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Notes on Bats of Sudan

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ABSTRACT

Based upon recent collections of bats from Bahr-el-Ghazal and Equatoria provinces in southern Sudan, *Epomophorus minor* is added to the list of species known from that country, and the geographic ranges of *Micropteropus pusillus*, *Eptesicus capensis*, *Eptesicus somalicus*, and *Chaerephon major* are extended within Sudan. Examples

of species poorly represented in museum collections were also collected, including *Nycteris thebaica*, *Chalinolobus variegatus*, and *Scotoecus hirundo*. Ecological notes were recorded; embryos and parasites were collected and preserved. Seventy-one species of bats are now known to occur in Sudan.

INTRODUCTION

The bat fauna of Sudan has not yet been extensively surveyed. In 1956, Setzer published results of the Anglo-Egyptian Sudan Project but did not include members of the Order Chiroptera. Kock (1969) published a major work on bats of Sudan, which was based primarily upon his collection from Kordofan Province. Koopman (1975) produced a comprehensive review of the bat species occurring in Sudan, examining specimens from museum collections in the United States and Europe. He provided maps of geographic distributions, notes on systematics, and keys to species both known to occur and likely to be found in Sudan. Sixty-six species were known from Sudan and 38 others were considered

likely inhabitants by Koopman (1975), who based his estimate on vegetation zones. Koopman also (in press) has reported additional Sudanese records (*Rousettus lanosus*, *Myotis welwitschii*, *Scotophilus borbonicus*, and *Pipistrellus crassulus*).

I collected bats from Khartoum, Bahr-el-Ghazal, and eastern Equatoria provinces in southern Sudan while working with the NIH-Sudan Project (a parasitology research group from Michigan State University). Bahr-el-Ghazal Province has not been as well surveyed as Kordofan, Upper Nile, or Equatoria provinces, which are also in southern Sudan. Bahr-el-Ghazal and Equatoria provinces fall within a vegetation region classified as semi-

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moist savanna. My collection extends the geographic ranges of several species, notably *Epomophorus minor*, previously recorded only from central Ethiopia and Kenya, and *Eptesicus capensis*. I also obtained specimens from areas farther west in Bahr-el-Ghazal Province than was noted in Koopman's (1975) report, and specimens of species poorly represented in museum collections: *Chalinolobus (Glaconycteris) variegatus*, *Scotoecus hirundo*, and *Nycteris thebaica*.

One hundred and eighty-two individuals of 13 species were collected. Because specimens were obtained over a period extending from the beginning of July 1982 through the end of January 1983, I was able to examine the reproductive schedules of several species, collect embryos, and note the habitat in which specimens were caught. Parasites were also collected and preserved. The total information offers additional insights into the poorly known bat fauna of a large African country and provides a basis for further systematic and ecological studies of the East African bat fauna in general.

METHODS, ABBREVIATIONS, AND GAZETTEER

Bats were collected from the middle of the rainy season in July 1982, through the middle of the dry season to February 1983. Collection sites are located in Bahr-el-Ghazal and eastern Equatoria provinces between latitudes 5 and 7°N and longitudes 25 and 33°E (figs. 1 and 2). The habitats sampled include dry and moist savanna, and gallery forests occurring along the rivers.

The 183 specimens collected were found in roosts, or collected with mist nets and have been prepared as skins and skulls, skeletons, or alcohol-preserved specimens. Standard measurements are in millimeters; weights are in grams. My collection (both bats and parasites) is housed at the Michigan State University Museum, East Lansing, Michigan.

I have organized accounts by family, genus, and species. Included with each species are measurements, ecological notes, and any other relevant information.

ABBREVIATIONS

AMNH, American Museum of Natural History,
New York
MNS, Staatliches Naturkunde Museum, Stuttgart

MSU, Michigan State University Museum
NMW, Naturhistorisches Museum, Vienna
SMF, Senckenberg-Museum, Frankfurt
ZMK, Universitets Zoologiske Museum, Copenhagen

GAZETTEER

Raga, 250 km NW Wau (318 km by road)
Deim Zubar, 150 km W Wau
Mbilli, 20 km SW Wau
Raffili, 90 km S Wau on Sue R.
Ngohalima, 12 km SW Wau on Bussere R.
Ngosulugu, 29 km SW Wau on Bussere R.
Rumbek, 150 km SE Wau
Mundri, 100 km NW Juba

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ACCOUNTS OF SPECIES

FAMILY PTEROPODIDAE

Six genera and eight species were known from Sudan in 1975 (Koopman, 1975). These included *Eidolon helvum*, *Rousettus aegyptiacus*, *Rousettus angolensis*, *Hypsignathus monstrosus*, *Epomops franqueti*, *Epomophorus labiatus*, *Epomophorus gambianus*, and *Micropteropus pusillus*. An additional species, *Rousettus lanosus*, recorded by Bergmans (1982) from Gilo, in the Imatong mountains, has been added to the list.

My collection of Sudanese bats includes three genera: *Eidolon*, *Epomophorus*, and *Micropteropus*. I collected specimens of *Eidolon helvum*, *Epomophorus labiatus*, and *Epomophorus minor*; the latter had not yet been recorded from Sudan. A total of 10 pteropodid species are now known from Sudan.

Eidolon helvum

SPECIMENS: One male from Khartoum (mummy, MSU 33516).

OTHER SUDAN RECORDS: Khartoum, Kordofan, Blue Nile, Upper Nile, Bahr-el-Ghazal provinces; see Koopman (1975) for specific localities.

REMARKS: The Sudanese population of *Eidolon* is referable to *E. h. helvum*, which has an extensive distribution south of the Sahara. This bat was classified as a resident of the forest-savanna (ecogeographic category) by Koopman (1975). It occupies dryer savanna and desert regions more frequently than do the other pteropodids in Sudan. At dusk, in Wau, large groups of *E. helvum* were seen high above the trees, presumably flying to feeding areas. Feeding flights of as far as 24 km have been reported for Nigeria (Okon, 1974). Its diet includes flowers of at least 10 genera, fruit of 34 genera, and leaves of four genera (Marshall, 1983). Food is detected primarily by smell, but also by sight. Trees are the preferred roosting site. Wings are wrapped around the body while roosting; the patterns in the wing membrane make the bat resemble a dead leaf. These bats in Ugandan populations are known to migrate during the dry season, in July and August, at which time they occur in small scattered roosts (Mutere, 1966, 1980). Introduction of Neem trees (*Azadirachta indica*) at El Obeid, Sudan, re-

portedly resulted in the appearance of *E. helvum*, not previously known from the area (Ayensu, 1974).

Epomophorus

Two specimens of *Epomophorus*, *E. labiatus* and *E. gambianus*, were reported from Sudan by Koopman (1975). I collected *E. minor* from several localities in southern Sudan, thus confirming Koopman's (1975) prediction of its occurrence. This prediction was based on the similarity of habitat (semim moist savanna) between the collection areas in central Ethiopia and Kenya, and those in southern Sudan. Species of *Epomophorus* are typically savanna forms, but are particularly abundant in forested areas in southern Sudan. They were collected in gallery forests, possibly due to fruit and roost site (tree roosting) availability along rivers. Mango groves were also favored roosting areas.

Epomophorus labiatus and *E. minor* usually fly several hours after sunset and were taken from the same net. There is notable sexual dimorphism in both of these species; males are larger than females. Juvenile male *E. minor* (lacking epaulets on shoulders characteristic of adults) resemble *E. labiatus* females. The separation of these species is based primarily on size; also, *E. minor* has weaker dentition and a shorter rostrum than does *E. labiatus*.

Epomophorus labiatus

SPECIMENS: 21. Bahr-el Ghazal Province: 8 (6 skins and skulls, 2 in alcohol) from Wau, 4 females (MSU 33376, 33379, 33380, and 33381) and 4 males (MSU 33377, 33378, 33387, and 33389); 4 females from Mbili (in alcohol, MSU 33391, 33392, 33393, and 33394); 2 males from Ngohalima (in alcohol, MSU 33382 and 33383); 2 females from Ngosulugu (in alcohol, MSU 33395 and 33396); 3 males from Raffili (skeletons, MSU 33397, 33398, and 33390); and 1 female from Raga (in alcohol, 33401). Equatoria Province: 3 (in alcohol) from Mundri, 1 male (MSU 33404) and 2 females (MSU 33402, 33403).

MEASUREMENTS (mean followed by observed range): Forearm, 10 males, 79.2 mm

(75–81), 7 females, 73.0 mm (70–74); condylobasal length, 4 males, 48.2 mm (47.1–48.9), 4 females, 41.2 mm (39.5–43.4); basilar length, 5 males, 43.9 mm (42.7–44.7), 4 females, 36.7 mm (34.3–39.6); weight, 10 males, 85.5 g (80–93), 8 females, 73.3 g (47.5–85).

OTHER SUDAN RECORDS: Upper Nile, Blue Nile, Equatoria, Kordofan Darfur, Kassala, Bahr-el-Ghazal provinces; see Koopman (1975) for specific localities.

REMARKS: *E. labiatus* is the most common of the pteropodid bats in southern Sudan. Males are extremely vocal while feeding and when caught in a mist net. Juveniles were captured in August and September, but not from September through December. This suggests that breeding occurs in spring or early summer in southern Sudan. No pregnant females were taken in the dry season. Breeding appears to take place early in the wet season so that the young are born during the middle of the rainy season when fruits are plentiful. No parasites were noticed in association with this species. *Epomophorus anurus* is regarded as a synonym of *E. labiatus* (Koopman, 1975).

Epomophorus minor

SPECIMENS: 8. Bahr-el-Ghazal Province: 2 (skins and skulls) from Wau, 1 female (MSU 33385) and 1 male (MSU 33384); 4 (in alcohol) from Mbilli, 3 females (MSU 33414, 33416, 33417) and 1 male (MSU 33415); 1 female from Raffili (in alcohol, MSU 33418). Equatoria Province: 1 female from Mundri (in alcohol, MSU 33419).

MEASUREMENTS: Forearm, 2 females, 65.0 mm (62–67), 2 males, 65.0 mm (64–66); condylobasal length, 1 male, 37.5 mm, 3 females, 36.8 mm (34.2–37.5); basilar length, 2 females, 30.2 and 37.6 mm, 2 males, 32.8 and 33.8 mm; weight, 1 female, 36 g, 2 males, 44.0 g (43–45).

REMARKS: There are no other records of *E. minor* from Sudan. The small size of the skull and body, and weak dentition separate it from *E. labiatus*. The overall appearance is that of a more delicate *E. labiatus* female; the rostrum is shortened and teeth are reduced in size. Both of these species were taken in the same net. No differences in activity period were noted, possibly because of the difficulty in identification of live or unprepared spec-

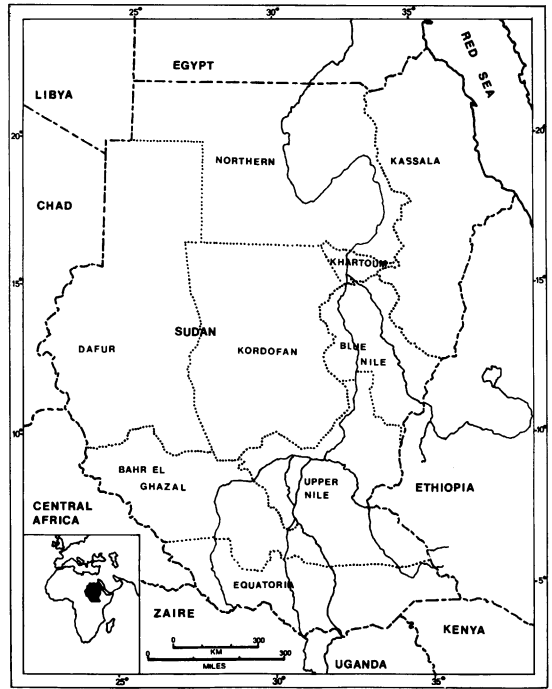


FIG. 1. Provinces of the Republic of Sudan and surrounding countries.

imens. Juvenile *E. labiatus* females are about the same size as males of *E. minor*. Juveniles were collected in September through December, but no pregnant females were taken. A closer look at the ecological and systematic relationship between *E. minor* and *E. labiatus* may prove interesting, given the similarities between these species.

Micropteropus pusillus

SPECIMENS: 9. Bahr-el-Ghazal Province: 4 (2 skins and skulls, 2 in alcohol) from Wau, 3 females (MSU 33386, 33406, 33407) and 1 male (MSU 33387); 1 female from Mbilli (skin and skull, MSU 33388); 1 female from Raffili (in alcohol, MSU 33410); 1 female from Rumbeck (in alcohol, MSU 33411). Equatoria Province: 2 females from Mundri (in alcohol, MSU 33413, 33412).

MEASUREMENTS: Forearm, 1 male, 53 mm, 3 females, 46.6 mm (40–50); head and body length, 1 male, 93 mm, 2 females, 80 and 94 mm; ear length, 1 male, 12 mm, 3 females, 14 mm (12–16); body weight, 1 male, 44.5 g, 5 females, 23.2 g (22–32).

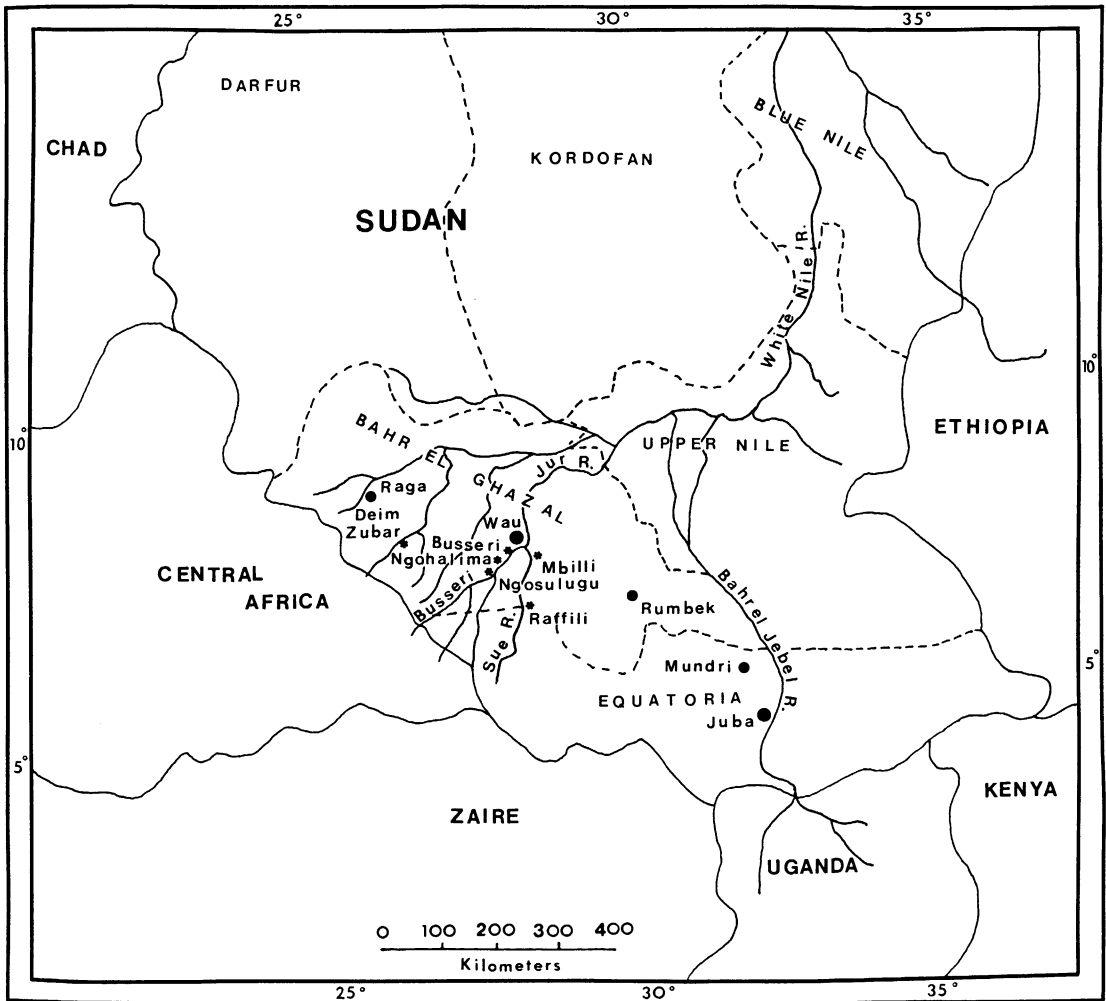


FIG. 2. My collecting localities in Bahr-el-Ghazal and Equatoria provinces, Republic of Sudan.

REMARKS: Specimens collected in Wau represent a more western distribution in Sudan than was previously known. The only other record in Bahr-el-Ghazal was from Bongo (one skin and skull in MNS mentioned by Andersen, 1912, p. 558), which is in the southeastern part of the province. No other species of *Micropteropus* occurs near the Sudan; *M. pusillus* is a widespread African species ranging throughout the tropical areas. Its small size and palatal ridge pattern (four rows split in the middle) easily separate it from species of *Epomophorus*, which share the same color pattern; brown with white at base of ears and white epaulets (tucked in shoulder pouches) in males. *Epomophorus*

labiatus, *E. minor*, and *Micropteropus pusillus* were collected in the same nets. These species probably specialize temporally, on the size of the fruits they eat, or species of plant that they frequent; all could be collected in mango groves (even when fruit was not in season). These bats were very docile compared to *E. labiatus*; they rarely struggled or tried to bite, and were not vocal.

FAMILY NYCTERIDAE

Nycteris

This is the only genus in the family; the species are primarily African. There are 10 distinct African mainland species occupying

various habitats. It is believed that the genus, originally a forest-adapted form, became freed from a dependence on trees for roosting sites with the desiccation of eastern Africa and southwestern Asia. The genus was able to invade savanna and eventually subdesert, roosting in hollow trees, aardvark or porcupine burrows, and caves. Five species have been recorded from Sudan: *N. nana*, *N. arge*, *N. hispida*, *N. macrotis*, and *N. thebaica*. *Nycteris grandis* was recorded from Zaire (Verschuren, 1957) and may occur along the southwestern edge of the Sudan (Koopman, 1975). *Nycteris parisi* was described from SW Somalia and it is probable that *N. parisi* occurs also in the Sudan (Koopman, 1975).

My collection includes only *N. thebaica*.

Nycteris thebaica

SPECIMENS: 1 from Bahr-el-Ghazal Province: male from Wau (skin and skull, MSU 33369).

MEASUREMENTS: 1 male, body length, 51 mm; tail length, 52 mm; ear length, 30 mm; forearm length, 45 mm; weight, 7.5 g.

OTHER SUDAN RECORDS: Equatoria, Bahr-el-Ghazal, Blue Nile, Kordofan, and Kassala provinces; see Koopman (1975) for exact localities.

REMARKS: The *thebaica* group of species is characterized by greatly reduced posterior lower premolars, crown entirely below cingula of adjacent teeth; upper incisors bifid; tragus pyriform (round); it roosts in caves or cavelike structures. This group is the most specialized, being now almost completely absent from the forest. It has invaded dry areas in northern Africa and southwestern Asia from which the genus is otherwise excluded (Koopman, 1975). *N. thebaica* has been taken from the southwestern corner of Bahr-el-Ghazal Province and was represented by only one specimen when Koopman examined the Sudan material available in 1975. The AMNH has only two specimens of this species from Sudan, one alcoholic from Lake Nyibor, Bahr-el-Ghazal Province, and one skin and skull from Nimule, Equatoria Province. The species is widespread throughout Africa, occurring as far north as Egypt and south to South Africa. Koopman (1975) classified *N. thebaica* as a Savanna-Palearctic form.

The specimen from Wau, Bahr-el-Ghazal Province, was obtained along the Bussere River in gallery forest. The riverbanks may provide necessary roost sites; overhangs and tree roots form small hollow areas. Even though this species is widely distributed, it is either uncommon or difficult to collect using a mistnet. Insects, spiders, and scorpions form a staple part of the diet (Vaughan, 1978). The bats flutter around trees and bushes in search of food which they pounce on and then consume either on the ground or in the vegetation. Such feeding behavior may make mist-netting for this species difficult. *N. thebaica* has been reported to roost in colonies of 500 to 600 individuals in a cavern in Botswana (Smithers, 1971, p. 83). Smaller groups or single individuals occur where there are no large roost areas. There were no signs of large colonies in the areas where I collected, although there were cavelike structures formed by boulders from outcrops along the rivers.

FAMILY VESPERTILIONIDAE

In this cosmopolitan family, 11 genera and 23 species are known to occur in Sudan (Koopman, 1975, in press). These include seven species of *Pipistrellus* (*P. nanus*, *P. kuhli*, *P. deserti*, *P. rusticus*, *P. ariel*, *P. rueppelli*, and *P. crassulus*) and five species of *Eptesicus* (*E. guineensis*, *E. somalicus*, *E. capensis*, *E. rendalli*, and *E. floweri*). *Chalinolobus* (*Glauconycteris*) *variegatus*, *Mimetillus moloneyi*, *Nycticeius schlieffeni*, *Scotoecus hirundo*, *Otonycteris hemprichi*, *Plecotus auritus*, and *Miniopterus schreibersi* are the only members of their respective genera known from Sudan. *Scotophilus* is represented by three species in Sudan; *S. leucogaster*, *S. gigas*, and *S. borbonicus* (including *nigritellus*), the smallest of the species. The first *Myotis* species known from Sudan, *M. welwitschii*, was reported in 1979 by Dieterlen and Rupp (1979). The first specimen of *Pipistrellus crassulus* from Sudan was obtained by Archer, 50 miles NW of Yambio; it was previously recorded from Zaire and Cameroon. It is now known to be widespread in the forest areas of tropical Africa (Koopman, in press). *Scotophilus borbonicus* has recently been recognized from Sudan by Koopman (in press).

My collection of bats from Sudan includes five of the ten genera known from Sudan and six species. The species collected include *Pipistrellus rueppelli*, *Chalinolobus variegatus*, *Scotoecus hirundo*, *Eptesicus capensis*, *Eptesicus somalicus*, and *Scotophilus leucogaster*.

Pipistrellus

This is a large complex genus with problems involving its interrelationship with *Eptesicus*. Seven species are presently recorded from Sudan (Koopman, 1975, in press). My collection contains only one of the species known from Sudan, *Pipistrellus rueppelli*.

Pipistrellus rueppelli

SPECIMENS: 2 from Bahr-el-Ghazal Province: 1 female from Ngohalima with embryos (skin and skull, MSU 33370); 1 male from Raffili (skin and skull, MSU 33371).

MEASUREMENTS: 1 female and 1 male, head and body length, 47 and 48 mm, respectively; tail length, 36 and 36 mm; ear length, 10 and 11 mm; forearm length, 35 and 33 mm; weight, 8 and 4.8 g.

OTHER SUDAN RECORDS: Equatoria, Bahr-el-Ghazal, Upper Nile, Blue Nile, Khartoum, Northern, Kassala provinces; see Koopman (1975) for specific localities.

REMARKS: This species is widely distributed in Sudan, but is not abundant. It occurs in gallery forests along rivers. The female with embryos was taken on September 29, which suggests that parturition occurs at the beginning of the dry season in this species.

Eptesicus

A cosmopolitan genus with many African species; five have been recorded from Sudan. The number of valid species in this genus is uncertain and the relationship with *Pipistrellus* is a problem in that there is no one character to separate these genera (Koopman, 1975).

Eptesicus somalicus

SPECIMENS: 14 from Bahr-el-Ghazal Province: 9 (5 skins and skulls; 1 skin only, 3 in alcohol) from Wau, 5 females and 4 males;

4 (skins and skulls) from Ngohalima, 3 females and 1 male; 1 from Raga (alcohol) male.

MEASUREMENTS: Head and body length, 4 males, 47.2 mm (37–50), 6 females, 41.5 mm (36–47); tail length, 4 males, 30.0 mm (26–35), 6 females, 29.0 mm (24–33); forearm length, 5 males, 28.4 mm (27–30), 7 females, 28.8 mm (27–30); weight, 6 males, 3.4 g (2.5–4.5), 7 females, 3.4 g (2.5–4.0); condylobasal length, 4 adult males, 10.9 mm (10.5–11.1), 4 adult females, 11.2 mm (11.0–11.9).

OTHER SUDAN RECORDS: Equatoria, Kordofan, Khartoum provinces; see Koopman (1975) for specific localities.

REMARKS: These specimens represent a more westerly distribution than previously noted in Sudan and the first record for Bahr-el-Ghazal Province. *E. somalicus* is very similar in appearance to *E. capensis*, differing in its smaller cranium. *E. somalicus* occurs sympatrically with *E. capensis* in southern Sudan, and ranges further north into more arid areas. Specimens were collected from buildings in Wau and in gallery forest along the Bussere River in Ngohalima.

Eptesicus capensis

SPECIMENS: 5 from Bahr-el-Ghazal Province: 5 (2 skins and skulls, 3 in alcohol) from Wau, 4 females (MSU 33374, 33375, 33436, 33438) and 1 male (MSU 33437).

MEASUREMENTS: Head and body length, 2 females, 41.5 mm (40–43); tail length, 27.5 mm (26–29); ear length, 11.5 mm (11–12); forearm length, 4 females, 31.0 mm (30–32); weight, 4 females, 4.0 g (3–5), 2 females, 2.5 and 3 g; condylobasal length, 2 females, 12.2 mm (12.1–12.3).

OTHER SUDAN RECORDS: Equatoria Province only; see Koopman (1975) for specific localities.

REMARKS: The range of *E. capensis* extends further north in the Sudan than previously noted. *E. capensis* appears to be confined to wetter savanna than *E. somalicus*. Collections of this species were made in villages and towns, where bats roosted in buildings.

Chalinolobus

African *Chalinolobus* were previously considered to be a distinct genus, *Glauconycteris*;

however, Koopman (1971) concluded that they are only a subgenus of the otherwise Australasian genus *Chalinolobus*. In Africa, nine species of *Chalinolobus* are known. Most of these are confined to the main forest block; *Chalinolobus variegatus* and *C. argentata* are the only savanna dwelling species. Only *Chalinolobus variegatus* has been recorded from Sudan. Koopman (1975) suggested that *C. argentata* may also reach southern Sudan, but my collection from southern Sudan contains only *C. variegatus*.

Chalinolobus (Glauconycteris) variegatus

SPECIMENS: 3 from Equatoria Province: 3 (in alcohol) from Juba, 2 females (MSU 33432, 33433) and 1 male (MSU 33434).

WEIGHTS (only measurement taken): 2 females, 10 g, 1 male, 11 g.

OTHER SUDAN RECORDS: Upper Nile and Kordofan provinces; see Koopman (1975) for specific localities.

REMARKS: This species has not been widely collected in Sudan. Koopman (1975) examined only one, which was from Upper Nile Province. This species is widespread in savannas but is not present in large numbers in southern Sudan. It roosts in trees and Koopman (1975) classified it as a forest-savanna species. My three specimens were roosting in a group of eight individuals on a low branch of a mango tree at an outdoor cafe in Juba. It is a very striking bat with orange fur and wing membranes, and with veins appearing as black variegation. Butterfly Bat is its common name.

Scotoecus

This genus, although close to *Nycticeius*, is now considered a full genus (Koopman, 1975). Two species are recognized, *S. hirundo* and *S. albofuscus*, but only *S. hirundo* has been reported from Sudan. My Sudanese collection includes one.

Scotoecus hirundo

SPECIMENS: 1 from Bahr-el-Ghazal Province: female from 5 mi S Wau (skin and skull, MSU 33372).

MEASUREMENTS: Body length, 47 mm; tail length, 3 mm; ear length, 11 mm; forearm length, 30 mm; weight, 7.5 g.

OTHER SUDAN RECORDS: Equatoria, Bahr-el-Ghazal, Blue Nile provinces; see Koopman (1975).

REMARKS: This species was represented in museum collections by only nine specimens at the time Koopman examined all available museum material from Sudan, in 1975. There are more records now, but the species is relatively uncommon in Sudan. *S. hirundo* is known to occur throughout the savanna areas of tropical Africa. Its distribution appears spotty. I collected another of this species in Kenya, on Lamu Island, off the northern coast (a male in alcohol, weighing 9 g, MSU 33435).

Koopman (in press) noted Hill's (1974) review of the genus, in which *S. hindei* was recognized as a species distinct from *S. hirundo* based on a series of measurements. Robbins (1980) attributed most of the differences Hill found to sexual dimorphism (males being larger than females); most of the *hindei* sample was male and most of the *hirundo*, female. The measurements that Koopman (1975) listed also show this general pattern. Koopman (in press) agreed with Robbins (1980) but suggested that more material is needed, of both sexes and from different geographic areas, before this matter is settled.

Scotophilus

Scotophilus is a widespread Old World tropical genus. Two species from Sudan were recognized by Koopman (1975), *Scotophilus nigrita* and *S. gigas*. Since then, many taxonomic changes have been made involving the African members of this genus, but there is still no agreement on the species to be recognized (Koopman, 1975). Koopman (in press) recognized three species from Sudan: *S. leucogaster*, previously referred to as *S. nigrita* (which is actually a senior synonym of *S. gigas*); *S. borbonicus* (= *nigritellus*), a small species distinct from the next larger species, *S. leucogaster*; and *S. nigrita* (= *gigas*), the largest of these three species.

In my collection from Sudan only *S. leucogaster* is represented.

Scotophilus leucogaster

SPECIMENS: 47. Khartoum: 1 male (skin and skull, MSU 33567). Bahr-el-Ghazal Province: 45 (10 skins and skulls, 23 in alcohol,

11 skeletons) from Wau, 16 males (MSU 33506, 33510, 33513, 33514, 33515, 33516, 33518, 33521, 33523, 33526, 33542, 33543, 33547, 33549, 33550, 33620) and 30 females (MSU 33507, 33508, 33509, 33511, 33512, 33517, 33519, 33520, 33522, 33524, 33525, 33527, 33528, 33538, 33539, 33540, 33541, 33544, 33548, 33577, 33578, 33613, 33616, 33617, 33618, 33622, 33623, 33624, 33625, 33628); 2 females from Raga (in alcohol, MSU 33551, 33552).

MEASUREMENTS: Head and body length, 9 males, 70 mm (62–75), 19 females, 71 mm (66–75); tail length, 9 males, 46.3 mm (41–50), 19 females, 47.7 mm (48–53); weight, 13 males, 19.9 g (17–25), 22 females, 20.8 g (17–23.5); condylobasal length, 9 males, 17.7 mm (16.2–18.0), 13 females, 17.2 mm (16.5–18.3).

OTHER SUDAN RECORDS: Equatoria, Bahr-el-Ghazal, Upper Nile, Kordofan, Darfur, Khartoum provinces; see Koopman (1975) for specific localities.

REMARKS: *Scotophilus leucogaster* is the most common bat in Wau. It roosts in buildings where it forms large colonies. The common name is the Yellow House Bat; specimens from Wau however, are more olive brown in color. The jaws are powerful for its size. Males have an obvious gland in the corner of the mouth between the cheek and gums. Ectoparasites were collected and preserved, including soft ticks, mites, and *Cimex*.

FAMILY MOLOSSIDAE

A widespread, almost cosmopolitan family, molossids have recently been studied on a worldwide basis by Freeman (1981). She used numerical methods to determine the number of natural groups. Freeman (1981) split the African members of the genus *Tadarida* Rafinesque into four genera: *Mormopterus*, *Tadarida*, *Chaerephon*, and *Mops*. These were considered subgenera in Koopman's (1975) treatment of the family. Freeman (1981) placed *Platymops* and *Sauromys* (both previously regarded as separate genera) as subgenera within the genus *Mormopterus*. Freeman's genera differ from Koopman's (1975) subgenera in two ways. Her genus *Tadarida* (in Africa) includes only the *teniotis* and *aegyptiaca* groups. Koopman's *bemmelini* group is transferred from *Tadarida* to *Chaerephon*. Freeman further combined the

subgenus *Xiphonycteris* with *Mops* into her genus *Mops*. All four of these genera and eleven species are known from Sudan. My collection includes three species: *Chaerephon major*, *C. pumila*, and *Mops condylura*.

Chaerephon

This name was first used by Dobson (1874) as a subgenus of *Nyctinomus*, but was raised to full generic rank by Andersen (1907). Ellerman, Morrison-Scott, and Hayman (1951) considered *Chaerephon* a subgenus of *Tadarida*. Koopman (1975) divided the genus *Tadarida* into three groups: *T. teniotis* (large forms), *T. aegyptiaca* (relatively small with low brain case), and *T. bemmelini* (relatively small with high brain case, anterior palatal emargination constricted). Freeman (1981) resurrected the genus *Chaerephon*, and I will follow her. The species of *Chaerephon* are medium-size *Tadarida*-like bats, with a less robust jaw and sagittal crest than *Mops*. The genus includes *C. ansorgei*, *C. bivitatta*, *C. aloysiisabaudiae*, *C. russata*, *C. major*, *C. nigrii*, *C. pumila*, *C. chapini*, *C. bemmelini*, *C. gallagheri*, *C. plicata*, *C. jobensis*, and *C. johorensis*. My collection includes *Chaerephon major* and *C. pumila*.

Chaerephon major (Trouessart)

SPECIMENS: 38 from Bahr-el-Ghazal Province: 38 (13 skins and skulls, 24 in alcohol, 1 skeleton) from Wau, 21 males (MSU 33462, 33463, 33466, 33467, 33468, 33470, 33472, 33478, 33480, 33482, 33483, 33485, 33487, 33490, 33491, 33492, 33494, 33495, 33499, 33500, 33619) and 16 females (MSU 33464, 33465, 33469, 33471, 33474, 33476, 33477, 33479, 33481, 33484, 33486, 33488, 33489, 33493, 33496, 33497).

MEASUREMENTS: Body length, 11 males, 67.6 mm (62–75), 11 females, 66.3 mm (63–72); tail length, 11 males, 32.5 mm (27–37), 11 females, 32.8 mm (28–38); ear length, 11 males, 16.3 mm (14–19), 11 females, 15.3 mm (13.8–16); forearm length, 11 males, 44.7 mm (39–47.8), 11 females, 46.6 mm (40–48); weight, 20 males, 14.8 g (10–19), 17 females, 14.7 g (11–17.5).

OTHER SUDAN RECORDS: Equatoria, Upper Nile, Blue Nile, Kordofan, Khartoum, northern provinces; see Koopman (1975) for exact locations.

REMARKS: *Chaerephon major* is a widespread savanna species. It occurs along the Nile River and its tributaries throughout Sudan. It probably also occurs away from rivers but most of the towns and villages are located along rivers and for convenience most collections are made close to towns. There are few roads between towns, which limits travel by land. The rivers are still the easiest means of travel throughout southern Sudan. My specimens provide the most western record of this species from Sudan, and the first record from Bahr-el-Ghazal Province. *Chaerephon major* was common in the town of Wau, living in colonies inside buildings. It cohabits buildings with *Scotophilus leucogaster* and leaves the roost to forage in early evening. Females were found with a single large embryo in late August; parturition probably occurs after peak rains. Several parasites were collected; nematodes under the skin of the lower leg (in a bundle); mites and ticks on wing membranes.

Chaerephon pumila

SPECIMENS: 7 from Bahr-el-Ghazal Province: 5 (3 skins and skulls, 2 in alcohol) from Wau, 2 females (MSU 33448, 33504) and 3 males (MSU 33447, 33449, 33505); 1 male from Dem Zubeir (in alcohol, MSU 33450), 1 female from Rumbek (in alcohol, MSU 33460).

MEASUREMENTS: Body length, 4 males, 58.1 mm (47.3–70), 2 females, 60.5 mm (60–61); tail length, 4 males, 28.3 mm (25–37), 2 females, 28.5 mm (27–30); ear length, 4 males, 13.4 mm (11–15), 2 females, 12.5 mm (12–13); forearm length, 4 males, 34.9 mm (33–36), 2 females, 34.5 mm (33–36); weight, 3 males, 9.3 g (8–11), 2 females, 12.5 g (10–14).

OTHER SUDAN RECORDS: Equatoria, Bahr-el-Ghazal, Upper Nile, Blue Nile, Kassala and Kordofan provinces; see Koopman (1975) for specific localities.

REMARKS: *Chaerephon pumila* is widely distributed throughout Sudan, mainly occurring along the Nile River and its tributaries. This may be due to the ease of collecting in or around towns and villages which are distributed along rivers. This species has not been collected in large numbers from any one

locality, suggesting that these bats may form small roosting colonies. My collections were made in villages and towns.

Mops

This generic name was first used by Lesson (1842). Ellerman, Morrison-Scott, and Hayman (1951) considered it a subgenus of *Tadarida*. Koopman (1975) considered those species of *Tadarida* sharing a reduced last upper molar and close anterior palatal emargination to be members of the subgenus *Mops*. Koopman (1975) grouped the species of *T. (Mops)* as follows:

T. condylura group (forms with only partially reduced third commissure on the last upper molar)—*condylura* (including *angolensis*, *leucostigma*, *osborni*, and *orientis*).

T. mops group (small forms with greatly reduced third commissure on last upper molar)—*niveiventer* (including *chitauensis*), *demonstrator* (including *faradjius*), and the Asian species *mops* and *sarasinorum* (including *lanei*).

T. midas group (large forms with greatly reduced third commissure on the last upper molar)—*trevori* (including *niangarae*), *congica*, *midas* (including *miarensis*).

Freeman (1981) did not recognize this division within *Mops*; the species consist of small, medium-sized, and large bats all sharing shallow to deep basisphenoid pits, ears joined over nose, and wrinkles on lips. The jaw structure indicates that hard-bodied insects are eaten by these species (Freeman, 1981). The species within the genus *Mops* include: *M. condylura*, *M. brachypterus*, *M. thersites*, *M. trevori*, *M. niangarae*, *M. congica*, *M. demonstrator*, *M. niveiventer*, *M. midas*, *M. nanulus*, *M. spurrelli*, *M. peter-soni*, *M. mops*, and *M. sarasinorum*. My collection contains only *Mops condylura*.

Mops condylura

SPECIMENS: 6 from Bahr-el-Ghazal Province: 1 female from Mbilli (skin and skull, MSU 33501); 1 male from Dem Zubeir (in alcohol, MSU 33444); 4 females from Raga (2 skins and skulls, MSU 33445, 33446, 2 in alcohol with embryos, MSU 33502, 33503).

MEASUREMENTS: 2 females, body length, 80.8 mm (71.5–90); tail length, 35.8 mm

(34.7–37); ear length, 14.8 mm (14.5–15.0); forearm length, 46.8 mm (46.0–47.5); weight, 26.0 g (22–30).

OTHER SUDAN RECORDS: Equatoria, Bahr-el-Ghazal, Blue Nile provinces; see Koopman (1975) for specific localities.

REMARKS: A common and widespread savanna species, but few are represented in collections from Sudan. My collections were made much further west in Sudan than noted by Koopman (1975), who suggested that competition with *Mops demonstrator* may be limiting numbers of *M. condylura*. I noticed that the places having *M. condylura* did not have *Chaerephon major* and vice versa. Two females with embryos were collected in November from Raga, in the western portion of Bahr-el-Ghazal Province, so perhaps parturition occurs during the middle of the dry season.

DISCUSSION AND SUMMARY

These additional records of Sudanese bats contribute to the understanding of the systematics and ecology of the savanna bat fauna. Koopman (1975, in press) has classified the species geographically as follows: forest—*Micropteropus pusillus*; forest savanna—*Eidolon helvum*, *Eptesicus somalicus*, *Chalinolobus variegata*, *Scotophilus leucogaster*, *Chaerephon pumila*, *Mops condylura*; savanna—*Epomophorus labiatus*, *Eptesicus capensis*, *Scotoecus hirundo*, *Chaerephon major*. I collected *Epomophorus minor* from within towns or along rivers where both *E. labiatus* and *Micropteropus pusillus* were also taken. They seem to use the same habitat. The riparian gallery forests in southern Sudan allow some forest dwelling species a suitable habitat to extend north into the savanna region. *Pipistrellus rueppelli* was only taken from thick riparian gallery forests, but it is not known from the main forest block of Africa. *Scotophilus leucogaster*, *Chaerephon major*, *C. pumila*, and *Mops condylura* were only taken in towns and villages, where they were roosting in buildings. These species may respond positively to human development due to the increase in available roost sites provided by buildings.

Reproductive patterns vary among the species examined. Parturition in most species

may occur primarily in the spring before the rains, based on the number of juvenile specimens collected in July. The only pregnant females collected between July and January were of *Chaerephon major*, *Pipistrellus rueppelli*, and *Mops condylura*. Four females of *Chaerephon major*, each with one large embryo, were collected between August 5 and August 18. One *Pipistrellus rueppelli* with two embryos was collected on September 20. Two *Mops condylura* with embryos were collected on November 28. These species appear to be the only ones parturient at the end of the rainy season.

Parasites (none of which have been identified) were collected from several species. Mites were found at the base of the tail of the *Nycteris thebaica* specimen. *Chaerephon major* (three specimens) had nematodes in the lower leg under the skin; mites and ticks were taken from the wing membrane of several specimens and seven trematodes and one cestode were taken from one specimen. *Scotophilus leucogaster* had ticks and mites on wing membranes; one specimen had eight trematodes in the large intestine and another had nematodes in the small intestine. One *Mops condylura* had nematodes in the small intestine.

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