, *H. armiger armiger*; 2, *H. a. swinhoei*; 3, *H. a. debilis*; 4, *H. a. terasensis*; 5, *H. pendleburyi*; 6, *H. turpis*.
Hipposideros muscinus group. In squares: 7, *H. muscinus muscinus*; 8, *H. m. semoni*; 9, *H. m. stenotis*; 10, *H. wollastoni*.
Hipposideros species *incertae sedis*. In triangles: 11, *H. cori*; 12, *H. obscurus*; 13, *H. papuanus*.

Hipposideros armiger group
(*Gloionycteris*, subgenus)

Large specialized bats derived from low down the *speoris* stem. Transverse nose-leaf complicated: somewhat enlarged, becoming lobate, the lobes slightly crenulate, pocketed, the degree of development partly dependent on sex; horseshoe without anterior notch; lateral leaflets four. Ears sub-acute, their outer edges emarginate behind the tips. Ears and noseleaves deeply pigmented.

Skull heavily ossified, the rostral area secondarily flattened, perhaps in accommodation to enlargement of the nasal foliation and frontal sac (compare *pratti*). Sagittal and temporal crests even more strongly developed than in *diadema* group. Palate broad (distance between m^{1-1} , approximately twice width of m^1). Premaxillae solidly fused together from their middle backward, the resulting fused structure fan-shaped behind (not pointed, as in the weakly fused *diadema*). Incisive foramina not enclosed by premaxillae. In the posterior narial region a distinct step down from the narial roof to the level of the roof of the pterygoid fossa can be observed. (In other groups already described the roofs of narial fossa and pterygoid fossa are approximately continuous on a single level.) Cochleae small; their diameters rather less than their distance apart. Angular process of mandible slenderer than in *diadema* group.

Upper incisors distinctly bilobate. Canines strong with heavy cingula, but no posterior cusps; p^2 excluded, terete in section through cingulum; p^4 in contact with c. Hypocones of m^1 and m^2 as in *cervinus* and *speoris* groups; parastyle of m^3 as in *speoris*. Outer lower incisor thicker than inner one, as in allied groups; crown height of p_2 from $1/3$ to $1/2$ that of p_4 .

The members of this group are restricted to the Asiatic mainland, Formosa and the Liu Kiu Islands. *H. turpis* of Liu Kiu, as pointed out by Andersen,¹ is a member not of the *speoris* but of the *armiger* group. Recently *pendleburyi* has been described from Siam.

Study of *armiger* bats from Sikkim (Field Mus. N.H. 35421), near the type locality of *armiger*, North Burma (A.M.N.H.), Siam (U.S.N.M.), Szechwan (A.M.N.H.), Fukien (A.M.N.H.), and a mounted specimen, skull inside, from Amoy (M.C.Z. 6283), type locality of *swinhoei*, offers no characters upon which to base any subspecies. U.S. N.M. 239916 from Mokusaku, Formosa, which represents *terasensis* is inseparable from *armiger* from the mainland. The validity of *debilis* from Malay Peninsula is questionable. *Turpis*, on the other hand, of which a large series exists at M.C.Z. and one at A.M.N.H., is distinct chiefly because so markedly small. *Pendleburyi* too is perhaps distinct.

¹ Andersen, 1906, Ann. Mag. Nat. Hist., (7) XVII p. 38.

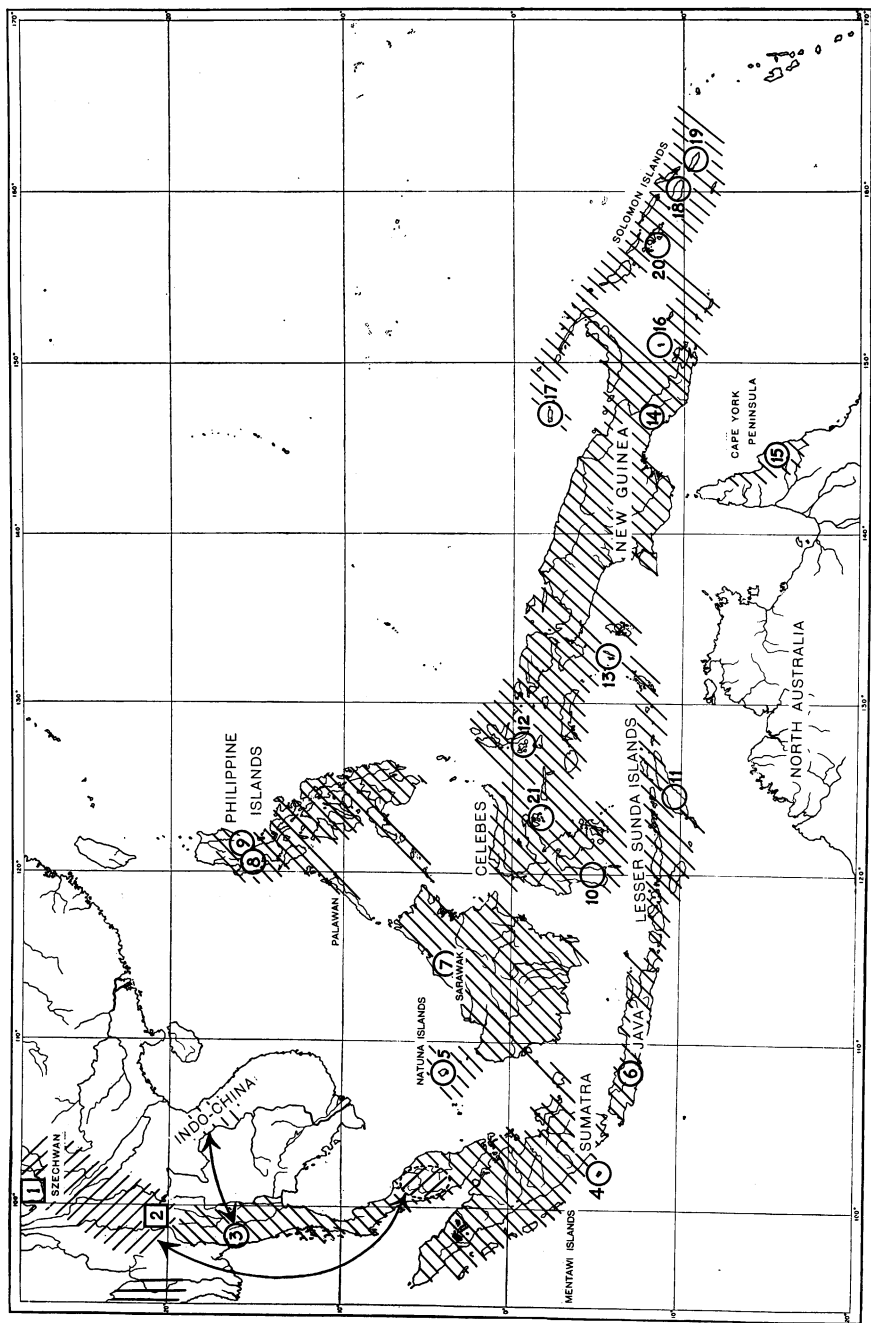


Fig. 4. *Hipposideros pratti* group. In square: 1, *H. pratti pratti*; 2, *H. p. lylei*. *Hipposideros diadema* group. In circles: 3, *H. diadema masoni*; 4, *H. d. enganus*; 5, *H. d. naturensis*; 6, *H. d. nobilis*; 7, *H. d. vicarius*; 8, *H. d. griseus*; 9, *H. d. andersoni*; 10, *H. d. speculator*; 11, *H. d. diadema*; 12, *H. d. euotis*; 13, *H. d. custos*; 14, *H. d. pullatus*; 15, *H. d. reginae*; 16, *H. d. trobrius*; 17, *H. d. mirandus*; 18, *H. d. oceanitis*; 19, *H. d. demissus*; 20, *H. d. dinops*; 21, *H. p. peltogenus*.

Hipposideros diadema group¹
(*Phyllorhina*,² subgenus)

The type species of this group, *diadema*, was recorded from Timor by Geoffroy St. Hilaire in 1813. It was the third species of *Hipposideros* to be made known to science. About a score of additional forms have now been named with type localities extending from Burma and the Nicobar Islands to the Philippines, northern Australia and the eastern Solomon Islands. Osgood³ records it from Lao Bao, Annam. *H. lankadiva* and allies occupy the Indian Peninsula and Ceylon.

Size from medium-large to large (forearm from 64 mm. to 96 mm.). Many forms of *diadema* are grayish, marked with white along the sides dorsal to the wings. Many show lack of pigment in the facial foliations. Frontal sac absent in both sexes. Horse-shoe without anterior notch (as in *speoris* group), provided with three or four lateral leaflets; an incipient "connecting process" (compare *Rhinolophus*) recalls the *cyclops* and *muscinus* groups; transverse noseleaf large, weakly lobate. Ears large, acute, their outer margins emarginate behind tip.

Skull with broad, well-inflated rostral region, well-broadened zygomatic and mas-

tooid areas. $\frac{\text{Rostral width}}{\text{Zygomatic width}}$ about 57 per cent; $\frac{\text{inter-orbital width}}{\text{rostral width}}$ about 38 per cent.

Sagittal crest high, reaching forward onto compressed inter-orbital region. Cochleae as in *speoris* group, infra-orbital foramen very large, closed by a slender bar which in some forms reaches a length of 3 mm. Incisive foramina in premaxillae quite narrow, their posterior walls formed by maxillae, except in material from Bali, Java, Borneo. Angular process of mandible well developed as in *speoris* group.

External lobe of incisors present. Canine without posterior cusp. Anterior premolar partly or wholly excluded from toothrow. Parastyle of m³ weak. Second lower incisor distinctly thicker than first (as in *speoris* group); lower canines with enlarged cingula, approximated; crown of p₂ about one-half height of crown of p₄.

Two moderately distinct divisions can be discerned in this group: the *diadema* division proper with numerous described insular races, distributed from Burma and Siam to Australia and the Solomon Islands, and the *lankadiva* division of Peninsular India and Ceylon. Their characters were defined by Andersen, 1905.

With but a limited number of specimens of *diadema* for study the following two proportional distinctions are seen: the ratio rostral width to zygomatic width results in 48 to 51 per cent in our material from Java, Bali, Papua, Solomon Islands, and even the large form *pelingsensis* (forearm, 96 mm.) from South Celebes; and in the smaller form (forearm 85 to 87 mm.), from both North and South Celebes, 57 to 58 per cent—an expression of the extreme inflation of the rostrum and relative narrowness of the zygomatic. The second ratio, of mastoid width to zygomatic width, provides widely variable results; maximum mastoid combined with less zygomatic expansion appears in the smaller North and South Celebes animals and in the Papua material—85 to 95 per cent; the reverse occurs in the giant South Celebes race, only 77 per cent; Balinese, 81 per cent; Solomon Islands, 83 per cent; but Javanese only 76 per cent.

Summarizing from our material, photographs of and notes on types, and on specimens loaned to us, three weakly marked divisions are indicated in *diadema*:

1.—*Diadema* proper, and numerous named races inhabiting Celebes, Timor and all of the regions of New Guinea, northern Australia and the Solomon Islands:

¹ Andersen, 1905, Ann. Mag. Nat. Hist., (7) XVI, pp. 497-507; 1907, Ann. Mus. Civ. Storia Nat., Genova, (3) III, pp. 6-11.

² The genus *Phyllorhina* Bonapart, a synonym of *Hipposideros*, is employable in the subgeneric sense to designate the *diadema* group of *Hipposideros*.

³ 1932, Field Mus. Nat. Hist., Zool., XVIII, p. 221.

	TYPE REGION	FOREARM
<i>diadema</i> proper ¹	Timor	77 mm.
<i>diadema eotis</i> Andersen	Batchian Island	"84-89"
<i>diadema speculator</i> Andersen	South Celebes	"76-87"
<i>diadema custos</i> Andersen	Kei Island	78
<i>diadema pullatus</i> Andersen	Papua	"75-81"
<i>diadema trobrius</i> Troughton	Trobriand Island	"73-76"
<i>diadema reginae</i> Troughton ²	N. Queensland	"79-82"
<i>diadema demissus</i> Andersen	San Christobal Island	63.5
<i>diadema mirandus</i> Thomas	Admiralty Island	67
<i>diadema oceanitis</i> Andersen	Guadalcanar Island	79

This species, though highly variable in size from place to place, is in general characterized by moderately to much expanded rostrum (49 to 57 per cent of zygomatic width), and widely expanded mastoid regions (83 to 94 per cent of same); the premaxillae not enclosing the incisive foramina; the teeth rather small. Our collections include several distinct races:

From South Celebes (*speculator*): forearm, ≈ 85 ; $c-m^3$, 12.5; rostrum very wide (10 mm.) and much inflated, longitudinally grooved; incisive foramina not completely enclosed by premaxillae; upper incisors almost touching; p^2 included; heel of p_4 not very broad. Of the same general type are the three specimens from North Celebes (*vicarius* ?) and specimens from Java (*nobilis*). The rostrum of *nobilis* is, however, narrower (9 mm.), not quite so high, the forearm 85 mm., and p^2 is excluded.

The series from Fly River, Papua (*pul-latus*), although smaller, agrees closely also with *nobilis*. It has forearm 74 mm., $c-m^3$, 11.8, and a narrower rostrum (8.5).

The bats from Solomon Islands, identified by Sanborn³ as *diadema oceanitis*, also agree substantially with the Papuan series.

¹ No topotypical specimens seen. Information based upon original description, in which the forearm in illustration, marked "natural size" is 77 mm.; not Andersen (1905) who gives forearm as 84-91 mm.

² I cannot separate *reginae* (M.C.Z. 29092 from Lake Barrine, Queensland) from our Fly River *pul-latus*.

³ 1931, Sanborn, Field Mus. Nat. Hist., Zool., XVIII, p. 24.

2.—Larger bats of the Greater Sunda region: forearm 80 to 90 mm.; rostrum usually more flattened than in the *diadema* division; rostral width 8.6 to 10 mm.; mastoid width proportionately less.

	TYPE REGION	FOREARM
<i>diadema nobilis</i> Horsfield	Java	87 mm.
<i>diadema enganus</i> Andersen	Enganus Island	89
<i>diadema natunensis</i> Chasen	Natuna Island	88
<i>diadema griseus</i> Meyen ⁴	Luzon Island	"82-86"
<i>diadema vicarius</i> Andersen	Sarawak	"80-86"

A specimen of *nobilis* A.M.N.H. 106736 from Cheribon, Java, and two, M.C.Z. 38416-38417 from Batavia, agree closely with each other. Specimens of *griseus* borrowed from M.C.Z. are slightly smaller than *nobilis*, particularly respecting their outer lower incisors. Some suggestion appears in the Philippine bats of enclosure of the incisive foramina in the premaxillae, as is typically the condition in the Balinese form.

3.—Very large species from Celebes, Peleng, and Rubiana, Solomon Islands: Forearm, 94-98 mm.; zygomata much expanded; rostrum moderately enlarged; premaxillae not wholly enclosing foramina, $c-m^3$, 14.0. Teeth quite heavy, particularly p^4 . These bats appear to be allied to *dinops*. And *dinops* itself, because of the great expansion of its zygomata, betrays closer affinity with *lankadiva* than do the forms with inflated rostra and proportionally narrower zygomatic width.

The South Celebes series (*pelingsensis*) is composed of bats almost as large as *dinops* of Rubiana. Forearm about 95 mm., pelage with pale brownish cast (similar to that mentioned for *custos*), and the white markings present in most forms obsolescent and buffy. Rostrum much lower and flatter than in those bats described—more like the rostrum of *lankadiva* (but back of palate less deeply V-shaped than in *lankadiva*). Zygomata widely expanded (20.8 mm.) in

⁴ *Andersen* Taylor from Philippines, considered a race distinct from *griseus*, was held by Lawrence to be synonymous. But Taylor's animal was certainly much smaller and might possibly have represented something analogous to *trobrius* or *pul-latus*.

comparison with rostral width (10.2 mm.), mastoid width slight.

	TYPE REGION	FOREARM
<i>dinops</i> Andersen	Rubiana Island	95 mm.
<i>pelingensis</i> Shamel	Peleng Island	93-97

Although *nicobarensis* and *masoni* belong to the *diadema* group no material is available to assist in determining their relationships. Probably they, with specimens in the U.S.N.M. and F.M.N.H. from Siam, represent the western and northern limits of range of *nobilis*.

The *lankadiva* section contains only *lankadiva*, *indus*, *mixtus*, *unitus*, *schistaceus*. The second, third and fourth are scarcely, if at all, separable from *lankadiva* of Ceylon, as the photographs of their type specimens show. *Schistaceus* appears to be farther removed. All have the characteristic palate and very heavy incisors and canines of *lankadiva*.

Only one specimen representing this branch of *Hipposideros* seems to exist in an American museum—M.C.Z. 32972.

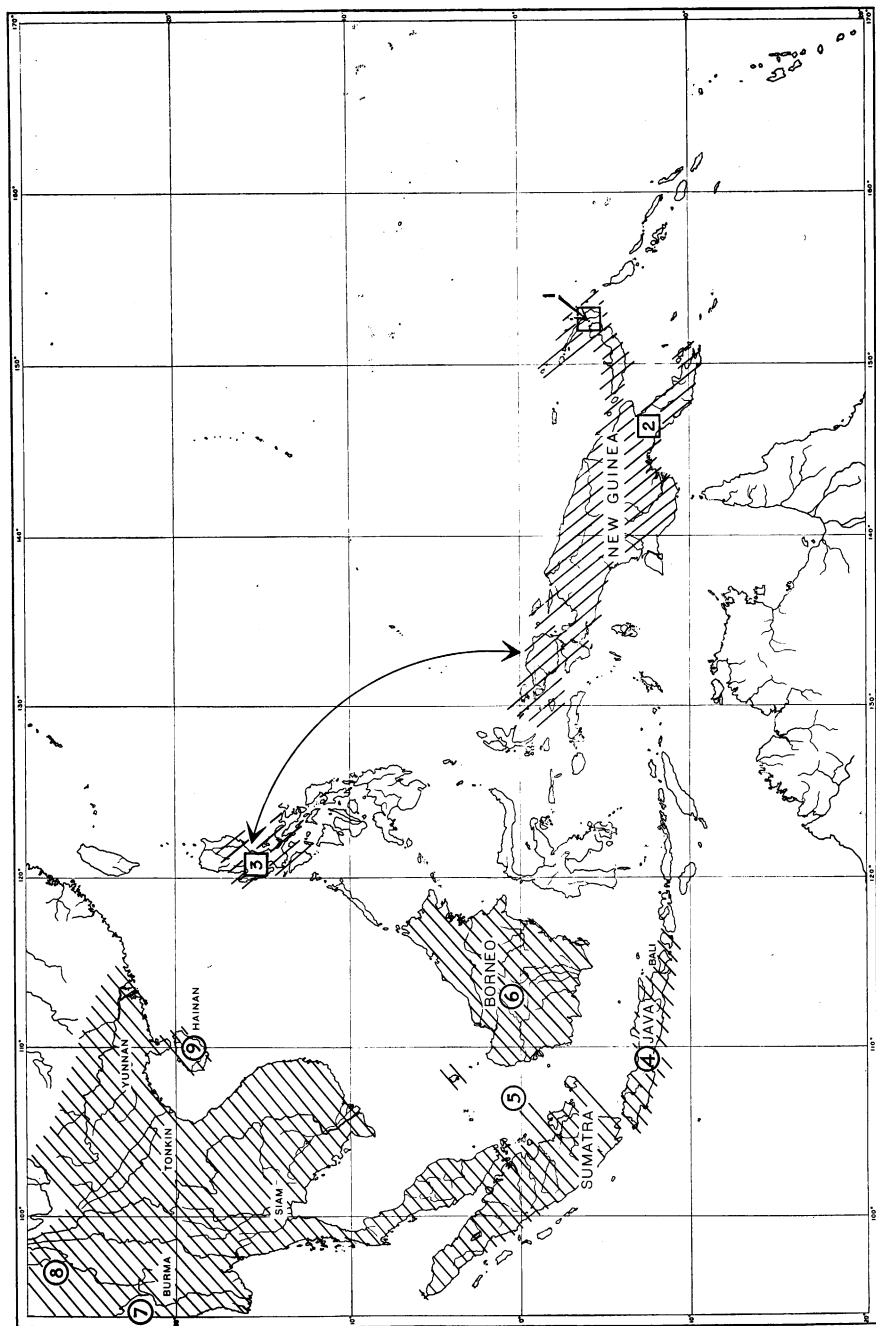


Fig. 5. *Hipposideros calcaratus* group. In squares: 1, *H. calcaratus*; 2, *H. cupidus*; 3, *H. coronatus* (doubtfully placed here); *Hipposideros speoris* group. In circles: 4, *H. larnatus larnatus*; 5, *H. l. barbensis*; 6, *H. l. leptophylla*; 7, *H. l. grandis*; 8, *H. l. poutensis*.

Hipposideros speoris group
(*Hipposideros*, subgenus)

Medium sized, strongly built species with emarginate ears, a small process at the antitragal fold, three lateral leaflets.

Skull with rostrum inflated, inter-orbital area short and constricted, a moderately developed sagittal crest. Zygomatics well expanded. Palate (excluding premaxillae) very slightly longer than broad. Incisive foramina partly enclosed by premaxillae. Premaxillae quite firmly fused together, their united posterior process wedge-shaped. Cochleae moderately large (width slightly exceeding the distance between them). Angular processes of mandible strong, prominent.

Upper incisor weakly bilobed; c without posterior cusp; p² partly excluded from toothrow; outer lower incisor slightly thicker than inner; crown of p² low—from 1/2 to 2/3 height of crown of p⁴.

Two sharply distinct species, which embrace a number of races and synonyms, are included under this heading; namely, *speoris* proper of Peninsular India, and *larvatus* = *vulgaris* of the Malay-China-Sunda region. *Abae* of central Africa, though specifically separable, yet is much closer to *speoris* than *larvatus*.

Other characters shared in common are: simple transverse leaf with three anterior septa; three lateral leaflets; short, relatively massive skull, with bullae only slightly wider than their distance apart; broad rostrum with well-developed supra-temporal ridges and incipient post-orbital processes; heavy dentition.

Speoris is distinguished from *larvatus* by obsolescence of the frontal sac in females (it is represented merely by a tuft of modified hairs), by its smaller size (forearm 54 mm. or less). To it are referable either as races or as synonyms: *pulchellus*, *templetoni* and *apiculatus*; also probably *penicillatus* and *taiiensis*.

Larvatus is considerably larger than *speoris*. The female possesses a frontal sac. Both sexes are recognized by the well-defined notch in the middle of the front edge of the horseshoe. A quite long list of names is here referred as subspecies or synonyms: *vulgaris*, *insignis*, *lepto-*

phylla, *grandis*, *neglectus*, *barbensis*, *poutensis* and probably *deformis*.

H. abae, although it resembles *speoris* in the obsolescence of the frontal sac in females and in having the anterior margin of the horseshoe entire, is a much larger species of bat, with forearm 57 mm. and c-m³, 8.3. The incisive foramina are almost wholly enclosed in the premaxillae. A posterior cusp is present on the canine.

H. speoris, the first bat of the genus *Hipposideros* to be recognized, was described by Schneider in Schreber's *Säugethiere*, Vol. 5, in an unpaginated separate bound (in Amer. Mus. copy) opposite pages 962 and 966, and illustrated in plate 59B. *Speoris*, according to Schneider, had three lateral leaflets, a horseshoe wider above than below, a transverse leaf about as wide as the horseshoe, a large transverse frontal sac, ears acute and emarginate, and part of the tip of the tail extending beyond the membrane. Schneider's title-line gave the origin of *speoris* as "Ostindien." Geoffroy and Peron believed the point of origin to be Timor but Peters considered that *speoris* came from Tranquebar, on the southeast coast of India. Dobson listed material from the Indian peninsula and Ceylon. Andersen gave "Ceylon, Kanara, Bombay, Khandeish, Mysore," and described a smaller race *pulchellus* from Bellary. *Speoris* has its headquarters in peninsular India and Ceylon and I now suggest restriction of its type locality to Tranquebar.

Bats referred by Andersen (1918) to *speoris speoris* are said to have the average forearm 52 mm. (49.8–54) and the length of skull from the base of canines 19.7 (19–20.3). The same measurements in *speoris pulchellus* were 49.4 (45.8–51.5) and 18.8 (18.0–19.8). The forearm in Schreber's plate measured 47 mm. But the illustration is not necessarily of natural size and the structure may also be slightly foreshortened. An excellent illustration of "*speoris*" was published by Phillips¹ recently.

A series of undoubted *speoris*, one from Trichinopoly and 18 from Ceylon, is avail-

¹ Phillips, 1935, *Manual of Mammals of Ceylon*, p. 93.

able at M.C.Z. for study. The characters of the species, based upon M.C.Z. 33748, ♂, and 27508, ♀ (both from Ceylon), may be defined as follows:

Ear slightly emarginate along outer edge, with distinct "kugelförmig Anhang" at antitragal fold, $1/2$ to $3/4$ of pinna naked, 15 mm. from notch, 10 from crown. Frontal sac large in males, in females obsolescent but invariably marked by tuft of dark brown hairs (hence, probably Gray's name of *penicillatus*). Supra-orbital tubercles developed, bearing several long setae and probably provided with glandular openings. Transverse leaf divided anteriorly by three distinct septa into four cells. In front of it the broad analogue of the "connecting process" of *Rhinolophus* is angular, low, and bears two setae each side. In front of the last the medium-sized horseshoe shows only the faintest trace of emargination of the center of its front edge (wholly unlike the deep notch observable in *larvatus*). Three lateral leaflets. Upper lip with two minute papillae, one above the other. Lower lip with two pairs of warts near the midline, the inner ones larger than the outer. Forearm, 51 mm. Thumb with basal joint 3.5, median joint 3.0. Tibia, 20; calcar, 9; tail, 21-22, five-jointed, the terminal point half exerted from uropatagium.

Skull rather short and massive. Zygomatic width exceeding mastoid width. Premaxillae not exceeding canines anteriorly. Inter-orbital constriction pronounced (2.6-2.9); rostral width, 5.1-5.4. Incisive foramina not wholly enclosed by premaxillae. Cochlea (2.7) slightly broader than their distance apart (2.1).

Upper incisor with external lobe rudimentary. Outer lower incisor not greatly thicker than inner one. Canines less proodont than in *cervinus*. Upper p^2 not wholly excluded from toothrow; lower p^2 with crown $1/2$ to $2/3$ height of crown of p_4 . Condylar-canine length, 16.8; $c-m^3$, 7.1 mm.

If subgeneric names should be employed under *Hipposideros*, *speoris* must belong in *Hipposideros*, subgenus. *Speoris* Schneider and *vulgaris* Horsfield (= *larvatus*) are probably consubgeneric, in which event

Speorifera Gray, 1866, of which *vulgaris* is designated type, falls as a synonym of *Hipposideros*, subgenus, of which Slater¹ has designated *speoris* the type.

H. larvatus is recognizable by a number of characters, one of the easiest to distinguish being the small but clearly defined median cleft in the anterior margin of the horseshoe. The forearm length varies from 57 to 63 mm. Tibia, 21 to 24, or less than 50 per cent of the forearm. Calcar = 12 mm. Ear emarginate. Lateral leaflets three. Transverse noseleaf with 3 septa and 4 cells. Frontal sac present in both sexes. This last character, the cleft noseleaf and the much greater size readily distinguish *larvatus* from *speoris*.

H. l. neglectus Sody, of Borneo, which was reputed to have the forearm longer than the Javanese race, is only doubtfully valid. Study of large series from Java, Borneo, a number of the islands of the South China Sea, Sumatra, Malay Peninsula, Siam, Indo-China and Hainan shows chiefly a considerable degree of individual variation in the length of the forearm (3-4 mm. is common). *H. l. grandis* G. M. Allen, whose type has been returned to the Indian Museum, has not been seen by me. Our Chindwin River topotypes are all strongly rufous and have forearms 62-64 mm. The teeth appear very slightly heavier than those of Javanese bats, but I am unable to observe the differences in m^3 of which Allen wrote.

As stated elsewhere, the types of *larvatus*, *vulgaris*, *deformis*, *insignis*, *barbensis* and *poutensis* have been studied; also topotypical material representing *grandis*, probably a synonym of *leptophylla*, and *neglectus*. The conclusion seems inescapable that all represent a single species of extensive range through Assam and Burma to China, Indo-China, Sumatra and adjoining islands, Java and Borneo. It appears to be unrepresented in the Philippine Islands and Celebes, nor does it extend (?) into peninsular India.

Hipposideros muscinus group

Ear acutely pointed as in the *cyclops* group and, to a less degree, *commersonii*

¹ Slater, 1901, Mamm. S. Africa, II, pp. 116-118.

group. Nasal foliations bearing the specialized club-shaped structures described for *cyclops*. Transverse leaf with three septa and four cells. Lateral leaflets, two. Tail \approx 150 per cent of tibia (compare *cyclops*). Length of basal phalanx to metacarpus of thumb is as 1.5 to 4 mm. Thus the metacarpus is much elongated, a condition even more pronounced in *Coelops*.

Skull with rostral area greatly broadened and inflated. Mastoid portion of skull scarcely at all widened. Zygomatic moderately expanded. Sagittal crest high, forking to form pair of temporal crests which enclose small frontal depression. Infra-orbital foramen minute, terete, sometimes paired. Palate short. Premaxillae fused throughout. Incisive foramina very large, oval, enclosed by ligulate processes from sides of premaxillae which reach maxillae, and posteriorly by a single median, fan-shaped process formed by the fused premaxillae. Postero-laterally the walls of the foramina are formed by maxillae. Cochleae extremely large, the largest for the genus; width of single cochlea about 6 to 8 times their distance apart (compare *cyclops*). Angular process elongate, connected by a thin web of bone to articular process.

Teeth arranged with molariform series parallel. Upper incisors weakly bilobate. Canine without posterior cusp. Canine and p^4 in contact, excluding minute p^2 . No trace of thickening of i_2 ; no overlap of i_1 . Anterior lower p small, its cusp only $1/4$ of height of crown of p_4 . The W-pattern of m^3 unreduced.

Although our material represents only Papuan *muscinus*, there can be almost no doubt that *muscinus*, *semoni* and *stenotis* of North Australia are conspecific. Dahl and Collett, both of whom wrote in 1897, evi-

dently had North Australian material, which they alluded to as *muscinus*.

Our series from the Astrolabe Mountains, behind Port Moresby (one also recorded by Thomas, 1897), is anatomically identical to the specimens collected in the western division of Papua, though in some of the Astrolabe animals the toothrow is a little longer. For distribution, see map, figure 3.

The status of *wollastoni* is doubtful. Its skull appears to be very close also to that of *muscinus* but the special characters of the transverse noseleaf, described by Thomas, distinguish it.

Hipposideros cyclops group (*Doryrhina*, subgenus)

Bats of this group are restricted to Africa. They show the specialized club-like structures of the nasal region in common with *muscinus*, structures so peculiar, specialized and seemingly functionless that they are unlikely to have arisen independently. Transverse noseleaf in *cyclops* with three well-developed septa and four cells. Two accessory leaflets to horseshoe. No tubercle-like process above eye. Tail greatly shortened—only 70 per cent of tibia.

Skull with well-rounded rostral swellings, a frontal depression, braincase unwidened at mastoid, palate short. Premaxillae wholly enclosing incisive foramina. Cochleae large—width of one approximately four times their distance apart.

Incisor retaining minute external lobe. Canine without cusp. Canine and p^4 in contact, totally excluding minute p^2 . No thickening of outer lower incisors.

Allen (1939) admits only the one species *cyclops*, with *micaceus* De Winton and *langi* J. A. Allen in synonymy. It appears to be restricted to Central and West Africa.

ANNOTATED LIST OF NAMED FORMS OF *HIPPOSIDEROS*¹

Alphabetically arranged

abae J. A. ALLEN, 1917, Bull. Amer. Mus. Nat. Hist., XXXVII, p. 432.

TYPE REGION.—Belgian Congo.

Related to *speoris*.

MATERIAL.—The type and series of paratypes at A.M.N.H.²; specimens at M.C.Z.

Remarks.—Distinguished from *speoris* by its greater size; forearm of type, 58.5 mm.; Allen gave a variation range of forearm from 54 to 60.5 (shortest 56 in males). Andersen (1918) gave the maximum of *speoris* as 54 mm. and minimum (sp. *pulchellus*) as 45.8. Both have "dark" and "red" phases. Allen believed *abae* related to *caffer*.

albanensis GRAY, 1866, Proc. Zool. Soc. London, p. 220.

TYPE REGION.—N. W. Queensland.

Related to *bicolor*, probable synonym of *aruensis*.

MATERIAL.—The type, B.M. 66.4.23.7, ♂; skin, with skull in fragments; photo. of palate and jaws.

REMARKS.—Forearm, measured in 1937, 39 mm.; by Gray, "1 1/2 inches."

amboinensis PETERS, 1871, Monatsber. Akad. Wiss. Berlin, p. 323.

TYPE REGION.—Amboina Island.

Related to *bicolor*, probably synonym of *aruensis*.

MATERIAL.—The type, Berlin, No. 369; photo. of skull (back of braincase broken).

anderseni TAYLOR, 1934, Philippine Land Mammals, p. 246.

TYPE REGION.—Luzon, Philippine Islands.

Related to *diadema*, probable synonym of *griseus*.

MATERIAL.—The type not seen.

angolensis SEABRA, 1898, Jour. Sci. Math. Phys. Nat., Lisboa, (2) V, p. 256.

TYPE REGION.—Angola, West Africa.

Subspecies of *caffer* (Allen, 1939).

MATERIAL.—One specimen at A.M.N.H.

antricola PETERS, 1861, Monatsber. Akad. Wiss. Berlin, p. 709.

TYPE REGION.—Luzon, Philippine Islands.

Related to *bicolor*.

MATERIAL.—Series at M.C.Z.; one at U.S.N.M.

REMARKS.—A smaller species of two closely similar (the other *erigens*) present in the Philippines. Forearm 39. The type could not be found while I visited Berlin in 1937.

apiculatus GRAY, 1838, Mag. Zool. Bot., II, p. 492.

TYPE LOCALITY.—Madras, India.

Related to *speoris*; probably synonymous.

MATERIAL.—Co-types: B.M. 19a, forearm 51 mm.; 19b (skull in skin; forearm 50); 19c photo. of skull; 19e (forearm 49; photo. of skull).

armiger HODGSON, 1935, Jour. Asiatic Soc. Bengal, IV, p. 699.

TYPE REGION.—Nepal, India.

MATERIAL.—Non-topotypical material from Sikkim, Burma, China, etc., in several museums in U.S.A.

aruensis GRAY, 1858, Proc. Zool. Soc. London, p. 107.—GRAY AND GRAY, 1859, Cat. Mamm. New Guinea Brit. Mus., pp. 1-2.

TYPE REGION.—Aru Islands.

Related to *bicolor*.

MATERIAL.—The type: B.M. 58.2.-20.1, ad. ♂, with skull in fragments; photo. of palate and toothrows.

atratus KELAART, 1852, Prodr. Fauna Zeylanica, p. 16.

TYPE REGION.—Ceylon.

Related to *aruensis*, of *bicolor* group.

MATERIAL.—Topotypes at M.C.Z. (obtained from W. W. A. Phillips, Ceylon); one at U.S.N.M.

atrox ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 380.

TYPE REGION.—Selangor, Malay Peninsula.

¹ *Tricuspidatus, stoliczkanus*, and related forms are omitted.

² Abbreviations used in this list: A.M.N.H., American Museum of Natural History, New York; M.C.Z., Museum of Comparative Anatomy, Cambridge, Mass.; F.M.N.H., Field Museum of Natural History, Chicago; C.M., Carnegie Museum, Pittsburgh; U.S.N.M., United States National Museum, Washington; B.M., British Museum, South Kensington, London; Berlin, Museum für Naturkunde, Invalidenstrasse Berlin.

Subspecies of *gentilis*, and related to *bicolor*.

MATERIAL.—The type: B.M. 1.3.9.4, ♀, with photo. of skull.
aureus KELAART, 1852, Prodr. Fauna Zeylanica, p. 17.

TYPE REGION.—Ceylon.

Probable synonym of *speoris*.

MATERIAL.—Co-types: B.M. 52.5.9.3 (♀, forearm 51); 52.5.9.4 (forearm 48); 52.5.9.5 (forearm 51), all from Trincomali.

REMARKS.—No data regarding skulls.
auritus TOMES, 1859, Proc. Zool. Soc. London, p. 76.

TYPE REGION.—India (label of type specimen).

Probable relative of *fulvus* and *bicolor*.

MATERIAL.—The type: B.N. 7.1.1.303 (forearm 38); photo. of skull.
barbensis MILLER, 1900, Proc. Wash. Acad. Sci., II, pp. 233–234.

TYPE LOCALITY.—St. Barbe Island, between Linga and Borneo.

Closely related to *larvatus*.

MATERIAL.—The type and paratype series at U.S.N.M.

batchianus MATSCHIE, 1900, Säuget. Kukenthal . . . Halmahera, Batjan u. Celebes, p. 273.

TYPE LOCALITY.—Batchian Island.

Related to *galeritus*.

MATERIAL.—The type: Berlin, No. 15628, ♀, in alcohol; photo. of skull.
beatus ANDERSEN, 1906, Ann. Mag. Nat. Hist., (7) XVII, p. 279.

TYPE REGION.—Cameroons.

Related to *caffer*.

MATERIAL.—Series at M.C.Z.; one at U.S.N.M.

bicolor TEMMINCK, 1835, Monogr. Mamm., II, p. 18.

TYPE LOCALITY.—Anjer coast, N. W. Java.

MATERIAL.—Series of co-types studied; photo. of skull of co-type "d."

bicornis HEUGLIN, 1861, Nova Acta Akad. Caes. Leop. Carol., Halle, XXIX, No. 8, pp. 4, 7.

TYPE REGION.—Eritrea.

Synonym of *caffer* (Allen, 1939).

brachyotus DOBSON, 1874, Jour. Asiatic Soc. Bengal, (N.S.) XLIII, pt. 2, p. 237.

TYPE REGION.—Central India.

Related to *galeritus*.

MATERIAL.—Photo. of skull of type.
breviceps TATE, described in this paper.
caffer SUNDEWALL, 1846, Öfversigt K. Svenska Vet. Akad. Forh., Stockholm, III, Art. 4, p. 118.

TYPE LOCALITY.—Near Port Natal, East Africa.

MATERIAL.—Skin, B.M. 49.11.22.11, and skull, 48.6.2.16 marked "co-type" (forearm 44). Large series in museums of U.S.A.

calcaratus DOBSON, 1877, Proc. Zool. Soc. London, p. 122.

TYPE LOCALITY.—Duke of York Island, between New Britain and New Ireland.

MATERIAL.—The type: B.M. 77.7.-18.13, adult ♀, with photo. of skull; topotype, A.M.N.H.
celebensis SODY, 1936, Natuur. Tijdschr. v. Ned. Ind., XCVI, p. 47.

TYPE REGION.—S. Celebes.

Related to *galeritus* and *cervinus*.

MATERIAL.—Sody coll. No. 4, adult ♀ (the type), with photo. of skull; series in Archbold collection.

centralis ANDERSEN, 1906, Ann. Mag. Nat. Hist., (7) XVII, p. 275.

TYPE REGION.—Uganda.

Subspecies of *caffer* (Allen, 1939).

MATERIAL.—The type: B.M. 99.8.-4.8, ♂ (forearm 52), no picture of skull; small series at U.S.N.M. and M.C.Z.; large series at A.M.N.H.

cervinus GOULD, 1863, Mamm. Australia, III, Pl. xxxiv.

TYPE REGION.—N. W. Australia.

Related to *galeritus*.

MATERIAL.—The type: B.M. 55.11.-7.13, with photo. of skull (back of skull destroyed); ample material from New Guinea in Archbold collection; large series from New Hebrides at U.S. museums.

cineraceus BLYTH, 1853, Jour. Asiatic Soc. Bengal, XXII, p. 410.

TYPE LOCALITY.—Punjab Salt Range Survey, near Pind Dádan Khan.

Related to *bicolor*; the smallest member of the group.

MATERIAL.—Scattered specimens from Burma, Siam, Indo-China in U.S. museums.

REMARKS.—Blyth writes "smaller than . . . *murinus* (Elliot)," then gives the forearm as 1 3/16 inches. *Murinus* was proposed first by Gray, 1838. A forearm of only 30 mm. is smaller than any I have seen in the genus.

commersonii E. GEOFFROY, 1813, Ann. Mus. Hist. Nat. Paris, XX, p. 263.

TYPE REGION.—Madagascar.

MATERIAL.—One specimen from Madagascar at U.S.N.M.; African material at U.S.N.M. and M.C.Z.

coronatus PETERS, 1871, Monatsber. Akad. Wiss. Berlin, p. 327.

TYPE REGION.—Mindanao, Philippine Islands.

This may represent the *calcaratus* (New Guinea) group in Philippines.

MATERIAL.—None.

REMARKS.—Peters erected the subgenus *Thyreorhina* ("upper noseleaf with thickened margin") to contain this species. It is possibly allied to *calcaratus*, which was still undescribed when Peters wrote. Neither Taylor nor Lawrence re-collected it during their work in the Philippines.

coxi SHELFORD, 1901, Ann. Mag. Nat. Hist., (7) VIII, p. 113.

TYPE REGION.—Sarawak, Borneo.

MATERIAL.—Photo. of skull only.

REMARKS.—An anomalous species with exceptionally broad intertemporal and mastoid region, and high rostral swellings. Forearm, 53 mm. Shelford describes two lateral leaflets, characteristic of the *galeritus* group, but says "no frontal gland in ♀." No skull characters were given and unfortunately I did not find the type in London.

Coxi may well belong with other specialized members of the *galeritus* group of Borneo and Philippines. *Pygmaeus* also lacks the frontal sac in the ♀.

crumeniferus PERON, 1807,¹ Voyage Decouv. Terres Australes, Atlas, Pl. xxxv.

TYPE REGION.—Timor.

Probably related to *galeritus* and *cer-*

vinus; oldest name for that group if relationship can be proved.

MATERIAL.—Peron's plate xxxv only.

REMARKS.—It is difficult to determine from Peron's plate the number of lateral leaflets. The 4-celled transverse leaf, the forearm length 53 mm. (on the plate), the frontal sac—all are characters common to males of *speoris* and *cervinus*. Geoffroy's (1813) picture of "*crumeniferus*" which clearly shows three lateral leaflets may have been drawn from different material. Peron's figures show a more lightly built bat than *speoris*. Also Timor is well within the extensive distributional range of the *galeritus* group, whereas, excepting the doubtfully identified *taiienseis*, *speoris* is unknown beyond India and Ceylon, some 2000 miles from Timor.

cupidus ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 383.

TYPE LOCALITY.—Eaga, Central Div., Papua.

Related to *calcaratus*.

MATERIAL.—The type: B.M. 97.12.-6.4, y. ad. ♂ in alcohol, and photo. of skull; series from New Guinea in Archbold collection.

curtus G. M. ALLEN, 1921, Revue Zool. Afrique, IX, p. 194.

TYPE LOCALITY.—Sakbayeme, Cameroons.

Related to *caffer* group.

MATERIAL.—The type seen at M.C.Z. *custos* ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 381.

TYPE LOCALITY.—Kei Island.

Related to *diadema*.

MATERIAL.—The type: B.M. 10.3.-1.27, ad. ♂, and photo. of skull.

cyclops TEMMINCK, 1853, Esquisses Zool. Guinée, p. 75.

TYPE REGION.—Gold Coast, West Africa.

MATERIAL.—Ample series in most U.S. museums.

REMARKS.—*Cyclops* (= *micaceus* = *langi*), which Peters (1871) separated from *Hipposideros* under the subgeneric name *Doryrhina*, finds its nearest relatives in the Torresian region (*muscinus*, *semoni*, *stenotis*). The very peculiar pair

¹ Date from Sherborn.

of club-like processes, placed one behind the other on the "sella" and posterior leaf, respectively, are unlikely to have originated independently. In the skulls of the African and Australian bats, quite profound differences are apparent, which shows that separation took place in remote times.

debilis ANDERSEN, 1906, Ann. Mag. Nat. Hist., (7) XVII, p. 37.

TYPE REGION.—Malay Peninsula.

Subspecies of *armiger*.

MATERIAL.—The type: B.M. 79.11.-21.80, ♂ (forearm 88), and photo. of skull; few in U.S.N.M. from Siam.

deformis HORSFIELD, 1824, Zool. Res. Java.

TYPE REGION.—Java.

Probable synonym of *larvatus*.

MATERIAL.—The type: B.M. 79.11.-21.94 (forearm 53), no photo. of skull.

demissus ANDERSEN, 1909, Ann. Mag. Nat. Hist., (8) III, p. 268.

TYPE REGION.—San Christobal, Solomon Islands.

Related to *diadema*.

MATERIAL.—The type: B.M. 13.11.-7.1, ad. ♂, photo. of skull (back of skull broken).

diadema E. GEOFFROY, 1813, Ann. Mus. Nat. Hist. Paris, XX, p. 263.

TYPE REGION.—Timor.

MATERIAL.—None from Timor.

dinops ANDERSEN, 1905, Ann. Mag. Nat. Hist., (7) XVI, p. 502.

TYPE REGION.—Rubiana Island, Solomon Islands.

Related to *diadema*.

MATERIAL.—The type: B.M. 88.1.5.-22, ad. ♀ in alcohol, with photo. of skull.
doriae PETERS, 1871, Monatsber. Akad. Wiss. Berlin, p. 326.

TYPE REGION.—Sarawak, Borneo.

Probably member of *bicolor* group, perhaps related to *aruensis*.

MATERIAL.—None.

dukhunensis SYKES, 1831, Cat. Mamm. Dukhun, p. 4.

TYPE REGION.—Dekkan, India.

Probable synonym of *speoris*.

MATERIAL.—None.

dycorom THOMAS, 1902, Ann. Mag. Nat. Hist., (7) IX, p. 291.

TYPE REGION.—Sarawak, Borneo.

Derivative of *galeritus* group.

MATERIAL.—Photo. of type-skull only; series from Borneo in Archbold collection; specimens in U.S.N.M.

REMARKS.—Thomas assumed *dycorom* to be "allied to *bicolor*" because of its lack of lateral leaflets, which are represented on each side by two small papillae. But the skull is that of a member of the *galeritus* group, specialized by shortening of the palate, toothrow and premaxillae, and reduction of p_2^2 . See also under *sabanus*.

enganus ANDERSEN, 1836, Ann. Mus. Civ. Storia Nat., Genova, (3) III, p. 8.

TYPE LOCALITY.—Engano Island.

Related to *diadema*.

MATERIAL.—Photo. of skull of type (ad. ♀) only.

erigens LAWRENCE, 1939, Bull. Mus. Comp. Zool., LXXXVI, p. 56.

TYPE LOCALITY.—Mt. Halcon, near Calapan, Mindoro, Philippine Islands.

Related to *bicolor*, distinct from *antricola*.

MATERIAL.—Type and paratypes at M.C.Z.

euotis ANDERSEN, 1905, Ann. Mag. Nat. Hist., (7) XVI, p. 502.

TYPE LOCALITY.—Batchian Island.

Related to *diadema*.

MATERIAL.—The type: B.M. 7.1.1.-312, ad. ♂, and photo. of skull (braincase destroyed).

fulgens ELLIOT, 1840, Cat. Mamm. S. Maharatta Country, p. 8.

TYPE REGION.—S. Maharatta Country, India.

Probably related to *bicolor*.

MATERIAL.—None.

fuliginosus TEMMINCK, 1853, Esquisses Zool. Guinée, p. 77.

TYPE REGION.—"Coast of Guinea."

Related to *caffer*.

MATERIAL.—Small series at M.C.Z.

fulvus GRAY, 1838, Mag. Zool. Bot., II, p. 492.

TYPE LOCALITY.—Madras, India.

Related to *bicolor*.

MATERIAL.—A specimen from Madras, B.M. 22a (also marked "m.") with forearm 38.5; no photo. of skull; also

material from Burma at U.S.N.M. and from India at M.C.Z.

galeritus CANTOR, 1846, Jour. Asiatic Soc. Bengal, XV, p. 183.

TYPE LOCALITY.—Penang, Malay Peninsula.

First-described species of its group, unless *crumeniferus*, 1807, can be definitely so assigned. Other members are *cervinus*, *celebensis*, *insolens*, *labuanensis*.

MATERIAL.—The type: B.M. 79.11.-21.85, ♂ (forearm 45.5), with photo. of skull. No topotypical material in U.S. Supposed "*galeritus*" from Borneo, Batu Island, Banka Island at M.C.Z. Sody¹ believed he had true *galeritus* in his large series from Celebes (later renamed *celebensis*). We have an equally large series from the same island. The photograph of the type shows an elongate braincase, zygomata not exceeding mastoid width, narrow rostrum, and p_2^2 too indistinct for interpretation.

gambiensis ANDERSEN, 1906, Ann. Mag. Nat. Hist., (7) XVII, p. 42.

TYPE REGION.—Gambia, West Africa. Subspecies of *gigas* (Allen, 1939).

MATERIAL.—One from Congo at M.C.Z. (?)

gentilis ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 380.

TYPE REGION.—Burma.

Related to *bicolor*.

MATERIAL.—Ample specimens from China at A.M.N.H. and M.C.Z.

gigas WAGNER, 1845, Archiv f. Naturges., XI, pt. 1, p. 148.

TYPE REGION.—Angola, West Africa.

Related to *commersonii*.

MATERIAL.—Two from S. W. Africa at M.C.Z.

gracilis PETERS, 1852, Reise nach Mossambique, Säügeth., p. 36.

TYPE REGION.—Zambesi River, East Africa.

Synonym of *caffer* (Allen, 1939).

MATERIAL.—Ample.

grandis G. M. ALLEN, 1936, Records Indian Mus., XXXVIII, pt. 3, p. 345.

TYPE LOCALITY.—Chindwin, Burma.

Subspecies of *larvatus*: not probably a synonym of *leptophylla*.

MATERIAL.—Type in India; series of three from Siam at U.S.N.M.

griseus MEYEN, 1833, Nova Acta Ac. Nat. C., XVI, No. 2, p. 608.

TYPE REGION.—Luzon, Philippine Islands.

Related to *diadema*.

MATERIAL.—Ample material at M.C.Z. and U.S.N.M.

REMARKS.—A small-toothed form (thickness of outer lower incisor .7-.8 mm.). Tendency for foramina to become enclosed by premaxillae. Upper incisors much smaller than in *nobilis*—crown width, .7-.8 mm.: .9-1.0 mm. *guineensis* ANDERSEN, 1906, Ann. Mag. Nat. Hist., (7) XVII, p. 275; 1907, Ann. Mus. Civ. Storia Nat., Genova, (3) III, pp. 17-20.

TYPE REGION.—Gaboon.

Subspecies of *caffer* (Allen, 1939).

MATERIAL.—Large series at M.C.Z.; few at U.S.N.M. and A.M.N.H.

indus ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 382.

TYPE REGION.—Kanara, India.

Subspecies of *lankadiva*.

MATERIAL.—The type: B.M. 12.11.-28.20, ♀ (forearm 75), and photo. of skull.

insignis HORSFIELD, 1824, Zool. Res. Java.

TYPE REGION.—Java.

Probable synonym of *larvatus*.

MATERIAL.—Photographs of two skulls, "co-types": B.M. 60.5.4.16 (in fragments, tooththrows only); B.M. 79.11.21.-94 (basal part of braincase destroyed).

insolens LYON, 1911, Proc. U. S. Nat. Mus., XL, p. 129.

TYPE REGION.—S. E. Borneo.

Related to *galeritus*.

MATERIAL.—Type and few paratypes at U.S.N.M.

This, like *labuanensis*, is a member of the *galeritus* group in which p_2^2 are relatively reduced.

javanicus SODY, 1937, Temminckia, II, p. 215.

TYPE LOCALITY.—Tjilitjap, C. Java.

Related to *bicolor*.

¹ 1930, Natuurk. Tijdschr., XC, pp. 267-270.

MATERIAL.—The type: Sody coll. No. 3, ad. ♂, and photo. of skull.

REMARKS.—One of the larger members of the group (forearm, 45.5; c-m³, 6.6). It is probably specifically identical to "specimen d" of the Jentink catalogue which was one of Temminck's co-typical series of *bicolor*.

labuanensis TOMES, 1858, Proc. Zool. Soc. London, p. 537.

TYPE REGION.—Labuan, Borneo.

Related to *galeritus*.

MATERIAL.—The type: B.M. 7.1.1.-305, and photo. of skull (the base of braincase broken). Two "*labuanensis*" from Sumatra at U.S.N.M.

langi J. A. ALLEN, 1917, Bull. Amer. Mus. Nat. Hist., XXXVII, p. 434.

TYPE REGION.—N. E. Belgian Congo. Synonym of *cyclops* (Allen, 1939).

MATERIAL.—The type and series of paratypes in A.M.N.H.

REMARKS.—Allen described and figured special structures to which writers on *cyclops* had not drawn attention.

lankadiva KELAART, 1852, Prodr. Fauna Zeylanica, p. 19.

TYPE REGION.—Ceylon. (Andersen records it from Burma.)

The continental offshoot of the chiefly insular *diadema* group.

MATERIAL.—One co-type: B.M. 7.-1.1.311, ♂ (forearm 82), and photo. of skull. (Collected by Kelaart. Marked "lectotype.") One specimen from Bombay at M.C.Z. *Lankadiva*, with the continental forms *unitus*, *indus*, *mixtus*, etc., is separable from *diadema* and allies by characters discussed by Andersen (1905).

larvatus HORSFIELD, 1823, Zool. Res. Java, No. 6, Pl. IX.

TYPE REGION.—Java.

Earliest known member of its group. Other forms are *neglectus*, *leptophylla*. Numerous synonyms.

MATERIAL.—The type: B.M. 79.11.-21.93 (forearm 53) no photo. of skull; large series from Java at U.S.N.M. and M.C.Z.; also from Burma, Siam, Karimata, Natuna, Nias, etc.

leptophylla DOBSON, 1874, Jour. Asiatic Soc. Bengal, LXIII, p. 234.

TYPE LOCALITY.—Khasia Hills, Assam.

Related to *larvatus*.

MATERIAL.—None.

longicauda PETERS, 1861, Monatsber. Akad. Wiss. Berlin, p. 708; 1871, *op. cit.*, pp. 321-322.

TYPE LOCALITY.—Surakarta, Java.

MATERIAL.—None.

REMARKS.—In all respects mentioned by Peters, except the extraordinary length of the tail, Peters' description of this species agrees with the *galeritus* group. It will doubtless prove to be atypical, however. Sody¹ believed he had obtained a series of Peters' species, even though the tails reached only 75 per cent of the length given for the type *longicauda*.

lylei THOMAS, 1913, Ann. Mag. Nat. Hist., (8) XII, p. 88.

TYPE REGION.—N. Siam.

Related to *pratti*.

MATERIAL.—None.

macrobullatus TATE, described in this paper.

major ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 380.

TYPE LOCALITY.—Engano Island.

Subspecies of *gentilis*, of *bicolor* group.

MATERIAL.—None.

marungensis NOACK, 1887, Zool. Jahrb., Syst., II, p. 272.

TYPE REGION.—West Tanganyika Territory.

Subspecies of *commersonii* (Allen, 1939).

MATERIAL.—One specimen at M.C.Z. *masoni* DOBSON, 1872, Jour. Asiatic Soc. Bengal, p. 338.

TYPE LOCALITY.—Moulmein, Burma.

Related to *diadema*.

MATERIAL.—None.

megalotis HEUGLIN, 1861, Nova Acta Akad. Caes. Leop. Carol., Halle, XXIX, No. 8, p. 4, 8; 1877, "Reise in Nordost Africa," II, pp. 20-21.

TYPE REGION.—Eritrea.

MATERIAL.—None.

REMARKS.—This unique specimen was separated by Peters (1871) under the subgenus *Syndesmotis*, on account of the

¹ Natuurk. Tijdschr., XC, p. 270.

band described by Heuglin as uniting the ears. Examination of the skin and skull will probably show that *megalotis* is aberrant in other characters also.

micaceus DE WINTON, 1897, Ann. Mag. Nat. Hist., (6) XX, p. 524.

TYPE REGION.—Gaboon.

Synonym of *cyclops* (Allen, 1939).

micropus PETERS, 1872, Monatsber. Akad. Wiss. Berlin, p. 256.

TYPE LOCALITY.—Dehra Doon, near Simla, N. India.

Related to *bicolor*, probably the north-western representative of *cineraceus*.

MATERIAL.—None.

mirandus THOMAS, 1914, Ann. Mag. Nat. Hist., (8) XIII, p. 437.

TYPE LOCALITY.—Manus Island, Admiralty Islands.

Related to *diadema*.

MATERIAL.—The type: B.M. 14.4.1.-8, ad. ♀, with photo. of skull.

mixtus ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 382.

TYPE REGION.—E. Mysore, India.

Subspecies of *lankadiva*.

MATERIAL.—The type: B.M. 13.4.-11.19, ♂ (forearm 81.5), with photo. of skull.

mostellum THOMAS, 1904, Ann. Mag. Nat. Hist., (7) XIII, p. 385.

TYPE REGION.—Kenya Colony.

Synonym of *marungensis* (Allen, 1939).

MATERIAL.—The type: B.M. 89.3.8.-3, ♂ (forearm 89.3), no photo. of skull.

murinus GRAY, 1838, Mag. Zool. Bot., II, p. 492.

TYPE REGION.—Peninsular India, probably.

Related to *bicolor*, probably synonym of *fulvus*.

muscinus THOMAS AND DORIA, 1886, Ann. Mus. Civ. Storia Nat., Genova, (2) IV, p. 203.

TYPE LOCALITY.—Fly River, Papua.

MATERIAL.—One co-type: B.M. 86.-11.3.10, ad. ♀ in alcohol, and photo. of skull. One in M.C.Z., from Mt. Misim, Dutch New Guinea. Series at A.M.N.H. from Fly River and Astrolabe Mountains.

REMARKS.—There is no doubt that *muscinus* is very closely related to *semoni* and *stenotis*. "Ear larger [than *cer-*

vinus], with inner margin convex from base to apex, . . . terminates in a very acute point . . ." Of the noseleaf the authors wrote "the sella has in the center . . . a fleshy tubercle . . . the erect posterior process [i.e., transverse leaf] has a small tubercle which projects forward . ." Those are the longitudinally placed, club-like processes to be seen in the two species named and in *cyclops* of Africa. "No frontal sac in ♀." The illustration of the noseleaf is very poor. No description of the skull was published. But the skull of the ♀ co-type mentioned as having been ceded to the British Museum has since been cleaned. It shows the characteristics of *semoni* and agrees with my topotypical series of *muscinus*: the parallel toothrows, the greatly enlarged rostrum, the closely approximated cochleae, etc.

nanus J. A. ALLEN, 1917, Bull. Amer. Mus. Nat. Hist., XXXVII, p. 434.

TYPE REGION.—Uele distr., Belgian Congo.

Related to *caffer*.

MATERIAL.—The type (in alcohol, skull cleaned) at A.M.N.H.

natunensis CHASEN, 1940, Bull. Raffles Mus., No. 15, p. 43.

TYPE LOCALITY.—Natuna Island.

Related to *diadema*.

MATERIAL.—None.

neglectus SODY, 1936, Natuurk. Tijdschr. Ned. Ind., XCVI, p. 46.

TYPE REGION.—Central Borneo.

Subspecies of *larvatus*.

MATERIAL.—Large series from Borneo at U.S.N.M. and one from Borneo at M.C.Z.

nequam ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 381.

TYPE REGION.—Selangor, Malay Peninsula.

Related to *bicolor*.

MATERIAL.—Photo. of skull of type only (B.M. 85.8.1.369. Braincase destroyed).

niangarae J. A. ALLEN, 1917, Bull. Amer. Mus. Nat. Hist., XXXVII, p. 438.

TYPE REGION.—Uele distr., Belgian Congo.

Subspecies of *gigas* (Allen, 1939).

MATERIAL.—The type in A.M.N.H.
niapu J. A. ALLEN, 1917, Bull. Amer. Mus.
 Nat. Hist., XXXVII, p. 431.

TYPE REGION.—N. E. Belgian Congo.
 Subspecies of *caffer* (Allen, 1939).

MATERIAL.—The type and small series
 at A.M.N.H.; one at M.C.Z.
nicobarensis DOBSON, 1871, Jour. Asiatic
 Soc. Bengal, XL, p. 262.

TYPE LOCALITY.—Nicobar Islands.
 Related to *diadema*.

MATERIAL.—None.
nicobarulae MILLER, 1902, Proc. U.S. Nat.
 Mus., XXIV, p. 781.

TYPE LOCALITY.—Nicobar Islands.
 Related to *bicolor*.

MATERIAL.—The type and a large se-
 ries of paratypes at U.S.N.M.
nobilis HORSFIELD, 1823, Zool. Res. Java,
 No. 6, Pl. VII.

TYPE REGION.—Java.
 Related to *diadema*.

MATERIAL.—Two "co-types" (skins),
 B.M. 79.11.21.83 (forearm 87), photo. of
 skull, basal part of braincase destroyed;
 B.M. 79.11.21.84 (forearm 82, no photo.
 of skull); also ample series from Java at
 M.C.Z. and U.S.N.M.

REMARKS.—Teeth larger than in
griseus, smaller than material from Bali.
 This is particularly noticeable in the in-
 cisors. Thickness of outer lower in-
 cisor, .9–1.0 mm.

obscurus PETERS, 1861, Monatsber. Akad.
 Wiss. Berlin, p. 709.

TYPE REGION.—Luzon, Philippine Is-
 lands.

MATERIAL.—None.

REMARKS.—Another difficult species,
 with emarginate ear, no "cells" in trans-
 verse noseleaf, frontal sac in ♂ (♀?),
 forearm 46. Later combined by Peters
 with *doriae* in *Cyclorhina* ("no lateral
 leaflets; transverse leaf with thin mar-
 gin"). Forearm 46 mm.

It may belong with *sabanus* or *dya-*
corum, aberrant Bornean members of the
galeritus group. Taylor (1934) believed
 he had re-collected it. Forearm of Tay-
 lor's animals, 41–44 mm.

oceanitis ANDERSEN, 1905, Ann. Mag. Nat.
 Hist., (7) XVI, p. 497.

TYPE REGION.—Guadalcanar Island,
 Solomon Islands.

Related to *diadema*.

MATERIAL.—The type, B.M. 88.1.5.23,
 ad. ♀ in alcohol, and photo. of skull;
 also one from Isabel Island, Solomons,
 at M.C.Z.

pallidus ANDERSEN, 1918, Ann. Mag. Nat.
 Hist., (9) II, p. 381.

TYPE REGION.—Kathiawar, India.

Subspecies of *fulvus*, related to *bicolor*.

MATERIAL.—The type, B.M. 18.8.3.5,
 ♂ (forearm 38); no photo. of skull.

papua THOMAS AND DORIA, 1886, Ann.
 Mus. Civ. Storia Nat., Genova, (2) IV,
 p. 204.

TYPE LOCALITY.—Misorì Island,
 Dutch New Guinea.

MATERIAL.—One co-type examined:
 B.M. 86.11.3.9, ad. ♀ in alcohol, and
 photo. of skull.

REMARKS.—A perplexing species with
 rostrum greatly widened (6 mm.) in pro-
 portion to mastoid width (10 mm.);
 c-m³, 7.6 mm.; while the forearm is only
 50.5 mm. Lateral leaflets only two.
 Pouch absent in female. The rostral
 character resembles *muscinus* but the
 tooththrows are convergent, the ears broad
 and not emarginate, and the bullae un-
 enlarged and not approximated. The
 tooththrow exceeds that of any known
 member of the *galeritus* group by at least
 1 mm. It even exceeds the tooththrow of
speoris, which *papua* resembles in lacking
 the frontal sac in females. If this species
 exists in Timor it may be the form which
 Peron (1807) named *crumeniferus*. The
 width of rostrum is similar to that of
wollastoni, which, however, has the en-
 larged cochleae and parallel tooththrows of
muscinus.

H. papua may have been derived from
 near the base of the *speoris* and *galeritus*
 (*cervinus*) stems.
pelingensis SHAMEL, 1940, J. Mamm., XXI,
 No. 3, p. 353.

TYPE LOCALITY.—Peleng Island, east
 of Celebes.

A member of *diadema* group, related to
dinops.

MATERIAL.—The type at U.S.N.M.; a
 series from S. Celebes at A.M.N.H.

penicillatus GRAY, 1838, Mag. Zool. Bot., II, p. 493.

TYPE REGION.—Somewhere in India. Probably synonymous with *speoris*.

MATERIAL.—None.

pendleburyi CHASEN, 1936, Bull. Raffles Mus., XII, p. 133.

TYPE REGION.—Peninsular Siam.

MATERIAL.—None.

"Appearing to differ [from *H. a. debilis*] in no essential except size." Forearm, 79–79.5 mm.; c-m³, 10.2.

pomona ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 380.

TYPE REGION.—Coorg, India.

Related to *bicolor*.

MATERIAL.—Photo. of type skull only (B.M. 18.8.3.4).

poutensis J. A. ALLEN, 1906, Bull. Amer. Mus. Nat. Hist., XXII, p. 483.

TYPE REGION.—Hainan Island.

Related to *larvatus*.

MATERIAL.—Type and paratypes in A.M.N.H.

pratti THOMAS, 1891, Ann. Mag. Nat. Hist., (6) VII, p. 527.

TYPE REGION.—Szechwan, China.

Represents a specialized group to which *lylei* also belongs.

MATERIAL.—Photo. of type skull only (B.M. 91.5.11.1, ♀); large series at A.M.N.H., U.S.N.M. and M.C.Z.

pulchellus ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 383.

TYPE LOCALITY.—Bellary, India.

Subspecies of *speoris*.

MATERIAL.—Photo. of skull of type only (B.M. 13.4.10.13).

pullatus ANDERSEN, 1905, Ann. Mag. Nat. Hist., (7) XVI, p. 498.

TYPE LOCALITY.—Haveri, Papua.

Related to *diadema*.

MATERIAL.—Four co-types: B.M. 97.8.7.6–9 (6–8, ♂; 9, ♀). Skulls of all extracted and cleaned. Photo. of skull of 97.8.7.9; series at A.M.N.H. from Papua.

pygmaeus WATERHOUSE, 1843, Proc. Zool. Soc. London, p. 67.

TYPE REGION.—Philippine Islands.

An isolated species probably derived from the line leading to the *galeritus* group.

MATERIAL.—Series in U.S.N.M. from Luzon.

REMARKS.—In spite of the very small size of this bat, the forearm, as pointed out by Lawrence,¹ is proportionately elongate. Thus, $\frac{\text{Forearm}}{\text{Tibia}} = \frac{39}{14}$, or 280%, whereas in the smallest member of the *bicolor* group, *cineraceus*, the same lengths are $\frac{34}{13}$, or 260%.

reginae TROUGHTON, 1937, Australian Zool., VIII, pt. 4, p. 275.

TYPE REGION.—N. Queensland.

Related to *diadema*; synonym of *pullatus*?

MATERIAL.—One specimen at M.C.Z. from Australia. I find no character by which this specimen can be separated from my series from the Fly River.

ridleyi ROBINSON AND KLOSS, 1911, J. Fed. Malay States Mus., IV, p. 241.

TYPE LOCALITY.—Singapore, Malay Region.

Large member of *bicolor* group.

MATERIAL.—None.

REMARKS.—Forearm, 47.2 mm.; mastoid width, 10.8; zygomatic width, 9.6; c-m³, 6.8.

ruber NOACK, 1893, Zool. Jahrb., Syst., VII, 586.

TYPE REGION.—Tanganyika Terr.

Related to *caffer*.

MATERIAL.—Large series at U.S.N.M. and M.C.Z.

sabanus THOMAS, 1898, Ann. Mag. Nat. Hist., (7) I, p. 243.

TYPE REGION.—N. Borneo.

MATERIAL.—Photo. of skull only.

REMARKS.—The peculiarities of *sabanus* emphasize the need of more collections to assist in establishing the relationships of such anomalous forms. Reduced noseleaf, absence of secondary leaflets, shortened palate, obsolescence of p²; also (Thomas, 1902, Ann. Mag. Nat. Hist., (7) IX, p. 272) a notched front edge of the horseshoe and the absence of vertical septa in the posterior noseleaf.

Thomas regarded it as a member of the *bicolor* group, probably because it lacks

¹ 1939, Bull. Mus. Comp. Zool., LXXXVI, p. 57.

lateral leaflets, but the relationship of zygomatic width to mastoid width and the broadening of the zygomata at their maxillary roots are more like that of the *galeritus* group than the *bicolor* group. The ears, at least in *dyacorum*, are emarginate and haired for most of their length, wholly unlike *bicolor* ears.

saevus ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 380.

TYPE LOCALITY.—Kei Islands.

Related to *bicolor*.

MATERIAL.—None.

REMARKS.—The *bicolor* bats of Queensland, Aru Island and South New Guinea (forearm 37–39) are definitely smaller than those of Ceram, Celebes, Halmahera, and also Kei (forearm 40–42). This difference appears also in the teeth: $c-m^3$, 5.1–5.3 mm. and 5.6–6.1, respectively. The former are referable to *aruensis*, the latter to *saevus* (= *toala*).

schistaceus ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 382.

TYPE REGION.—Bellary, India.

MATERIAL.—The type: B.M. 13.4.10.3, ♂, and photo. of skull.

According to Andersen, an offshoot of *lankadiva*.

schneideri THOMAS, 1904, Zool. Anz., XXVII, p. 722.

TYPE REGION.—Sumatra.

MATERIAL.—Photo. of skull only.

REMARKS.—The picture of the skull of the type indicates close relationship to the *galeritus* group; zygomatic width exceeds mastoid width; palate and premaxillae rather short. P^2 is absent and p_2 much reduced. The ear is emarginate and frontal gland well developed. Further details were given by Andersen¹ in 1907. Forearm, 48 mm.; $c-m^3$, 6.7.

semoni MATSCHIE, 1903, Zool. Forschungen, Austral. u. Malay. Archip., V, Art. 6, p. 774.

TYPE LOCALITY.—Cooktown, Queensland.

MATERIAL.—None.

REMARKS.—Member of *muscinus*, a specialized Torresian group, which in-

cludes *stenotis*, whose nearest relative appears to be *cyclops* of Central Africa.

CHARACTERISTICS.—Horseshoe with two club-like processes, one behind the other; elongate, acute, pointed ears; toothrows parallel; p_2^2 markedly reduced; cochleae much enlarged and very close together. See also *stenotis*, *muscinus*, *papua* and *wollastoni*.

sinensis ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 380.

TYPE REGION.—Fukien.

Subspecies of *gentilis*, member of *bicolor* group.

MATERIAL.—The type: B.M. 92.2.1.3 (forearm 38.5), and photo. of skull (braincase destroyed). Many specimens from China at U.S.N.M., A.M.N.H. and M.C.Z.

REMARKS.—*Gentilis* itself would seem to be conspecific with *fulvus* of Peninsular India.

speculator ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 381.

TYPE REGION.—S. Celebes.

Related to *diadema*.

MATERIAL.—Photo. of skull of type only; series at A.M.N.H. from Celebes. *speoris* SCHNEIDER, in Schreber's Säuge-thiere, V, and plate.

RANGE.—India and Ceylon.²

GENOTYPE.—Nearest allied species are *abae* in Africa and *larvatus* of the Burma-Sunda area.

MATERIAL.—Series from Ceylon at M.C.Z.; 3 from India at U.S.N.M.

REMARKS.—Characters given elsewhere, under discussion of the genotype of the genus *Hipposideros*.

stenotis THOMAS, 1913, Ann. Mag. Nat. Hist., (8) XII, p. 206.

TYPE LOCALITY.—Mary River, Northern Territory, North Australia. Related to *muscinus*.

MATERIAL.—The type: B.M. 97.4.12.7, ♀ in alcohol, and photo. of skull; series from Papua in A.M.N.H., 3 from North Australia at U.S.N.M.

REMARKS.—Closely allied, if not equal, to *semoni*.

swinhoei PETERS, 1870, Proc. Zool. Soc. London, p. 616.

¹ Ann. Mus. Civ. Storia Nat., Genova, (3) III, pp. 1–22.

² Various authors cite it from Java and Borneo.

TYPE LOCALITY.—Amoy, China.

Subspecies of *armiger*.

MATERIAL.—Photo. of type-skull; one topotype (from Amoy) at M.C.Z.; others from China at U.S.N.M., M.C.Z. and A.M.N.H.

taiiensi FITZINGER, 1869, Sitzungsber. Akad. Wiss. Wien, LX, p. 865.

TYPE LOCALITY.—Tahiti?

MATERIAL.—None.

REMARKS.—*Taiiensi* appears to be referable either to the *speoris* group or to the *galeritus* group. *Speoris*, otherwise restricted to Peninsular India and Ceylon, agrees closely with Fitzinger's description of 3 lateral leaflets subtending the horseshoe in *taiiensi*. On the other hand *cervinus*, of the *galeritus* group, with but two leaflets, extends at least as far eastwards as New Hebrides Islands. Dobson (P.Z.S., 1877, p. 121) wrote, "we are not absolutely certain that the specimen . . . was really obtained at the Island of Tahiti."

templetoni KELAART, 1849-50, Jour. Ceylon Branch, Royal Asiatic Soc., (2) II, p. 322.

TYPE REGION.—Ceylon.

Probable synonym of *speoris*.

MATERIAL.—Two co-types: B.M. 52.1.24.2 and 4, and photos. of skulls (base of braincase in each destroyed).

terasensis KISHIDA, 1924, Zool. Mag. Tokyo, XXXVI, p. 42.

TYPE REGION.—Formosa.

Subspecies of *armiger*.

MATERIAL.—One specimen from Formosa at U.S.N.M.

REMARKS.—This form and *swinhoei* seem to be indistinguishable from *armiger*.

thomensis BOCAGE, 1891, J. Sci. Math. Phys. Nat. Lisboa, (2) II, p. 88; 1904 (7) VI, p. 67.

TYPE LOCALITY.—San Thomé Island.

Subspecies of *commersonii* (Allen, 1939).

MATERIAL.—None.

toala SHAMEL, 1940, J. Mamm., XXI, No. 3, p. 352.

TYPE LOCALITY.—Toeare, Celebes.

"Subsp. of *gentilis*," member of *bicolor* group. Probable synonym of *saevus*.

MATERIAL.—The type at U.S.N.M.

REMARKS.—The describer of *toala* compared it with *gentilis* and *sinensis* rather than with the geographically (and genetically) nearer *aruensis*, *saevus*, etc. We have other specimens from Celebes which I believe to be closest to *saevus*.

trobrius TROUGHTON, 1937, Australian Zool., VIII, pt. 4, p. 276.

TYPE LOCALITY.—Trobriand Islands.

Related to *diadema*.

MATERIAL.—None.

turpis BANGS, 1901, Amer. Nat., XXXV, p. 561.

TYPE REGION.—Liu Kiu Islands.

Related to *armiger*.

MATERIAL.—The type and paratypes at M.C.Z.; one topotype at A.M.N.H.

REMARKS.—*Turpis*, like *pendleburyi*, seems to differ from *armiger*, *swinhoei*, *debilis* and *terasensis* chiefly by its smaller size.

unitus ANDERSEN, 1918, Ann. Mag. Nat. Hist., (9) II, p. 382.

TYPE REGION.—Saugor, C. P., India.

Subspecies of *lankadiva*.

MATERIAL.—The type: B.M. 12.11.-29.20, ♀ (forearm 87.5), and photo. of skull.

vicarius ANDERSEN, 1905, Ann. Mag. Nat. Hist., (7) XVI, p. 499.

TYPE REGION.—Sarawak.

Related to *diadema*.

MATERIAL.—Photo. of skull of type only; two from Sarawak at M.C.Z. These disagree with *griseus*, and agree with *nobilis* in the size of the incisors: thickness of *i*₂, .9 mm., width of crown of *i*₁, 1.0 mm. Mastoid width : zygomatic width = 15:19. Enclosure of foramina by premaxillae incipient.

vittata PETERS, 1852, Reise nach Mossambique, Säugeth., p. 32.

TYPE LOCALITY.—Ibo Island, Cap Delgado Group, East Africa.

Synonym of *gigas* (Allen, 1939).

MATERIAL.—Three from Zanzibar at M.C.Z.

vulgaris HORSFIELD, 1824, Zool. Res. Java.

TYPE REGION.—Java.

Probable synonym of *larvatus*.

MATERIAL.—The type: B.M. 79.11.-21.575 (forearm 56), and photo. of skull (back of braincase broken).

wollastoni THOMAS, 1913, Ann. Mag. Nat. Hist., (8) XII, p. 205.

TYPE LOCALITY.—Utakwa River, S. W. New Guinea.

MATERIAL.—The type: B.M. 13.6.-18.4, ad. ♀ in alcohol, and photo. of skull.

REMARKS.—Thomas compared this bat with *muscinus* but not with *semoni* and *stenotis*, to which it is obviously also closely related. It appears to reach the very apex of specialization in this little group of Torresian bats by the development of the remarkable secondary transverse leaf behind the primary transverse leaf. In the African *caffer* (mentioned by Thomas) the secondary development arises directly from the base of the primary one. Its crest, lower than the

primary crest, is serrate. But in *wollastoni* the two are separated by the interrupted groove described by Thomas.

The skull resembles that of *muscinus* in all essential characters: greatly enlarged rostrum and cochleae, parallel tooththrows, etc.

wrighti TAYLOR, 1934, Philippine Bur. Sci., Monogr. 30, p. 237.

TYPE LOCALITY.—Baguio, Benguet, Philippine Islands.

Related to *bicolor*.

MATERIAL.—None.

REMARKS.—If we accept Lawrence's¹ interpretation, Taylor has redescribed *antricola* Peters. See also *antricola* and *erigens*.

¹ 1939, Bull. Mus. Comp. Zool., LXXXVI, pp. 54-56.

HIPPOSIDEROS MATERIAL IN THE ARCHBOLD COLLECTIONS

	Alcoholic	Skin and Skull
<i>Hipposideros larvatus</i> Horsfield		6
N. W. Borneo: Perboewa (Landak)		6
Sumatra: Bukit Panggoel (Bankoda)		3
South Sumatra: Macarah Doewa (Palembang)		18
Mentawi Islands: N. Pagi		4
<i>Hipposideros galeritus labuanensis</i> Tones		
N. W. Borneo: Perboewa (Landak)		21
<i>Hipposideros galeritus galeritus</i> Cantor (?)		
Mentawi Islands: N. Pagi		8
<i>Hipposideros galeritus celebensis</i> Sody		
South Celebes: Talassa (Maros)		29
" " : Banti-moerang		3
<i>Hipposideros galeritus cervinus</i> Gould		
Dutch New Guinea: Hollandia	20	25
" " " : Weyland Mountains		2
Papua: Oriomo River	72	7
<i>Hipposideros insolens</i> Lyon		
N. W. Borneo: Perboewa		7
<i>Hipposideros schneideri</i> Thomas		
Mentawi Islands: N. Pagi		7
<i>Hipposideros dyacorum</i> Thomas		
N. W. Borneo: Perboewa (Landak)		9
<i>Hipposideros breviceps</i> Tate		
Mentawi Island: N. Pagi		38
<i>Hipposideros diadema pelingensis</i> Shamel		
South Celebes: Talassa (Maros)		17
<i>Hipposideros diadema nobilis</i> Horsfield		
Java: Cheribon		1
Bali: Oboed		3
Bali: N. W. Nossa Tenida		5
<i>Hipposideros diadema euotis</i> Andersen		
N. Celebes: Koemersot		3
S. Celebes: Talassa (Maros)		3
<i>Hipposideros diadema pullatus</i> Andersen		
Papua: Upper Fly River	4	12
<i>Hipposideros bicolor major</i> Andersen		
Mentawi Islands: N. Pagi		3

<i>Hipposideros bicolor aruensis</i> Gray		
Papua: Fly River		9
" : Wassi Kussa River		6
Dutch New Guinea: Idenburg River	1	9
" " " : S. of Geelvink Bay		1
<i>Hipposideros bicolor aruensis</i> , yellow phase		
Bali: Saugsit		9
<i>Hipposideros bicolor saevus</i> Andersen		
Celebes: Peleng Island		2
" : Roeroekan		1
Halmahera		1
<i>Hipposideros cupidus</i>		
Papua: Javereri, Musgrave River		4
Dutch New Guinea: Hollandia	1	5
<i>Hipposideros calcaratus</i>		
Papua: Javereri, Musgrave River		7
" : Middle Fly River	3	6
" : Upper Fly River (Red phase)		4
Dutch New Guinea: Hollandia	1	1
<i>Hipposideros muscinus muscinus</i>		
Papua: Upper Fly River	1	2
" : Middle Fly River	2	3
" : Wassi Kussa River	2	2
" : Sogeri, East of Port Moresby		6

HIPPOSIDEROS OF THE NEW GUINEA AREA

New Guinea and nearby territories—the Solomon Islands and tropical Australia—contain representatives of three widely distributed groups, namely, *bicolor*, *galeritus* and *diadema*. In addition they are the home of two autochthonous groups, *muscinus* and *calcaratus*. The former appears to be distantly related to *cyclops* of Central Africa. The latter may possibly be allied to *coronatus* of the Philippine Islands. Two anomalous species are *wollastoni*, apparently a specialized offshoot of the *muscinus* group, and *papua* (of which we have no specimens) springing possibly from the basal stem from which the *speoris* and *galeritus* groups are derived.

H. bicolor is generally found in Southern Papua in hollow trees growing in the patches of gallery woods that margin the streams of the plains country. But it also occurs in densely forested areas. The forms that have received names are *amboinensis* (Amboina), *saevus* (Kei), *aruensis* (Aru) and *albanensis* (Cape York, N. Queensland). They are almost indistinguishable, differing only very slightly in size. The oldest name is *aruensis*.

H. calcaratus and *H. cupidus*, related but perfectly distinct members of the same group, have seemingly been confused at

different times. I collected both species in the limestone caverns at Javereri, upper Kemp Welch River basin, but in different caves. Specimens of *calcaratus* were secured in hollow trees along the middle Fly River and four bats, representing the bright rufous stage of the same species, were shot and brought into camp by the bushmen at Palmer River. At Hollandia, on the north coast of Dutch New Guinea, several *cupidus* and a single *calcaratus* were collected. Both species are present at Duke of York Island, the type locality of *calcaratus*. Our bats from the Tabar Islands and U.S.N.M. 18480 from Jobi are all referable to *cupidus*.

H. galeritus cervinus is in the same case as *aruensis*, a widely dispersed form showing occasional slight geographical variations. The bats found in the caverns at Dogwa, Oriomo River, include two color phases, red and gray, and are slightly larger than specimens from Hollandia and Weyland Mountains, but these differences appear to be too inconstant to merit a distinct subspecific name.

Galeritus bats of the region already named are *cervinus* (Cape York, N. Queensland), *batchianus* (Batjan) and *crumeniferus* (Timor), the last still uncertainly

identifiable, so that the name employed provisionally should be *cervinus*. The species is widely distributed, reaching 4000 feet (Shaw-Meyer in the Weyland Mountains).

H. diadema has had ten forms named in the New Guinea region. It seems to be a highly plastic species. A series brought in by natives of the upper Fly River is referred to *pullatus*. It is open to question whether true *diadema* of Timor, *custos*, *pullatus*, *oceanitis*, *reginae*, *speculator* should not be synonymized. *Euotis*, rather larger, and *demissus* and *mirandus*, much smaller, may be separable. To determine the matter a much larger series than I have with topotypes is required. *Dinops* is very much larger and has the rostrum lower and flatter, and the zygomata more expanded.

H. muscinus, whose very near relatives are *semoni* and *stenotis* (both perhaps synonymous), was found along the middle and upper Fly River in hollow trees. Not many specimens, however, were taken, the bats appearing to be solitary. They were collected again at Baruari on the Astrolabe Range, Central Division, Papua, by means

of sticks, whipped rapidly to and fro across fly-ways. A specimen (M.C.Z. 29927) was taken by Stevens at Morobe, Mt. Misim, 5700 feet.

H. wollastoni must be left provisionally as a distinct species belonging to the *muscinus* group. The skull, judging from its photograph, is identical to those of *muscinus* but Thomas's description of the "double" transverse leaf is so precise that one cannot doubt an important difference exists. *Wollastoni* is known only from the type from the Utakwa River, Dutch New Guinea.

H. papua, another dubious species, must likewise be left undisturbed. The greater size of skull, teeth and forearm precludes any very close relationship to the smaller Papuan species, while, on the other hand, it is much smaller than any variety of *diadema*. Unlike *wollastoni* it is founded upon two specimens, both from Misor Island, of which the female was sent to the British Museum and the male was kept at Genoa. Our photograph shows the skull of the female.

