

# TAXONOMY AND ZOOGEOGRAPHY OF THE FRUIT BATS OF THE PEOPLE'S REPUBLIC OF CONGO,

WITH NOTES ON THEIR REPRODUCTIVE BIOLOGY (MAMMALIA, MEGACHIROPTERA)

by

W. BERGMANS

*Institute of Taxonomic Zoology, University of Amsterdam, The Netherlands*

## ABSTRACT

This study deals with 272 Megachiroptera from the People's Republic of Congo, belonging to 13 taxa: *Eidolon helvum helvum* (Kerr), *Rousettus aegyptiacus unicolor* (Gray), *Lissonycteris angolensis angolensis* (Bocage), *Myonycteris torquata* (Dobson), *Hypsignathus monstrosus* Allen, *Epomops franqueti franqueti* (Tomes), *Epomophorus* cf. *labiatus* (Temminck), *Epomophorus wahlbergi haldemani* (Halowell), *Micropteropus grandis* Sanborn, *Micropteropus pusillus* (Peters), *Scotoonycteris zenkeri zenkeri* Matschie, *Scotoonycteris ophiodon* Pohle, and *Megaloglossus woermanni* Pagenstecher.

Of these, *Epomophorus* cf. *labiatus* and *Micropteropus grandis* are recorded from this country for the first time. The known ranges of *Epomophorus* cf. *labiatus* and *Micropteropus grandis* are greatly extended towards the west. In morphology and zoogeography ten species correspond with populations to the north and, with the possible exception of both *Scotoonycteris* species, to the south; towards the east the distribution of *Rousettus aegyptiacus* and both *Scotoonycteris* species is possibly discontinuous. The two *Epomophorus* species and *Micropteropus grandis* are linked with populations towards the south and east only.

Seasonal biannual reproduction is assumed for *Epomops franqueti*, *Epomophorus wahlbergi* and *Micropteropus pusillus*. Data on reproduction in other species are scarce or lacking.

## INTRODUCTION

Bats of the People's Republic of Congo have been the subject of three recent studies (Brosset, 1966a; Aellen & Brosset, 1968; Adam & Le Pont, 1974). Although these papers contain a considerable amount of information they also demonstrate that the study of bats from this country has only just begun. This is particularly true with regard to the zoogeography and taxonomy of the Megachiroptera.

The present paper deals exclusively with Megachiroptera from the Republic and attempts to

clarify the zoogeographic and taxonomic ties of the populations inhabiting this country. From the 24th of October till the 29th of December 1972 I paid a visit to the Republic to study and collect fruit bats. Most of the time was spent at Pointe Noire, some small trips were made from there, and the last week I stayed in Brazzaville.

The first author who mentioned fruit bats from the Republic is probably Dybowski (1893), who observed *Hypsignathus monstrosus* Allen, 1861, near Liranga. Notes on his report are included in my account of this species in the taxonomic section. De Pousargues in his studies on the mammals of French Congo (1896; 1897) listed specimens of *Hypsignathus monstrosus*, *Micropteropus pusillus* (Peters, 1867) and *Eidolon helvum* (Kerr, 1792), collected in 1885 by J. de Brazza, probably in what is now the Republic but without exact data. From De Pousargues' introductory notes, which hold important information on the various French zoological expeditions in this part of Africa, it can be inferred that these specimens probably originate from along the river Alima and from the right bank of the river Congo between the mouth of the Alima and Brazzaville. I studied several of his specimens (if not all) in the collections of the Muséum National d'Histoire Naturelle in Paris, but have not included them in the present report because of their uncertain provenance. Malbrant & Maclatchy (1949), who in their introduction also provide useful historical information on mammal collecting in the Republic, observed and in some cases collected *Eidolon helvum*, *Epomops franqueti franqueti* (Tomes, 1860), *Hypsignathus monstrosus*, *Epomophorus wahlbergi haldemani* (Halowell, 1846), and *Micro-*

*pteropopus pusillus*. I have traced only a few specimens from their collections, mainly in the American Museum of Natural History, New York. Brosset (1966a) could add *Rousettus aegyptiacus occidentalis* Eisentraut, 1959 — a junior synonym of *R. ae. unicolor* (Gray, 1870) —, *Myonycteris torquata* (Dobson, 1878), and *Myonycteris wrough-toni* Andersen, 1908 — in my opinion a synonym of *M. torquata* (see Bergmans, 1976) — to the faunal list of the Republic. Aellen & Brosset (1968) extended it further with *Lissonycteris angolensis angolensis* (Bocage, 1898). As a first result of my visit in 1972 I reported on the occurrence in the Republic of *Scotonycteris ophiodon* Pohle, 1943 and *Scotonycteris zenkeri* Matschie, 1894 (Bergmans, 1973). Adam & Le Pont (1974) extended the list with *Megaloglossus woermanni* Pagenstecher, 1885. In the present paper, *Epomophorus* cf. *labiatus* (Temminck, 1837) and *Micropteropus grandis* Sanborn, 1950, are first recorded from the Republic.

## MATERIALS AND METHODS

Three unreported collections of Megachiroptera, consisting of 215 specimens altogether, form the main basis of the present work: the material collected by myself in 1972 and now in the Zoölogisch Museum, Amsterdam (ZMA), the collection of the Laboratoire de Zoologie of the University of Brazzaville (UBRA), and the modest collection of the Laboratoire Emile Roubaud of the Office de la Recherche Scientifique et Technique Outre-Mer (O.R.S.T.O.M.) in Brazzaville (LER). Apart from these I examined most of the material described earlier by Brosset (1966a) and Aellen & Brosset (1968), in the Muséum National d'Histoire Naturelle, Paris. Some odd samples were encountered in other collections and are mentioned in the taxonomic section. The total number of examined specimens is 272. They belong to 13 species.

In the enumerations of material in the taxonomic section, A. = alcoholic specimen, A./S. = alcoholic specimen with extracted skull, F. = formalin specimen, S./S. = dry skin and skull; D. & V. stands for collectors A. Descarpentries and A.

Villiers; all specimens with ZMA numbers have been collected by the author. UBRA registration numbers include the sex of the specimen involved; unfortunately, in a number of cases the sex had been wrongly determined, initially. Where data are not mentioned, they are lacking.

Body and skull measurements have been taken with callipers and are in mm. Teeth measurements were obtained with the help of a stereoscopic microscope and a micrometer disc, and are also in mm. As during the last few years it has appeared to me that certain measurements are not always obtained in the same way by different authors, it may be useful to define those used in this paper.

**Head and body length:** The projection of the distance between the tip of the nose and the most caudal part of the body, except the tail. It is impossible to stretch a fruit bat in the same way as, for instance, a rodent, so that there is always an angle between head and body. For this reason this measurement should be regarded as an indication rather than an exact measurement. (A better way would be to measure this distance on the unstretched animal, with the help of a cord which, to start from the nose tip, precisely follows the dorsal surface of head and body in the median plane.)

**External tail length:** The length of the tail from the skin where it emerges to the tip. Often the tail can only be felt; in such cases its external length is stated to be 0 mm.

**Ear length:** The distance from the distal tip of the ear to the most proximal point of its outer margin, which is the point of insertion of this margin.

**Forearm length:** The length of the forearm in situ, including the joints with the upper arm and hand; in order to standardize results and to minimize the contributions of the joints, the elbow and wrist are bent so that both upperarm and metacarpals are lying against the forearm (as far as possible, without forcing them).

**Metacarpal length:** The length of the metacarpal in situ, from its external proximal end to halfway the joint with the first phalanx.

**Tibia length:** The length of the tibia in situ. As the joints here cannot be bent much more than 90°, it is better to stretch them and to measure the tibia as exactly as its bony ends can be located. This measurement should be regarded as an indication rather than an exact measurement.

**Foot length (cum unguis):** The length of the foot when stretched, from the back side of the heel to the tip of the longest claw.

**Greatest skull length:** The distance between prosthion and opisthocranium. The opisthocranium or most caudal point of the skull can be situated either on the occipital region of the braincase, or in the median plane on the line connecting the most caudal points of the condyli occipitales, or on the sagittal/occipital crest.

**Condylbasal length:** The distance between prosthion and the intersection of the median plane and the line connecting the most caudal points of the condyli occipitales.

**Rostrum length:** The distance between prosthion and the most anterior point of the orbit margin. This way of measuring the rostrum length seems more correct than measuring between the most distal point of the nasal bones and anterior orbit margin, which is often done.

**Palatal length:** The distance between prosthion and the intersection of the tangent of the middle of the caudal margin of the palatum and the median plane.

**Cranium width:** The width of the actual braincase above the caudal insertions of the zygomatic arches. This measurement is not very exact.

**Interorbital width:** The distance between the innermost points of the interorbital constriction in the skull roof.

**Postorbital width:** The distance between the innermost points of the postorbital constriction of the skull roof. Here, the skull roof is not so clearly delimited as at the level of the interorbital constriction. Hence, this measurement is less precise.

**Zygomatic width:** The distance between the most distal point of the left zygomatic arch and that of the right zygomatic arch.

**Mandible length:** Of one mandibular half, the distance between its most distal point and the most caudal point of its condylus articularis.

Teeth rows, widths over canines and molars, and teeth have been measured over the cingula. Teeth lengths have been measured approximately in line with the orientation of the teeth row involved, and teeth widths perpendicular to these lengths.

Zoogeography, taxonomy and reproduction periodicity are discussed per species in the taxonomic section. General notes on zoogeography and on reproduction in relation to climate are given in a general discussion following this section.

Localities where fruit bats are known to occur in the Republic are indicated on the map (fig. 1), which also shows the main vegetation types as derived from a provisional vegetation map in use at the Laboratoire de Zoologie of the University of Brazzaville. Adam & Le Pont (1974) mentioned 27 named caves inhabited by fruit bats in a small region of the Bangou Massif. Due to the scale of the map only a few of these could be mapped (no. 13-16). Figs. 3 and 4 were made with a camera lucida, by the author.

#### ABBREVIATIONS OF COLLECTIONS

AMNH	American Museum of Natural History, New York.
BMNH	British Museum (Natural History), London.
FMNH	Field Museum of Natural History, Chicago.
IRSN	Institut Royal des Sciences Naturelles de Belgique, Brussels.
LER	Laboratoire Emile Roubaud (O.R.S.T.O.M.), Brazzaville.
MAKB	Museum Alexander Koenig, Bonn.
MNHN	Muséum National d'Histoire Naturelle, Paris.
MRAC	Musée Royal de l'Afrique Centrale, Tervuren.
RMNH	Rijksmuseum van Natuurlijke Historie, Leiden.
ROM	Royal Ontario Museum, Toronto.
UBRA	Laboratoire de Zoologie, University of Brazzaville, Brazzaville.
UMB	Uebersee-Museum, Bremen.
USNM	United States National Museum, Washington.
ZMA	Zoologisch Museum, Amsterdam.

#### TAXONOMIC SECTION

##### 1. *Eidolon helvum helvum* (Kerr, 1792)

**Material.** — Dinguembo near Cotovindo: 2 adult ♀♀, 1 adult ♂, 6-XII-1972, S./S. (ZMA 15.529-31). Brazzaville: 1 adult ♀, XII-1965, F. (UBRA). Locality unknown: 1 ♂, 18-X-1965, skin only, F. (UBRA).

**Measurements.** — The UBRA female had a forearm length of 121.3, the UBRA male one of 117.2. Measurements of Dinguembo specimens in table I.

**Remarks.** —

*Eidolon helvum* has been reported before from Brazzaville (Malbrant & Maclatchy, 1949; Brosset, 1966a; Aellen & Brosset, 1968), and from Ewo and the Stanley Pool region (Malbrant & Maclatchy, 1949).

The present specimens offer practically no exception to the general rule of morphological uniformity within African mainland *Eidolon*. The sixth palatal ridge in specimen ZMA 15.530 is not serrated as is usual, but smooth.

At the time of visiting, 6-XII-1972 at noon, the *Eidolon* colony at Dinguembo consisted of thousands of individuals roosting in palm trees up to about 10 m in height in a small patch of ombrophil forest frequented by bat hunters. Specimen ZMA 15.529 was actually found dead on the forest floor, shot and overlooked by a hunter. The previous evening at about 18.30 p.m. I had seen large flocks

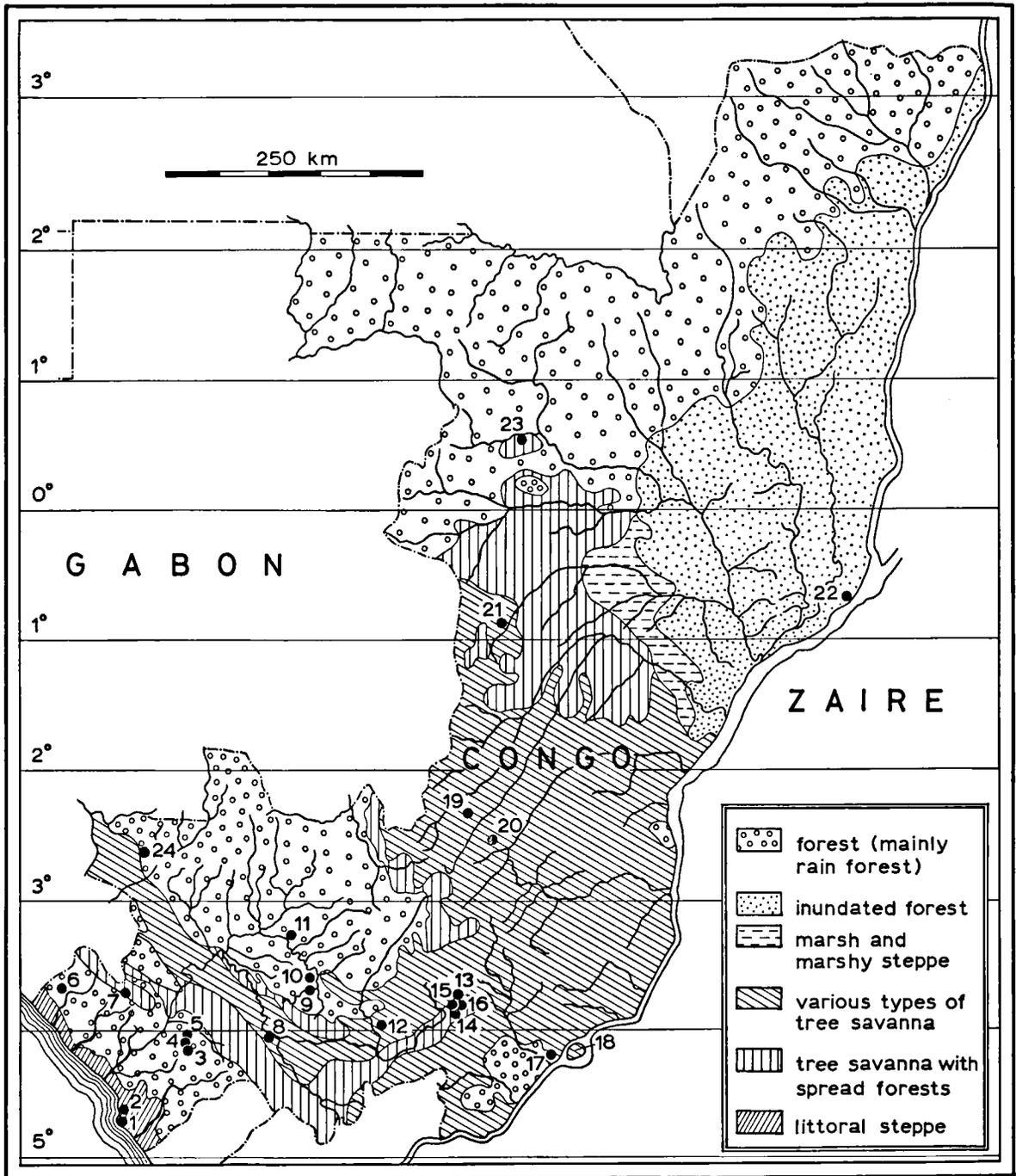


Fig. 1. Vegetation map of the People's Republic of Congo (based on a map in use at the Laboratoire de Zoologie of the University of Brazzaville in 1972) showing also the localities mentioned in the text. The Bangou Massif region centres around localities 13-16. Plateau Konkouya is a small area (diameter about 20 km) just west of Lekana. The Pool Region borders the river Congo at the level of Stanley Pool, i.e. the widening of the river just northeast of Brazzaville.

- |                 |                             |                         |              |
|-----------------|-----------------------------|-------------------------|--------------|
| 1. Pointe Noire | 7. Dinguembo                | 13. Mountembessa        | 19. Lekana   |
| 2. Loandjili    | 8. Loudima                  | 14. Mpoka               | 20. Djambala |
| 3. Dimonika     | 9. Grand Bois               | 15. Matouridi           | 21. Ewo      |
| 4. Bouloungi    | 10. Sibiti                  | 16. Meya Nzouari & Meya | 22. Liranga  |
| 5. Makaba       | 11. Komono                  | 17. Brazzaville         | 23. Odzala   |
| 6. N'Gongo      | 12. Mouyondzi & Kila N'Tari | 18. Ile M'Bamou         | 24. Divenié  |

TABLE I

Measurements of *Eidolon helvum helvum* (Kerr) from Dinguembo, *Rousettus aegyptiacus unicolor* (Gray) from Dimonika, and *Lissonycteris angolensis angolensis* (Bocage) from Pointe Noire (ZMA) and Kila N'Tari (MNHN), People's Republic of Congo. Body measurements of ZMA specimens measured in the field.

Species	<i>Eidolon helvum helvum</i>			<i>Rousettus aegyptiacus unicolor</i>			<i>Lissonycteris a. angolensis</i>		
	♂	♀	♀	♂	♂	♀	♂	♂	♀
Specimen	ZMA 15.531	ZMA 15.530	ZMA 15.529	MNHN CG 1975-801	UBRA 7-♂-72- 03-13	MNHN CG 1975-802	ZMA 15.536	ZMA 15.537	MNHN CG 1975-793
Head and body length	185	185	175	175		165	107	107	
External tail length	?	14	12	12.5		18		9	9.5
Ear length	24.9	28.8	29.9	20		19	22.7	24.8	19.8
Forearm length	122.8	126.5	123	97.8	93.9	93.9	72.0	76.7	77.8
Third metacarpal length						61.5			54
Fifth metacarpal length				62		57			50.5
Tibia length	52.8	54.0	53.9	45		41	32.4	33.1	32.5
Foot length (c. u.)				26		23			20.5
Greatest skull length	56.6	56.0	53.7	44.1	44.2	43.8	40.6	42.0	41.7
Condylbasal length	54.2	54.3	52.5	42.6	42.8	42.3	38.5	41.0	39.8
Rostrum length	21.9	21.1	20.6	16.3	16.5	16.3	15.9	16.0	15.0
Palatal length	31.1	31.3	29.2	23.3	24.5	24.3	23.5		23.0
Cranium width	20.3	21.4	20.5	17.9	17.7	17.0	15.9	15.2	16.0
Interorbital width	8.6	8.8	9.0	8.2	8.7	7.8	6.8	7.4	6.6
Postorbital width	9.9	10.4	10.0	9.5	8.4	9.2	7.9	8.6	9.3
Zygomatic width	34.7	33.0	31.8	25.5	27.9	25.7	24.0	23.8	
Mandible length	44.5	44.9	43.3	34.5	35.0	34.6	32.0	32.7	31.9
C <sup>1</sup> -C <sup>1</sup> exteriorly		9.4	9.6	9.0		9.1	7.8	7.7	7.6
C <sup>1</sup> -M <sup>2</sup>		20.6	20.9	17.1	16.8	17.0	15.3	16.1	15.3
M <sup>2</sup> -M <sup>2</sup> exteriorly		16.6	17.2	13.3	13.6	13.3	12.0	12.7	12.6
C <sub>1</sub> -M <sub>3</sub>		23.6	23.2	18.6	18.8	18.9	16.6	17.7	17.2

of *Eidolon* flying at altitudes of 100 to 200 m approximately, near the very nearby village of Moukitsa. They were heading northeastward and presumably belonged to the same colony.

Both females from Dinguembo were pregnant. The embryos measured 22 and 30 mm in situ. This could indicate a seasonal reproduction cycle as in the colony at Kampala, Uganda, studied by Mutere (1967), where pregnancies occurred from October to February and March, and matings took place from April to June. The two countries do have a rather similar annual rain distribution (to which the breeding cycle in Kampala is related). However, the male from Dinguembo had active testes (length 14 mm) which is incompatible with

this cycle, because in Kampala the testes weight is at an absolute minimum in November.

## 2. *Rousettus aegyptiacus unicolor* (Gray, 1870)

Material. — Dimonika: 1 adult ♀, A./S., 22-I-1964, D. & V. (MNHN 1975-802); 1 adult ♀, F., 14-III-1972 (UBRA); 1 adult ♂, A./S., 17-I-1964, D. & V. (MNHN 1975-801); 1 juv. ♂, skull, 8-III-1970 (UBRA); 1 juv. and 3 adult ♂ ♂, 2 S./S., 2 A., 13-III-1972 (UBRA); 1 juv., F., 14-III-1972 (UBRA). Grand Bois: 1 ♀, F., 25-V-1972 (UBRA). Kila N'Tari, cave: 1 adult ♂, A./S., 25-V-1960, coll. R. Taufflieb (MNHN CG 1975-794); 2 adult ♂ ♂ and 4 juvs., A., II-1963 (LER 214). Makaba: 2 juvs., F., 12-III-1970 (UBRA). Meya: 1 juv., F., 19-V-1972 (UBRA). Locality unknown: 1 adult ♀, F. (UBRA); 1 specimen, F., 13-III-1972 (UBRA).

Measurements. — Tables I and II. See also below.

Remarks. —

*Rousettus aegyptiacus* was already known from Meya Nzouari (Taufflieb, 1962), from Brazzaville, Dimonika and Sibiti (Brosset, 1966a), from Loudima (Allen & Brosset, 1968), and from 15 caves, besides Meya Nzouari, in the Bangou Massif region, the region of Loudima, Kila N'Tari, and the region of Divenié (Adam & Le Pont, 1974).

Allen & Brosset suggested that specimens from the Republic would represent the subspecies *unicolor* (Gray). This placement seems logical, as the type-specimen of *unicolor* came from Gabon and the distribution areas of other subspecies are geographically remote.

Eisentraut, in his revision of the infraspecific taxonomy of *Rousettus aegyptiacus* (1960), recognized three subspecies in Africa: *aegyptiacus* (Geoffroy Saint-Hilaire, 1810), *leachi* (Smith, 1829) and *occidentalis* Eisentraut, 1960; the latter should be considered a synonym of *unicolor* (see Koopman, 1966) as will be discussed later. A fourth subspecies, *arabicus* Anderson & De Winton, 1902, has been recorded from Harar, eastern Ethiopia (Hayman & Hill, 1971) but does not need to be discussed here. *R. ae. aegyptiacus* is found in Egypt and northern Ethiopia and probably northern Sudan (Koopman, 1975); *leachi* is known from southern Sudan, Uganda, Kenya, Tanzania, Zaire, Zambia, Malawi, Mozambique and South Africa; *unicolor/occidentalis* occurs from Senegal to Cameroon, and from here southward to Angola.

It is not known whether these subspecies meet, but from our present knowledge this does not seem very likely. Kock (1969) did not collect *Rousettus* in Sudan, where *leachi* occurs in the extreme south and *aegyptiacus* probably in the north since it also occurs in northern Ethiopia (Koopman, 1975). The subspecies *unicolor/occidentalis* and *leachi* appear to be separated by a large north-south belt from where no specimens of *R. aegyptiacus* have been recorded yet: Chad and the Central African Empire (Viellard, 1974), Zaire between 16° and 26°E (Hayman et al., 1966; Allen, 1966), Angola east of 16°E (Hill & Carter, 1941), Zambia west of 27°E (Ansell, 1969), Namibia (Shortridge, 1934; Roer, 1975), Botswana (Smithers,

1971), Rhodesia west of 32°E (Harrison, 1959), and South Africa except for a rather narrow zone along its southern and eastern coasts (Roberts, 1951; Ellerman et al., 1953).

Hayman et al. (1966) provisionally assigned all their Zaire specimens to *leachi* and suggested that typical *aegyptiacus* might also be found in Zaire. With the forementioned distribution of *leachi* in mind I have little doubt that all their specimens from eastern Zaire represent this race, and certainly not *aegyptiacus*, but their samples from Thysville and Tamba Tamba in Lower Congo most probably belong to *unicolor/occidentalis* and not to *leachi*.

Eisentraut (1960) based his new subspecies *occidentalis* on 83 specimens from the Mount Cameroon region, 9 from Senegal, Guinea and Ivory Coast, 1 from Sangmelima, south Cameroon, and 4 from Lastoursville, Gabon. The holotype came from Mueli, on the north side of Mount Cameroon (MAKB 59.450). Koopman (1966) synonymized *occidentalis* with *Eleutherura unicolor* Gray, 1870, from "Gaboon". Later he had an opportunity to study the holotype specimen of *unicolor*, an adult female (BMNH 62.8.26.1) and found that its skull shows good agreement with and falls within the variability of four male skulls from Sierra Leone, Ghana and Angola, being the only available "West African" skulls in the British Museum (Koopman, in litt., 25-VIII-1972). I agree with Koopman that specimens from Angola and Gabon should be identified as *unicolor*, and specimens from the People's Republic of Congo likewise, but it is not true that they agree completely with specimens from the Mount Cameroon region and farther west. As Eisentraut (1960) remarked, his specimens from Sangmelima and Lastoursville possess larger body, skull and cheek teeth measurements than typical *occidentalis*. His theory about a possible increase in measurements from the Mount Cameroon region towards Angola is confirmed by the present specimens. The forearm lengths in nine adult specimens run from 93.9 to 106.3 (mean 98.7). The greatest skull lengths in three specimens are 43.8, 44.1 and 44.2. For other measurements see tables I and II. As the variation seems clinal and the differences modest, I do not think that a taxonomic distinction, which then would be between *unicolor* (southern Cameroon,

TABLE II

Cheek teeth measurements of *Rousettus aegyptiacus unicolor* (Gray) and *Lissonycteris angolensis angolensis* (Bocage) from the People's Republic of Congo: length X width, measured over the cingula.

Species	<i>Rousettus aegyptiacus unicolor</i>						<i>Lissonycteris angolensis angolensis</i>		
	♂	♂	♂	♂	♂	♀	♂	♂	♀
Specimen	MNHN CG 1975-794	MNHN CG 1975-801	UBRA 1-d-8-03-70	UBRA 3-d-72-03-13	UBRA 7-d-72-03-13	MNHN CG 1975-802	ZMA 15.536	ZMA 15.537	MNHN CG 1975-793
Locality	Kila N'Tari	Dimonika	Dimonika	Dimonika	Dimonika	Dimonika	Pointe Noire	Pointe Noire	Kila N'Tari
P <sup>1</sup>			0.8 x0.9	0.8 x0.8	0.8 x0.7				
P <sup>3</sup>	3.1 x1.85	2.85x1.7	2.6 x1.7	2.4 x1.7	2.5 x1.6	2.85x1.75	2.25x1.8	2.2 x1.9	2.5 x1.85
P <sup>4</sup>	3.3 x2.2	3.2 x2.1	3.0 x2.1	2.9 x2.0	2.9 x2.0	3.1 x2.1	2.5 x2.0	2.6 x2.2	2.7 x2.2
M <sup>1</sup>	3.3 x2.1	3.0 x2.0	2.9 x2.1	2.8 x1.8	2.7 x2.0	3.0 x1.9	2.25x1.85	2.4 x2.1	2.5 x1.85
M <sup>2</sup>		2.25x1.6		2.1 x1.5	2.0 x1.5	2.0 x1.6	1.8 x1.5	2.15x1.8	1.85x1.7
P <sub>1</sub>			1.4 x1.6	1.7 x1.4	1.5 x1.2				
P <sub>3</sub>	2.9 x1.75	2.5 x1.6	2.5 x1.7	2.4 x1.6	2.4 x1.5	2.7 x1.6	2.1 x1.5	2.2 x1.6	2.5 x1.85
P <sub>4</sub>	3.1 x1.9	2.7 x1.85	2.6 x1.8	2.5 x1.8	2.5 x1.7	2.7 x1.9	2.8 x1.8	3.0 x1.9	3.2 x1.85
M <sub>1</sub>	3.25x1.85	3.0 x1.7	2.6 x1.6	2.4 x1.6	2.6 x1.6	2.85x1.7	2.5 x1.7	2.5 x1.8	3.1 x1.9
M <sub>2</sub>	2.6 x1.7	2.4 x1.7	2.4 x1.6	2.2 x1.5	2.5 x1.6	2.7 x1.6	2.1 x1.6	2.2 x1.7	2.25x1.85
M <sub>3</sub>		2.0 x1.2		1.7 x1.2	1.6 x1.2	2.0 x1.25	1.3 x1.2	1.6 x1.3	1.5 x1.4

Gabon, People's Republic of Congo, western Zaire and Angola) and *occidentalis* (from Senegal to Mount Cameroon), should be made.

The specimens examined provided no additional information on the reproduction of this species in the Republic. Brosset (1966a) mentioned a female from Brazzaville with a large embryo in November. Likewise in the south of the Republic, Adam & Le Pont (1974) captured pregnant females on 8/10 and 28 December, and lactating females on 28 December and in February and March. They observed births in captivity (in the Republic, under climatologically natural conditions) in August-November and in December. At Kasokero (0°22'S 32°E), Uganda, *Rousettus aegyptiacus* gives birth twice a year, in March and in September, before the onset of the rainfall peaks (Mutere, 1968).

### 3. *Lissonycteris angolensis angolensis* (Bocage, 1898)

Material. — Kila N'Tari, cave: 1 adult ♀, A./S., 25-V-1960, coll. R. Taufflieb (MNHN 1975-793). Mountembessa, cave I: 3 adult ♀♀, 1 juv., A., IX-1969 (LER). Mpoka, cave II: 1 adult ♀, skull, 17-I-1968 (LER); 1 adult ♀, A., (LER 10 G). N'Gongo: 2 juvs., F., 1-III-1970 (UBRA). Pointe Noire: 2 adult ♂♂, S./S., 14-XII-1972 (ZMA 15.536-7). Sibiti, cave: 1 juv., A., 1-VI-1969 (LER). Locality unknown:

1 adult ♂ (probably Mpoka, cave II), A. (LER 9 G); 1 juv. (probably Mpoka, cave II), A. (LER); 1 juv., A. (LER 741).

Measurements. — Tables I and II. See also below.

Remarks. —

*Lissonycteris angolensis angolensis* was first recorded from the Republic by Aellen & Brosset (1968) from caves at Matouridi and Mpoka, and Adam & Le Pont (1974) mentioned still 15 other caves in the same Bangou Massif region where the species occurs.

I agree with Novick (1958), Lawrence & Novick (1963), Rosevear (1965), Brosset (1966a), Aellen & Brosset (1968), De Vree (1971) and Anceaux de Faveaux (1972: 232) that *Lissonycteris* is different from *Rousettus* on a generic level.

In the present material, the three adult males have forearm lengths of 72.0, 76.7 and 81.3, and the six adult females of 76.2, 77.6, 77.8, 78.2, 78.7 and 78.7. Greatest skull lengths (and zygomatic widths) are 40.6 (24.0) and 42.0 (23.8) in two adult males, and 39.8 (23.8), 40.9 (—), and 41.7 (—) in three adult females. The only difference with the diagnosis of the typical subspecies in the revision by Eisentraut (1965) is that the cheek teeth of the three specimens in which these could be measured (table II) tend to connect



Fig. 2. View of the narrow zone of palm trees ("palmes roniers") and shrubs bordering the beach just south of the C.P.C. Wharf, Pointe Noire. Collecting site of *Lissonycteris angolensis angolensis*, *Micropteropus grandis* and *Micropteropus pusillus*. After a colour slide by the author.

the size ranges of this subspecies and of *ruwenzorii* Eisentraut, 1965.

The Pointe Noire specimens roosted by day under the packs of dead leaves hanging down from the stems of palm trees in a small fringe of trees and shrubs along the beach (fig. 2), just south of the C.P.C. Wharf. I have not been able to identify these palms which in French were called "palmes roniers" (*Borassus* sp.).

The dorsal fur in one of these two specimens (ZMA 15.536) is rather reddish brown, in the other more greyish brown. The local people hunted *Lissonycteris* for food (as well as *Nycteris grandis* Peters, 1871, of which I captured a few some 5 km south of Pointe Noire: ZMA 15.651-7).

The LER specimen from Sibiti is a newborn one. It was collected on the 1st of June and has a forearm length of 31.0. The two males from Pointe Noire caught on 14 December had testes of  $5.0 \times 4.7$  (ZMA 15.536) and  $5.4 \times 4.4$  (ZMA

15.537). The testes of the latter specimen had weak veins running over their surface.

It appears that Adam & Le Pont (1974) found large embryos or still-born young from May till September ("en mai-septembre") and in November, and suckling young carried by their mothers in January-February and in June. They concluded that reproduction in *Lissonycteris angolensis* might be either continuous or biannual, in April-May-June and in October-November. It is unfortunate that they did not produce more exact data (dates and measurements of embryos and juveniles). From literature data on *L. angolensis* at other localities at southern latitudes Anciaux de Faveaux (1972: 231) concluded an austral reproduction cycle in the sense of Brosset (1966c).

#### 4. *Myonycteris torquata* (Dobson, 1878)

Material. — Brazzaville: 1 adult ♂, A/S., 28-XI-1963, D. & V. 556 (MNHN). Dimonika: 5 adult ♀♀ and 3 juvs., S/S.,

8/10-III- and 14-VI-1970 (UBRA 2/3-♀-70-03-08, 2/3/6-♀-70-03-09, 3-♂-70-03-10, and 1-♂- and 3-♀-70-06-14); 2 adult ♀ and 2 juvs., F., 10/13-III-1972 (UBRA). Makaba: 2 juvs., F., 12-III-1972 (UBRA). Odzala: 1 juv. ♀, A./S., 1-XI-1963, D. & V. (MNHN). Pointe Noire: 1 adult ♂, S./S., 28-XI-1972 (ZMA 15.423). Sibiti: 1 adult ♀, A./S., 25-XI-1963, D. & V. (MNHN). Locality unknown: 1 juv., F., 13-III-1972 (UBRA; most probably from Dimonika or Makaba).

Measurements. — Forearm lengths in two adult males are 55.8 and 62.0, and in eight adult females 58.3-65.6 (mean 60.9); greatest skull lengths in two adult males are 30.9 and 32.4, in four adult females 31.4-32.0.

#### Remarks. —

The specimens from Brazzaville and Sibiti were mentioned and discussed by Brosset (1966a). All specimens listed above served for a revision of the genus *Myonycteris* (see Bergmans, 1976), in which only one species on the African mainland was recognized and, in spite of some geographical variation, no subspecies. In adult specimens from the Republic forearm lengths from 55 to 66, and greatest skull lengths from 30 to 33.5 may be expected.

For an account of the known data on ecology and biology of this species the reader is referred to Bergmans (1976).

The few data existing on reproduction of *Myonycteris* in the Republic — the female from Sibiti, caught 25-XI, had a large foetus and the male from Pointe Noire, caught 28-XI, had rather large but not active testes — would be in agreement with the September to May reproduction cycle as concluded for the species from Cameroon to Congo by Anciaux de Faveaux (1972: 235), with copulation around September and birth in December/January.

#### 5. *Hypsignathus monstrosus* Allen, 1861

Material. — Odzala: 1 adult ♀ and 1 adult ♂, A./S., 30-X-1963 and X-1963 respectively, D. & V. (MNHN CG 1975-803/4). Locality unknown: 1 adult ♀, A., coll. J. P. Adam no. 147 (MNHN 1975-805).

Measurements. — Table III.

#### Remarks. —

Dybowski (1893: 132) observed great numbers of fruit bats, with a wing spread of nearly 80 cm,

picking ripe figs from a tree during flight, near Liranga. During the day these bats roosted together in a large tree. He does not mention the name of the bats but his illustration (: 133, fig. 44) clearly depicts *Hypsignathus monstrosus*. In this drawing 22 specimens hang solitarily from the branches of a tree and one is climbing along a branch in a fashion known from *Eidolon* but, as far as I know, not from *Hypsignathus*. Malbrant & Maclatchy (1949) appear to have observed *Hypsignathus monstrosus* near the mouth of the Ubangi River. The Odzala specimens are those recorded by Brosset (1966a).

It is generally assumed that morphologically *Hypsignathus monstrosus* is quite uniform throughout its known distribution area (West- and Central-African forests and isolated forests in southern Ethiopia, Uganda, eastern Kenya, northern Zambia and Angola).

#### 6. *Epomops franqueti franqueti* (Tomes, 1860)

Material. — Brazzaville: 1 juv. ♂, 3 adult ♀♀, A./S., 7-XI-1963, D. & V. 138, 147, 149, 154 (MNHN); 1 adult ♀, 1 juv. ♀, A./S., 13-XI-1963, D. & V. 182-3 (MNHN); 1 adult ♀, 1 subadult ♀, A./S., XII-1963, D. & V. 987-8 (MNHN); 1 juv., F., XII-1965 (UBRA); 1 adult ♂, A., 17-X-1966 (LER W880/199); 2 adult and 3 juv. ♀♀, 4 A./S., 1 S./S., 23/28-XII-1972 (ZMA 15.643-7). Dimonika: 1 adult ♀, skull, 8-III-1970 (UBRA 2-♀-8-03-70); 3 juv. ♂♂, S./S., 11-III-1970 (UBRA 1-♂-70-03-11 and 2/3-♂-11-03-70); 1 adult ♂, skin and 1 ♀, S./S., 14-III-1970 (UBRA 1-♀- and 2-♂-70-03-14); 1 adult ♀, 2 ♀♀, 1 juv. ♂, S./S., 13-III-1972 (UBRA 4-♀-, 6-♂-, 10-♀- and 11-♂-72-03-13); 2 adult ♀♀, F., 29-V-1972 (UBRA). Grand Bois: 1 specimen, F., 25-V-1972 (UBRA). Ile M'Bamou: 1 ♀, S./S., 15-XII-1970 (UBRA 1-♀-15-12-70); 1 adult ♀, F., 25-III-1972 (UBRA). Makaba: 1 adult ♀, F., 14-III-1972 (UBRA). Meya: 1 adult ♀, F., 19-V-1972 (UBRA). N'Gongo: 1 ♀, 1-III-1970 (UBRA). Odzala: 1 adult ♀, A., 1-XI-1963, D. & V. 104 (MNHN). Pointe Noire: 1 adult ♂, A., 29-VI-1963, coll. R. Taufflieb (LER 205); 1 ♀, S./S., 4-III-1970 (UBRA 1-♀-4-03-70); 1 adult ♂, 1 adult ♀, S./S., 2/3- and 7-XI-1972 (ZMA 15.641-2). Sibiti: 1 juv. ♀, S./S., 17-XI-1963, D. & V. 201 (MNHN); 1 adult and 2 subadult ♂♂, A./S., 20/26-XI-1963, D. & V. 278, 370, 435 (MNHN). Locality unknown: 1 ♂, F., (UBRA); 1 juv., A. (LER).

Measurements. — Table III.

#### Remarks. —

*Epomops franqueti franqueti* has been recorded before from Brazzaville by Malbrant & Maclatchy

TABLE III

Measurements of *Hypsignathus monstrosus* Allen and *Epomops franqueti franqueti* (Tomes) from the People's Republic of Congo.

Species	<i>Hypsignathus monstrosus</i>			<i>Epomops franqueti franqueti</i>						
	♂	♀	♀	♂♂			♀♀			
Sex										
Locality	Odzala	Odzala	? Brazzaville							
Specimen	MHNN CG 1975-804	MHNN CG 1975-803	MHNN CG 1975-805	n	mean	min.-max.	n	mean	min.-max.	
Head and body length	245	225	195	1	155		3	118	115	-123
External tail length	0	0	0	1	0		2		0	- 0
Ear length	31.8	27.3	27.3	1	26.7		2		25.3-	26.2
Forearm length	128.3	117.7	117.5	5	92.8	86.2-97.4	15	89.3	85.7-	93.7
Third metacarpal length	88	79.5	73.5							
Fifth metacarpal length	86.5	77	72.5							
Tibia length	55	49	43						35.3-	35.5
Foot length (c.u.)	33.5	30	29.5							
Greatest skull length	67.9	59.8		2	49.0-51.4		10	46.0	43.3-	49.3
Condylobasal length	67.4	59.2		2	48.0-50.7		9	45.2	42.7-	48.4
Rostrum length	33.0	27.1		2	20.0-20.9		9	17.9	17.3-	19.8
Palatal length	39.6	34.1		2	27.1-28.6		10	25.5	23.9-	27.0
Cranium width	22.7	21.0		2	18.0-19.0		10	17.1	16.5-	18.3
Interorbital width	12.5	12.0		2	7.9- 8.0		10	7.1	6.6-	7.6
Postorbital width	12.0	11.5		2	9.4-10.4		10	9.0	8.1-	10.5
Zygomatic width	34.9			2	28.7-29.0		8	26.4	25.4-	27.1
Mandible length	54.4	47.4		2	39.1-40.1		10	36.1	34.0-	38.8
C <sup>1</sup> -C <sup>1</sup> exteriorly	14.0	12.9		1	9.4		3	9.1	8.7-	9.4
C <sup>1</sup> -M <sup>1</sup>	22.5	19.9		2	16.1-16.7		10	15.1	14.4-	16.0
M <sup>1</sup> -M <sup>1</sup> exteriorly	20.9	18.6		2	14.2-15.4		10	13.9	12.8-	14.7
C <sub>1</sub> -M <sub>2</sub>	23.2	24.6		2	17.9-19.0		10	16.9	16.2-	18.0
M <sup>1</sup> length				5	3.3	3.0- 3.5	12	3.16	2.8-	3.4

(1949), from Brazzaville, Dimonika and Sibiti by Brosset (1966a) and from Brazzaville and Pointe Noire by Aellen & Brosset (1968). An additional locality is Komono where R. Malbrant collected a female in June 1942 (AMNH 120321; not examined by the present author).

The forearm lengths in 5 males are 86.2-97.4 (mean 92.8) and in 15 females 85.7-93.7 (mean 89.3). The greatest skull lengths are 49.0 and 51.4 in 2 males and 43.3-49.3 (mean 46.0) in 10 females. The Republic specimens thus clearly belong to the nominate race as described in Andersen (1912), but their average measurements (table III) are only little larger than in the specimens from the Mount Cameroon region found to inter-

mediate between the two named subspecies by Eisentraut (1963). The hypothesis of a clinal size variation with smaller specimens in western and larger ones in central Africa, as suggested by the latter author, receives some support from this.

In the 19 specimens in which this could be checked, the third palatal ridge was not divided in the middle.

The ZMA Pointe Noire specimens were caught near mango trees in a house garden in the town. The ZMA Brazzaville specimens were taken inside the forested but urban O.R.S.T.O.M. compound. One of these specimens was netted between 00 and 01 a.m., another one between 01.30 and 05.30

a.m., and the remaining five between 23 p.m. and 06 a.m.

An adult male with probably active testes ( $6.5 \times 4.5$ ) was caught 2/3-XI at Pointe Noire (ZMA 15.641). A lactating female with an embryo with a total length in situ of 35.5 was taken 23-XII at Brazzaville (ZMA 15.645); females with developed nipples in the material listed above were taken in March, May, November and December.

Brosset (1966a), who examined at least part of the same material from the Republic but also other specimens, records a pregnant female from Sibiti on 23-XI and lactation in females from Brazzaville in November and December. At Mount Cameroon Eisentraut (1963) caught pregnant or lactating females early in February and found initial stages of embryos in March, from which he concluded a possibly well-defined seasonal reproduction. Anciaux de Faveaux (1972: 217), who compiled all literature data on reproduction, suggested a continuous polyestrous reproduction. However, Okia (1974b), working at Entebbe, Uganda, found two breeding cycles, one from April to early September and one from late September to late February, with births taking place at the ends of these periods — which is at the beginning of the rainy seasons — and mating shortly afterwards. Young bats are probably not weaned until a few weeks before the occurring of new births (Okia, 1974b), and when this is not realized the inherent almost continuous lactation of adult females may confuse attempts to establish the seasonal character of reproduction. I would rather not use the term “continuous polyestrous” for this clearly seasonal and “only” bi-annual reproduction.

In the Republic juvenile females (forearm lengths: 75.2 and 77.6) and a juvenile male (79.9) were caught 7/17-XI, and subadult males (91.8 and 95.4; no epaulettes) 23/26-XI, and subadult females (80.6, 86.6, and 87.0) 23/27-XII. From these data on growth and the data on reproductive phases cited above it may be inferred that in the Republic reproduction in *Epomops franqueti* is probably not much different from that found for the Uganda population by Okia (1974b). This ties in with the fairly similar yearly rain distribution pattern in both countries.

## 7. *Epomophorus* cf. *labiatus* (Temminck, 1837)

Material. — Pointe Noire: 1 young adult ♀, S./S. in A., 29-XI-1972 (ZMA 15.667).

Measurements. — Table IV.

Remarks. —

A female *Epomophorus* of the *gambianus*-group with a forearm length of 69.1 and a greatest skull length of 40.3 would, at least according to Hayman et al. (1966) and Hayman & Hill (1971), be identified as *E. anurus* Heuglin, 1864. In recent publications dealing with the relation between *labiatus* and *anurus* the latter is tentatively considered a synonym (Kock, 1969; Koopman, 1975) or a subspecies (Largen et al., 1974) of the former. As long as neither the type-specimens nor series from the type-localities have been compared, I prefer to maintain at least subspecific ranks for both. The present specimen is then provisionally assigned to *labiatus*, as its skull morphology and teeth dimensions agree rather with accounts of this taxon than with those of *anurus*. Dr. J. E. Hill of the British Museum (Natural History), who examined the Pointe Noire specimen, is also of this opinion (in lit., 24-IV-1975). He further comments: “There seems good evidence in our collections to suggest that *anurus* and *labiatus* are subspecifically distinct, but this introduces a curious distributional pattern, with *labiatus* in Sennaar and in eastern Ethiopia, in Congo (Brazzaville) much further south, and in Tanzania; meanwhile *anurus* is found in the southern Sudan, in southern and western Ethiopia, in Kenya, Uganda and the eastern Congo, and in west Africa.”

If the Pointe Noire specimen is rightly identified as *labiatus* this would be the first record of this species from the Republic. The nearest collecting locality of *labiatus* seems to be Mulongo, Zaire ( $7^{\circ}50'S$   $26^{\circ}58'E$ ) (Gallagher & Harrison, 1977) and the present record would extend its known range about 1700 km westward.

There are some slight differences between the Pointe Noire specimen and *labiatus* from Sudan. Most cheek teeth but especially the molars are essentially shorter than in the lectotype from Sennar (RMNH; Jentink, 1887: 251, specimen b), which has been examined in this connection. Table

IV gives teeth measurements of both specimens. However, all teeth lengths except of  $M_2$  match the lower values measured in ten females from Sudan referred to *labiatus* by Kock (1969). The rostrum of ZMA 15.667 appears to be rather wide. It measures 8.0 over  $C^1-C^1$  and 11.9 over  $M^1-M^1$ , against ranges of 6.7-8.0 (mean 7.3) and 10.4-11.5 (mean 10.9) respectively, in the ten females

TABLE IV

Measurements of *Epomophorus* cf. *labiatus* (Temminck) and *Epomophorus wahlbergi haldemani* (Halowell) from Pointe Noire, People's Republic of Congo, and teeth measurements of the lectotype of *Epomophorus labiatus* (Temminck) from Sennar, Sudan.

Species	<i>Epomophorus</i> cf. <i>labiatus</i>		<i>Epomophorus wahlbergi haldemani</i>				
	♀	♀	♂♂		♀♀		
Specimen	ZMA 15.667	lectotype RMNH	ZMA 15.541	ZMA 15.547	n	mean	min.-max.
Head and body length	93		134		4	106.5	104 - 110
External tail length	2		1		4	3.3	0 - 5.5
Ear length	20.5		22.3		4	22.9	22.8 - 23.1
Forearm length	69.1		81.9		5	80.4	78.5 - 82.5
Third metacarpal length	50.5						
Fifth metacarpal length	47						
Tibia length	30.5				2		34.1 - 34.5
Foot length (c. u.)	17.6						
Greatest skull length	40.3		48.9		5	46.3	46.0 - 46.7
Condylbasal length	39.6		48.9		5	46.2	45.7 - 46.7
Rostrum length	15.3		19.8		5	18.7	18.1 - 19.2
Palatal length	23.2		29.0		3	27.2	26.9 - 27.7
Cranium width	15.5		17.4		5	16.9	16.0 - 18.6
Interorbital width	6.9		7.9		5	7.9	7.6 - 8.6
Postorbital width	9.6		10.2		5	10.0	9.8 - 10.3
Zygomatic width	23.0		27.2		5	25.4	24.8 - 25.9
Mandible length	32.2		40.6		5	37.5	37.0 - 37.8
$C^1-C^1$ exteriorly	8.0		9.5		4	9.0	8.8 - 9.2
$C^1-M^1$	14.0		17.3		5	16.3	16.2 - 16.4
$M^1-M^1$ exteriorly	11.9		14.4		5	13.8	13.5 - 14.2
$C_1-M_2$	15.2		18.7		5	18.0	17.8 - 18.2
$P^3$ length	2.4	2.8	3.0	2.75	5	2.9	2.7 - 3.1
width	1.6	1.5	1.8	1.75	5	1.8	1.6 - 1.9
$P^4$ length	2.9	2.8	3.4	3.1	5	3.2	3.1 - 3.25
width	1.7	1.6	1.9	1.75	5	1.9	1.8 - 2.1
$M^1$ length	2.8	3.7	3.5	3.6	5	3.4	3.5 - 3.6
width	1.7	1.7	1.9	1.8	5	2.0	1.9 - 2.1
$P_3$ length	2.0	2.3	2.5	2.6	5	2.6	2.5 - 2.7
width	1.5	1.4	1.7	1.6	5	1.75	1.6 - 1.85
$P_4$ length	2.5	2.7	2.85	3.0	5	2.9	2.8 - 3.0
width	1.5	1.5	1.8	1.9	5	1.8	1.6 - 1.9
$M_1$ length	2.7	3.2	3.3	3.3	5	3.2	3.1 - 3.4
width	1.6	1.6	1.7	1.9	5	1.9	1.75- 2.0
$M_2$ length	1.6	2.3	2.1	2.1	5	2.15	2.0 - 2.2
width	1.4	1.6	1.7	1.7	5	1.65	1.6 - 1.7

from Sudan measured by Kock (1969), several of which have greater skulls than ZMA 15.667. In the Pointe Noire specimen the width over  $M^1-M^1$  is 51.3% of its palatal length. In six adult *labiatus* from Torit, Sudan ( $4^{\circ}27'N$   $32^{\circ}31'E$ ) which I could examine, the width over  $M^1-M^1$  varied from 41.3-44.2% of the palatal length (26.2, 27.8 and 28.1) in three females, and from 41.8-44.5% of this length (28.3, 29.3 and 29.7) in three males (FMNH 66548-51, -53, -55).

The soft palate of ZMA 15.667 had initially been dried together with the skull, but has later been softened in water and, after the ridges had resumed as much of their original volume as possible, fixated in a 5% solution of formalin. It appears as if the second, third and fourth ridges each consist of rather pronounced right and left halves which are only weakly interconnected in the middle (fig. 3).

#### 8. *Epomophorus wahlbergi haldemani* (Hallowell, 1846)

Material. — Pointe Noire: 1 adult ♀, S./S., 4-III-1970 (UBRA 2-♀-4-03-70); 2 juv. ♂♂, A./S., 6- and 19-XI-1972 (ZMA 15.549, 15.666); 1 adult ♂, S./S., 20-XI-1972 (ZMA 15.541); 3 adult ♀♀, S./S., 21/22-, 28- and 30-XI-1972 (ZMA 15.542-4); 1 juv. ♀, A., 30-XI-1972 (ZMA 15.550); 1 adult ♀ and 1 subadult ♀, A./S., 13-XII-1972 (ZMA 15.545-6); 1 subadult ♂, A./S., 14-XII-1972 (ZMA 15.547).

Measurements. — Table IV.

#### Remarks. —

Malbrant & Maclatchy (1949) already recorded this species from Pointe Noire, but it seems not to have been collected or observed elsewhere in the Republic. In Zaire its distribution appears equally sparse, being confined to Lower Congo, western Kasai and Katanga in the south, the Rutshuru area in the east, and the western Uelle region in the north (Hayman et al., 1966). In Gabon it occurs at Cap Lopez, Port Gentil, Mouïla (Allen et al., 1917; Malbrant & Maclatchy, 1949) and Omboué (USNM 220898). Mouïla is in a savanna offshoot at about 150 km from the coast, the other localities are coastal. As yet, *E. wahlbergi* has not been found further eastward in Gabon (Brosset, 1966b). Jones (1971) did not collect it in Rio Muni. Aellen

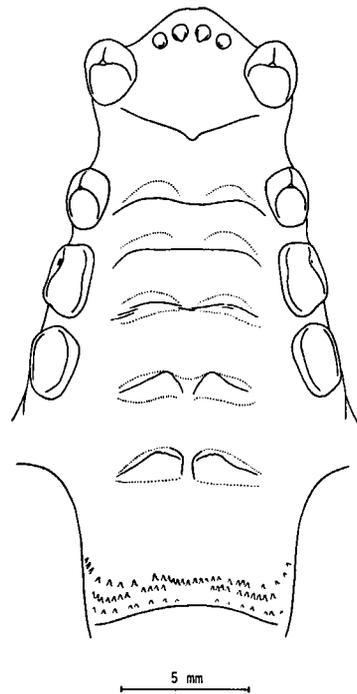


Fig. 3. Palatal ridge pattern of *Epomophorus* cf. *labiatus* (Temminck) collected at Pointe Noire (ZMA 15.667). The palate has first been dried and later re-softened in water.

(1952) found only one published record for Cameroon: the Wouri estuary. The species is not known from the Central African Empire (Viel-liard, 1974), Sudan (Kock, 1969; Koopman, 1975) and Ethiopia (Largen et al., 1974).

Its distribution seems therefore essentially restricted to woodland savanna regions in northeast Zaire, east of the Western Rift and south of the Central-African high forest region. From these regions it may penetrate by way of woodland savanna incursions into the forest zone. This is probably the explanation for its occurrence in Gabon and in the Republic, where all known collecting sites are in or at stretches of woodland savanna cutting through the forest from the south. Its alleged occurrence in southwest Cameroon (Aellen, 1952) needs re-investigation. If proved correct, its occurrence there should probably be explained according to the hypothesis here presented. As coastal Cameroon has most probably been covered with forest during at least the last 70.000 years (Moreau, 1966), and possibly at least partly very much longer (see for some botanical references Gartlan, 1975), *Epomophorus wahl-*

*bergi* could only be a fairly recent immigrant of cleared forest areas. Populations from western central Africa (e.g. Gabon and the Republic) are probably not at all in contact with the ones in northeast Zaire.

The subspecies *baldemani* differs from the typical race in being smaller, which is most apparent in the male skulls (Andersen, 1912: 522). The present specimens agree well with the measurements given for *baldemani*. As intermediates between *baldemani* and *wahlbergi* have been found in Kenya and on the islands of Zanzibar and Pemba it is possible that *baldemani* is a junior synonym of *wahlbergi* (see Hayman & Hill, 1971) and that the supposedly taxonomical differences express some clinal variation. In this respect the publication of measurements of series from a number of different localities through the species range is highly desirable.

The only fully adult male, taken on 20-XI, had well-veined testes of  $7.3 \times 5.0$  (formalin measurement). One female, taken on 21/22-XI, was lactating. Three others were pregnant; the total lengths of the embryos in situ were 21.8 (28-XI), 25.5 (30-XI) and 30.5 (13-XII), respectively. The latter was of a subadult female with fused but well visible skull base sutures. (In this context it is of interest to note that shoulder tufts in male epomophorine bats seem to develop only after the bats have attained their full-grown size. Thus, females are possibly ahead of males in reaching sexual maturity. Mutere (1968) found indications that in *Rousettus aegyptiacus* males might attain sexual maturity also later than females.)

Juveniles with forearms of 68.6 (♂), 66.4 (♀), 69.1 (?) and 67.0 (♂) were caught on 19-XI, 28-XI, 30-XI and 6-XII, respectively. A full-grown (pregnant) subadult female with a forearm length of 80.0 was taken on 13-XII, a subadult male with an equally long forearm and no epaulettes one day later.

All these data suggest a defined seasonal reproduction. In fact they resemble those for *Epomops franqueti* in the Republic (this paper), which would imply two cycles per year with births occurring around the end of February and the beginning of September. The above-mentioned

juveniles would then be from the first 1972 birth period, and the subadults from the second 1971 period. If so, the animals would be full-grown at the age of about 15 months, females would take part in the second reproduction cycle after their own birth, and males probably in the third.

Anciaux de Faveaux (1972: 214-215), adding up data from literature, concluded a biannual cycle with birth periods in March and in October or November, but nevertheless does not exclude the possibility of a continuous polyestrous reproduction. I would suggest that one and the same species of fruit bat may well demonstrate differently timed reproduction cycles in different parts of its distribution area, according to the local climatic regimes, and that in studies aiming at the unravelling of reproduction patterns, sets of data from regions with different climatic conditions should therefore be treated separately.

One specimen (ZMA 15.545) was lightly infested with unidentified parasites at the caudal margins of its wings (Acari; *Teinocoptes* sp.?).

## 9. *Micropteropus grandis* Sanborn, 1950

Material. — Pointe Noire: 1 young adult ♂, S./S., 20-XII-1972 (ZMA 15.535).

Measurements. — Table V.

Remarks. —

The Pointe Noire specimen is considered young adult because of its just budding epaulettes, its only slightly worn teeth and its closed but visible sutures between basioccipital and sphenoid and between sphenoid and vomer. In September 1977 I had an opportunity to compare it with the holotype of *Micropteropus grandis* preserved in Chicago (FMNH 66433) which it matched in nearly all respects. The small differences all seem ascribable either to normal infraspecific or geographic variation (the holotype being from Dundo, northeast Angola), or to the difference in age between the two specimens. The holotype is a somewhat older, adult female, to judge from its skull characters and teeth wear.

When compared to the holotype, the Pointe Noire specimen has a frontal which is slightly

more domed posteriorly, slenderer zygomatic arches (greatest width 1.9 against 2.6 in the holotype), a lower and more backwards oriented processus coronoideus, and generally slightly smaller teeth; its upper incisors are a little wider, and the distance  $I^1-I^1$  is about equal to  $I^1-I^2$  instead of somewhat longer as in the holotype; the distance  $P^3-P^4$  is relatively shorter,  $P^4$  is not rectangular as in the holotype but slightly diverging backwards;  $P_1$  is smaller,  $P_2$  and  $P_3$  are a little narrower, and  $M_1$  and  $M_2$  somewhat shorter. In number, position and morphology, its palatal ridges are similar to those in the holotype and in the only other known adult specimen of the species, the male specimen from Dundo described and figured by Hayman (1963; Dundo Museum no. 5007).

As Hayman (1954) observed, the holotype of *Micropteropus grandis* does have the epomophorine white tufts at the ear bases (contrary to what Sanborn claimed in 1950), and so do the Dundo specimen recorded by Hayman (1963: fig. 4) and the Pointe Noire specimen. The latter also shows the white shoulder tufts typical of epomophorine males, be it in a very early stage. This proves that the Dundo male examined by Hayman (1963), without "evident epaulette or glandular sac", was at least sexually subadult.

Colour and distribution of the fur in the Pointe Noire specimen do not distinguish it from other small epomophorines, except the aberrant *Plerotes anchietae* (Seabra, 1900).

The new specimen is the first record of this species from the People's Republic of Congo. The known distribution, which until now was restricted to Dundo, is extended over a distance of about 950 km, approximately towards the west-north-west. Eisentraut (1958) referred to two Tanzanian bats as possible representatives of *Micropteropus grandis*. I have examined these bats (UMB 3679 and 3682), and consider them to be allied with *Epomophorus minor* Dobson, 1880 and *E. labiatus*, respectively.

The Pointe Noire specimen was netted between 21 and 23 p.m. in a small stand of palm trees and lower shrubs behind the beach near the C.P.C. Wharf (fig. 2).

The holotype specimen carried a young one when caught. This juvenile male (FMNH 66434) has a forearm length of 45.8 and a head length of about 28.3. It has its full milk dentition, with no permanent teeth breaking through yet. The Pointe Noire male has testes of  $3.4 \times 2.6$  without surface veins.

#### 10. *Micropteropus pusillus* (Peters, 1867)

Material. — Bouloungi: 1, F., 8-III-1970 (UBRA); 2 adult ♀ and 1, F., 14-III-1970 (UBRA). Brazzaville: 1 adult ♀, A./S., 29-XII-1963, D. & V. 986 (MNHN); 1 adult ♀, F., 31-VII-1967 (UBRA 67-07-31/01); 2 juv. ♀♀, A., 23-XII-1972 (ZMA 15.909-10); 1 subadult ♀, A., 24-XII-1972 (ZMA 15.911); 2 adult ♀♀, S./S., 25-XII-1972 (ZMA 15.884-5); 1 adult ♂, 1 adult ♀, S./S., 26-XII-1972 (ZMA 15.864, 15.866); 1 adult ♀, S./S., 1 juv. ♀, A., 27-XII-1972 (ZMA 15.887, 15.912). Dimonika: 1 juv. ♂, A., 7-I-1964, D. & V. 1007 (MNHN); 1 adult ♂, A./S., 18-I-1964, D. & V. 1175 (MNHN); 1 juv. ♀, A., 20-I-1964, D. & V. 1222 (MNHN); 1 subadult, S./S., 8-III-1970 (UBRA 4-♂-70-03-08); 1, 1 adult ♂, S./S., 9-III-1970 (UBRA 4-, 5-♂-70-03-09); 1 adult ♂, S./S., 10-III-1970 (UBRA 2-♂-70-03-10); 1 adult ♂, S./S., 11-III-1970 (UBRA 4-♂-70-03-11); 1 adult ♀, 1 juv., S./S., 1 adult ♀, and 1, F., 14-VI-1970 (UBRA 2-, 4-♀-70-06-14; UBRA); 1 adult ♂, 2 adult ♀♀, 4, F., 11-III-1972 (UBRA); 1, S./S., 13-III-1972 (UBRA 5-♂-72-03-13); 2 adult ♀♀, F., 29-V-1972 (UBRA). Djambala: 1 adult ♀, A., 17-X-1951, coll. H. E. Beatty (FMNH 73821). Grand Bois: 1 adult ♂, 1 ♀, F., 25-V-1972 (UBRA). Ile M'Bamou: 1, skull, 23-III-1970 (UBRA 4-♀-23-03-70); 1 adult ♀, 1 juv., S./S., 15-XII-1970 (UBRA 2-♀-. 3--70-XII-15); 2 adult ♀♀, 2, S./S., 23-III-1971 (UBRA 3-♀-, 5-♀-, 6-♂-, 7-♀-71-03-23); 4, F., 25-III-1972 (UBRA). Lekana: 1 juv., S./S., 10-I-1970, coll. J. P. Grillet (UBRA 1-♂-10-01-70). Loandjili: 1 adult ♀, 1 adult ♂, S./S., 1 juv. ♂, A., 1/2-XII-1972 (ZMA 15.880, 15.861, 15.906). Makaba: 1, F., 2-III-1972 (UBRA); 1 adult ♂, 1, F., 12-III-1972 (UBRA); 1, F., 13-III-1972 (UBRA); 1 adult ♂, F., (UBRA). Meya: 1 adult ♀, 2, F., 19-V-1972 (UBRA). Plateau Konkouya: 1, F., 10-I-1970 (UBRA). Pointe Noire: 1 adult ♀, 1 juv. ♀, S./S., 27-X-1972 (ZMA 15.865, 15.888); 3 juv. ♀♀, S./S., 28-X-1972 (ZMA 15.889-91); 1 adult ♂, S./S., 30/31-X-1972 (ZMA 15.892); 1 adult ♀, 1 juv. ♂, S./S., 31-X-1972 (ZMA 15.866, 15.893); 1 adult ♀, 1 adult ♂, S./S., 2-XI-1972 (ZMA 15.867, 15.851); 1 adult ♀, S./S., 2/3-XI-1972 (ZMA 15.868); 1 subadult ♀, S./S., 3-XI-1972 (ZMA 15.894); 1 adult ♂, S./S., 4-XI-1972 (ZMA 15.852); 1 juv., S./S., and 1 juv. ♂, A., 6-XI-1972 (ZMA 15.895-6); 1 juv. ♀, 2 juv. ♂♂, A., and 1 adult ♀, S./S., 12-XI-1972 (ZMA 15.897-9, 15.869); 1 adult ♂, S./S., 15-XI-1972 (ZMA 15.853); 1 juv. ♂, S./S., 2 immature ♀♀, A., 16-XI-1972 (ZMA 15.900-1, 15.871); 1 adult ♀, A., 1 subadult ♂, S./S., 19-XI-1972 (ZMA 15.870, 15.854); 2 subadult ♂♂, A., 21-XI-1972 (ZMA 15.855-6); 1 adult ♂, S./S., 22-XI-1972 (ZMA 15.857); 1 adult ♀, 1 adult ♂, S./S., 1 juv. ♀, 1 juv. ♂, A., 25-XI-1972 (ZMA 15.872, 15.858, 15.902-3); 1 juv. ♀, A., 1 adult ♀, S./S., 26-XI-1972 (ZMA 15.904, 15.873); 1 adult ♀,

A., 1 adult ♂, S./S., 27-XI-1972 (ZMA 15.874, 15.859); 1 adult ♀, S./S., 1 juv. ♀, A., 28-XI-1972 (ZMA 15.875, 15.905); 1 subadult ♂, 1 adult ♀, A., 2 adult ♀ ♀, S./S., 30-XI-1972 (ZMA 15.860, 15.876-8); 1 adult ♀, S./S., 1-XII-1972 (ZMA 15.879); 1 adult ♀, S./S., 3/4-XII-1972 (ZMA 15.881); 1 adult ♀, S./S., 11-XII-1972 (ZMA 15.882); 1 juv. ♂, A., 1 adult ♀, S./S., 13-XII-1972 (ZMA 15.907, 15.883); 2 adult ♂ ♂, S./S., 1 juv. ♀, A., 21-XII-1972 (ZMA 15.862-3, 15.908). Sibiti: 1 adult ♀, A./S., D. & V. 204 (MNHN); 1 juv. ♀, A., 18-XI-1963, D. & V. 228 (MNHN); 1 juv. ♂, A., 1 juv. ♂, A., 3 adult ♀ ♀, A./S., 19-XI-1963, D. & V. 257, 258, 260-2 (MNHN); 1 juv. ♂, A., 20-XI-1963, D. & V. 279 (MNHN); 1 adult ♂, A./S., 21-XI-1963, D. & V. 293 (MNHN); 1 juv. ♂, A., 1 adult

TABLE V

Measurements of *Micropteropus grandis* Sanborn and *Micropteropus pusillus* (Peters) from Pointe Noire, People's Republic of Congo.

Species	<i>Micropteropus grandis</i>				<i>Micropteropus pusillus</i>			
	<i>grandis</i>				ZMA collection			
	♂	♂♂		♀♀	n	mean	min.-max.	
Sex	ZMA 15.535	n	mean	min.-max.	n	mean	min.-max.	
Head and body length	99	14	76	70 -82	17	77	67 -85	
External tail length	3.8	12	1.7	0 - 3.8	15	1.6	0 - 3.5	
Ear length	17.5	14	15.2	13.5 -16.6	17	15.2	14.1 -18.7	
Forearm length	62.3	14	50.2	46.4 -51.6	17	51.9	49.6 -54.8	
Third metacarpal length	43							
Fifth metacarpal length	41							
Tibia length	28.7	5	21.6	20.2 -23.2	7	22.4	21.5 -23.3	
Foot length (c.u.)	18							
Greatest skull length	35.4	11	28.9	27.8 -30.5	13	28.5	27.8 -29.4	
Condylbasal length	34.8	11	28.2	26.8 -29.5	13	27.7	26.9 -28.7	
Rostrum length	13.1	11	9.6	9.1 -10.5	13	9.25	9.1 -10.0	
Palatal length	20.2	10	15.5	14.6 -16.5	12	15.3	14.8 -16.0	
Cranium width	14.3	11	12.6	12.2 -13.4	13	12.7	12.2 -13.1	
Interorbital width	6.0	11	5.2	4.8 - 5.6	13	5.35	4.9 - 6.2	
Postorbital width	9.0	11	8.3	7.9 - 8.7	13	8.4	8.2 - 8.9	
Zygomatic width	21.6	9	18.0	16.9 -18.6	12	17.9	17.5 -18.8	
Mandible length	28.3	11	22.2	21.4 -23.4	13	22.05	21.5 -23.3	
C <sup>1</sup> -C <sup>1</sup> exteriorly	6.9	11	6.1	5.6 - 6.8	11	6.0	5.5 - 6.3	
C <sup>1</sup> -M <sup>1</sup>	11.8	11	9.0	8.7 - 9.6	11	9.0	8.6 - 9.5	
M <sup>1</sup> -M <sup>1</sup> exteriorly	11.2	11	9.6	9.1 -10.3	11	9.5	9.2 - 9.8	
C <sub>1</sub> -M <sub>2</sub>	13.1	11	9.9	9.4 -10.5	11	10.0	9.6 -10.7	
P <sup>3</sup> length	2.25	9	1.7	1.55- 1.8	10	1.7	1.6 - 1.8	
width	1.25	9	1.1	1.0 - 1.25	10	1.05	0.9 - 1.15	
P <sup>4</sup> length	2.4	10	2.0	1.8 - 2.2	10	2.0	1.8 - 2.2	
width	1.5	10	1.2	1.0 - 1.3	10	1.2	1.05- 1.3	
M <sup>1</sup> length	2.6	10	2.0	1.8 - 2.1	10	1.95	1.8 - 2.1	
width	1.5	10	1.2	1.05- 1.25	10	1.2	1.05- 1.3	
P <sub>3</sub> length	1.85	10	1.55	1.3 - 1.7	10	1.5	1.4 - 1.6	
width	1.1	10	0.95	0.9 - 1.05	10	0.95	0.9 - 1.05	
P <sub>4</sub> length	2.2	10	1.85	1.6 - 1.95	10	1.8	1.75- 2.0	
width	1.25	10	1.05	1.0 - 1.1	10	1.05	1.0 - 1.1	
M <sub>1</sub> length	2.6	10	1.9	1.8 - 2.2	10	1.9	1.75- 2.1	
width	1.4	10	1.05	1.0 - 1.1	10	1.05	1.0 - 1.1	
M <sub>2</sub> length	1.75	10	1.3	1.25- 1.6	10	1.3	1.15- 1.5	
width	1.4	10	0.9	0.9 - 1.0	10	0.95	0.8 - 1.05	

♀, A./S., 22-XI-1963, D. & V. 312-3 (MNHN); 3 adult ♂♂, A./S., 1 juv. ♂, 1 juv. ♀, A., 23-XI-1963, D. & V. 367-9, 371-2 (MNHN); 1 adult ♀, A./S., 26-XI-1963, D. & V. 436 (MNHN); 2 juv. ♀♀, A., 5-XII-1963, D. & V. 701, 710 (MNHN); 1 juv. ♀, A., 6-XII-1963, D. & V. 732 (MNHN); 1 adult ♂, A./S., 7-XII-1963, D. & V. 770 (MNHN); 1 adult ♀, A./S., 8-XII-1963, D. & V. 792 (MNHN); 1 adult ♀, S./S., 19-IV-1965, coll. F. Vincent (UBRA 1-♀-19-04-65). Locality unknown: 1 (UBRA); 1 adult ♀, A. (LER 172 PP).

Measurements. — Table V. Although measurements are available of specimens from most of the localities mentioned, table V gives only those of male and female series from Pointe Noire as these are of the same population. But probably *Micropterus pusillus* is quite uniform through the southern part of the Republic (where most studied specimens come from), as the following measurements indicate if compared to those in table V. They pertain to all examined adult specimens from the Republic.

	Greatest skull length			Forearm length		
	n	mean	min.-max	n	mean	min.-max.
♂♂	19	29.0	27.8-30.5	28	50.0	46.4-53.4
♀♀	28	28.5	26.8-29.4	44	52.0	49.5-54.8

Remarks. —

Malbrant & Maclatchy (1949) recorded *Micropterus pusillus* from Komono. A small series was collected there by them on 18-VI-1942, and is now in the AMNH collection (120312-20). Brosset (1966a) mentioned specimens from Brazzaville, Dimonika and Sibiti. The species appears to be very common in the Republic south of 2°S. It certainly was very abundant in Pointe Noire during my stay there, and appeared to be so in Brazzaville as well.

It is known in southern Zaire from Lower Congo to Katanga (Hayman et al., 1966), and from northern Angola (Hill & Carter, 1941). In Gabon, Malbrant & Maclatchy (1949) caught specimens at Kango (0°15'N 10°11'E; AMNH 120265; MNHN 1947-212-15) and Booué (0°03'S 11°58'E). I found specimens from Lambaréné (0°41'S 10°13'E) and Franceville (1°40'S 13°31'E) in the MNHN collection (1896-3435 and 1884-582, respectively). In Rio Muni, Jones (1971; 1972) found it to be "the most common Pteropid", although he collected it only in and near Bata (1°52'N 9°46'E). Aellen (1952) found only one record for Cameroon, from Yaoundé. In the AMNH collections I noticed other Cameroon localities: 5 km south of Eseka (3°37'N 10°44'E; 236277); Mboakon (6°20'N 12°48'E; 236278); 14 km south of Ngaoundere (7°20'N

13°35'E; 241019); and 55 km northeast of Obala (4°10'N 11°32'E; 241020). In the ROM collections there are specimens from Great Soppo (04°09'N 09°13'E; 68996); 2 km south of Buea Station (04°07'N 09°13'E; 68927) and Meanja (04°17'N 09°24'E; 69087). In the MNHN collection there is an alcoholic specimen from Ob-la, Cameroon (locality not traced; possibly Obala).

Populations from Guinea and Ivory Coast attain some slightly higher average body and skull measurements (Van Orshoven & Van Bree, 1968; Bergmans et al., 1974) but on the whole the geographic variation in size is strikingly small.

From the available data on reproduction two cycles per year may be inferred. Two males with testes of 6.2 × 3.5 and 5.3 × 3.7 respectively, were collected 2- and 4-XI. In the last third of November and in December, 10 males (9 from Pointe Noire and 1 from Brazzaville) had testes measurements ranging from 2.8 × 2.3 to 4.7 × 3.5 (mean length 3.6, mean width 2.7). Out of 18 adult females from Pointe Noire and Loandjili 11 bore embryos: on 25-XI (length embryo in situ 11.8), 27-XI (9), 28-XI (11.5), 30-XI (7, 14.3 and 15.9), 1-XII (3.5), 1/2-XII (19.3), 3/4-XII (17.3), 11-XII (16.4) and 13-XII (17.0); one other female was probably pregnant but could not be checked on this. Brosset (1966a) found lactation in one female and almost full-grown embryos in three females at Dimonika, between 18 and 23 January.

The foregoing data suggest a cycle with conception during October (and possibly the beginning of November) and births by the end of the following January, but most likely after that period. The juveniles and subadults I collected from 27-X to 27-XII, with forearm lengths of 44.8 to 47.5 (7 males) and 42.5 to 51.6 (17 females) were most probably born around the end of January of the same year. The largest subadult female, taken on 30-XI, was pregnant (length embryo in situ 14.3), so that females born in January or February probably become sexually active in their ninth or tenth month, that is before they are full-grown, and may give birth to their first offspring at the age of 1 year.

The immature males, collected between 31-X and 13-XII, had no shoulder tufts yet. If the general assumption that the male epaulettes are part of a mechanism to attract the opposite sex is valid (Rosevear, 1965: 96) or, in other words, that males do not take part in reproduction before their epaulettes have developed, in *Micropteropus pusillus* males reach sexual maturity later than females (see also the remarks on *Epomophorus wahlbergi* in this paper). All males with developing, i.e. short or half-grown, epaulettes appear to be full-grown in every other respect.

The following data are related to what seems a second cycle. One female (UBRA 67-07-31/01), taken on 31-VII at Brazzaville, bore an embryo with an approximate length of 22 mm. I collected lactating females at Pointe Noire on 27-X, and 2-, 2/3-, 12-, 19-, 26- and 28-XI, and at Brazzaville on 25-XII.

The data on specimens from Brazzaville seem not to disagree with those from more western localities, but they are far too few to conclude synchronized cycles under the two climatic regimes involved here (see the General Discussion in the present publication).

Again, the picture is not unlike that suggested for *Epomops franqueti* and *Epomophorus wahlbergi* in the Republic, with two cycles per year and births during February and September.

Juveniles collected on 27-, 28- and 30-X and 6-XI still had upper incisors of their milk dentition (usually the last shed elements in these bats) while their  $M^1$  and  $M^2$  (and in one case also  $P^3$  and  $P^4$ ) were in the process of emerging. It would be interesting to know for how long these January/February juveniles had become independent. It could be rather short before the ending, in September, of their mothers' new pregnancies. Unless the same females do not take part in two cycles per year, this September generation would have a much shorter time for this, namely until January/February at most, i.e. 4 to 5 months against 6 to 7 months in the January/February generation. (Brosset, 1966b, observed females of *Myonycteris torquata* from northwest Gabon in captivity, taking part in two reproduction cycles per year. Mutere, 1968, concluded the same for females of *Rousettus aegyptiacus* in the wild, at Kasokera in Uganda.)

Of the 40 ZMA specimens of which I could examine the dentition in detail, 8 show dental anomalies: 15.854 has a small left  $M^2$  and a small right  $M_3$ ; 15.852 has two  $P^1$  but lacks a left  $I_1$ ; 15.851 has relatively very small incisors and first lower premolars; 15.863 has no right  $I_1$  and a small left  $I_1$  and right  $I_2$ ; 15.881 has no  $I_1$  and small  $I_2$ ; 15.857 has no left  $P_1$ ; 15.885 has only the left  $I_2$ , of its lower incisors; 15.862 lacks both  $P^3$  and  $I_1$ .

Variations in the palatal ridge pattern were also observed, but will form the subject of another paper.

Specimen ZMA 15.880 from Loandjili and specimen ZMA 15.907 from Pointe Noire were infested with wing margin parasites (Acari; *Teimocoptes* sp.?).

#### 11. *Scotonycteris zenkeri zenkeri* Matschie, 1894

Material. — Dimonika: 1 adult ♂, S./S., 10-III-1970 (UBRA 1-♂-70-03-10). Locality unknown, but most probably also Dimonika: 1 immature, S./S., 9-III-1970 (UBRA 7-♂-70-03-09).

Measurements. — Table VI.

Remarks. —

De Vree (1971) explained that the differences between the subspecies *Scotonycteris zenkeri zenkeri* and *S. z. occidentalis* (Hayman, 1974) are to be found in the form of the postdental palate and in the position of  $M^1$ . The subspecies *zenkeri* from Cameroon, Fernando Poo, Gabon, eastern Zaire (Hayman & Hill, 1971), the People's Republic of Congo and the Central African Empire (Vielliard, 1974) would have straight, converging lateral postdental palate margins and a relatively more backward  $M^1$ ; the subspecies *occidentalis* from Liberia, Ghana (Hayman & Hill, 1971) and Ivory Coast (De Vree, 1971; Bergmans et al., 1974) would have convex lateral postdental palate margins and its  $M^1$  relatively less backward. The palate differences have been illustrated by Rosevear (1965: fig. 18) and the different positions of  $M^1$  by Bergmans et al. (1974: fig. 3). It is obvious from the latter figure that the position of  $M^1$  is related to the dimensions of the dental elements. The eastern *zenkeri* has heavier teeth than the western

*occidentalis*, hence a relatively longer C<sup>1</sup>-M<sup>1</sup> length, which is compensated for by a further backward extension (and not, as it seems, by a lengthening of the rostrum).

On the two specimens from the Republic I made the following notes. Both have almost straight (and converging) though faintly convex postdental palate margins and the position of their M<sup>1</sup> is also in accordance with the concept of the typical race.

The adult male has a reddish brown back fur and a wide, lightly coloured, but not sharply bordered longitudinal band across its chin, throat and belly. The juvenile is darker brown and not very reddish above (most probably the usual juvenile colouration), and ventrally it has the same light band as the adult male.

*Scotoonycteris zenkeri* has recently been found in southwestern Nigeria (Happold & Happold,

TABLE VI

Measurements of *Scotoonycteris zenkeri* Matschie and *Scotoonycteris ophiodon* Pohle from Dimonika, and of *Megaloglossus woermanni* Pagenstecher from Ile M'Bamou, People's Republic of Congo.

Species	<i>Scotoonycteris zenkeri</i>		<i>Scotoonycteris ophiodon</i>		<i>Megaloglossus woermanni</i>
	♂	?	♀	?	?
Sex					
Specimen	UBRA	UBRA	UBRA	UBRA	UBRA
	1-6-70-03-10	7-6-70-03-10	8-6-72-03-13	9-9-72-03-13	2-9-23-03-71
Forearm length	47.3	45.6	87.4	82.0	
Greatest skull length	26.4	-	42.9	+ 38	26.5
Condylbasal length	-	-	41.5	+ 36.7	
Rostrum length	8.7	8.2	15.9*	10.4**	10.3
Palatal length	14.3	13.3	25.2	+ 21.5	14.0
Cranium width	12.0	11.1	17.0	16.1	11.3
Interorbital width	5.0	4.5	7.5	6.9	4.1
Postorbital width	6.6	6.9	7.2	8.2	7.1
Zygomatic width	16.8	-	27.3	23.1	14.4
Mandible length	19.5	18.3	33.0	31.0	20.2
C <sup>1</sup> -C <sup>1</sup> exteriorly			9.9	8.8	4.7
C <sup>1</sup> -M <sup>1</sup>	8.2	8.0	15.1	13.8	
C <sup>1</sup> -M <sup>2</sup>					8.6
M <sup>1</sup> -M <sup>1</sup> exteriorly	8.4	7.1	17.0	14.0	
M <sup>2</sup> -M <sup>2</sup> exteriorly					6.4
C <sub>1</sub> -M <sub>2</sub>	9.4	9.2	16.9	16.0	
C <sub>1</sub> -M <sub>3</sub>					9.7
Length x width of:					
p <sup>3</sup>			2.9 x 2.3	2.8 x 2.2	
p <sup>4</sup>			2.75 x 2.25	2.75 x 2.15	
M <sup>1</sup>			2.4 x 2.3	2.4 x 2.2	
P <sub>3</sub>			2.75 x 2.1	2.75 x 2.0	
P <sub>4</sub>			3.15 x 2.3	3.0 x 2.2	
M <sub>1</sub>			2.9 x 2.4	2.8 x 2.15	
M <sub>2</sub>			1.6 x 1.75	1.75 x 1.8	

\* This measurement is from front of orbit to tip of premaxilla. The distance from front of orbit to tip of nasal is 12.6.

\*\* From front of orbit to tip of nasal.

1978), who on the basis of colour and external measurements assign their specimens to the typical race. This would leave the so-called Dahomey Gap as the separating barrier between the two subspecies. Examination of the postdental palate and dentition of these specimens should verify their subspecific position. The typical race has never yet been collected in the Congo basin. The most eastward collecting localities west of the Congo basin are Le Maboké in the Central African Empire ( $3^{\circ}53'N$   $18^{\circ}01'E$ ) (MNHN collection), Belinga in Gabon ( $1^{\circ}13'N$   $13^{\circ}10'E$ ), and Dimonika in the People's Republic of Congo. These are widely separated from the known localities in eastern Zaire, which are all well east of the Congo basin proper (Hayman et al., 1966; Bergmans et al., 1974: 37-38, 42).

In relation to what has been found for *Rousettus aegyptiacus* (this paper), *Lissonycteris angolensis* (see Hayman et al., 1966; Hayman & Hill, 1971) and *Myonycteris torquata* (see Bergmans, 1976; the gap between western and eastern specimens is larger than suggested in that paper, as the right coordinates of Kamikoni are  $01^{\circ}16'S$   $29^{\circ}19'E$ ), it is important to know whether specimens of *Scotonycteris zenkeri* from west and east of the Congo basin are as congruent as current literature suggests.

## 12. *Scotonycteris ophiodon* Pohle, 1943

Material. — Dimonika: 1 adult ♀, S./S., 13-III-1972 (UBRA 8-♂-72-03-13); 1 subadult, S./S., 13-III-1972 (UBRA 9-♀-72-03-13).

Measurements. — Table VI. A number of the present measurements differ slightly from those I published before (1973). This is due to careful re-examination under better conditions. Moreover the skulls have been further cleaned in the mean time.

Remarks. —

On these two specimens of *Scotonycteris ophiodon* I have reported before in extenso (Bergmans, 1973). Dr. G. Vattier-Bernard of the Laboratoire de Zoologie of the University of Brazzaville has been so kind to send them to me for re-examination. Softening up of the abdominal skin learned that the larger specimen, thought to be a male, is a female. Of the other specimen the sex could not be determined with certainty. It is possibly also a female.

Since 1973 several other representatives of this rare species have come to my knowledge. Eisentraut (1973) mentions four specimens in his collections from Cameroon instead of the three mentioned in earlier papers, but does not give details. Coe (1976) records two new specimens from Mount

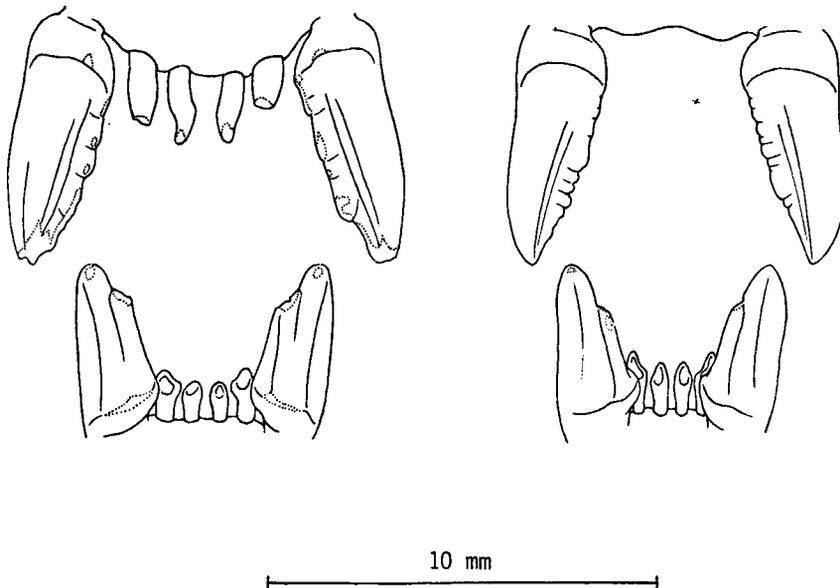


Fig. 4. Caudal view of upper and lower canines and incisors of two *Scotonycteris ophiodon* Pohle from Dimonika. Left: UBRA 8-♂-72-03-13 (a female!). Right: UBRA 9-♀-72-03-13.

Nimba in Liberia, and in the USNM collection I found five hitherto unpublished specimens from Tars Town, Liberia (481679, 481681-2, 481695), and possibly from 32 miles west of Prestea, Ghana (414017).

As far as could be ascertained, forearm lengths/greatest skull lengths in four adult males are  $76.0/\pm 38$  and  $76.7/38.0$  (Tars Town),  $73/\dots$  (Mount Nimba),  $74.6/38.2$  (Malende, Cameroon); and in five adult females  $81.4/37.4$  (Tars Town),  $\dots/38.3$  (? 32 miles west of Prestea),  $73.5/\pm 37$  (Mueli, Cameroon),  $77.8/40.2$  (Malende),  $87.6/43.3$  (Dimonika). The adult specimen from Dimonika, and also the subadult ( $82.4/\pm 41$ ) are larger than all other specimens known.

Coe (1976) described the yellow suffusion of the skin in live animals, a colour that practically vanishes in dry skins (Eisentraut, 1963), and mentions as another outstanding feature the large canines with well-developed secondary cusps. It is not clear whether both upper and lower canines are meant. The Dimonika specimens have upper canines with notched inner ridges running from cingulum to tip, and lower canines with less notched inner ridges running from the cingulum upwards over about three fourths of the height of the teeth (fig. 4). Of course this is most distinct in the subadult because its teeth are unworn.

### 13. *Megaloglossus woermanni* Pagenstecher, 1885

Material. — Dimonika: 3 ♀♀ and 1, A./F., 10-III-1972 (UBRA). Ile M'Bamou: 1 ♀, skull, 23-III-1971 (UBRA 2-♀-23-03-71). Makaba: 1 ♀, F., 12-III-1970 (UBRA). N'Gongo: 1 ♀, F., 1-III-1970 (UBRA). Locality unknown: 1 adult ♂, A. (LER).

Measurements. — Skull measurements of the Ile M'Bamou specimen are given in table VI. Forearm lengths of five females are 43.4-45.0 (mean 44.1) and of one male 41.7.

Remarks. —

*Megaloglossus woermanni* has been recorded from the Republic for the first time by Adam & Le Pont (1974), who observed it near six caves in the Bangou Massif region, among which those of Matouridi and Meya. Its occurrence in the

Republic is not surprising as it had been recorded before from Banana in southwest Zaire and from Lastoursville in Gabon (Bergmans & Van Bree, 1972). I did not check the dentition of the present female specimens, except the one from Ile M'Bamou, and they may all have been either adult or subadult. Nevertheless I have the impression that neither in size nor in morphology the specimens differ from those collected in Gabon and western Zaire as far as examined by Bergmans & Van Bree (1972).

Two females collected on 10-III at Dimonika bore one large embryo each. One of these embryos had a total length in situ of about 20.5. Adam & Le Pont (1974) found suckling young in February and in May but give no particulars about the size of these. Those in February may have been from an autumn cycle, those in May of the same cycle as the embryos in March.

## GENERAL DISCUSSION

### ZOOGEOGRAPHY

The Megachiropteran fauna of the People's Republic of Congo roughly consists of three elements:

#### 1. Forest species

*Scotoonycteris ophiodon*  
*Scotoonycteris zenkeri zenkeri*  
*Megaloglossus woermanni*  
*Lissonycteris angolensis angolensis*  
*Myonycteris torquata*  
*Hypsignathus monstrosus*  
*Epomops franqueti franqueti*

#### 2. Species of forest and savanna

*Eidolon helvum helvum*  
*Rousettus aegyptiacus unicolor*

#### 3. Savanna species

*Epomophorus* cf. *labiatus*  
*Epomophorus wahlbergi baldemani*  
*Micropteropus grandis*  
*Micropteropus pusillus*

(1) The forest Megachiroptera intrinsically belong to the West- and Central-African lowland rain

forest biome, though in some cases admittedly with some apparent distributional discontinuities. Their occurrence in the rain forests of the Republic is therefore not surprising. Presumably, *Megaloglossus woermanni* and *Hypsignathus monstrosus* also occur in the eastern inundated forests (fig. 1), while the other species possibly avoid these, to judge from their known distribution. But the distribution of all forest species seems continuous to Lower Congo and northern Angola in the south (with the possible exception of both *Scotoonycteris* species, which have not (yet) been collected there), and to Gabon, Rio Muni, southern Cameroon and the Central African Empire in the north.

(2) Within the limits set by food availability, the species inhabiting both forest and savanna are restricted by their particular habitat preferences rather than by the limits of certain types of vegetation. *Eidolon helvum* preferably roosts gregariously in relatively tall trees, quite irrespective of their setting. *Rousettus aegyptiacus* roosts in caves and probably also in cave-like places. Like *Megaloglossus* and *Hypsignathus*, *Eidolon* probably also inhabits the inundated forests. *Rousettus*, however, may meet a serious barrier there, as suitable dry caves may not be available. The distribution of both is continuous to the north and south.

(3) Of the four savanna species only *Micropteropus pusillus* seems to be equally distributed towards the areas north, east and south of the Republic, though its distribution is necessarily patchy. It inhabits savanna areas virtually surrounded by forest, as for example Booué in Gabon, and such populations are either remnants from before the dominance of the forest in the Congo basin (75000-52000 years ago; see Moreau, 1966: 51) or the species is able to populate such areas via habitats that are less appropriate, such as coastal and gallery forests.

As I have discussed in the taxonomic section, *Epomophorus wahlbergi haldemani* most probably penetrated the Republic from the southeast. In the light of its known distribution the alternative of a relict theory as presented for *Micropteropus pusillus* seems less feasible, but should not be wholly excluded as there would be some evidence for its occurrence north of the Congo basin (Hayman et

al., 1966). The species presently identified as *Epomophorus* cf. *labiatus* would also be a south-eastern element, since *labiatus* has never been collected in Gabon, Rio Muni, or Cameroon, nor in western or central Zaire.

Finally, *Micropteropus grandis* seems a truly southern element, formerly known exclusively from Dundo, northeastern Angola (7°22'S 20°50'E), and now also from Pointe Noire. Its occurrence in the south of the Republic connects this region, as far as Megachiroptera are concerned, with the belt of savanna and savanna/forest mosaic along the southern limits of the Central-African forest block. The Lunda District in northeast Angola, in the centre of this belt, has been characterized by Hayman (1963: 85) as highly interesting from the mammalogical point of view because "presenting, in close proximity, essential elements of both the Guinea-Congo and the Zambesian-Rhodesian faunas". Forest elements intrude this area, which is essentially of a savanna type, via the gallery forests along many rivers draining the area in a northern direction.

A forest species which may occur (but has not yet been found) in the Republic is *Casinycteris argynnis* Thomas, 1910. Mr. L. W. Robbins collected it in 1973 at Meyo-Nkoulou, 15 km south of Ambam (2°24'N 11°18'E), southern Cameroon (MRAC), and it is also known from Luluabourg in Zaire (5°53'S 22°26'E) (MRAC 33348).

The savanna fruit bat *Epomophorus pousarguesi* Trouessart, 1904, has been collected at Bangui in the Central African Empire (Bergmans, 1978). This is not far from the northeastern border of the Republic, but as the country there is covered with forest, this species is not likely to be indigenous. The occurrence of its relative, *Epomophorus gambianus gambianus* (Ogilby, 1835), has been claimed for Lower Congo by Hayman et al. (1966) and could therefore be expected in the south of the Republic. Examination of the single specimen (IRSN 186b) on which this record was based, however, revealed that it had been wrongly identified and actually belongs to *E. wahlbergi haldemani*.

*Micropteropus intermedius* Hayman, 1963, described from Dundo, northeast Angola, and later

found at Luluabourg and Thysville (5°16'S 14°53'E) in Zaire (MRAC 32380 and 22661, respectively) can be expected to be found in the south of the Republic.

#### CLIMATE AND REPRODUCTION

The climate of the Republic can be divided into four subclimates (Anciaux de Faveaux, 1972: 7-9).

1. The Congolese Subclimate. Between 4°N and 2°S. Rainfall throughout the year, with peaks in April and October. Mean annual temperature (m.a.t.) 24.4°-26°C.

2. The Gabonese Subclimate. Between 0° and 4°S, and west of about 15°30'E. Rain periods from the end of September till probably late in January, and from probably somewhere early in February till the end of May. Anciaux de Faveaux (loc. cit.) is not too precise in dating the short dry season. Descarpentries & Villiers (1964) state that it lasts from mid-January till February, but also that it is often hardly discernable. M.a.t. 26°-26.5°C.

3. The Angolese/Lower Congo Subclimate. South of 4°S and restricted to altitudes of 350 m and more. Rainfall from October to May, with a minimum in January/February. M.a.t. 19.5°-25.2°C.

4. The South-Congolese Subclimate. In Batéké land, i.e. between about 1° and 4°S and east of about 15°30'E. Rainfall from September to May, with peaks in April and in November/December and a minimum in January/February. M.a.t. 24.7°C.

Data on reproduction under the conditions of the Congolese and Angolese/Lower Congo Subclimates are not available. Except for a slight difference in time, the remaining two subclimates seem quite similar. In the Gabonese Subclimate, prevailing in the regions of Pointe Noire, Dinguembo, Dimonika and Sibiti considered in this paper, the rains appear to begin a few weeks later than in the South-Congolese Subclimate which comprises the Brazzaville region.

The period shortly before and during the start of the rains is favoured by at least some Megachiroptera as the time to give birth. In Uganda, Mutere (1967, 1968) found this for *Eidolon helvum* and *Rousettus aegyptiacus*, and Okia

(1974a & b) for *Epomophorus anurus* and *Epomops franqueti*. It logically follows that species with populations at either side of the equator, which are thus living under inversed climatological conditions, may accordingly show two different reproduction cycles. Brosset (1966c) found a strictly seasonal reproduction cycle in some equatorial Microchiroptera, with births occurring in March and April north of what was called the biological equator, and in September and October south of this. He estimated the position of the biological equator to be between 1° and 4°N, and in the area here under discussion it would be at about 3°N. South of this latitude, which includes all available data from the Republic, austral reproduction, with births in September and October, is to be expected. Certain species however, are obviously polyestrous and go through two cycles per year. This is what Mutere (1968) found for *Rousettus aegyptiacus* and Okia (1974a & b) for *Epomophorus anurus* and *Epomops franqueti*.

For the southern part of the Republic west of about 15°30'E the following, somewhat generalized, tentative picture can be sketched. Biannual reproduction with births around February and September may occur in *Epomops franqueti*, *Epomophorus wahlbergi* and *Micropteropus pusillus*. *Eidolon helvum* probably gives birth in February but whether it is monestrous or also breeding biannually, with births around September, needs investigation. *Megaloglossus woermanni* gives birth around April and most probably also around December. *Lissonycteris angolensis* would also go through two cycles, with births in June to September and in November (? December). Birth periods in *Myonycteris torquata* are possibly in June and almost certainly around December. Births in *Rousettus aegyptiacus* take place from August till November (in captivity) and around January. Data on other species are scarce or lacking. All data apply to the region with the Gabonese Subclimate except for a single record of *Rousettus* which stems from the South-Congolese Subclimate region. It appears that births occur just before or during the start of the rain periods in the epomophorines, and possibly in *Eidolon*, in the midst of the rains in *Megaloglossus*, and in the long dry

period and during the end-September/end-January rains in *Lissonycteris* and possibly in *Myonycteris* and *Rousettus*.

About *Eidolon helvum* at Kampala, Uganda, Mutere (1967: 159-160) writes that "births occur in February-March just before the onset of the high rainfall peak. As the young bats take about one month to be weaned, they are ready to fend for themselves in a lush environment where there is an ample supply of food, which may therefore assume an ultimate role". In his study of the bi-annual breeding of *Rousettus aegyptiacus* the same author also suggests that the date of birth might be so fixed as to ensure food abundance for the young after weaning (Mutere, 1968).

But are young fruit bats weaned so shortly after birth? A juvenile *Eidolon helvum* female in the zoo of the University of Ife, Nigeria, was weaned after 14.5 weeks of hand-rearing (Blackwell, 1967). When brought to the zoo it had a head and body length of 10 cm and must have been at least a few weeks old already. Kulzer (1958) found that in captivity young *Rousettus aegyptiacus* stay with their mother for at least four months. In biannually breeding *Epomops franqueti* in Uganda, young bats (also born just before the periods of maximum rainfall) are perhaps not completely weaned until a few weeks before the occurrence of new births (Okia, 1974b). The same has been suggested for *Pteropus rodricensis* Dobson, 1878, which recently bred in the Jersey Zoological Park; the young bats (two) were observed to suckle regularly at the age of 23 weeks, and at six months still roosted usually under their mothers' wings (Pook, 1978).

Thus, it rather appears that the young of *Eidolon helvum* and *Rousettus aegyptiacus* become fully independent at the start of the relatively dry period following upon that of the heavy rains. During this period food would be relatively scarce, according to Mutere's hypothesis. But is food really relatively scarce during any time of the year, for such opportunistic feeders as these medium-sized fruit bats most probably are? The necessary information to answer this question is lacking but, at any rate, such periods of relative food scarcity and abundance are almost impossible to be correlated logically with the

observed seasonality of reproduction. (Not only newly independent young bats would have to cope with the supposed relative scarcity, but also adult females in their last two months of pregnancy, for instance.)

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#### ADDENDUM

Since the completion of the manuscript of the present paper the author had an opportunity to study an additional collection of 45 Megachiroptera which had recently been collected in "Congo" by Prof. Dr. Jean Dorst, and placed in the Muséum National d'Histoire Naturelle, Paris. Four species were involved: *Rousettus aegyptiacus* (2 specimens), *Epomops franqueti* (5), *Micropteropus pusillus* (37) and *Megaloglossus woermanni* (1). According to Prof. Dorst (in lit., 3-X-1978) these specimens were collected at Ile M'Bamou (*Rousettus*), or at Meyya (*Epomops*; *Megaloglossus*), or at both localities (*Micropteropus*). Taxonomically or zoogeographically this collection offered no surprises; all specimens fit in with the findings in this paper. As the specimens are not labelled, whatever information on reproduction cycles they could have provided is lost.

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