

New Data on *Scotophilus gigas* Dobson, 1875 (Microchiroptera — Vespertilionidae)

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Introduction

So far as collecting is concerned *Scotophilus gigas* seems to be amongst the rarest bats. Yet in spite of this, it has a wide range in Africa. During the third Belgian expedition to the Republic of Togo (DE VREE and VAN DER STRAETEN 1971) I captured a specimen of *Scotophilus gigas*, an adult male (KMMA 35027), on the 11th December 1969 near Borgou (10°46' N — 00°35' E). The animal was caught at dusk in a mist net, set over the bed of the Sansargou, a river that almost runs dry at that time of the year. It is a large specimen with a forearm of 85.5 mm, a total skull length (incisors included) of 33.3 mm and a weight of 83 g. The specimen from Borgou is the first recorded for the Republic of Togo and the third known specimen for West Africa.

Scotophilus gigas was described by DOBSON (1875) from a single specimen from Lagos (Nigeria) and the only other West African example so far reported is from Richard-Toll in Senegal (DORST 1960). ALLEN (1939) also listed this species from Ghana, but according to ROSEVEAR (1965:296) there is no evidence that confirms its occurrence in that country. Most recently KOCK (1969) obtained three specimens at Kadugli in the Sudan. Up to now only twelve other examples have been recorded from Zaïre (Congo-Kinshasa) (HAYMAN 1957; BENOIT 1958; HAYMAN et al. 1966), Malawi (KERSHAW 1922), Rhodesia (ELLERMAN et al. 1953) and Mozambique (DALQUEST 1965, 1966).

All recent collecting localities of this species, which was formerly (ROSEVEAR 1953:88 and map 61) thought to be an inhabitant of the moist forest belt, suggest that new findings must be expected throughout the relatively dry woodlands and savannahs. Indeed, apart from the type specimen, said to have come from Lagos, this bat has never again been collected in the closed forest zone. As pointed out recently by ROSEVEAR (1965:296) the exact origin of the type and the precise nature of its vegetational background are not clear. Moreover the other West African localities (Richard-Toll and Borgou) and Kadugli (Sudan) lie within the drier open-woodlands and savannahs of the Sudan type. The actual place of capture of the type may therefore well have been in the same vegetation zone.

Until recently the variation in size of *Scotophilus gigas* was very little known. This misled DALQUEST (1965:258) to describe a new species from Mozambique, which he named *S. alvenslebeni* and which differed from *S. gigas* by its smaller size. He did so solely on published external measurements without actually having seen the type of *S. gigas*. Reexamination of the type and of the other British Museum's specimens of *gigas* showed *alvenslebeni* to be conspecific with *gigas* (DALQUEST 1966:134).

However there has been a good deal of confusion over the forearm length of the

type of *S. gigas*. The forearm of *S. gigas* was said to be about 85 mm in length by ELLERMAN et al. (1953:85), but also this figure was only based on DOBSON's measurement of the type, being 3".4 or 86 mm (DALQUEST (1966; HAYMAN 1967:102). HAYMAN's reexamination of the type proved it to have a forearm of only 80 mm and he concluded that DOBSON's 3".4 is in all likelihood an error for 3".2. Yet formerly the same author (1957:44) quoted the type as having a forearm of 86 mm. Moreover, it is of interest to note in this connection, that some of the supplementary measurements given by DOBSON (1878:262), particularly the length of the third metacarpal, 3".2, do not support entirely HAYMAN's view. In the absence of detailed remeasurement figures, this question needs further investigation.

As far as we know at present the forearm of *Scotophilus gigas* ranges from 68 to 87 mm (KOCK 1969:204). According to HAYMAN (1967:102) the majority of the specimens now in the collections of the British Museum, have forearms under 80 mm in length. In recent literature however the forearm length of these specimens varies from 68 to 80 mm (DALQUEST 1966), from 70 to 80 mm (ROSEVEAR 1965:297) and from 75 to 80 mm (HAYMAN 1967:102). No forearm measurements of the Senegal and Zaïre material have ever been reported. Moreover, no detailed cranial measurements were published, except those for the Sudan and Mozambique specimens. In any case, the measurements currently available do not allow a proper analysis of the taxonomy of this species.

In order to complete the unsatisfactory knowledge of the variation in size of *Scotophilus gigas* most of the previously reported specimens were re-examined. The opportunity was taken to add to this report data of previously not recorded material from Zaïre. As a result, much additional information about the external and cranial measurements of this species became available.

Materials and Methods

I took advantage of a recent visit to the British Museum (Natural History) (BM) to measure the holotype and the other specimens of *Scotophilus gigas* and to compare them with the specimens in the collections of the Musée d'Histoire Naturelle in Paris (MHNP), the Senckenberg-Museum in Frankfurt (SMF), the Koninklijk Museum voor Midden-Africa in Tervuren (KMMA) and the Koninklijk Belgisch Instituut voor Natuurwetenschappen in Brussels (KBIN).

A total of 21 specimens has been examined:

Lagos (?), Nigeria: BM 72.10.24.5 (holotype) ♀ ad. (in alcohol, skull extracted) — Richard-Toll, Senegal: MHNP 1960-80 ♀ ad. (in alcohol, skull extracted) — Borgou, Togo: KMMA 35027 ♂ ad. (in alcohol, skull extracted) — Kadugli, Nuba Mts., Sudan: SMF 32785 ♀ ad. (skull only), SMF 32786 ♂ ad. and SMF 32787 ♀ ad. (in alcohol, skulls extracted) — Albertville, Zaïre: KMMA 22948 ♂ ad., KMMA 29294 ♀ ad., KMMA 29297 ♂ ad. and KBIN 14598 ♂ ad. (all in alcohol, skulls extracted); KMMA 31718 ♂ ad. (skin only); KMMA 29293 ♂ imm.; KMMA 29295 ♀ imm.; KMMA 29296 ♂ imm., KMMA 33585 ♀ subad. and KMMA 33586 ♀ subad. (all in alcohol) — Chiromo, Ruo, Malawi: BM 22.12.17.53 ♂ ad. and BM 22.12.17.54 ♀ ad. (skin and skull); BM 22.12.17.55 ♂ ad. (skull only) — Mtondo, Ruo, Malawi: BM 22.12.17.55a ♂ ad. (skin, skull damaged) — Odzi, Rhodesia: BM 47.7 ♂ ad. (skin and skull).

External and cranial measurements of the adult specimens as given in table 1 are taken with vernier callipers to the nearest tenth of a millimeter. The greatest length of the skull and the length of the mandible do not include the incisors. The length of the toothrows is measured from the anterior edge of the alveole of the canine to the posterior edge of the alveole of the third molar.

In order to simplify the tables the measurements are abbreviated as follows: length of forearm: Fa; length of third metacarpal: Metac. 3; greatest length of skull: Gsl; condylobasal length: Cbl; zygomatic width: Zyg; mastoid width: Mast; width of braincase: Brain; least interorbital width: Ior; length of upper toothrow: c — m³; width across the upper canines: c¹ — c¹; width across the upper molars: m³ — m³; length of the mandible: Mand; length of lower toothrow: c — m₃.

Table 1
Measurements of *Scotophilus gigas* Dobson (in mm)

Museum and Reg. number	Sex	Fa	Metac. 3	Gsl	Gbl	Zygr	Mast	Brain	Tor	c ¹ - c ¹	m ² - m ²	c - m ³	Mand	c - m	Locality
BM 72.10.24.5	♂	86.0	81.0	32.1	28.0	21.3	18.5	13.3	6.6	10.8	13.3	10.9	22.9	12.6	Nigeria
holotype															
MNHHP 1960-80	♀	86.5	81.5	30.2	27.0	20.9	17.0	13.1	6.9	10.3	13.0	10.5	22.2	12.2	Senegal
KMMA 35027	♀	85.5	81.0	31.2	27.0	20.5	17.1	13.1	6.4	10.5	12.8	10.7	22.6	12.5	Togo
SMF 32787	♂	88.0	82.5	30.4	27.5	20.5	18.1	12.9	6.9	10.3	12.8	10.7	22.7	12.0	Sudan
SMF 32786	♂	83.5	77.5	30.1	26.8	—	17.3	13.1	6.6	10.2	12.2	10.5	22.2	12.0	"
SMF 32785	♂	—	—	30.0	26.5	19.8	17.3	12.4	6.4	9.8	12.2	10.3	21.9	11.8	"
KMMA 22948	♂	82.5	78.0	29.0	25.9	20.5	17.3	12.8	6.8	10.2	12.5	9.9	21.5	11.4	Zaire
KMMA 29294	♂	84.0	80.0	28.5	25.6	20.8	17.8	13.0	6.7	10.4	13.0	10.0	21.4	11.2	"
KMMA 29297	♂	80.5	77.0	29.1	25.8	20.6	17.6	12.6	6.4	10.5	12.9	10.0	21.5	11.5	"
KMMA 31718	♂	80.0	76.0	—	—	—	—	—	—	—	—	—	—	—	"
KBIN 14598	♂	81.0	77.0	29.5	25.8	21.3	17.2	13.0	6.6	10.5	13.0	10.1	21.5	11.5	"
BM 22.12.17.53	♂	78.0	75.0	29.3	25.7	20.5	17.1	12.8	6.4	10.5	12.7	10.1	21.4	11.3	Malawi
BM 22.12.17.54	♂	80.5	77.0	28.9	25.5	—	17.2	12.8	6.5	10.5	12.6	9.9	21.0	11.2	"
BM 22.12.17.55	♂	—	—	29.4	25.6	20.5	17.4	13.0	6.6	10.2	12.8	9.9	21.1	11.2	"
BM 22.12.17.55a	♂	77.5	73.0	—	—	—	—	—	—	10.3	12.5	9.9	—	11.2	"
BM 47.7	♂	—	73.0	30.4	26.3	20.6	17.9	13.2	6.5	10.4	12.8	9.8	21.6	11.2	Rhodesia

Table 2
Mean and range for external and cranial measurements of *Scotophilus gigas* and comparison of the sexes

	♂ + ♀			♂			♀		
	n	M	min. — max.	n	M	min. — max.	n	M	min. — max.
Fa	13	82.6	77.5—88.0	8	81.1	77.5—85.5	5	85.0	80.5—88.0
Metac. 3	14	77.8	73.0—82.5	9	76.4	73.0—81.0	5	80.4	77.0—82.5
Gsl	14	29.9	28.5—32.1	9	29.8	29.0—31.2	5	30.0	28.5—32.1
Cbl	14	26.4	25.5—28.0	9	26.2	25.6—27.0	5	26.7	25.5—28.0
Zyg	12	20.6	19.8—21.3	8	20.5	19.8—21.3	4	20.9	20.5—21.3
Mast	14	17.5	17.0—18.6	9	17.3	17.1—17.6	5	17.7	17.0—18.6
Brain	14	12.9	12.4—13.3	9	12.9	12.4—13.1	5	13.0	12.8—13.3
Ior	14	6.6	6.6—6.9	9	6.5	6.4—6.8	5	6.7	6.5—6.9
c1—c1	15	10.4	9.8—10.8	10	10.3	9.8—10.5	5	10.5	10.3—10.8
m ³ —m ³	15	12.7	12.2—13.3	10	12.6	12.2—13.0	5	12.9	12.6—13.3
c—m ³	15	10.2	9.8—10.9	10	10.1	9.8—10.7	5	10.4	9.9—10.9
Mand	14	21.8	21.0—22.9	9	21.7	21.1—22.6	5	22.0	22.0—22.9
c—m ³	15	11.6	11.2—12.6	10	11.6	11.2—12.5	5	11.8	11.2—12.6

Reexamination of the type specimen

The type, an adult female preserved in alcohol, is in good condition and still corresponds closely to the description of DOBSON (1875:122—123). The skull is intact, except left m² and m³, which are slightly damaged at the external face.

The external measurements of DOBSON (1875, 1878) do accord with those of the type specimen today. As regards the components of the wing the type description figures (given in brackets) correspond closely with the remeasurement figures given here: length of: forearm 86 (3".4 or 86 mm), third finger 145.5 (5".75 or 146 mm), third metacarpal 81 (3".2 or 81 mm), fifth finger 104 (4".15 or 105 mm), fifth metacarpal 75 (2".9 or 74 mm).

However as to the length of the forearm I found the type to be an abnormal animal. Indeed the left forearm measures 86 mm, whereas the right one only 80 mm. This probably accounts for the divergent figures given by different authors. Yet, all evidence points to the fact that the right forearm is abnormal. In the first place the right radius is somewhat distorted near its distal end. Moreover, the third metacarpal measures 81 mm on both sides; since the length of this bone has an average of 4 to 5 mm less than that of the forearm in the other specimens I measured (see table 1), one can expect a forearm length in the order of 85 or 86 mm. DOBSON undoubtedly measured the left forearm and it seems likely that he noticed the anomaly of the right forearm, without mentioning it. It may be concluded that in this case the exact length of the forearm of the type, is that measured on the left forearm, thus 86 mm.

The cranial measurements of the type specimen are given in table 1. Since the width across the molars could not be measured accurately, due to the damaged left m³, I quoted this measurement from ROSEVEAR (1965:297).

Size variation

The limits of measurements of *Scotophilus gigas* as known at present from 16 adult specimens, which were available to me, are given in table 2. I did not examine the Mozambique specimen, but the measurements given by DALQUEST (1965:258), fall within the range of variation.

The length of the forearm varies from 77 to 88 mm. The most striking difference with the size range of this species as given by previous authors lies in the lower limit of this measurement. As I mentioned earlier there is considerable confusion in the literature concerning the lower limit of the forearm range of the British Museum's specimens. This is due to the fact that the forearms of specimen BM 47.7 from Odzi (Rhodesia) have been removed during preparation of the skin; the forearm length was consequently based on the collector's measurement, mentioned on the label: "c. 68 from relaxed skin". However the length of the third digit metacarpal, which is 73 mm, suggests that the forearm was much longer than 68, since in all of the measured specimens the forearm length exceeds the length of the third metacarpal. As compared with the other specimens, this means that the forearm of BM 47.7 measured 77 or 78 mm and it seems likely that the collector's 68 is an error for 78.

The Zaïre material of the Koninklijk Museum voor Midden-Afrika includes two subadult and three immature specimens. Their forearm length and the length of the third metacarpal (in brackets) are: KMMA 33585 ♀ subad.: 81 (76); KMMA 33586 ♀ subad.: 81 (77); KMMA 29293 ♂ imm.: 77 (64); KMMA 29295 ♀ imm.: 78 (65); KMMA 29296 ♂ imm.: 73 (61).

Sexual dimorphism

The material at present available indicates that the females have larger forearm measurements than the males. Considering both east and west African specimens the range of the forearm length is given in table 2; it shows the females as being on the average 4 mm longer than the males.

In his account on *Scotophilus gigas* from the Sudan, KOCK (1969: 204) stated that the female specimen is the largest in external measurements, but not in cranial measurements. Reexamination of these specimens does not offer confirmation of this statement, since the Sudan female has a larger forearm and also a larger skull than the two males from that country (see table 1).

The measurements of the present material do not reveal any significant cranial differences between the sexes. The absolute ranges are in most cases very similar, but as regards averages the females are a trifle larger than the males (see table 2). However in the Zaïre and Malawi females the cranial length parameters are smaller than in the males of the corresponding localities. It is clear that a much larger number of specimens is required to point out the existence of a difference in skull size between the sexes.

Discussion

In both body and cranial measurements the Togo male is one of the largest animals. It conforms closely with the type from Nigeria and with the Senegal example. It

can be seen that the specimens from the Sudan are clearly in agreement with the west African specimens, while the specimens from Zaïre and Malawi clearly range much smaller and do not differ significantly from each other. While it is true that an overlap exists between the Zaïre and Sudan animals in the length of the forearm, this overlap is very slight and is probably due to sexual dimorphism.

The skulls on the contrary are significantly different, especially in the length measurements. Indeed, as regards these skull measurements, the Zaïre specimens lie in an appreciably lower range and are obviously in the same class as those from Malawi.

Based on the material at present available for measurement the specimens from the Zaïre-Malawi-Rhodesia-Mozambique region seem to be sufficiently distinct and provisionally merit differentiation as an eastern subspecies: *Scotophilus gigas alvenslebeni* Dalquest. The range of size of the west African and Sudan specimens, which represent the typical race *Scotophilus gigas gigas* Dobson, is given in table 3. The external measurements and the cranial length parameters of *alvenslebeni* are significantly smaller both in range and mean.

But, apart from size, there is one constant structural difference in the skull, which can be used to separate the two subspecies: the dorsal outline of the nasal emargination. In all *alvenslebeni* specimens this is U-shaped; in all *gigas* examples on the contrary this emargination is relatively smaller and nearly V-shaped (see

Table 3

Comparison of measurements of *Scotophilus gigas gigas* and *S. g. alvenslebeni*

	<i>gigas</i>			<i>alvenslebeni</i>		
	n	M	min. — max.	n	M	min. — max.
Fa	5	85.9	83.5—88.0	8	80.5	77.5—84.0
Metac. 3	5	80.7	77.5—82.5	9	76.2	73.0—78.0
Gsl	6	30.7	30.0—32.1	8	29.3	28.5—30.4
Cbl	6	27.1	26.5—28.0	8	25.8	25.5—26.3
Zyg	5	20.6	19.8—21.3	7	20.7	20.5—21.3
Mast	6	17.5	17.0—18.5	8	17.4	17.1—17.9
Brain	6	13.0	12.4—13.3	8	12.9	12.8—13.2
Ior	6	6.6	6.4—6.9	8	6.6	6.4—6.8
c ¹ —c ¹	6	10.3	9.8—10.8	9	10.4	10.2—10.5
m ³ —m ³	6	12.7	12.2—13.3	9	12.7	12.5—13.0
c—m ³	6	10.6	10.3—10.9	9	10.0	9.8—10.1
Mand	6	22.4	21.9—22.9	8	21.4	21.0—21.5
c—m ₃	6	12.2	11.8—12.6	9	11.3	11.2—11.5

Table 4

Comparison of cranial ratios of *Scotophilus gigas gigas* and *S. g. alvenslebeni*

	<i>gigas</i>			<i>alvenslebeni</i>		
	n	M	min. — max.	n	M	min. — max.
Zyg/Cbl	5	75.7	74.5—77.4	7	80.1	78.3—82.5
Mast/Cbl	6	64.6	63.0—66.0	8	67.6	66.5—69.5
Brain/Cbl	6	47.8	46.8—48.9	8	50.0	48.8—50.8
m ³ —m ³ /Cbl	6	46.8	45.5—48.1	8	49.6	48.3—50.8
c—m ³ /m ³ —m ³	6	83.4	80.8—86.1	9	78.1	76.6—79.5
c ¹ —c ¹ /c—m ³	6	97.3	95.1—99.1	9	104.3	103.0—106.1



Crania of *Scotophilus gigas* — a, b, d: *S. g. alvenslebeni*, KMMA 29297 ♂ — c: *S. g. gigas*, KMMA 35027 ♂. (ca. 2 × orig. size)

figure). Moreover several cranial ratios, such as zygomatic width / condylobasal length, $m^3 - m^3$ / condylobasal length, mastoid width / condylobasal length, width of braincase / condylobasal length, $c - m^3$ / $m^3 - m^3$ and $c^1 - c^1$ / $c - m^3$ differ significantly and are valid characters to separate the two proposed subspecies (see table 4).

It is however not possible to distinguish between the two subspecies using colour as a criterion. There is a considerable variation in colour, but as far as can be established from alcohol specimens the pelage of the back in *gigas* is in general a shade lighter than in *alvenslebeni*. The belly fur is yellowish white in *gigas*, but in *alvenslebeni* it ranges from white, through pale yellowish to red-brownish.

From a comparison of the specimens known so far it does seem that there are two really distinct forms. Whether the observed differences are on the subspecific or specific level remains for the moment to be solved. Although in my opinion the cranial differences are important enough to justify eventually a specific separation, I still propose provisionally, awaiting the advent of more adequate material, to regard *alvenslebeni* as a smaller race of *gigas*.

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Summary

The cranial and external measurements of twenty-one specimens of *Scotophilus gigas*, including the holotype and most of the hitherto reported specimens, were analysed to establish the range of size variation as well as the sexual variation. The taxonomy of the species is discussed and it is proposed that the specimens from Zaïre, Malawi, Rhodesia and Mozambique may be provisionally differentiated as a subspecies, *S. gigas alvenslebeni* Dalquest.

Zusammenfassung

Neue Daten über Scotophilus gigas Dobson, 1875

Schädel- und äußere Maße von 21 Exemplaren von *Scotophilus gigas* wurden analysiert, um das Ausmaß der Größenvariante und der Geschlechtsunterschiede festzustellen; zu dem untersuchten Material gehören der Holotypus und die meisten bisher beschriebenen Exemplare. Die Taxonomie der Exemplare wird diskutiert, und es wird vorgeschlagen, die Exemplare von Zaïre, Malawi, Rhodesien und Mozambique provisorisch als Unterart zu differenzieren: *S. gigas alvenslebeni* Dalquest.

Résumé

Nouvelles-donnees sur Scotophilus gigas Dobson, 1875

Les mensurations crâniennes et corporelles de vingt et un spécimens de *Scotophilus gigas*, y compris le type et la plupart des spécimens antérieurement signalés, ont été analysées à fin de pouvoir déterminer la variation et le dimorphisme sexuel. La taxonomie de cette espèce est discutée et en conclusion il est proposé de considérer provisoirement les spécimens provenant de Zaïre, Malawi, Rhodésie et Mozambique comme une race orientale *S. g. alvenslebeni* Dalquest.

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