Scientific Contribution

First record and echolocation call of Glauconycteris argentata (Dobson, 1875) from Gabon

Daniel PEEREBOOM[1], Stefan VAN LIESHOUT[1], Kathryn J. JEFFERY[2,3,4] & Wim BERGMANS[5]

[1] Consultancy Bureau E.C.O. Logisch, P.O. Box 38, 2910 AA Nieuwerkerk aan den IJssel, The Netherlands. daniel@eco-logisch.com.
[2] Agence Nationale des Parcs Nationaux de Gabon, Batterie 4, Libreville, B.P.20379, Gabon. jefferykath@gmail.com.
[3] Institute de Recherche en Écologie Tropicale, B.P.13354, Libreville, Gabon.
[4] University of Stirling, Stirling, Scotland, FK9 4LA, UK.
[5] Pieter Pauwstraat 10-1, 1017 ZJ Amsterdam, The Netherlands. BergmansWim@kpnplanet.nl.

Key words: Chiroptera, *Glauconycteris argentata*, **Lopé National Park, conservation, Gabon, echolocation.**

Introduction

The insectivorous bat fauna of Gabon is still poorly known despite the detailed studies of Brosset in the Makokou and Bélinga regions (BROSSET, 1966, BROSSET, 1969). After Brosset several smaller studies on insectivoures bats were conducted, on species diversity in the Gamba protected area complex (RODRIGUEZ *et al*. 2006) and on bats and infectious diseases (POURRUT *et al*., 2007; TOWNER *et al*., 2007; POURRUT *et al*., 2009; MAGANGA *et al*., 2011). In total 37 species of insectivorous Chiroptera have been recorded for Gabon (BROSSET, 1966; AFRICAN CHIROPTERA REPORT, 2011). We carried out a bat study in a forest-savanna mosaic in northern Lopé National Park, central Gabon, from January to April 2010. The purpose of this study was to describe the calls of insectivorous bat species occurring in the Central African forest zone, thereby serving as a basis for acoustic bat surveys in this biome. Acoustic surveys can improve our knowledge of the distribution and ecology of insectivorous bats. This knowledge could help clarify their role as virus disperser to enable their inclusion in conservation schemes. Here we present a description of the echolocation calls of *Glauconycteris argentata* (Dobson, 1875) and the first record of this species for Gabon.

Materials and methods

The study was carried out in a 50 km² study area in northern Lopé National Park, central Gabon (see Figure 1). The park is characterized by a diversity of habitat types. While most of the park is covered by tropical lowland forest, the study area is dominated by savannas interspersed with natural forest fragments and gallery forests. Gabon's principal river, the Ogooué, flanks the northern boundary of the study area, and a chain of hills runs along the western side. A block of continuous forest flanks the western and southern boundaries. Bats were caught during 33 trapping sessions from January till April 2010. On the 2nd February 2010, two ground level mist-nets with dimensions of 12 x 4 meters and 18 x 4 meters were placed across and beside a stream in a gallery forest (11°36'00 E, 0°7'00 S) adjacent to a bridge (Figure 1). A third mist-net (9 x 4 m) was placed above the bridge at 3 meters above ground level. The nets were opened from 18.00 - 22.00 p.m. Captured bats were immediately removed from the nets and stored in holding bags for a maximum of 4 hours before being examined and measured. The following measurements were recorded: forearm length, from the elbow to the carpals with the wings folded; 3rd metacarpal: length of the metacarpal of the third digit; 1st and 2nd phalanx of third digit: length of the first and second phalanges of the third digit, respectively; tail length: from the tip of the tail to its base adjacent to the anus; tragus length: length from the base of the tragus to the tip; ear length: from the lower border of the external auditory meatus to the tip of the pinna; ear width: maximum width of the ear; rostrum width: width of rostrum across canines; tibia length: from the knee joint to the ankle; head-body length: maximum length from tip of the nose to base of the tail. All measurements are given in mm. In addition, photographs were taken for subsequent examination, droppings were collected and stored in RNA latter and one ectoparasite was collected. These samples are stored at the Agence Nationale des Parcs Nationaux de Gabon with field number 87. Echolocation calls were recorded using a Pettersson D240X bat detector with an Edirol R09 recorder during the few seconds after their release, at or close to their capture site. The recordings were made in a semi-open habitat on a savanna at approximately 30 meters from a forest edge. The echolocation calls were analysed by using Batsound v.3.3. software from Pettersson Electronics AB. The sampling rate was set at 44.1 kHz with a 16 bit resolution.

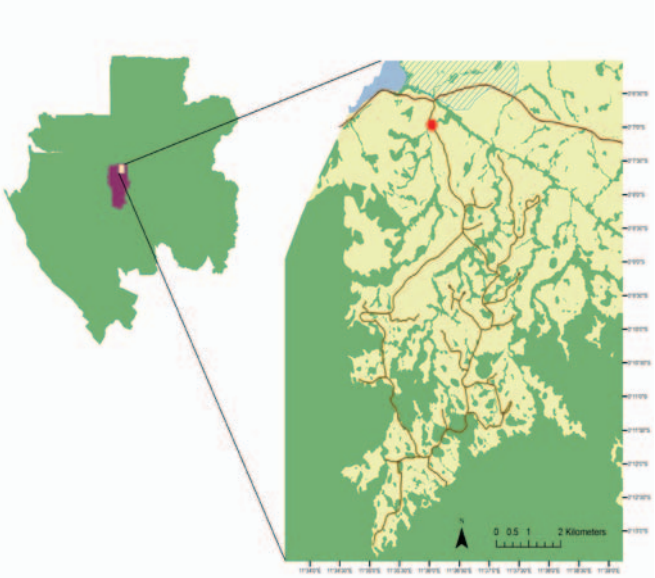

Figure 1: Map of Gabon with location of Lopé National Park (left) and detailed map of study area (right). Green areas denote forest, yellow savanna, blue the river Ogooué. Blue hatched lines indicate the location of Lopé village and brown lines are roads. The red spot indicates the location of the mist nets placed on the 2nd February 2010.

Results

189 Individuals of 29 species of insectivorous bats were caught and their echolocation calls were recorded and analyzed (PEEREBOOM *et al. in prep*). An adult female Silvery Butterfly Bat (*G. argentata)* was captured on the 2nd

ISSN 1812-1268

Table 1. External measurements (in mm) of the female *G. argentata* with field number 87 captured in Lopé National Park, Gabon, in comparison with ranges of females given by PETERSON and SMITH (1973).

Measurement	Lopé NP	PETERSON and SMITH
forearm	42.6	40.0-43.7 (n=45)
3rd metacarpal	42	39.2-45.4 (n=45)
1st phalanx of 3rd digit	15.5	13.7-16.0 (n=45)
2nd phalanx of 3rd digit	28.7	21.5-25.1 (n=44)
tail	52.6	41-53 (n=42)
tragus	3.4	-
ear length	9.6	9-14 (n=42)
ear width	6	-
rostrum width	7.6	-
tibia	20.2	16.9-19.6 (n=41)
head-body	47.4	-

Figure 2 (top) and 3 (below). *Glauconycteris argentata* with field number 87 from Lopé NP. Clearly visible are the pale flanks, the general greyish colour, the slightly curved inner margin of the tragus and the absence of a strong reticulated pattern on the wings membrane.

Table 2. Echolocation parameters for the captured individual of *Glauconycteris argentata* with field number 87. The following call parameters were calculated from a total of 16 pulses: minimum frequency (Fmin), maximum frequency (Fmax), dominant frequency (domF), pulse duration (DUR), dominant frequency of the first harmonic (HARM), and interpulse interval (IPI).

	Mean	SD	min	max
Fmin (kHz)	31.59	1.48	28.42	34.45
Fmax (kHz)	89.16	7.11	77.95	101.60
DOMF (kHz)	43.96	1.8	40.26	47.14
DUR (ms)	2.4	0.31	2.0	3.0
HARM (kHz)	94.04	8.55	81.82	104.6
IPI (ms)	55	34	24	128

of February 2010 at 19:15 hours at 0.5 m above the water surface in the net positioned across the stream. The bat, with field number 87, was identified as *G. argentata* based on external measurements (Table 1), the pale wing membranes which lacked a strongly reticulated pattern on wings and tail membrane; grey ventral pelage and dull brown dorsal pelage with pale pelage on the flanks (see Figures 2 and 3). The tragus of our individual is sickle-shaped, with a strongly curved outer margin and a slightly curved inner margin (see Figure 2). The bat was not lactating or showing any other signs of reproduction.

Comparisons

Several similar-sized species of *Glauconycteris* occur in Africa. Compared to *Glauconycteris alboguttata* J. A. Allen, 1917, our individual lacks the seal brown pelage, dark wing membranes, the obvious shoulder spots and *G. abloguttata* is slightly smaller in size (EGER and SCHLITTER, 2001). *Glauconycteris beatrix* Thomas, 1901 and *Glauconycteris humeralis* J. A. Allen, 1917 have dark interfemoral membranes, lack the dorsolateral pale-coloured pelage and are smaller in size, with forearm under 40 mm (ROSEVEAR, 1965; EGER and SCHLITTER, 2001). *Glauconycteris curryae* Eger and Schlitter, 2001 is smaller in size (forearm 33.5 – 38.0 mm), lacks the dorsolateral pale-coloured pelage of *G. argentata* and differs in general colour (EGER and SCHLITTER, 2001). *Glauconycteris egeria* Thomas, 1913 is smaller in size (forearm 37 mm), has larger ears and a longer and narrower tragus (ROSEVEAR, 1965). *Glauconycteris gleni* Peterson and Smith, 1973 closely resembles *G. argentata* but lacks the characteristic dorsolateral pale-coloured pelage of *G. argentata*, the markings of venation of the interfemoral membrane are considerably darker and the interfemoral membrane wither (PETERSON and SMITH, 1973). *Glauconycteris kenyacola* Peterson, 1982 is similar in size to *G. argentata*, but with distinctive whitish facial markings on nose, chin and at the base of the ears (PETERSON, 1982). *Glauconycteris poensis* (Gray, 1842) is smaller in size with forearm under 40 mm and the colouration of the pelage averages much darker grey (ROSEVEAR, 1965; PETERSON, 1982). The tragus of *G. poensis* has strongly curved inner margins, where the tragus of *G. argentata* has a slightly curved inner margin. *Glauconycteris variegata* (Tomes,1861) resembles *G. argentata* in shape and size, but differs in the characteristic markings of venation of the interfemoral membrane in *G. variegata* and the shape of the inner margin of the tragus is straight in *G. variegata*.

This species was captured only once during 33 trapping sessions, which also yielded 24 other insectivorous species and 5 species of Pteropodidae (PEEREBOOM *et al. in prep*).

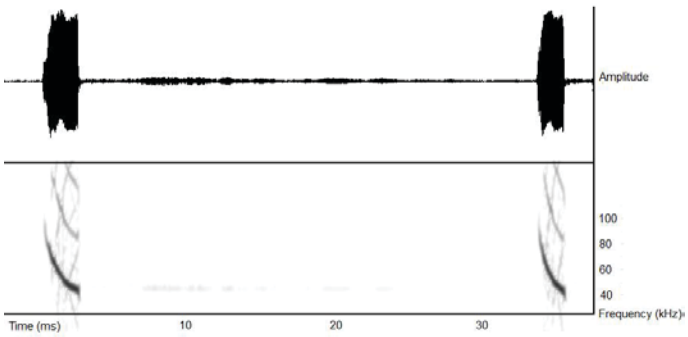

Figure 4. Waveform and spectrogram of two calls emitted by *G. argentata* with field number 87. The spectrogram was produced using Hanning window, FFT size 256.

Echolocation calls

The echolocation calls of this individual were frequency-modulated with a short quasi-constant frequency component (FM-qCF, see Figure 4). This type of call is often produced by vespertilionid bats that forage in semi-cluttered habitat close to trees, above clearings, or forest edges and trails (ALDRIDGE and RAUTENBACH, 1987). Our individual of *G. argentata* emitted echolocation calls with a dominant frequency around 44 kHz. The calls ranged in frequency from around 89 kHz to 32 kHz. A single harmonic was present in all pulses with a maximum energy around 94 kHz.

Discussion

This new record fills a gap in the known distribution of *G. argentata*, which is widespread in Central and East Africa (JACOBS *et al.*, 2008). The species is recorded from neighbouring countries Cameroon and Congo and is believed to be native but never before recorded from Gabon. *G. argentata* is associated with tropical forests and moist woodlands and has been recorded roosting in groups of up to 30 individuals in palm trees where they cling to the leaves near the midrib in groups (ROSEVEAR, 1965). During our inventory, nets were placed at potential flight paths and therefore potentially species-rich sites such as riverine forests, forest edges, or forest paths. Our single observation suggests that the species may be quite rare in northern Lopé. There is no data available on the foraging behaviour of *G. argentata*. The species might also be a high foraging species and our single observation could therefore also be caused by the limited amount of elevated mist nets during our survey.

This is the first description of the echolocation call of this species. The echolocation call parameters of this individual may not be representative for the species. More calls of different individuals, recorded in different habitats and regions within its distribution range need to be analysed for a comprehensive assessment of echolocation calls of this species. Our recordings of the echolocation call can also differ from normal foraging echolocation calls caused by stress in the animal from trapping and handling the individual.

Acknowledgements

We thank the Gabonese Government agencies for granting us permission to execute this research in their country, notably the Centre National de Recherche en Science et Téchnologie (CENAREST) and the Agence Nationale des Parcs Nationaux (ANPN) for research and park authorizations. Fieldwork was hosted by the Station d'Études des Gorilles et Chimpanzés, CIRMF, Lopé National Park, Gabon. Excellent technical and logistical assistance in the field was provided by Vianet Mihindou of the Ministère de l'Économie Forestière (MINEF). The Centre de Coordination Ouest pour l'Etude et la Protection des Chauves-souris in Genève was helpful by providing several publications.

References

ALDRIDGE, H.D.J.N., RAUTENBACH, I.L. 1987. Morphology, echolocation and resource partitioning in insectivorous bats. *Journal of Animal Ecology* **56 (3)**: 763-778.

BROSSET, A. 1966. Les Chiroptères du Haut-Ivindo (Gabon). *Biologica Gabonica* **2(1)**: 47-86

BROSSET, A. 1969. Recherches sur la biologie des Chiroptères troglophiles dans le nord-est du Gabon. *Biologica Gabonica* **5**: 93-115.

AFRICAN CHIROPTERA REPORT. 2011. *African Chiroptera Report 2011*. African Chiroptera Project, Pretoria. i - xviii, 1-4474.

EGER, J.L., SCHLITTER, D.A. 2001. A new species of *Glauconycteris* from West Africa (Chiroptera: Vespertilionidae). *Acta Chiropterologica* **3 (1)**: 1-10.

JACOBS, D., COTTERILL, F.P.D. and TAYLOR, P.J. 2008. *Glauconycteris argentata*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 13 December 2011.

MAGANGA, G. D., BOURGAREL, M., EBANG ELLA, G., DREXLER, J. F., GONZALEZ, J.P., DROSTEN, C. and LEROY, E. M., 2011. Is Marburg virus enzootic in Gabon? *The Journal of infectious diseases* **204 (Suppl. 3)**: 800-803.

PEEREBOOM *et al*. (*in prep.*) Bat diversity in Lopé National Park, Gabon and a description of echolocation calls from 24 bat species.

PETERSON, R.L., 1982. A new species of *Glauconycteris* from the east coast of Kenya (Chiroptera: Vespertilionidae). *Canadian Journal of Zoology* **60(10)**: 2521-2525.

PETERSON, R.L., SMITH, D.A. 1973. A new species of Glauconycteris (Vespertilionidae, Chiroptera). *Life Sciences Occasional Papers* **(22)**: 1-9.

POURRUT, X., DELICAT, A., ROLLIN, P. E., KSIAZEK, T. G., GONZALEZ, J.P. and LEROY, E. M., 2007. Spatial and temporal patterns of Zaire ebolavirus antibody prevalence in the possible reservoir bat species. *The Journal of infectious diseases* **196(S2)**: 176-183.

POURRUT, X., SOURIS, M., TOWNER, J. S., ROLLIN, P. E., NICHOL, S. T., GONZALEZ, J.P. and LEROY, E. M., 2009. Large serological survey showing cocirculation of Ebola and Marburg viruses in Gabonese bat populations, and a high seroprevalence of both viruses in *Rousettus aegyptiacus*. *BMC Infectious Diseases* **9(1)**: 159.

RODRIGUEZ, R.M., HOFFMAN, F., PORTER, C.A., BAKER, R.J. 2006. The bat community of the Rabi Oil Field in the Gamba Complex of protected areas, Gabon. *Bulletin of the Biological Society of Washington* **12**: 365-370.

ROSEVEAR, D.R. 1965. *Bats of West Africa*. Trustees of the British Museum (Natural History), London.

TOWNER, J. S., POURRUT, X., ALBARINO, C. G., NKOGUE, C. N., BIRD, B. H., GRARD, G., KSIAZEK, T. G., GONZALEZ, J.P., NICHOL, S. T. and LEROY, E. M., 2007. Marburg virus infection detected in a common African bat. *PLoS ONE* **2(8)**: e764.

Submitted: 09 November 2011
Accepted: 05 January 2012
Managing Editor: V. Van Cakenberghe