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Diversity and distribution of bats (Mammalia Chiroptera) in Burkina Faso

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ABSTRACT Herein we review available information on the bat fauna of Burkina Faso, synthesizing data on a considerable number of museum specimens collected in the country between 1964 and 2010. We aim to give an exhaustive review of the locally occurring taxa and their distribution overlaid on different phytogeographic areas. To achieve this objectives, available information about bats in Burkina Faso were gathered to a database from scientific publications and museums from 1964 to 1993. This database was complemented by new field collections from 2002 to 2009. In total, 3,480 bat specimens, collected over a period of 46 years from 164 localities and belonging to 51 species, were examined. The different taxa are distributed into 24 genera and nine families. The fauna includes the following families: Pteropodidae (seven species), Hipposideridae (seven species), Emballonuridae (three species), Nycteridae (five species) and Molossidae (six species) and occur in all phytogeographical zones in Burkina Faso. However, Rhinolophidae (three species) were absent in the North-Sahelian zone but occur in the other parts of the country. Similarly, Vespertilionidae (17 species) were absent in the South-Sahelian. Rhinopomatidae (two species) were only present in the extreme north and the extreme south of the country, while the Megadermatidae (one species) were present only in the Sudanian zone.

KEY WORDS Bat; Burkina Faso; distribution; species richness; West Africa.

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INTRODUCTION

Significant collections of bats from Burkina Faso are preserved in several museums. The most important one is found in the National Museum of Natural History at Washington D.C. (USNM) and comprises more than 1,100 specimens. They come from a project on mammal collection, the Smithsonian Institution African Mammal Project conducted between 1961 and 1972 in 20 countries of North, West and South Africa (Schmidt et al., 2008).

The first publication referring to bats from Burkina Faso was made by Kock (1969), who mentioned three species from Nouna. The second one was produced by Poché (1975) who mentioned six species, including five new ones for Burkina Faso, among USNM specimens collected by the Smithsonian Institution African Mammal Project. A year later, another species from Bobo-Dioulasso was quoted by Adam & Hubert (1976). The first study which dealt specifically with bats of Burkina Faso was conducted by Koopman et al. (1978). They listed a total of 27 species including 18 new ones for the country. Then, Green (1983) collected nine species in Burkina Faso including one new for the country. Between 1980 and 1981, another major study of bats from Burkina Faso was conducted by Koch-Weser (1984). She published 24 species including six first records for Burkina Faso. Two species deposited at USNM in 1965 and 1968 were published in 2006 by African Chiroptera Project (2006). By 1984, 36 species of bats had already been identified in Burkina Faso. Since the late 1980s, no first record has been reported from Burkina Faso. Meanwhile, many other species have been reported in neighboring countries (Kock et al., 2002; Djossa, 2007; Weber & Fahr, 2007; Fahr, 2008). Also, the principal study for West African bats species made by Rosevear (1965) mentioned a lot a species present in West Africa and not yet encountered in Burkina Faso. In addition, it is now well established that only intense and long term sampling can lead to accurate estimations of species richness and abundance (Kalko et al., 1996; Simmons & Voss, 1998; Bergallo et al., 2003; Sampaio et al., 2003), which in turn represent important indices in biodiversity conservation planning (Lim & Engstrom, 2001; Andelman & Willig, 2002).

Therefore, our study will be based on this work and will consist initially in gathering all existing information on bats of Burkina Faso, conducting field trips for capturing and identifying the various species, multiplying opportunities of capturing new species for the country and particularly, in establishing the geographical coordinates of areas in which species are captured or observed. It will thus increase for sure the number of species of bats present in Burkina Faso and especially a significant increase of geographical coordinates of species because the results achieved will be used later for modeling the distribution of bats in the country. This modeling will help to have an idea of the variation in the richness of species across the entire national territory and therefore, to identify areas with high potential, that is to say, areas that contain a great variety of bats. Since it is from the modeling results that measures will be taken for the conservation of bats in Burkina Faso, it was necessary to identify the various areas to prospect for a wide coverage, to put a particular emphasis on areas that can potentially contain a large number of species and manage to identify different sites in these areas where sampling will be made. And for that, we formulated the following assumptions.

Weather determines the richness of species (Hawkins et al., 2003). Indeed, according to Tews et al. (2004), the majority of studies shows that there is a positive correlation between habitat heterogeneity and diversity of species (August, 1983). From the North to South of Burkina Faso, there is an increase in rainfall and hence an improvement of vegetation with the savanna which gets gradually grassy and shrubby, tending towards a woodland in the far Southwest. The North of the country which is less watered and thus covered by sparse vegetation will be therefore less rich in species than the south which is well watered and with more developed vegetation. Climate is not the only factor influencing species richness and may not explain the diversity pattern for all taxonomic groups (Hawkins et al., 2003). Indeed, availability, abundance and distribution of food resources are also significant factors that affect the organization and dynamism of bats (Kalko et al., 1996; Kalko, 1997, 1998). Since there is an increase in biomass in Burkina Faso from north to south, we can conclude that diversity is higher in the South thanks to the increase of this biomass that will allow each species to find the resources needed for their food.

As observed by some authors (Bernard, 2001; Lim & Engstrom, 2001; Kalko & Handley, 2001; Sampaio et al., 2003), there is a positive correlation between complexity of habitat and diversity of bats, complexity of habitat being the vertical development of vegetation (August, 1983). In addition, complex habitats can provide more nests and allow the exploitation of environmental resources in various ways and thus increase species diversity (Bazzaz, 1975). And as the South of the country has a set of specific habitats such as the various protected forests, gallery forests and the numerous rock formations such as the cliffs of Banfora, peaks of Sindou and the range of Gobnangou that increase the complexity of the environment, we believe that this area can contain bats in abundance. Indeed, these rock formations provide additional shelters to bats through the various cracks and caves they have.

As already shown by Fahr & Kalko (2010), the diversity of bats increases with environmental heterogeneity and habitat complexity. Added to availability of food resources, the South may potentially contain a great diversity of bats. In addition, all existing information on bats in Burkina Faso from publications and museums indicate that many areas had not yet been visited or had been poorly studied especially in the Southwest. That's why we naturally put a particular focus on this part of the country to fill the sampling gaps. For this, the latest publication referring to bats from Burkina Faso was made by Kangoyé et al. (2012). She captured 45 species among which 15 species including 2 frugivorous and 13 insectivorous were recorded for the first time in Burkina Faso. These new species recorded increased the bats diversity of Burkina Faso from 36 to 51.

MATERIAL AND METHODS

Study area

Burkina Faso is a Sahelian country with a total area of 274,200 km^2 and landlocked in the heart of West Africa. It occurs between 9°20'–15°3' N and, 2°20'E–5°3' W. It is bounded by Niger, Mali, Ghana, Ivory Coast, Benin and Togo. The majority (about 75%) of the country occurs on crystalline Precambrian basement rock, which gives a generally flat terrain (Ministère de l'Environnement et de l'Eau, 1999). The hydrographic network is relatively dense despite the precarious weather conditions (Dipama, 2010). Burkina Faso is characterized by a tropical climate, precisely a Sudano-Sahelian one, generally alternating two seasons: a long dry season from October to April and a short rainy season from May to September. The larger portion of the country lies in the Sudanian climatic zone, including central and southern parts. The northern area is under the influence of Sahelian climate (Ministère de l'Environnement et de l'Eau, 1999).

According to Guinko (1984) and Fontès & Guinko (1995), we distinguish two major phytogeographic areas on the basis of climate, vegetation and fauna: the Sahelian and the Sudanian areas, each divided into two sectors (north and south) (Fig. 1).

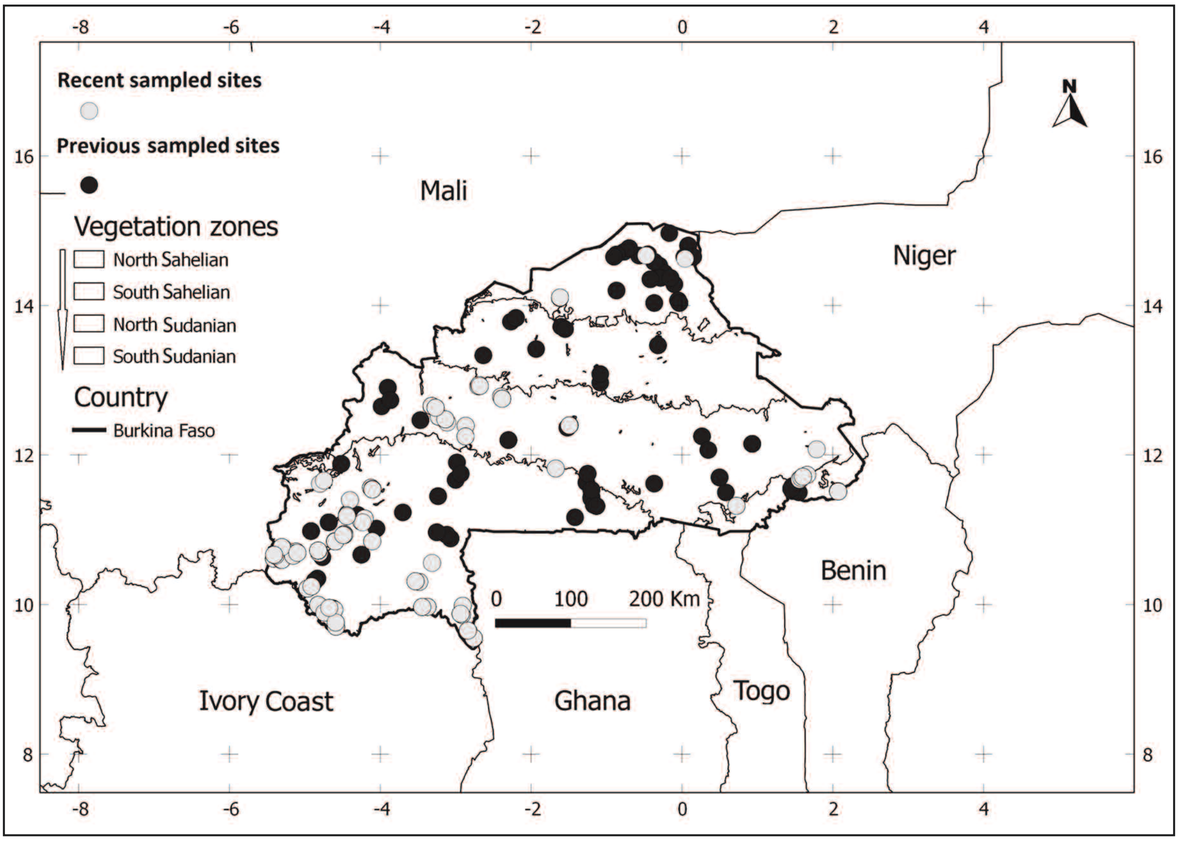

Figure 1. Previous and recent sampling sites of bats in Burkina Faso in relation to vegetation zones.

Sahelian phytogeographical vegetation area includes tree and shrub steppes, grassy steppes, tiger bush and riparian formations (Ganaba, 2008). North-Sahelian area lies north of the fourteenth parallel and is characterized by a set of species typical of the Sahara and Sahel that rarely occur further to the south in the country. South-Sahelian zone extends between the thirteenth and fourteenth parallel. This is the area where interfere many Sudanian ubiquitous species, but the general appearance of vegetation, low enough, is dominated by the Sahelian and Saharan elements. The Sudanian phytogeographic area is located south of the thirteenth parallel.

The vegetation is characterized by a set of savannas (from woodland to grassland). North-Sudanian area is located between the thirteenth and twelfth parallel (13° and 11° 30'). Savannas have the look of rustic landscapes. South-Sudanian sector is the area below the parallel 11° 30'. The vegetation is dense. Savannah is generally higher and better covering.

Data collection

The first phase of this work consisted in gathering all publications made on the bats of Burkina Faso. At this level, information about all species as well as areas where the species were found, especially geographic coordinates have been collected and integrated to a data base. Secondly, data from museums hold specimens from Burkina Faso were used to complete our data base. Specimens from Burkina Faso are conserved in museums including: American Museum of Natural History, New York (AMNH); Natural History Museum, London (BMNH); Muséum d'Histoire naturelle Genève (MHNG); Muséum national d'Histoire naturelle, Paris (MNHN); Musée Royal de l'Afrique Centrale, Tervuren (MRAC); Royal Ontario Museum, Toronto (ROM), Senckenberg Museum, Frankfurt/M. (SMF), and National Museum of Natural History, Smithsonian Institution, Washington, DC (USNM). Most collections have been personally reviewed by Dr. Jakob Fahr (BMNH, MHNG, MNHN, and USNM). Sampling sites and coordinates are presented in Table 1.

Recently, new data were collected by Laurent Granjon and his colleagues either during field trips mainly devoted to rodent sampling (from 2002 to 2005), or within the framework of the FSP (Fonds de Solidarité Prioritaire) project N° 2002-87 "Gestion durable des ressources sylvo-pastorales et production fourragère dans l'Ouest du Burkina-Faso" (from 2006 to 2008) These specimens are housed at the University of Braunschweig in Germany and IRD Bamako. Sampling sites, coordinates, dates of capture, number of nets used and capture effort made are presented in Table 2. Finally, the most recent data were collected by the BIOTA project (Biodiversity Monitoring Transect Analysis in Africa) from 2008 to 2009. This last data, that represents the main contribution to this paper, permitted to fill sampling gaps and leaded to the description of some species new for Burkina Faso (Kangoyé et al., 2012). The corresponding specimens are housed in the University of Ouagadougou, Burkina Faso. Sampling sites, coordinates, dates of capture, number of nets used and capture effort made are presented in Table 3. All collection localities are mapped in figure 1.

During BIOTA collect, we captured bats with Japanese nylon or polyester nets of Vohwinkel mark (length: 6 m or 12 m, height: 2.80 m, 5 floors, mesh: 16 mm, denier 70/2) black. A Garmin GPS 12 was used to take the coordinates of the sites visited. The nets have been installed and open, either all night from 6 pm to 6 am, 6 pm to 12 pm and from 4 am to 6 am, or part of the night from 6 pm to 12 pm depending on the movement of bats. The nets were visited regularly to remove the bats captured according to the intensity of capture. Each captured bat was placed individually in a capture cotton bag. Each bat was then weighed with a Pesola weighing machine with an accuracy of 0.25 g, 1g or 2 g depending on the size of the specimen. The forearm of the bat was measured with a Mahr caliper 16U with an accuracy of 0.1 mm.

The following parameters were recorded: sex, age (juvenile, sub-adult, young-adult or adult) according to Antony (1988), the reproductive status (testicles in the abdomen or testicles in the scrotum for males; nulliparous, pregnant, lactating or post-lactating for females) according to Racey (1988). Bats were therefore identified using the keys of Rosevear (1965), Hayman & Hill (1971) and the compilation of Bergmans (2002). Once identified, bats were released on site.

Species which were difficult to identify and other specimens were conserved in alcohol 70% to verify identification, to confirm their presence in

Locality	Latidude	Longitude	Publications
Aribinda	14.200	-0.867	Koch-Weser, 1984
Arli River	11.517	1.467	Green, 1983
Arli-NP	11.550	1.450	Koopman et al., 1978; Green,1983
Arly	11.583	1.467	Poché, 1975; Green, 1983; Bergmans, 1988;Van Cakenberghe & De Vree, 1993
Bal-y-ata	14.283	-0.100	Koch-Weser, 1984
Banfora	10.633	-4.767	Bergmans, 1988
Barga	13.783	-2.267	Poché, 1975; Koopman et al., 1978
Barga (9 km NE)	13.833	-2.200	Koopman et al., 1978; Van Cakenberghe & De Vree, 1998
Bigou River	11.500	0.583	BMNH
Bobo Dioulasso	11.200	-4.300	Koch-Weser, 1984; Bergmans, 1988
Bokouongou River	11.500	1.550	Green, 1983
Bontioli (Bougouriba River)	10.883	-3.067	Hill & Harrison, 1987
Boromo	11.750	-2.933	Koopman et al., 1978; Koch-Weser, 1984
Bossey-Dogabe	14.533	-0.300	Koch-Weser, 1984
Bourzanga	13.683	-1.550	Koch-Weser, 1984; Kock et al., 2001
Boussouma (5 km N)	12.967	-1.083	Koopman et al., 1978; Bergmans, 1988
Cella (1 km N)	11.617	-0.367	Koopman et al., 1978; Bergmans, 1989
Comoé River	9.950	-4.633	Hill & Harrison, 1987
Dedougou	12.467	-3.467	Koch-Weser, 1984
Deux Bales (Black Volta River)	11.667	-3.000	BMNH
Diebougou	10.967	-3.250	Koch-Weser, 1984; Kock et al., 2001
Dindéresso	11.217	-4.433	Hervy & Legros, 1981c
Dio	13.333	-2.633	Koopman et al., 1978; Sakamoto et al., 1979; Van Cakenberghe & De Vree, 1998
Diomga	14.067	-0.050	Koch-Weser, 1984; Kock et al., 2001
Djibo	14.100	-1.617	Koch-Weser, 1984; Aulagnier et al., 1987
Djipologo	10.933	-3.117	Koopman et al., 1978; Robbins et al., 1985; Bergmans,1988; Van Cakenberghe & De Vree, 1993; Van Cakenberghe & De Vree,1998
Dori	14.033	-0.033	Koch-Weser, 1984; Aulagnier et al., 1987
Fada N'Gourma	12.067	0.350	Robbins et al., 1985
Fo	11.883	-4.517	Poché, 1975; Koopman et al., 1978; Bergmans, 1988; Bergmans, 1989; Bergmans, 1991; Koch-Weser, 1984
Forêt de Lera	10.600	-5.317	Hervy & Legros, 1981c
Founzan	11.450	-3.233	Koopman et al., 1978; Van Cakenberghe & De Vree,1985; Bergmans,1988; Van Cakenberghe & De Vree,1993; Van Cakenberghe & De Vree,1998
Gandéfabou	14.767	-0.700	Koch-Weser, 1984
Goden	12.200	-2.300	Poché, 1975; Koopman et al., 1978; Robbins et al., 1985; Van Cakenberghe & De Vree, 1985; Van Cakenberghe & De Vree,1993
Gorgadji (17 km E)	14.033	-0.367	Koopman et al., 1978
Gorom-Gorom	14.433	-0.233	Koch-Weser, 1984
Karfiguéla (near Banfora)	10.689	-4.809	
Kaya	13.083	-1.083	SMF
Koumbia (Bobo Dioulasso)	11.233	-3.700	Adam & Hubert, 1976 [as from "Bobo-Dioulasso"]
Koutoura	10.350	-4.833	Koch-Weser, 1984; Bergmans, 1991
Koutoura (5 km SW)	10.317	-4.867	Koopman et al., 1978; Bergmans, 1988; Van Cakenberghe & De Vree,1993;Van Cakenberghe & De Vree, 1998
Markoye	14.650	0.033	Koopman et al., 1978
Menegou	14.367	-0.283	Koch-Weser, 1984
Natiaboani	11.700	0.500	Koopman et al., 1978; Sakamoto et al., 1979; Robbins et al., 1985; Van Cakenberghe & De Vree, 1985; Bergmans, 1988; Van Cakenberghe & De Vree, 1985;Van Cakenberghe & De Vree, 1998; Csorba et al., 2003
Nayouré (3 km SE)	12.250	0.267	Koopman et al., 1978, Sakamoto et al., 1979; Van Cakenberghe & De Vree, 1985; Csorba et al., 2003
Nazinga [Forêt Classée de Nazinga]	11.167	-1.417	Bergmans, 1988
Nobéré (1 km S)	11.533	-1,200	Koopman et al., 1978; Van Cakenberghe & De Vree, 1993; Csorba et al., 2003
Nobéré (11 km S)	11.450	-1.200	Koopman et al., 1978
Nobéré (12 km S)	11.433	-1.200	Koopman et al., 1978
Nobéré (2 km S)	11.533	-1.200	Koopman et al., 1978
Nobere (9 mi S)	11.417	-1.200	Koopman et al., 1978; Van Cakenberghe & De Vree, 1985
Nouna)	12.733	-3.867	Kock, 1969; Koch-Weser, 1984; Kock et al., 2001
Orodara	10.983	-4.917	Koopman et al., 1978; Koch-Weser, 1984

Table 1/1. Gazetteer of previously records: data from publications and museums from 1964 to 1993 (continued).

Locality	Latidude	Longitude	Publications
Orodara (27 km ENE)	11.100	-4.683	Koopman et al., 1978; Van Cakenberghe & De Vree, 1985; Bergmans, 1989; Bergmans, 1997; Van Cakenberghe & De Vree, 1993; Van Cakenberghe & De Vree, 1998; Csorba et al., 2003
Ouagadougou	12.367	-1.517	Koopman et al., 1978, Koch-Weser 1984, Robbins et al., 1985, Bergmans 1988; Volleth, 1989; Volleth & Heller, 1994 ;Kock et al., 2001
Ougarou	12.150	0.933	Koopman et al., 1978; Robbins et al., 1985; Bergmans, 1988
Oulo	11.900	-2.983	Koopman et al., 1978; Van Cakenberghe & De Vree, 1993; Van Cakenberghe & De Vree, 1998
Oursi	14.683	-0.450	Koch-Weser, 1984; Aulagnier et al., 1987
Petoye	14.583	-0.367	Koopman et al., 1978; Koch-Weser, 1984; Robbins et al., 1985
Piyiri (7 km N) [= Pigahiri]	11.317	-1.133	Koopman et al., 1978
Pô-NP (Red Volta River)	11.333	-1.167	Koopman et al., 1978
Saba	14.717	-0.767	Koch-Weser, 1984; Van Cakenberghe & De Vree, 1994
Saouga	14.367	-0.150	Koch-Weser, 1984
Seguenega (6 km SE)	13.417	-1.933	Koopman et al., 1978
Sideradougou	10.667	-4.250	Koopman et al., 1978; Koch-Weser, 1984; Bergmans, 1988; Bergmans, 1989; Bergmans, 1991; Van Cakenberghe & De Vree, 1993
Sintao	13.717	-1.600	Koch-Weser, 1984
Soumousso	11.017	-4.050	Hervy & Legros, 1981a; 1981b
Takaboungou	14.650	0.150	Koch-Weser, 1984
Tambao	14.800	0.083	Koch-Weser, 1984; Van Cakenberghe & De, Vree 1994
Tassamakat	14.350	-0.417	Koch-Weser, 1984
Tatarko	13.467	-0.317	Koopman et al., 1978; Koch-Weser, 1984; Van Cakenberghe & De Vree, 1998
Tazawat (Oursi) [= Tasamakat?]	14.350	-0.417	MNHN
Terhar	14.683	-0.867	Koch-Weser, 1984
Tin-A-kof	14.967	-0.167	Koch-Weser, 1984
Tin-Ediar	14.667	-0.567	Koch-Weser, 1984
Toni	12.650	-3.983	Koch-Weser, 1984
Tounté	14.650	-0.900	Koch-Weser, 1984
Voko	11.633	-1.267	Bergmans, 1991

Table 1/2. Gazetteer of previously records: data from publications and museums from 1964 to 1993.

Locality	Site	Latitude	Longitude	Date	# of nets	Total capture effort
Nazinon River (near)	along river	11.8200	-1.6733	17-18.4.2002	2	16
Djibo	near pond	14.1071	-1.6157	29.10.2004	1	5
Oursi	Near Oursi pond	14.6680	-0.4750	31.10 - 1.11.2004	2	6
Markoye	next to inselberg	14.6242	0.0432	3.11.2004	1	3,5
Karfiguéla (Comoé River, near Banfora)	gallery forest of Comoé riveré	10.6890	-4.8085	27.2.2005	1	4
Bama	orchard (pawpaw)	11.3974	-4.4022	1.3.2005	1	12
Dafra (gallery forest)	gallery forest	11.1102	-4.2505	1.12.2006	2	6
Hameau de Dafra (Koro village)	village	11.1000	-4.2333	1.12.2006	DR	
Dafra	near river & orchards	11.1083	-4.2500	3.12.2006	2	6
Cascade de Kou (Koro village)	forest	11.1523	-4.2072	4.12.2006	2	6
Kourouma (gallery forest)	dry forest close to gallery forest	11.6581	-4.7470	7.12.2006	2	24
Kourouma (village)	village	11.6159	-4.7992	9.12.2006	DR	
Toussiana (Banfora cliff)	gallery forest	10.8443	-4.5987	25.4.2008	2	6
Toussiana (near)	degraded gallery forest	10.8478	-4.6001	26.4.2008	1	3,5
Koba River (gallery forest, near Dounonso)		10.8466	-4.1075	30.4.2008	2	8
Koba River (savanna, near Dounonso)	savanna	10.8460	-4.1062	1.5.2008	2	15
10	**16**			**17**	**23**	**121**

Table 2. Sampling sites, dates of capture, number of nets used and capture effort made from 2002 to 2008. Capture effort = the number of hours during which a 12 m-net was open overnight; # of nets = number of nets used; DR = day roost.

Locality	Site	Latitude	Longitude	Description	Date	# of nets	Capture effort
F.C. & R.P.F. Comoé-Léraba	Site 1	9.9560	-4.6768	Folonzo village	21.4.2008	6	30
	Site 2	9.9323	-4.6085	near Comoé river	22.4.2008	4	48
	Site 3	9.9958	-4.8217	near termite mound	23.4.2008	5	60
	Site 4	9.8935	-4.7411	near water way	24.4.2008	5	48
	Site 5	9.7613	-4.5908	near dense forest at *Guibourtia copalifera*	25.4.2008	4	48
	Site 6	9.7043	-4.5866	near Confluent Comoé-Leraba	26.4.2008	4	96
F. C. Niangoloko	Site 1	10.2149	-4.9644	near road	28.4.2008	6	72
	Site 2	10.2427	-4.9118	in front of cave	29.4.2008	4	32
P.U. Bangr-Weoogo	Site 1	12.3975	-1.4891	near *Khaya senegalensis*	17.6.2008	4	32
	Site 2	12.3963	-1.4927	near pond	18.6.2008	4	30
	Site 3	12.3967	-1.4890	near pond	19.6.2008	2	24
F.C. Péni	Site 1	10.9437	-4.4776	near road	7.8.2008	2	12.5
	Site 2	10.9315	-4.4779	shrubby savanna	8.8.2008	4	20
	Site 3	10.9301	-4.4912	woodland	9.8.2008	5	55
R.B. Mare aux Hippopotames	Site 1	11.5624	-4.1222	shrubby savanna	11 – 12.8.2008	12	132
	Site 2	11.5435	-4.1053	woodland (near forest)	13.8.2008	6	66
	Site 3	11.5393	-4.1042	shrubby savanna(near forest)	14.8.2008	6	66
	Site 4	11.5460	-4.1041	dense forest	15.8.2008	6	66
F.C. Kou	Site 1	11.1828	-4.4427	woodland (near forest)	16 – 17.8.2008	8	72
	Site 2	11.1956	-4.4418	shrubby savanna (near forest)	18.8.2008	4	44
F.C. Niouma	Site 1	12.9228	-2.6798	shrubby savanna	30.10.2008	4	22
	Site 2	12.9363	-2.6880	clear forest	31.10.2008	6	45
	Site 3	12.9198	-2.6986	near pond	1.11.2008	6	54
F.C. Toessé	Site 1	12.7528	-2.3830	near pond	2.11.2008	5	40
	Site 2	12.7825	-2.3977	near stream	3.11.2008	6	46.5
	Site 3	12.7534	-2.3829	near pond	4.11.2008	4	31
F.C. Sa	Site 1	12.6537	-3.3201	shrubby savanna	24.11.2008	4	39.3
	Site 2	12.6329	-3.2664	gallery forest (except forest)	25.11.2008	6	52
	Site 3	12.6570	-3.3186	woodland (near river)	26.11.2008	6	45
F.C. Toroba		12.5120	-3.2236	gallery forest (near river)	28 – 29.11.2008	13	152.8
F.C. Kari	Site 1	12.4341	-3.1122	shrubby savanna	30.11.2008	4	36
	Site 2	12.4772	-3.1366	gallery forest (near river)	1 – 2.12.2008	15	180
F.C. Tissé		12.2487	-2.8692	gallery forest (near river)	3.12.2008	7	82.3
F.C. Oualou		12.3922	-2.8672	gallery forest	5.12.2008	8	46
Karfiguéla (Cascades de Banfora)	Site 1	10.7232	-4.8222	cave, hill, river	17 – 18.2.2009	14	47.5
	Site 2	10.7215	-4.8211	cave, hill, river	19.2.2009	7	10.5
Pics de Sindou		10.6535	-5.1536	herbaceous steppe with some woody	21.2.2009	7	21.9
Néguéni		10.6542	-5.3894	hill (along stream)	23.2.2009	4	3.5
	Cave 1	10.6545	-5.3890	hill, cave	23.2.2009	DR	
	Cave 2	10.6656	-5.4075	hill, cave	23.2.2009	DR	
Toussiana	Site 1	10.8466	-4.5978	gallery forest (along stream)	25.2.2009	5	15.5
	Site 2	10.8442	-4.5978	gallery forest, hill, stream	26.2.2009	4	9
	Site 3	10.8446	-4.5987	dense forest	27.2.2009	6	20
Galgouli	Site 1	9.9678	-3.4438	herbaceous steppe (along stream)	28.4.2009	7	29.8
	Site 2	9.9689	-3.3735	gallery forest (along stream)	29.4.2009	6	12.4
Loropéni	Site 1	10.3040	-3.4832	gallery	30.4.2009	4	20
	Site 2	10.3120	-3.5323	woodland (along dam)	1.5.2009	6	31.5
Batié	Site 1	9.8630	-2.9171	woodland (along dam)	2.5.2009	5	23.8
	Site 2	9.8771	-2.9336	woodland (rupicolous bar)	3.5.2009	4	18
Mouhoun River		9.5535	-2.7601	gallery forest (along river)	4.5.2009	5	25
F.C.Koulbi		9.6522	-2.8376	gallery forest (along river)	5.5.2009	6	25.5
Bambassou		9.9837	-2.9059	gallery forest (along river)	6.5.2009	6	31.5
Tikitianao		10.5570	-3.3130		7.5.2009	DR	
Parc National du W	Site 1	11.5160	2.0701	gallery forest	11.8.2009	5	11.3
	Site 2	11.5117	2.0723	gallery forest	12.8.2009	6	53.3
Chaine de Gobnangou	Saboarkori 1	11.6720	1.5617	shrubby savanna (along mountain chain)	14.8.2009	7	38.5
	Saboarkori 2	11.6919	1.5842	woodland (along mountain chain)	15.8.2009	5	56.3
	Yirini	11.7354	1.6616	shrubby savanna (along mountain chain)	16.8.2009	6	33
	Yirini, cave	11.7105	1.6055	cave	17.8.2009	DR	
	Tindangou	11.6922	1.5842	cave	17.8.2009	DR	

Table 3/1. Sampling characteristics for the BIOTA project data collection from 2008 to 2009 (see belove) (continued).

Locality	Site	Latitude	Longitude	Description	Date	# of nets	Capture effort
Diapaga		12.0765	1.7871		18.8.2009	DR	
Pama		11.3207	0.7241	woodland (near pond)	19.8.2009	4	22.5
Outourou	Site 1	10.6145	-5.4100	gallery (between hill)	18.9.2009	9	35
F.C. Lera	Site 1	10.6086	-5.3094	gallery forest	19.9.2009	4	27.5
	Site 2	10.5973	-5.3130	gallery forest	20.9.2009	8	24
	Site 3	10.5976	-5.3049	gallery forest	21.9.2009	8	22
Kankalaba	Site 1	10.7532	-5.2834	gallery forest	22.9.2009	8	40
	Site 2	10.7660	-5.3056	gallery forest	23.9.2009	9	42.5
	Site 3	10.7685	-5.3055	gallery forest	24.9.2009	8	39
Niofila	Site 1	10.6917	-5.0991	shrubby savanna (between dam and mountain)	27.9.2009	8	96
	Site 2	10.7095	-5.1162	woodland (near mountain)	28.9.2009	4	18
	Site 3	10.6859	-5.1270	forest	29.9.2009	9	108
32	**72**				**74**	**399**	**2937.3**

Table 3/2. Sampling characteristics for the BIOTA project data collection from 2008 to 2009 (sampling sites, capture dates, number of nets used and capture effort). F.C.: Protected forest; R.P.F.: Partial wildlife reserve; P.U.: Urban park; B.R.: Biosphere reserve; DR: day roost. # of nets = number of nets. Capture effort = number of hours during which a net of 12 m is open overnight (i.e. this number is divided by two for a 6m-net).

the various areas, for the preparation of measurement Tables and reference collections of the University of Ouagadougou.

Body measurement (accuracy 0.1 mm) and cranial measurements (accuracy 0.01 mm) were conducted on these specimens. The cranial measurements are performed under a binocular magnifying glass branded Leica MZ8. Body measurements are: HB (head and body length from tip of snout to posterior margin of anus); Tail (length of tail from posterior margin of anus to tip of tail); Tot (total length, HB + Tail); Ear (length of ear from lower margin of conch to tip of ear); Trag (length of tragus along posterior margin from base to tip); FA (length or forearm including carpals); 3Met (length of metacarpal of third digit, excluding carpals); 3Ph1 (length of first phalanx of third digit); 3Ph2 (length of second phalanx of third digit); 3Ph3 (length of third phalanx of third digit); 4Met (length of metacarpal of fourth digit, excluding carpals); 4Ph1 (length of first phalanx of fourth digit; 4Ph2 (length of second phalanx of third digit); 5Met (length of metacarpal of fifth digit, excluding carpals); 5Ph1 (length of first phalanx of fifth digit); 5Ph2 (length of second phalanx of fifth digit); Tib: length of tibia; HF (length of hind foot, including claws). Cranial measurements are: C-C - width across crowns of upper canines, Mn-Mn - width across crowns of posterior upper molars, C-Mn - length of upper (maxillary) tooth row from front of canine to back of posterior molar.

Mapping of species distribution

To develop distribution maps of each species across the country, the Quantum GIS 1.8.0 software was used. Country limits and phytogeographic areas according to Fontès & Guinko (1995) were also used. These information were used in Quantum GIS 1.8.0 to produce a background map. On this map, we added thereafter, for each species, the locations where species was recorded (captured or observed).

RESULTS

Data collected between 1964 and 1993 include 1,669 specimens belonging to 36 species, collected at 77 sites.

Recent data (between 2002 and 2009) were collected during two phases; between April 2002 and May 2008 at 16 sites with 172 specimens belonging to 17 species identified; and between April 2008 and September 2009 (72 sites) with 1,639 specimens belonging to 45 species identified.

The combination of previously and recent data represent 164 sites with a total of 3,480 specimens examined. Their total give 51 species derived from the 46 years of observation. These 51 species were spread over 24 genera and 9 families, including one frugivorous and 8 insectivorous families. Insectivorous have greater species diversity compared to frugivorous. Frugivorous have 7 species in a single family, Pteropodidae and Insectivorous have 44 species distributed into 8 families: Hipposideridae (7), Megadermatidae (1), Rhinolophidae (3), Rhinopomatidae (2), Emballonuridae (3), Nycteridae (5), Molossidae (6) and Vespertilionidae (17).

Family PTEROPODIDAE
Genus *Eidolon* Rafinesque, 1815
Eidolon helvum (Kerr, 1792)

This species is found in almost all phytogeographic zones of Burkina Faso (Fig. 2). It is a migratory species (Thomas, 1983; Richter & Cumming, 2008; Ossa et al., 2012). *Eidolon helvum* moves from the forest zone during the wet season to northern woodlands and savannas, and may even reach the edge of the desert (Horáček et al., 2000). It forms colonies of thousands of individuals, which are frequently located near cities or villages. From 2009 to 2014 each year a large colony roosts in the urban park Bangr-Weoogo in downtown Ouagadougou. Some individuals have been observed during the month of May in the Southwest in the village of Tikitianao but the entire colony had not yet arrived. Another colony was also observed in August in the city of Diapaga in the Southeast.

Genus *Epomophorus* Bennett, 1836
Epomophorus gambianus (Ogilby, 1835)

Epomophorus gambianus is widely distributed in the Sudanian zone of Burkina Faso, though with fewer localities in the northern part (Fig. 2). The species is commonly found in West Africa and widely distributed in both Guinean and Sudanian savannas while only a few specimens have been found in the Sahelian zone. The latter zone with Acacia and deciduous shrubs seems to represent the northern limit of the species (Boulay & Robbins, 1989).

Genus *Hypsignathus* Allen, 1861
Hypsignathus monstrosus H. Allen, 1862

Hypsignathus monstrosus has been recorded from the southwest of the South-Sudanian area (Fig. 2). This species is mainly found in the forest zone, but extends into savannas along gallery forests and forest islands (Bergmans, 1989; Fahr et al., 2006). As such, localities in southern Burkina Faso are probably near its range northern limit (Koopman et al., 1978).

Genus *Lissonycteris* K. Andersen, 1912
Lissonycteris angolensis (Bocage, 1898)

This species occurs in the southwestern part of Burkina Faso (Fig. 2). Its presence is probably due to the fact that it is a species extending from the forest areas of West Africa to the wet savannas. In this part of the country, *Lissonycteris angolensis* is mainly found in hilly areas and cliffs that provide suitable day roosts such as caves and rock overhangs. We located several day roosts in the cliffs of Banfora.

Genus *Micropteropus* Matschie, 1899
Micropteropus pusillus (Peters, 1868)

Micropteropus pusillus is less widely distributed in Burkina Faso than *Epomophorus gambianus*, with most records from woodlands of the Sudanian zone and only few records in the North-Sudanian area (Fig. 2). Although this species ranges up to 14°N in West Africa (Owen-Ashley & Wilson, 1998), no specimens have been captured so far in the Sahelian area of Burkina Faso.

Genus *Nanonycteris* Matschie, 1899
Nanonycteris veldkampii (Jentink, 1888)

Nanonycteris veldkampii was captured in the Sudanian zone (Fig. 2). This species migrates during the wet season from the forest zone to the northern Sudanian zone (Thomas, 1983). In agreement with this, all captures were made during the wet season in protected forests, gallery forests along Gobnangou range and next to water points.

Averages of body measurements (except Ear, Tib, and HF) and cranial measurements of males are smaller than the measurements of females. The maximum measurements of the forearm and wings and the cranial measurement (MM) of males are lower than the minimum measurements of females (Table 4). The wings of females are longer than those of males.

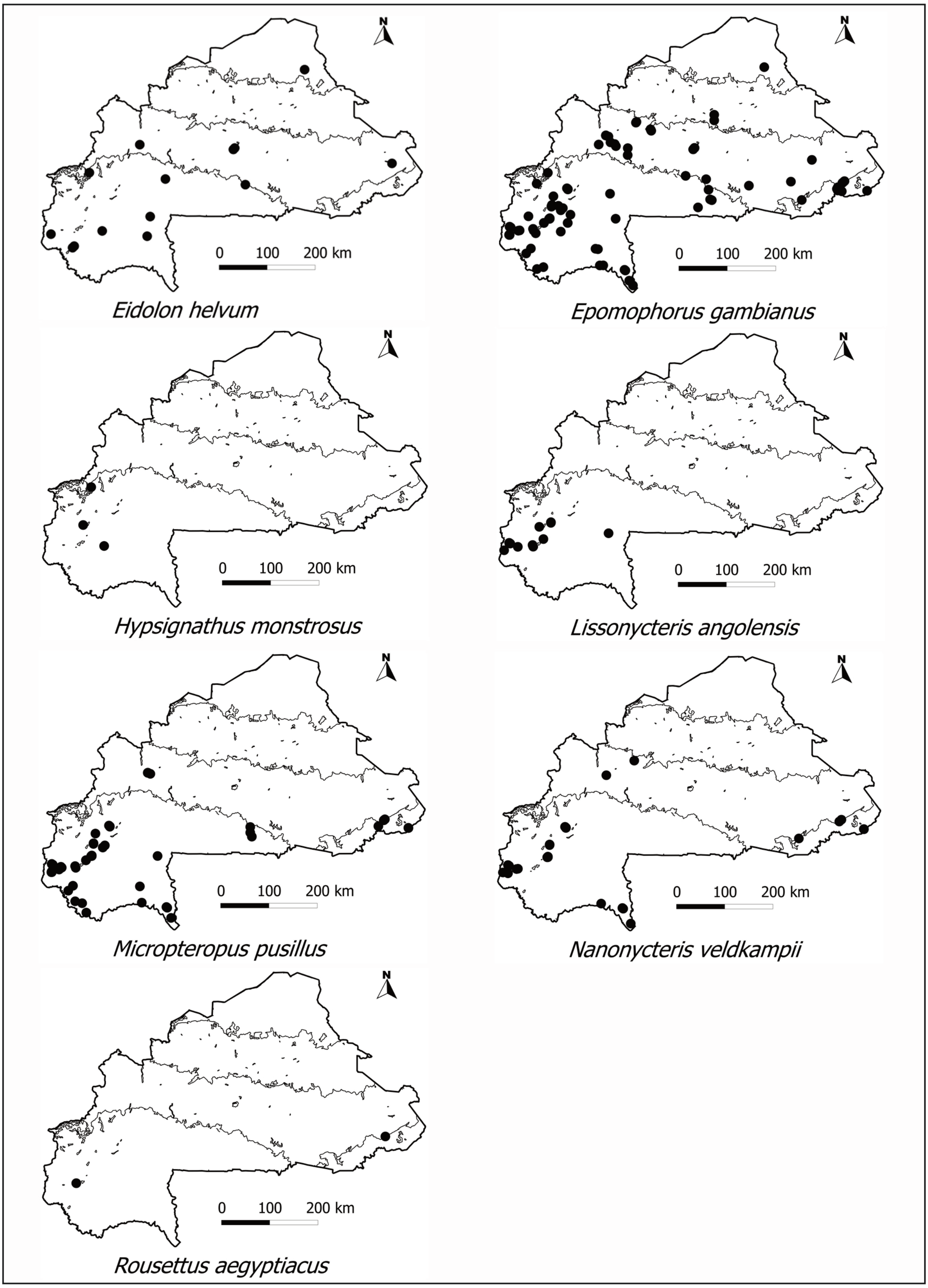

Figure 2. Distribution of Pteropodidae in Burkina Faso.

Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
Eidolon helvum																						
♂		258.0		24.7	27.6		115.2	81.0	50.1	83.2		79.9	39.7	52.3	68.5	33.0	36.0	49.6	28.4	10.45	17.23	21.90
Epomophorus gambianus																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂♂	X	127.8	138.1	6.8	27.6		89.7	65.9	40.5	53.7		62.6	30.7	32.7	63.3	30.5	30.4	39.3	21.0	10.14	14.09	21.13
	Min	120.0	127.5	4.6	26.4		88.8	64.7	39.6	49.6		61.8	29.2	30.2	62.2	28.9	29.0	37.8	20.1	9.97	13.77	20.26
	Max	144.0	143.7	9.3	29.6		92.1	67.1	41.7	56.5		63.4	31.3	34.2	64.0	31.2	31.9	40.5	21.7	10.49	14.65	21.80
	n=	4	4	4	4		4	4	4	4		4	4	4	4	4	4	4	4	4	4	4
♀♀	X	87.5	132.2	8.3	26.7		86.1	64.0	40.0	51.9		60.8	29.6	32.5	61.8	30.2	29.1	36.9	20.7	9.57	13.74	19.92
	Min	64.0	125.6	6.0	25.2		84.0	61.2	39.1	50.3		58.4	27.3	31.3	59.5	29.0	27.9	36.2	19.6	9.27	13.29	18.64
	Max	112.0	137.8	10.1	28.3		88.7	66.5	41.1	53.1		63.4	31.5	33.5	63.3	31.9	30.2	37.4	22.3	9.79	14.57	20.84
	n=	4	4	4	4		4	4	4	4		4	4	4	4	4	4	4	4	4	4	4
Lissonycteris angolensis																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂♀	X	55.0	104.2	13.1	20.8		69.6	50.6	34.8	42.0		49.0	26.0	27.2	47.9	22.6	24.5	30.0	19.9	7.44	10.84	13.81
	± SD	4.1	6.8	1.0	1.0		2.8	2.1	1.7	2.1		1.8	1.2	1.0	1.8	1.0	1.4	1.3	1.6	0.22	0.52	0.69
	Min	46.0	98.3	11.2	19.1		66.3	47.9	32.3	39.4		46.1	24.1	25.7	45.0	20.5	22.0	27.9	18.1	7.16	10.19	13.11
	Max	58.0	119.5	14.2	22.3		73.3	55.1	38.0	45.7		51.8	27.7	29.1	50.6	23.8	26.2	32.0	23.0	7.74	11.76	14.87
	n=	6	7	7	7		7	7	7	7		7	7	7	7	7	7	7	7	5	6	6
Micropteropus pusillus																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂♂	X	29.8	78.2	7.9	16.3		51.9	38.6	23.7	31.4		38.1	17.4	20.3	37.5	17.6	18.5	22.7	13.3	6.16	10.03	9.14
	± SD	2.6	4.0	0.9	0.6		1.1	1.3	0.6	1.4		1.1	0.5	0.7	0.9	0.5	0.9	0.5	0.7	0.21	0.39	0.39
	Min	27.0	72.9	6.9	15.4		50.2	36.4	22.7	28.8		36.2	16.6	19.3	36.0	16.7	17.0	22.2	11.9	5.80	9.40	8.42
	Max	34.0	84.2	9.0	16.9		53.2	40.1	24.6	32.6		39.5	18.1	21.4	38.5	18.2	19.7	23.2	13.9	6.46	10.60	9.50
	n=	5	5	5	5		5	5	5	5		5	5	5	5	5	5	5	5	5	5	5
♀♀	X	25.6	77.1	7.3	16.7		51.3	37.7	24.1	31.8		37.4	17.4	20.2	36.5	17.5	18.3	21.7	13.6	5.93	9.25	8.63
	Min	21.0	71.7	6.4	15.8		49.3	36.7	23.0	29.5		36.0	16.7	19.4	34.7	17.1	17.8	20.9	13.3	5.61	8.86	8.22
	Max	34.0	82.4	8.3	17.7		54.2	39.1	25.6	32.5		39.1	18.9	21.2	37.9	18.2	19.0	23.2	14.0	6.09	9.90	9.29
	n=	5	4	4	4		4	4	4	4		4	4	4	4	4	4	4	4	4	4	4
Nanonycteris veldkampii																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂♂	X	19.4	67.3	5.6	16.3		46.7	34.5	22.0	28.0		33.6	16.1	17.9	33.8	15.3	15.3	19.0	12.7	5.03	6.95	7.13
	± SD	3.1	4.2	1.0	1.0		1.3	1.0	0.9	1.8		1.1	0.7	0.9	1.3	0.8	0.8	0.9	0.4	0.16	0.21	0.21
	Min	15.0	61.9	3.9	14.7		45.4	32.4	21.1	25.7		31.6	15.2	16.3	31.7	14.2	14.2	18.0	11.9	4.87	6.64	6.86
	Max	26.0	76.3	6.7	17.7		48.9	35.8	23.7	30.9		35.0	17.1	19.2	36.2	16.8	16.8	20.6	13.2	5.31	7.22	7.54
	n=	8	8	8	8		8	8	8	8		8	8	8	8	8	8	8	8	7	7	7
♀		28.0	74.9	7.3	17.4		54.5	41.8	26.4	34.1		40.7	18.4	19.6	40.8	17.8	18.0	22.6	13.0	5.46	7.26	7.68
♀		21.0	69.1	5.8	15.8		50.8	39.4	24.5	31.9		37.3	17.9	19.7	37.5	17.3	17.5	18.9	12.7	5.31	7.34	7.36
Rousettus aegyptiacus																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂♂	X	144.8	136.1	22.1	21.7		98.0	64.8	42.4	58.3		63.0	33.6	36.8	60.7	30.9	28.3	45.1	26.0	9.41	13.50	17.29
	Min	130.0	133.6	18.0	20.9		93.5	63.0	41.9	54.6		61.0	32.3	36.0	58.3	30.7	28.1	42.8	20.0	8.93	13.28	16.86
	Max	162.0	139.7	26.2	22.5		101.3	66.3	42.9	60.5		64.3	35.7	37.7	62.6	31.1	28.4	48.0	30.2	10.12	13.63	17.65
	n=	4	3	4	4		4	3	3	3		3	3	3	3	3	3	4	4	4	4	4

Table 4. Measurements of Pteropodidae from Burkina Faso.

Genus *Rousettus* Gray, 1821

Rousettus aegyptiacus (E. Geoffroy, 1810)

Rousettus aegyptiacus was recorded from the western and eastern part of the South-Sudanian zone (Fig. 2). In the Sudanian zone, *R. aegyptiacus* has been captured in rocky formations that provide a wide variety of day roosts for this cave-dwelling species (Hayman, 1967; Qumsiyeh, 1985). Indeed, several specimens have been captured in the cliffs of Banfora where their shelters have been observed and where one of the caves contained about 500 to 2000 individuals. Two other specimens have been captured along Gobnangou range.

It looks like *Lissonycteris angolensis* but the averages of body measurements (except Ear, HF) and cranial measurements of *L. angolensis* are lower than those of *R. aegyptiacus*. In addition, maximum measurements (except Ear, HF) of *L. angolensis* are below the minimum measurements of *R. aegyptiacus* (Table 4).

Family HIPPOSIDERIDAE

Genus *Asellia* Gray, 1838

Asellia tridens (E. Geoffroy, 1813)

Asellia tridens is particularly found in North and Northeast Africa (Hayman, 1967; Horáček et al., 2000). This desert species extends into the North-Sahelian zone of Burkina Faso (Fig. 3), which is probably its southern limit.

Genus *Hipposideros* Gray, 1831
Hipposideros abae J. A. Allen, 1917

Hipposideros abae is known in forest areas as well as in woody savannas (Aellen, 1952). According to Koopman et al. (1978), it probably reaches its Northern limit in Burkina Faso. Indeed, all specimens are located only in the Southwest in the South-Sudanian zone (Fig. 3). Most specimens captured during the BIOTA collect come from a cave where *H. tephrus*, *H. ruber*, *Nycteris macrotis* and *Rhinolophus landeri* were also captured. *Hipposideros abae* is known to present two color phases, gray and red, like the other members of the family (Rosevear, 1965). However, all specimens captured during the late BIOTA collect were shows almost the same orange-yellow color except one specimen captured at Kankalaba which shows a darker color tending towards red.

Males are not different from females (Table 5)

Hipposideros cyclops (Temminck, 1853)

Hipposideros cyclops is located in the extreme Southwest in the South-Sudanian zone (Fig. 3). All three specimens have been captured in the protected forest and partial wildlife reserve of Comoé-Léraba, next to a dense forest at Guibourtia copalifera and not far from the Comoé-Léraba confluence. This forest species (Rosevear, 1965) is common in the gallery forests and forest islands of the National Park of Comoé in Ivoiry Coast. However, it extends from forests into savannas (Fahr, 1996). It would therefore be extended into this part of Burkina Faso near the Ivorian border. The number of our specimens does not allow us to conclude a sexual dimorphism (Table 5). However, sexual dimorphism is pronounced, with females being larger than males (Decher & Fahr, 2005).

Hipposideros jonesi Hayman, 1947

This species has been found in the southwest (Sudanian zone) of the country and in the extreme southeast of the South-Sudanian zone (Fig. 3). One orange-yellow phase was observed on the captured specimens.

Hipposideros ruber (Noack, 1893)

Hipposideros ruber is widely distributed and is located in all phytogeographic areas (Fig. 3). It is more common in the South being gradually rare towards the North. The specimens have been captured in an arborous savanna along a rupicolous bar in a mountain range, at the entrance to a cave, in a gallery forest, the cliffs of Banfora, a wooded savanna along a dam, a shrubby savanna between a mountain and a dam, a wooded savanna near a mountain and a cave, and in a wooded savanna next to a managed water point near the Nazinon river and not far from a water point. The captured specimens showed two phases of color: some were brown and others orange-yellow. The cytochrome b from several specimens has been sequenced by CBGP (J.-F. Cosson & S. Chollet, unpubl. data). According to these data, two specimens from Dafra, one specimen from Djibo and one specimen from Koba River belong to clade D1 as designated by Vallo et al. (2009), while seven specimens from Toussiana belong to clade C1. Twenty-two individuals (2 males, 19 females, 1 unsexed, none sequenced) from Toussiana, site 1, called at 140.8±1.0 (138.5-142.3) kHz. One male from Karfiguéla called at 140.2 kHz.

Hipposideros tephrus Cabrera, 1906

It is located in the West and South of the country (Fig. 3). It is present in all phytogeographic zones except in the North-Sahelian one. A specimen has been captured in a forest at the entrance to a cave where *Hipposideros abae*, *H. ruber*, *Nycteris macrotis* and *Rhinolophus landeri* live together. The other specimens have been captured in a pocket of forest on a rocky substratum rich in *Raphia* palm and next to the Nazinon River. All specimens that we captured were presenting a single orange-yellow phase.

Hipposideros tephrus is smaller than *H. ruber*. The averages of body measurements and cranial measurements of *H. tephrus* are lower than those of *H. ruber*. However, there is an overlap on all body measurements (except HB). Nevertheless, cranial measurements reveal that the maximum values of *H. tephrus* are smaller than the minimum values of *H. ruber* (Table 5). A specimen from waterfalls of Kou is member of clade A2 following the designation adopted by Vallo et al. (2009), which should be named *H. tephrus*.

Hipposideros vittatus (Peters, 1852)

It is the largest of Hipposideridae among those

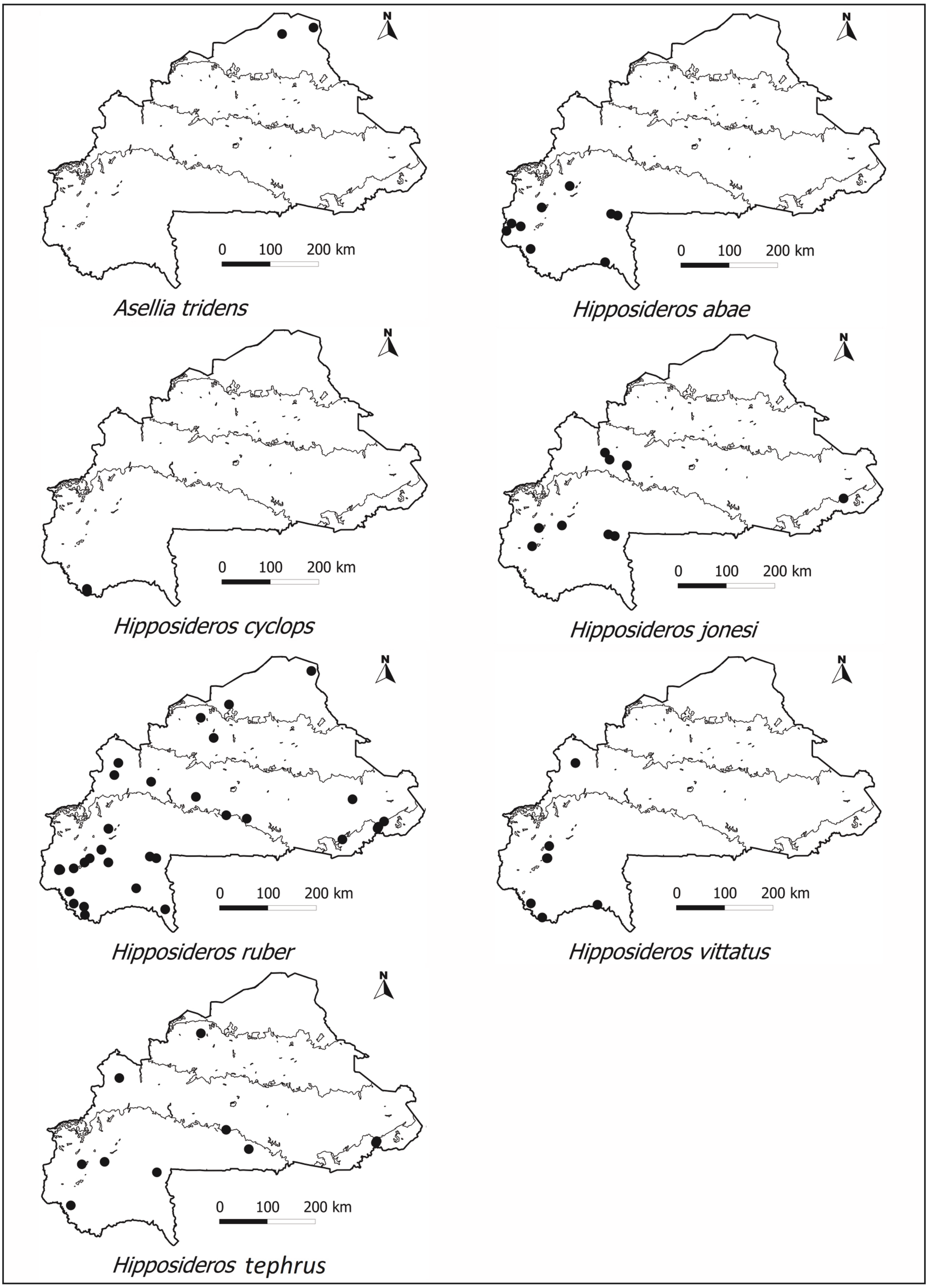

Figure 3. Distribution of Hipposideridae in Burkina Faso.

found in Burkina Faso (see Table 5). Present in branches of trees as well as in caves (Pye, 1972; Vaughan, 1977), it is located west of the Sudanian zone (Fig. 3). The specimens have been captured in woodland, next to a gallery forest, in a shrubby and arborous savanna and in an herbaceous steppe located along a river.

Body measurements show that males are not different from females. On the other hand, the maximum values of cranial measurements of females are lower than the cranial measurements of males (Table 4). All captured specimens were yellow.

Family MEGADERMATIDAE
Genus *Lavia* Gray, 1838
Lavia frons (E. Geoffroy, 1810)

This species is found in savannas and semi-wooded areas (Vaughan & Vaughan, 1986) but not widely distributed in Burkina Faso, where it has been recorded from a few areas in the southern part of the country (Fig. 4). In eastern Kenya, it regularly roosts in thorny Acacia trees (Vaughan & Vaughan, 1986; Vaughan, 1987); hence it is surprising that there are no records from northern Burkina Faso. Some specimens have been captured near water points.

Males are not really different from females. Body measurements and cranial measurements do not enable to separate them (Table 6).

Family RHINOLOPHIDAE
Genus *Rhinolophus* Lacépède, 1799
Rhinolophus alcyone Temminck, 1853

Rhinolophus alcyone was distributed in the extreme southwest of the South-Sudanian zone (Fig. 5). In Burkina Faso, this forest species probably depends on gallery forests that provide similar conditions to rainforests further south. All captured specimens were gray, resembling that of *R. fumigatus*.

Averages of body measurements (except 3Ph1, 5Ph2, Tib and HB) and cranial measurements of males from *R. alcyone* are smaller than those of males from *R. fumigatus*. Only the maximum value of the ear of males from *R. alcyone* species is less than the minimum value of the ear of males from *R. fumigatus*. And the minimum value of the tibia of *R. alcyone* is higher than the maximum value of the tibia of *R. fumigatus*. All other values are not distinctly separated. As regards females, all values (except 5Ph2) of *R. alcyone* are smaller than the averages of *R. fumigatus*. Moreover, all values (except HB, Tail, 3Ph1, 5Ph2 and Tib) of *R. alcyone* are smaller than the minimum values of *R. fumigatus* (Table 7).

Rhinolophus fumigatus Rüppell, 1842

In Burkina Faso, *Rhinolophus fumigatus* has been recorded in the Sudanian zone, with several localities in the north of the South-Sudanian zone and few localities in the western North-Sudanian zone (Fig. 5). *Rhinolophus fumigatus* is present in more open habitats than *R. alcyone* (Rosevear, 1965), which explains its wider distribution in Burkina Faso than *R. alcyone*. Like *R. landeri*, *R. fumigatus* does not live only in caves. According to Koopman et al. (1978), they were captured in huts. Some specimens were observed during the BIOTA collect in a large rock cleft in the Gobnangou range.

Five males called at 54.2 ± 0.4 (53.4-54.4) kHz. Two collected specimens had a horseshoe width of 11.3 and 11.5 mm, respectively. Averages of body measurements do not help to distinguish males from females. On the other hand, the averages of cranial measurements of males are higher than those of females (Table 7).

Rhinolophus landeri Martin, 1838

Rhinolophus landeri occurs in almost all phytogeographic zones of Burkina Faso except in the North-Sahelian zone (Fig. 5). Day roosts are caves, house of worship, bridges, and wells (Aellen, 1952; Menzies, 1973; Koopman et al., 1978; Kock et al., 2002), and the dependency on cave-like structures might explain the concentration of records in the southwest of the country, with its numerous rocky formations. The ability to roost in environments other than caves might explain its presence in other parts of the country, and this species probably occurs throughout most of Burkina Faso. It would therefore not be surprising to find it almost everywhere in Burkina Faso, particularly in rock formations in the South-East. Most specimens have been

Hipposideros abae																					
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	Tib	HF	C-C	M^3-M^3	C-M^3
♂♂	X	14.7	63.0	32.4	20.8		59.7	41.9	18.4	19.6		40.8	12.3	10.4	36.8	15.3	11.4	24.3	10.9	5.98	8.93	8.76
	± SD	1.0	1.6	2.1	1.0		1.5	1.1	0.7	1.1		1.3	0.5	0.6	1.0	0.5	0.6	0.7	0.4	0.15	0.15	0.15
	Min	12.0	58.9	27.5	19.1		56.7	39.5	16.9	17.4		37.7	11.0	9.2	34.9	14.2	10.7	22.8	9.6	5.77	8.66	8.53
	Max	17.5	65.2	36.3	22.5		62.6	43.9	19.5	21.9		44.4	13.3	11.8	39.8	16.5	12.7	25.6	11.6	6.44	9.16	9.11
	n=	25	25	25	25		18	25	25	25		25	25	25	25	25	25	25	25	24	25	24
♀♀	X	18.0	61.8	31.7	20.4		60.1	44.1	18.9	20.6		42.9	13.0	10.8	38.9	15.4	12.0	24.6	10.5	5.92	8.99	8.76
	± SD	4.3	3.6	1.3	0.9		2.3	1.4	0.8	1.0		1.8	0.6	0.8	1.1	0.7	0.8	1.1	0.6	0.13	0.17	0.15
	Min	13.0	57.4	30.2	19.1		56.4	42.6	17.9	19.1		41.0	12.1	9.5	37.8	14.7	10.4	23.3	9.1	5.74	8.78	8.53
	Max	26.3	69.0	34.0	21.7		63.0	47.3	20.1	22.4		46.6	13.9	11.6	41.2	16.4	12.8	26.6	11.3	6.11	9.36	9.03
	n=	7	7	7	7		7	7	7	7		7	7	7	7	7	7	7	7	7	7	7
Hipposideros cyclops																					
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	Tib	HF	C-C	M^3-M^3	C-M^3
♂		34.0	77.5	25.7	32.8		70.1	55.5	20.1	27.4		57.4	14.2	14.2	55.5	16.5	15.0	30.4	17.5	8.01	11.27	9.80
♀		49.0	75.4	29.5	32.1		70.3	59.7	21.2	27.2		59.2	15.8	15.0	57.6	18.2	15.4	35.9	18.3	7.80	11.25	10.29
♀		44.0	76.9	29.5	30.9		70.6	56.7	21.0	22.2		59.3	14.7	15.2	57.5	16.5	14.5	35.8	17.9	7.78	10.70	10.00
Hipposideros jonesi																					
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	Tib	HF	C-C	M^3-M^3	C-M^3
♂♂	X	7.2	48.9	23.2	23.4		46.7	34.0	14.7	16.9		35.8	10.9	8.7	32.8	12.3	10.1	21.7	7.8	3.68	5.83	5.93
	± SD	0.3	2.5	2.7	1.4		0.8	0.6	0.5	0.8		0.7	0.4	0.5	0.9	0.4	0.3	0.9	0.3	0.12	0.16	0.09
	Min	7.0	46.2	17.8	21.6		44.9	33.1	14.2	15.5		34.5	9.9	8.0	31.6	11.8	9.6	20.3	7.3	3.48	5.63	5.82
	Max	8.0	54.5	26.4	25.2		47.3	34.8	15.8	17.6		36.5	11.2	9.2	34.1	12.8	10.5	22.8	8.2	3.84	6.03	6.07
	n=	7	7	7	7		7	7	7	7		7	7	7	7	7	7	7	7	7	7	7
♀		6.0	43.7	22.6	20.5		44.4	32.2	14.5	15.8		33.9	10.0	8.2	31.6	11.9	9.5	20.2	7.2	3.27	5.50	5.68
Hipposideros ruber																					
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	Tib	HF	C-C	M^3-M^3	C-M^3
♂♀	X	9.9	52.1	30.0	15.7		49.1	37.2	16.2	16.3		36.2	11.2	9.1	32.7	13.9	9.9	20.6	9.0	4.90	7.20	7.03
	± SD	1.3	2.1	3.2	0.9		1.3	1.9	0.7	1.0		2.3	0.5	0.6	1.7	0.5	0.5	0.8	0.6	0.25	0.23	0.19
	Min	7.0	48.0	23.0	13.4		46.5	33.6	14.8	14.1		32.0	10.2	7.7	29.6	12.9	9.1	19.0	7.8	4.29	6.58	6.66
	Max	13.5	58.3	38.8	17.6		52.4	41.4	17.7	18.4		41.9	12.1	10.2	36.3	14.8	11.0	22.7	10.8	5.26	7.80	7.44
	n=	48	48	48	48		97	48	48	48		48	48	48	48	48	48	90	88	74	89	89
Hipposideros vittatus																					
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	Tib	HF	C-C	M^3-M^3	C-M^3
♂		82.0	104.	37.4	30.4		109.	81.0	37.5	44.5		78.1	28.8	16.6	78.7	29.4	18.4	45.8	22.2	10.93	13.52	13.36
♂		120.0	109.	32.2	29.7		102.	77.2	34.8	39.8		75.5	28.8	16.2	73.2	28.8	15.8	43.0	20.9	11.16	13.68	13.32
♀♀	X	77.0	99.9	33.1	27.6		96.5	70.9	32.4	38.9		69.5	26.6	15.4	68.3	27.3	16.6	38.8	20.0	9.86	12.80	12.47
	± SD	9.0	2.9	4.0	1.3		2.9	2.3	1.0	2.1		2.2	1.1	0.8	2.4	1.4	0.9	1.1	1.2	0.10	0.30	0.22
	Min	63.0	96.4	26.0	25.4		93.6	67.7	30.6	36.0		66.0	25.2	14.3	65.5	25.4	15.1	37.3	18.5	9.73	12.30	12.17
	Max	93.0	104.	38.4	29.7		102.	74.7	33.9	42.0		72.6	28.9	16.5	73.0	30.1	17.8	40.9	21.7	10.00	13.16	12.91
	n=	7	7	7	7		7	7	7	7		7	7	7	7	7	7	7	7	7	7	7
Hipposideros tephrus																					
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	Tib	HF	C-C	M^3-M^3	C-M^3
♂♀	X	6.3	45.2	28.6	13.3		44.9	33.3	14.6	15.8		33.0	9.9	8.8	29.3	12.5	10.2	18.2	7.9	3.67	5.68	5.57
	± SD		1.1	2.2	0.5		1.2	1.0	0.5	0.5		1.0	0.3	0.4	1.2	0.4	0.4	0.7	0.4	0.10	0.14	0.09
	Min	5.5	43.6	25.2	12.9		42.0	32.0	13.9	15.2		31.9	9.6	8.0	28.1	11.9	9.6	16.9	7.1	3.48	5.36	5.31
	Max	7.0	46.8	31.2	14.2		47.0	35.1	15.3	16.6		35.0	10.4	9.2	31.7	13.0	10.8	19.4	8.6	3.84	5.91	5.70
	n=	2	6	6	6		21	6	6	6		6	6	6	6	6	6	22	7	16	17	18

Table 5. Measurements of Hipposideridae from Burkina Faso.

Lavia frons																					
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂		23.5	66.7		40.1	25.1	61.6	45.7	25.5	39.4		48.9	16.1	14.1	51.8	16.8	16.5	34.4	16.5	5.85	8.86	9.47
♂		22.3	69.1		43.6	23.4	60.8	44.6	24.0	40.5		47.8	16.0	15.5	50.7	16.6	15.9	33.8	16.8	5.87	9.18	8.67
♀♀	X	28.5	70.2		42.8	26.5	61.3	45.7	25.4	42.1		49.8	15.9	14.9	52.1	17.2	16.7	34.5	16.7	6.25	9.09	9.23
	Min	26.3	66.0		41.8	25.1	60.0	45.1	25.1	41.3		49.5	14.4	14.6	51.4	16.7	16.6	33.7	15.5	6.22	8.74	9.05
	Max	31.0	74.2		44.3	28.0	62.3	46.3	25.8	42.7		50.4	17.4	15.2	53.1	17.9	16.8	35.1	17.2	6.28	9.44	9.40
	n=	3	4		4	4	4	4	4	4		4	4	4	4	4	4	4	4	2	2	2

Table 6. Measurements of Megadermatidae from Burkina Faso.

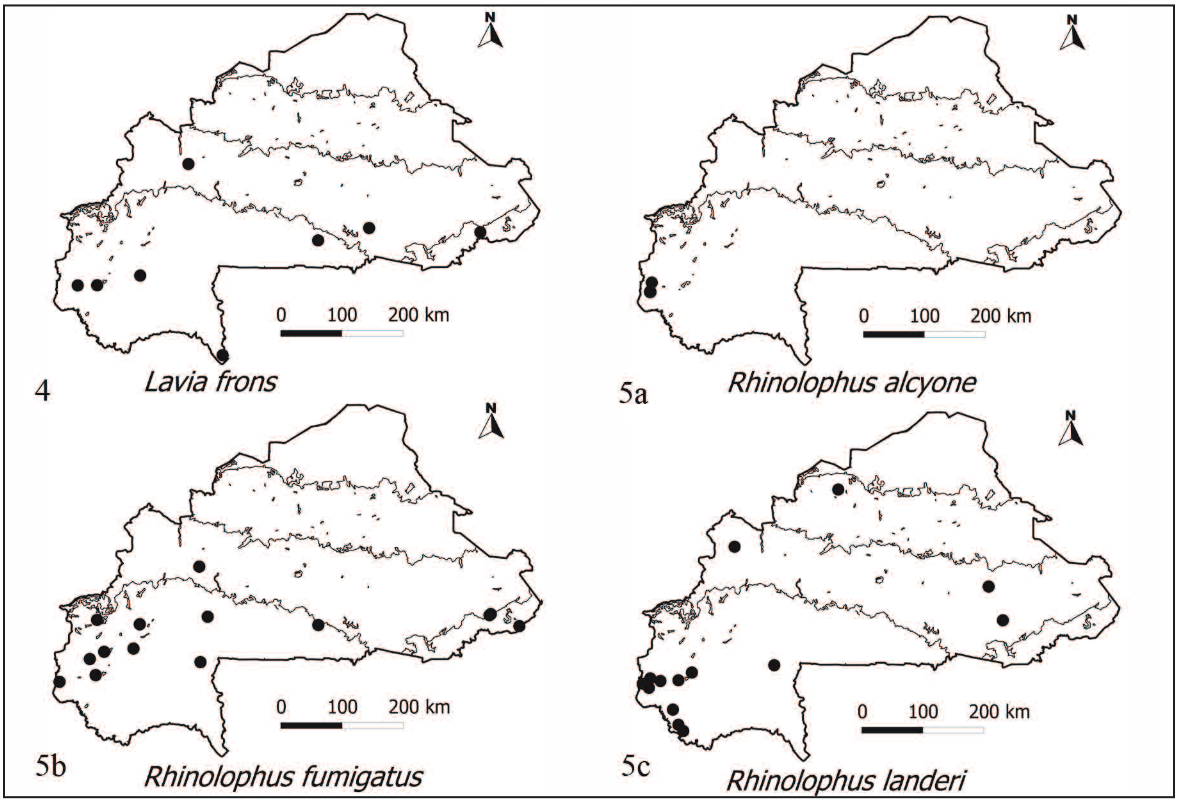

Figure 4. Distribution of Megadermatidae in Burkina Faso. Figure 5. Distribution of Rhinolophidae in Burkina Faso.

Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
Rhinolophus alcyone																						
♂♂	X	13.1	56.7	26.3	19.8		50.4	36.6	17.4	26.6	2.7	41.6	8.8	16.4	40.1	11.9	14.9	23.6	12.1	6.31	8.42	8.67
	Min	12.0	55.5	22.8	19.7		49.5	35.1	16.9	24.6	2.7	41.0	8.0	15.2	39.2	11.4	14.2	23.2	11.4	6.01	8.15	8.28
	Max	14.0	57.6	30.6	19.9		51.1	38.0	18.1	28.2	2.8	42.5	9.3	17.3	42.1	12.3	15.6	24.4	13.0	6.50	8.66	8.84
	n=	4	4	4	4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
♀		12.0	54.8	25.4	20.2		48.8	35.7	16.3	26.7	2.7	40.4	8.4	15.2	40.2	11.8	13.8	22.5	10.5	5.47	8.09	8.12
Rhinolophus fumigatus																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂♂	X	16.1	64.2	27.0	24.4		53.4	39.4	17.0	29.4	3.1	41.9	10.3	17.8	42.5	13.1	14.2	21.6	11.6	6.79	8.97	8.88
	± SD	1.6	5.4	2.4	1.8		1.5	1.0	0.7	1.4	0.3	1.0	0.7	0.9	0.9	0.7	1.2	1.3	1.0	0.29	0.33	0.27
	Min	12.0	57.0	23.3	21.7		50.4	37.5	16.2	26.3	2.5	39.9	9.3	16.3	40.7	11.8	12.8	18.6	10.1	6.26	8.35	8.29
	Max	17.5	74.6	31.0	27.0		55.4	40.5	18.3	30.9	3.5	43.3	11.5	19.2	43.7	14.1	16.2	22.9	13.6	7.24	9.39	9.07
	n=	9	9	9	9		9	8	8	8	5	8	8	8	8	8	8	8	9	6	6	6
♀♀	X	15.2	60.6	28.0	24.3		53.0	39.5	16.4	28.5	3.4	42.3	10.0	17.8	42.7	12.7	13.7	22.3	11.1	6.64	8.70	8.56
	Min	10.0	57.0	23.5	22.9		50.3	38.5	15.7	27.8	3.2	41.8	9.9	17.0	42.4	12.3	13.5	22.0	10.7	6.43	8.25	8.30
	Max	18.0	67.0	34.0	25.0		55.7	40.4	17.1	29.2	3.6	42.7	10.1	18.5	42.9	13.0	13.9	22.5	12.0	6.80	9.03	8.66
	n=	4	4	4	4		4	2	2	2	2	2	2	2	2	2	2	2	4	3	3	5
Rhinolophus landeri																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂♂	X	5.9	45.3	23.4	17.1		41.4	28.4	12.8	19.2		31.7	6.4	11.9	30.6	9.0	11.6	17.9	8.4	4.72	6.72	6.54
	± SD	0.6	3.8	1.8	0.8		1.5	1.3	0.4	1.9		1.9	0.4	1.2	2.0	0.4	0.7	0.6	0.1	0.19	0.12	0.14
	Min	5.0	42.9	20.3	16.2		39.1	26.6	12.0	16.3		29.6	5.9	10.0	27.9	8.3	10.7	17.0	8.1	4.50	6.54	6.44
	Max	6.9	53.7	25.9	18.5		44.1	30.4	13.2	21.9		34.8	6.7	13.2	33.4	9.4	12.7	18.6	8.6	5.04	6.85	6.82
	n=	6	6	6	6		6	5	5	5		5	5	5	5	5	5	6	6	5	5	5
♀♀	X	7.4	44.9	24.3	16.5		41.5	28.4	12.9	19.9		31.3	6.5	12.6	30.4	9.0	12.1	17.4	8.3	4.37	6.58	6.45
	± SD	1.2	2.6	2.0	0.9		1.0	1.0	0.5	1.5		1.2	0.4	0.7	1.3	0.6	0.6	0.6	0.6	0.28	0.14	0.11
	Min	5.5	41.2	21.1	14.9		40.0	26.7	11.9	16.9		29.4	5.8	10.5	28.4	7.3	11.0	16.4	7.3	3.93	6.23	6.19
	Max	9.5	54.1	30.2	18.0		43.4	31.1	14.0	22.8		34.0	7.4	14.1	33.0	10.1	13.4	18.4	10.3	4.96	6.86	6.67
	n=	22	22	22	22		22	22	22	22		22	22	22	22	22	22	22	22	21	21	21

Table 7. Measurements of Rhinolophidae from Burkina Faso.

captured from a cave where we placed nets at the entrance. Several other species were also present, including *Hipposideros abae*, *H. ruber*, *H. tephrus* and *Nycteris macrotis*. All specimens that we captured were orange-yellow; which makes it easier to distinguish it from *R. alcyone* and *R. fumigatus*. One male was calling at 108.5 kHz. It had a horseshoe width of 7.0 mm and well-developed reddish-brown axillary tufts. A female called at 105.6 kHz with a horseshoe 7.3 mm wide.

Family RHINOPOMATIDAE
Genus *Rhinopoma* E. Geoffroy, 1818
Rhinopoma cytops Thomas, 1903

Hulva et al. (2007) restrict *R. hardwickii* to Asia and *R. cystops* to Africa and Western Asia. *Rhinopoma cytops*, found in the Northern Sahara (Horáček et al., 2000) is a species from desert to semi-desert areas (Hill, 1977; Van Cakenberghe & De Vree, 1994). In Burkina Faso, it has been found in the northern Sahelian as well as in the South-Sudanian zone, suggesting a rather loose association with climatic areas in the country (Fig. 6). In the South-Sudanian area, its presence seems to be linked to the presence of rocky formations and rugged topography.

Averages of body measurements (except HB, 3Ph1, 3Ph2, 4Ph2 and 5Ph2) of males are smaller than those of females. On the other hand, averages of cranial measurements of males are higher than those of females (Table 8). The tail being actually longer than the forearm, one can distinguish it from *R. microphyllum*.

Rhinopoma microphyllum (Brünnich, 1782)

Rhinopoma microphyllum seem to occur in similar habitats as *R. cystops* (Qumsiyeh, 1985). In Burkina Faso, *R. microphyllum* has been recorded from the North-Sahelian zone (Fig. 6). Although this

		Rhinopoma cystops																				
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂♂	X	9.8	62.0	69.0	19.2	7.5	57.1	39.0	9.5	14.8		33.7	12.5	10.1	39.1	10.1	8.8	25.5	12.6	4.23	7.78	6.01
	Min	8.5	54.0	64.5	18.3	6.8	54.9	37.6	8.5	12.1		31.8	11.8	9.1	37.0	9.1	7.5	23.0	11.2	4.14	7.66	5.97
	Max	10.5	68.1	71.8	20.7	8.3	58.4	40.9	10.2	16.0		35.6	12.8	11.2	40.6	10.5	9.6	27.3	13.5	4.31	7.91	6.07
	n=	4	4	4	4	4	4	4	4	4		4	4	4	4	4	4	4	4	4	4	4
♀♀	X	11.5	60.5	71.0	19.6	7.2	59.4	41.5	8.7	14.3		34.6	12.6	9.7	40.7	10.8	8.4	27.0	13.0	4.21	7.66	5.86
	Min	9.5	58.1	68.8	18.1	6.8	57.2	38.6	7.7	13.7		32.5	11.5	9.0	38.5	9.5	8.0	24.7	12.6	4.09	7.49	5.79
	Max	14.0	62.1	74.5	20.5	7.8	60.6	43.5	9.3	15.1		36.1	13.2	10.5	42.0	12.1	8.9	28.3	13.2	4.28	7.79	5.96
	n=	3	3	3	3	3	3	3	3	3		3	3	3	3	3	3	3	3	3	3	3

Table 8. Measurements of Rhinopomatidae from Burkina Faso.

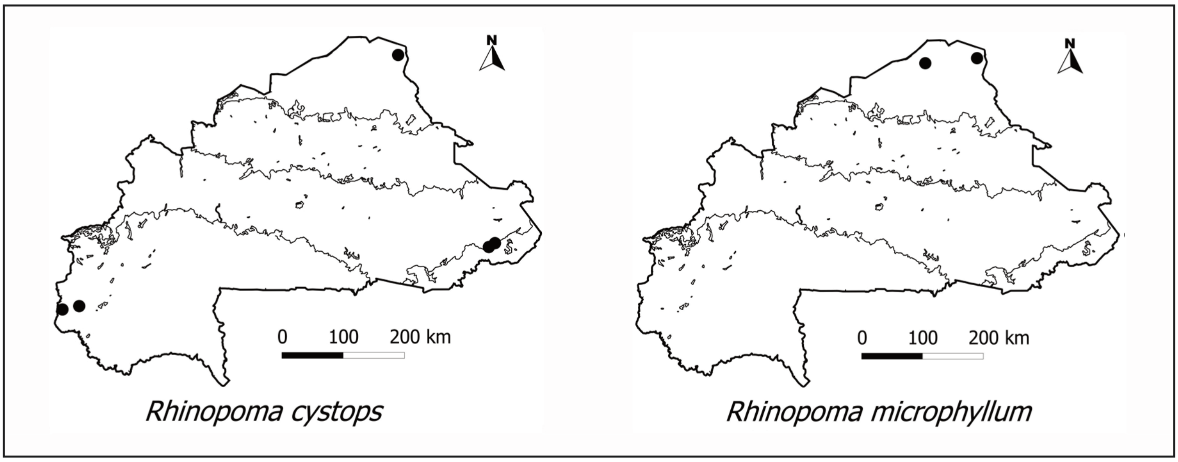

Figure 6. Distribution of Rhinopomatidae in Burkina Faso.

species has often been encountered in the same day roosts as *R. cystops* (though usually in smaller numbers) (Schlitter & Qumsiyeh, 1996), no specimen was recorded in the Sudanian zone of Burkina Faso.

Family EMBALLONURIDAE
Genus *Coleura* Peters, 1867
Coleura afra (Peters, 1852)

Rarely seen in West Africa, *Coleura afra* is located in the southwest in the South-Sudanian zone (Fig. 7). This cave-dwelling species has been captured only in this part of the country. Thousands of individuals have indeed been observed in this cave located on a hill at Néguéni. It is the smallest of Emballonuridae present in Burkina Faso (Table 9).

As observed by Goodman et al. (2008), males differ from females. Indeed, averages of body measurements and cranial measurements of the females are larger than those of males. In addition, maximum cranial measurements (M3-M3 and C-M3) of males are smaller than the minimum cranial measurements of females (Table 9).

Genus *Taphozous* E. Geoffroy, 1818
Taphozous nudiventris Cretzschmar, 1830

Also known in the North of Sahara (Horáček et al., 2000), *Taphozous nudiventris* is particularly located in the North-Sahelian zone (Fig. 7). However, this species widely distributed in the dry areas of African savannas (Koopman, 1975) has just been located in the extreme southwest in the South-Sudanian zone. Its presence could be explained by the nature of the area in which these specimens have been captured. Indeed, the peaks of Sindou represent specific formations with very little vegetation and water with a lot of cracks that can lodge this species. As indicated by Benda et al. (2006), this species is often captured in its lodgings, in narrow shelters and in cracks. Actually in the peaks of Sindou, *T. nudiventris* has been captured at the top of the peaks, in cracks of rocks serving as shelters.

Body measurements (except 4Ph2 and 5Ph2) and all cranial measurements show that *T. nudiventris* is larger than *T. perforatus* (Table 9).

Taphozous perforatus E. Geoffroy, 1818

Found in the northern Sahara (Horáček et al., 2000), *Taphozous perforatus* is widely distributed in the Sahelian zone (Fig. 7). Also present in the W park bordering Niger (Poché, 1975), it was not surprising to encounter it in this part of Burkina Faso. Indeed, *T. perforatus* has just been located in the extreme South-East in the South-Sudanian zone.

But unlike the specimens captured by Poché (1975) in the hollow of a baobab, specimens captured in Burkina Faso during the BIOTA collect come from a cave. These have been captured on the Gobnangou range in the presence of a colony of

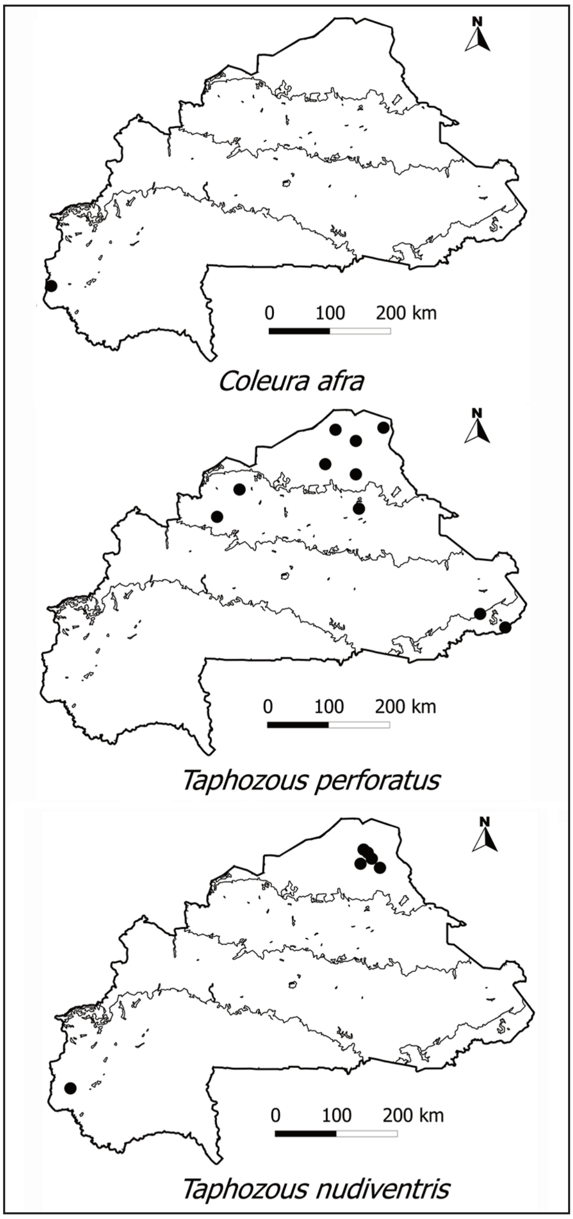

Figure 7. Distribution of Emballonuridae in Burkina Faso.

Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
Coleura afra																						
♂♂	X	9.8	64.0	17.8	15.3	6.0	51.1	44.9	16.3	17.2		36.8	12.6	6.5	32.6	13.2	5.8	18.2	10.2	4.13	7.83	7.02
	Min	9.5	63.2	16.3	15.2	5.5	49.9	43.1	15.1	16.7		35.3	12.2	5.9	32.3	12.8	5.4	18.1	10.1	4.10	7.77	6.96
	Max	10.5	64.4	20.3	15.5	6.8	52.1	45.9	17.2	18.1		37.8	12.9	7.4	33.0	13.9	6.1	18.4	10.3	4.17	7.88	7.12
	n=	3	3	3	3	3	3	3	3	3		3	3	3	3	3	3	3	3	3	3	3
♀♀	X	11.2	66.4	17.9	15.8	6.3	52.7	48.2	17.7	17.4		38.8	13.2	7.1	33.8	14.0	5.9	19.0	10.6	4.25	8.17	7.33
	Min	10.5	65.8	16.9	15.5	6.2	51.1	46.4	17.6	16.4		37.3	12.9	6.7	33.0	13.9	5.4	18.2	10.2	4.14	8.16	7.24
	Max	11.5	67.3	20.0	16.3	6.5	54.0	49.9	17.8	18.3		39.7	13.4	7.4	34.8	14.1	6.6	20.2	10.8	4.32	8.18	7.39
	n=	3	3	3	3	3	3	3	3	3		3	3	3	3	3	3	3	3	3	3	3
Taphozous nudiventris																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂		60.0	105.3	38.9	20.8	6.1	80.5	74.6	31.7	30.5		60.8	16.8	9.6	52.3	16.6	9.8	32.3	16.2	6.22	11.22	11.51
♂		61.5	108.2	37.2	21.0	6.7	73.4	67.7	28.5	30.2		55.4	16.6	8.9	47.2	16.0	9.2	31.2	17.9	6.63	11.07	11.08
♀		53.0	102.9	40.3	19.9	6.2	75.9	70.6	29.9	31.8		56.1	16.2	6.8	46.9	16.3	9.2	32.3	14.7	5.69	10.55	11.34
Taphozous perforatus																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂		20.3	70.1	26.7	18.8	5.0	63.7	56.9	20.5	21.5		46.6	12.8	9.6	38.0	13.9	9.2	25.9	12.2	3.89	8.17	8.42
♂		18.0	73.5	25.5	19.2	6.1	62.5	56.4	19.9	21.6		46.0	13.1	9.0	37.2	13.5	8.5	24.5	13.0	3.76	8.48	8.42
♀ (YAD)		16.3	67.0	27.7	16.8	5.0	61.4	55.1	18.5	19.8		44.5	11.6	8.3	36.0	13.5	8.2	23.9	12.1	3.71	8.15	8.38
♀		19.5	72.1	25.5	18.0	5.5	63.4	57.1	20.0	21.5		46.3	12.5	9.1	37.2	13.9	9.6	24.3	12.8	3.76	8.29	8.34

Table 9. Measurements of Emballonuridae from Burkina Faso.

about a hundred specimens. Others have been captured just at a cave entrance in an old attic in the presence of some *Rhinopoma cystops*. Like *R. cystops*, the presence of *T. perforatus* in this part of Burkina Faso seems to be linked to the presence of caves. It would therefore not be surprising to find specimens in the caves of the Southwest.

Family NYCTERIDAE

As pointed by Van Cankenberghe & De Vree (1998), *Nycteris thebaica* and *N. gambiensis* are species difficult to distinguish. Indeed, the measurements do not allow us to separate the few specimens collected during 2002 to 2009. They have been captured in a shrubby savanna next to a mountain assembly line, in a gallery forest along a river, in a gallery forest close to a depression, in a house and in the palaces of Senoufo kings.

Genus *Nycteris* Cuvier et E. Geoffroy, 1795

Nycteris gambiensis (K. Andersen, 1912)

Nycteris gambiensis is mainly found in savannas of West Africa (Van Cakenberghe & De Vree, 1998). In Burkina Faso, it is particularly located in the western Sudanian zone with a few areas in the east (Fig. 8).

Nycteris grandis Peters, 1865

Nycteris grandis is located in the extreme Southwest in the South-Sudanian zone (Fig. 8). In Burkina Faso, it is easily distinguished from other Nycteridae by its large size (Table 10). Unlike Adam & Hubert (1976), who stated that it cannot be found outside the Guinean zone; or Van Cakenberghe & De Vree (1993) who said that *N. grandis* is restricted to rainforests, its presence in the protected forest of Lera in a gallery forest, confirms the statement of Rosevear (1965) according to which *N. grandis* can also be present outside the rainforest, in dense and moist gallery forest. Also, in Southern and Central Africa, this species is well known to occur outside of the rainforest zone (Monadjem et al., 2010).

Nycteris hispida (Schreber, 1774)

Present in the woody Guinean and Sudanian areas, *Nycteris hispida* is widely distributed in the West of the Sudanian zone with a few specimens in the East (Fig. 8). Although Rosevear (1965) thinks that it could spread further into the Sahelian areas, no specimen was captured in this part of Burkina Faso. All specimens captured in BIOTA project were brown. Some females captured during the month of September were carrying their young.

Nycteris macrotis Dobson, 1876

Known in the forests and savannas of West Africa (Adam & Hubert, 1976; Van Cakenberghe & De Vree, 1985), *Nycteris macrotis* is located in all phytogeographic zones in Burkina Faso (Fig. 8). The diversity of its habitats composed of hollow logs, hollowed termitarium, wells and even simple holes in the ground (Adam & Hubert, 1976), enables this species to be found in all parts of Burkina Faso. However, it is more present in the South-Sudanian zone with a reduction of its presence in the North. Five specimens were captured in the protected forest of Niangoloko at the entrance to a cave with other species such as *Hipposideros abae*, *H. tephrus*, *H. ruber* and *Rhinolophus landeri*. All specimens collected during our study had two colors. Some were brown and other orange-yellow.

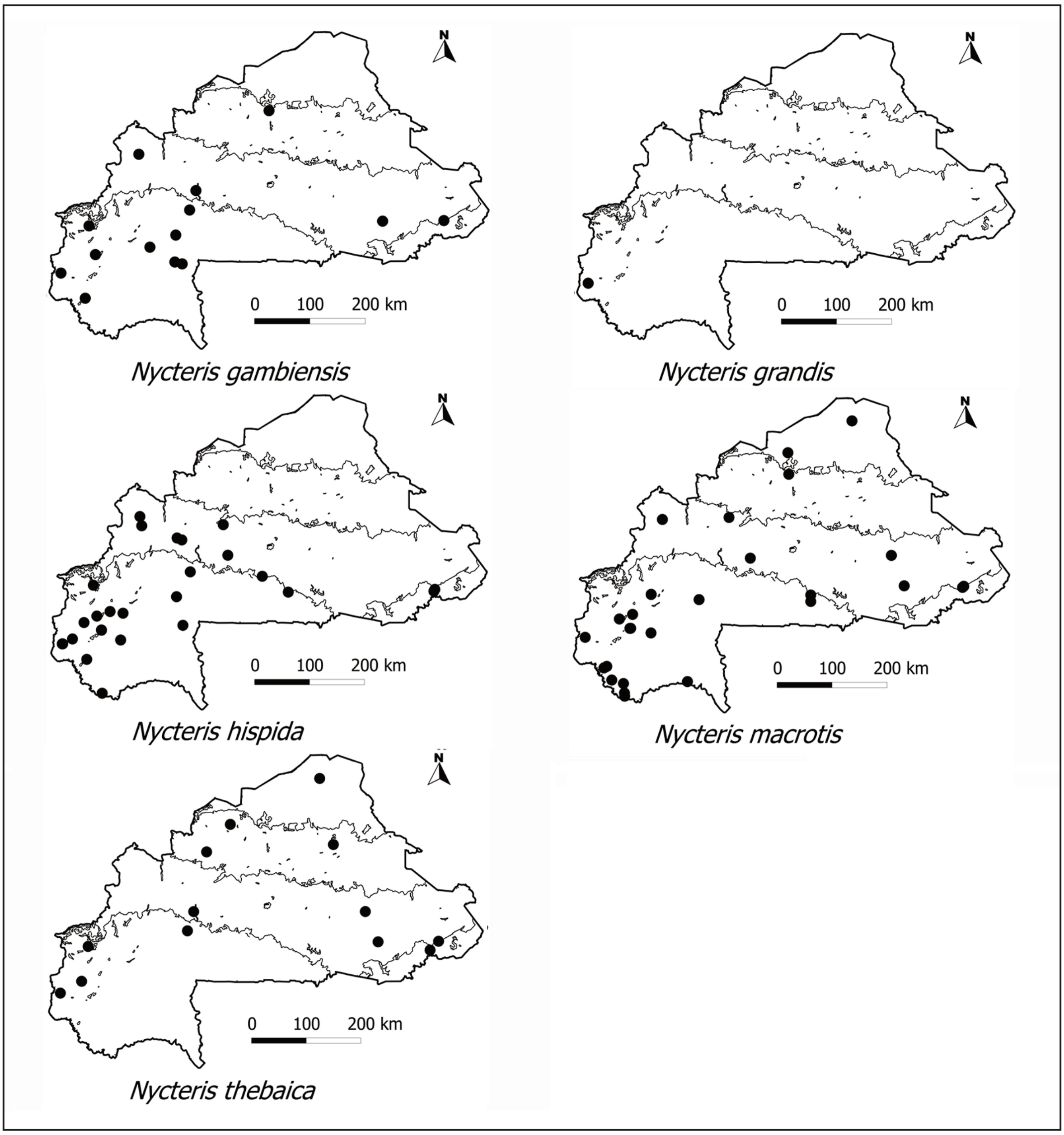

Figure 8. Distribution of Nycteridae in Burkina Faso.

Nycteris grandis																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂		22.0	69.1	66.9	30.1	6.4	55.5	44.0	28.1	29.2	5.2	47.7	16.4	13.0	50.7	15.9	14.8	29.0	12.5	6.93	10.16	9.32
♀		24.0	69.8	63.5	30.4	6.3	57.4	44.3	28.8	29.9	5.5	49.0	16.1	13.9	52.0	16.4	14.5	30.5	13.4	6.65	10.33	9.06
Nycteris hispida																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂♂	X	6.3	45.1	45.5	21.0	4.8	38.9	31.9	21.9	21.1	3.1	33.9	12.2	7.7	34.0	12.1	9.4	19.4	8.5	4.24	6.49	5.83
	± SD	0.4	0.9	0.9	0.8	0.3	1.0	0.6	0.7	0.7	0.7	0.5	0.5	0.7	0.7	0.3	0.2	0.8	0.7	0.20	0.13	0.15
	Min	5.8	43.5	43.9	19.7	4.3	37.6	30.8	20.9	20.1	1.7	32.8	11.3	6.4	33.2	11.6	9.1	18.2	7.4	4.03	6.31	5.54
	Max	7.0	46.1	46.7	22.3	5.1	40.9	32.5	23.0	22.1	4.1	34.5	12.9	8.5	34.9	12.7	9.7	20.8	9.5	4.55	6.76	5.96
	n=	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
♀		6.5	45.5	52.1	23.4	5.1	39.2	33.0	22.7	22.8	3.2	36.0	13.4	9.3	35.1	13.5	9.9	18.8	9.0	4.53	6.81	5.85
Nycteris macrotis																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂♂	X	12.5	55.6	55.0	30.7	8.0	47.9	37.7	24.8	24.3	4.7	41.2	13.8	11.7	43.3	13.4	12.7	23.6	11.4	5.77	8.29	7.46
	± SD	1.2	1.2	2.7	1.7	0.3	2.2	1.4	1.2	1.0	0.8	1.5	0.8	0.9	2.7	0.7	1.1	0.9	0.9	0.18	0.26	0.24
	Min	11.0	54.0	50.3	28.6	7.5	44.1	36.1	22.8	22.5	4.0	39.5	12.6	9.9	39.1	12.0	10.4	21.9	9.8	5.45	7.87	7.15
	Max	14.5	57.4	58.8	33.4	8.6	51.4	40.5	26.3	26.0	6.0	44.6	15.2	13.0	48.3	14.4	14.2	24.6	12.6	6.00	8.72	7.81
	n=	8	8	8	8	8	8	8	8	8	7	8	8	8	8	8	8	8	8	8	8	8
♀♀	X	14.5	58.6	57.3	31.9	7.9	48.6	38.9	26.1	25.4	4.5	43.2	14.5	11.7	44.5	14.0	12.7	24.4	11.5	5.68	8.43	7.51
	± SD	1.9	2.7	3.7	1.8	0.5	1.6	1.2	0.6	1.6	0.9	1.0	0.6	0.7	1.3	0.5	0.8	0.7	0.8	0.19	0.25	0.16
	Min	12.0	55.6	51.5	29.0	6.9	46.3	36.6	24.6	23.1	2.5	41.6	13.5	10.6	42.2	13.0	11.2	23.2	10.3	5.27	7.94	7.26
	Max	18.0	64.7	63.9	35.2	8.6	51.4	41.2	27.3	28.5	5.8	44.5	15.5	12.5	46.7	14.8	14.0	25.3	12.8	6.12	8.96	7.85
	n=	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	12	13
Nycteris thebaica* and *N. gambiensis																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂♂	X	7.0	47.1	50.0	26.8	7.5	41.1	32.6	22.5	21.2	3.8	35.2	12.6	9.3	35.5	12.5	10.4	22.2	9.2	4.18	6.58	6.22
	± SD	0.8	0.8	3.0	1.1	0.3	1.6	1.2	0.7	1.1	0.4	1.2	0.9	0.5	1.3	0.8	0.4	0.8	0.5	0.10	0.20	0.14
	Min	6.5	46.1	45.8	25.1	7.0	38.9	30.3	21.2	19.4	3.3	32.9	11.6	8.6	33.4	11.4	9.9	21.0	8.4	4.06	6.35	6.06
	Max	8.5	48.4	53.4	28.1	7.7	43.5	33.5	23.3	22.8	4.4	36.1	13.8	9.9	36.9	13.7	11.2	23.4	9.8	4.34	6.92	6.45
	n=	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
♀		10.0	50.2	52.6	30.8	7.7	43.8	36.5	25.1	26.2		38.0	13.4	11.1	39.3	13.9	12.4	22.7	9.9	4.74	7.22	6.71
♀		8.0	48.3	52.5	30.1	7.1	43.0	32.2	22.4			35.6	12.9	9.1	36.6	12.6	11.1	22.6	9.2	4.41	6.87	6.44

Table 10. Measurements of Nycteridae from Burkina Faso.

Nycteris thebaica E. Geoffroy, 1818

Found in all phytogeographic zones, even the desert and the Arabian Peninsula except rainforests and central Sahara (Van Cakenberghe & De Vree, 1993), *Nycteris thebaica* is present in all phytogeographic areas in Burkina Faso (Fig. 8). Indeed, this anthropic species lives in habitats such as millet granaries as well as in trees (Adam & Hubert, 1976). However, it seems less present in the South-Sudanian zone than the rest of the country.

Family MOLOSSIDAE
Genus *Chaerephon* Dobson, 1874
Chaerephon major (Trouessart, 1897)

Even if they captured it in only two areas, Koopman et al. (1978) had already suggested that *Chaerephon major* was probably widespread in Burkina Faso (Fig. 9). Indeed, as a typical African savanna species (Koopman, 1975; McLellan, 1986), *C. major* is present in all phytogeographic areas of Burkina Faso except in the South-Sahelian zone. Lodged in crevices, cracks or in aggregates of rocks in rivers, hollow trees and holes in houses (Rosevear, 1965), it would therefore not be surprising to find it in the South-Sahelian zone. All three new specimens have been captured in the protected forest of Niouma in a shrubby savanna and in an open forest. *Chaerephon major* is smaller than *C. nigeriae*. The maximum values of body measurements (Bm, HB, FA, 3Met, 4Met, 5met, 5Ph1 and 5Ph2) and cranial measurements of *C. major* are lower than the body measurements and cranial measurements of *C. nigeriae* (Table 11).

Chaerephon nigeriae Thomas, 1913

Chaerephon nigeriae is located in Southcentral and extreme Southwestern part in Sudanian zone (Fig. 9). The five specimens have been captured in a gallery forest along a stream at Galgouli and in an open forest and shrubby savanna in the protected forest of Niouma. It is the largest *Chaerephon* found in Burkina Faso.

The measurement of the forearm helps to separate it from others present in Burkina Faso (Table 11).

Chaerephon pumilus (Cretzschmar, 1830)

Chaerephon pumilus is the most easily found species in Burkina Faso among Molossidae. It is the smallest *Chaerephon* in Burkina Faso. It is therefore recognizable by its size. Present in a variety of habitats, in semi-arid areas in the North to the forest areas of the South (Happold, 1987), *C. pumilus* is present in all phytogeographic areas in Burkina Faso, even though it is mainly located in the Sudanian zone (Fig. 9). Only a few specimens are known from the Sahelian zones. Very often found in roofs of houses, *C. pumilus* finds in southern Burkina Faso, a variable and high number of habitats, able to serve as its lodging places.

Genus *Mops* Lesson, 1842
Mops condylurus (A. Smith, 1833)

Found in the Sahelian areas and even in rainforests, *Mops condylurus* has no preference for any particular habitat (Rosevear, 1965). In Burkina Faso, it is located in the Sudanian zone (Fig. 9). The specimens have been captured in a shrubby savanna on the edge of a forest, in a shrubby savanna near a mountain assembly line, and next to a pond.

Measurements of body and cranial measurements do not help in distinguishing males from females (Table 11).

Mops demonstrator (Thomas, 1903)

Rarely seen in West Africa, it is the second time that *Mops demonstrator* is reported in Burkina Faso. The four specimens examined by Koopman et al. (1978), have been captured near the river Nazinon. The specimen examined during the BIOTA collect has also been captured along a stream in a grassy steppe. All specimens have been located in the extreme South in the South-Sudanian zone (Fig. 9). It is easily comparable to *M. condylurus*.

Cranial measurements do not allow to distinguish them, but the body measurements (Tail, FA, 3Met, 3Ph1, 3Ph2, 4Met, 4Ph1, 4Ph2, 5Met, Tib and HF) of *M. demonstrator* are smaller than those of *M. condylurus* (Table 11).

Mops midas (Sundevall, 1843)

Mops midas is a species of African savannas (Koopman, 1975) and particularly isolated in the forests of savannas (Peterson, 1972). Like all other *Mops* found in Burkina Faso, it is located in the Sudanian zone (Fig. 9). Only two specimens are reported from Burkina Faso. These specimens, examined by Koopman et al. (1978), have been captured near the river Nazinon, almost the same environment from where they reported *M. demonstrator*. This is the only area of presence of this species known to date in Burkina Faso, as no other specimen of *M. midas* has yet been captured.

It is the largest of *Mops* found in Burkina Faso. Aside from the measurement of tragus of *M. midas* which is below the minimum values of *M. condylurus* and those of *M. demonstator*, all other measurements of *M. midas* are superior to the maximum values of *M. condylurus* and the measurements of *M. demonstrator* (Table 11).

Family VESPERTILIONIDAE
Genus *Glauconycteris* Dobson, 1875
Glauconycteris variegata (Tomes, 1861)

Glauconycteris variegata is located in West Central area in the North-Sudanian zone (Fig. 10). As noted by Rosevear (1965) this is a species that inhabits open areas rather than rainforests.

Genus *Myotis* Kaup, 1829
Myotis bocagii (Peters, 1870)

Myotis bocagii has been found in the southwest and southeast of the Sudanian zone (Fig. 10). It is a forest species also found in the gallery forests along rivers, in savanna areas (Green, 1983). All specimens captured during BIOTA collect are from the cliffs of Banfora. This is the second area where the species is identified.

Genus *Neoromicia* Roberts, 1926

Neoromicia capensis (A. Smith, 1829)

Neoromicia capensis is located at the extreme southwestern area in South-Sudanian zone (Fig. 10). The specimen has been captured in a gallery forest along a stream between hills.

Measurements of body and cranial measurements of *N. capensis* exceed the maximum measurements (except Bm, 3Ph3, HF of males and except Bm, 3Ph3, HF, CC, and CM of females) of *N. somalica*. They are also higher than the maximum values (except 3Ph2, 3Ph3, Tib, HF of males and except HB, Tail, 3Ph3, 4Ph1 and HF of females) of *N. guineensis* (see Table 13 and 14). Body measurements do not really allow distinguishing them. However, measurement of the forearm of *N. capensis* is larger than that of *N. somalica* and *N. guineensis* (Table 12).

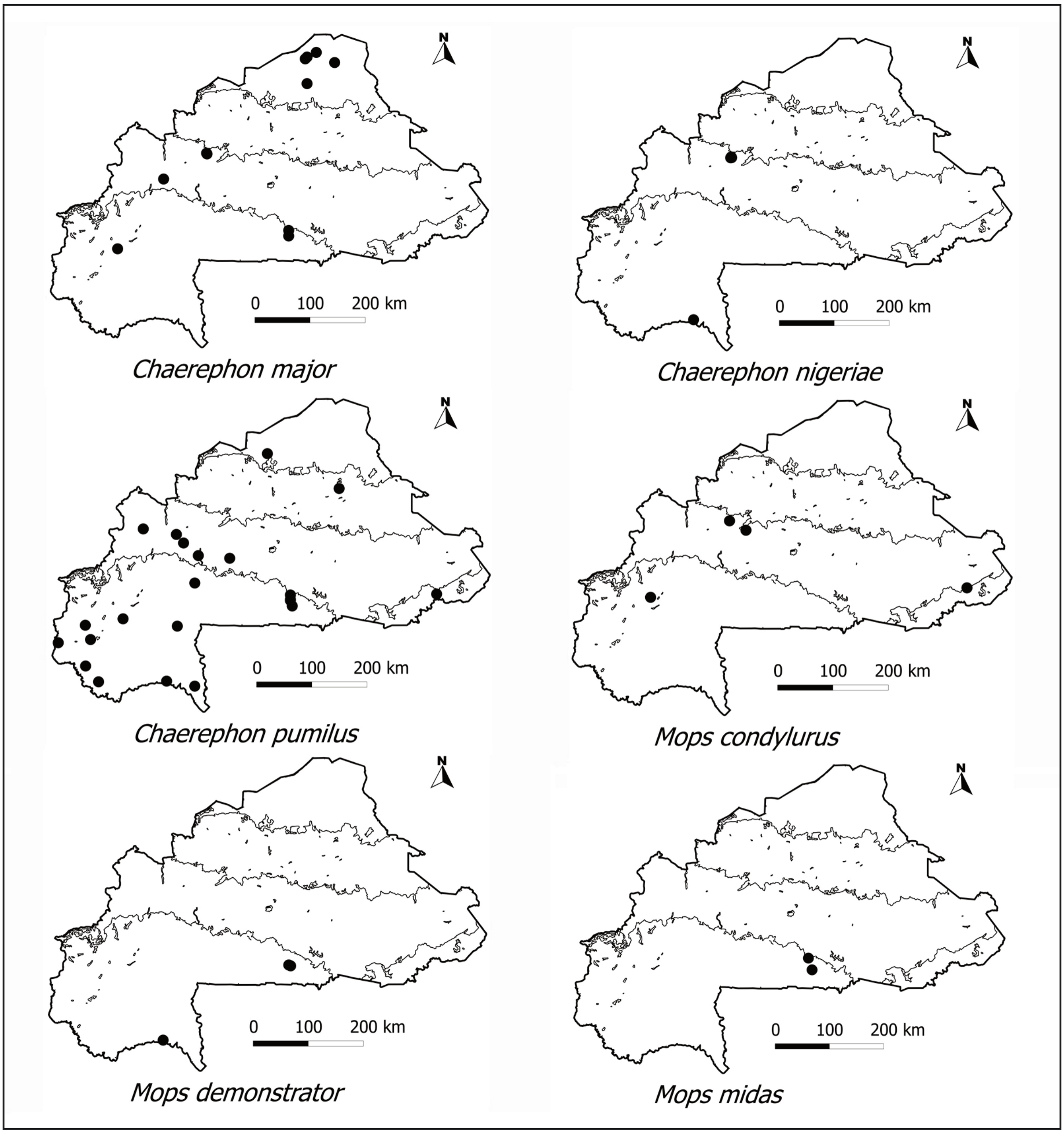

Figure 9. Distribution of Molossidae in Burkina Faso.

Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
Chaerephon major																						
♂♂	X	15.1	66.7	34.3	17.1	3.5	43.0	44.0	19.0	17.7	8.3	42.2	15.6	12.2	27.4	13.4	5.1	13.4	8.3	4.97	8.20	7.01
	± SD	0.2	0.3	2.6	0.7	0.1	0.8	1.3	0.9	0.6	1.2	1.2	0.5	0.7	1.0	0.3	0.5	0.7	0.6	0.08	0.07	0.17
	Min	14.8	66.2	31.1	16.0	3.4	42.0	42.2	18.0	16.7	7.1	41.0	14.9	11.2	25.9	13.0	4.6	12.3	7.6	4.84	8.14	6.74
	Max	15.3	66.9	36.9	17.8	3.7	44.2	45.8	20.1	18.5	10.0	43.9	16.1	13.0	28.4	13.9	5.5	14.3	9.4	5.06	8.31	7.21
	n=	3	4	4	4	4	5	4	4	4	4	4	4	4	4	4	4	5	5	4	4	4
♀ (USNM 452890)							40.4											12.0	8.2	5.07	7.82	6.65
Chaerephon nigeriae																						
♂		18.5	73.0	41.4	21.3	3.0	48.7	50.0	20.4	20.9	8.5	47.9	16.4	13.2	30.7	15.0	6.5	15.0	9.1	5.43	8.96	7.60
♂		20.3	74.8	40.1	21.6	3.0	49.6	49.9	21.1	20.5	9.5	47.5	16.9	12.7	30.2	15.7	5.8	15.9	8.8	5.90	8.83	7.64
♀		18.8	72.2	34.9	17.5	3.4	47.7	48.0	19.4	18.4	8.7	47.5	15.3	12.4	30.1	14.6	5.6	14.7	8.5	5.33	8.79	7.43
Chaerephon pumilus																						
♂♂	X	8.6	53.3	30.7	15.5	3.2	36.1	36.4	15.1	14.9	6.5	35.4	12.6	10.3	23.3	11.1	4.0	11.7	6.7	4.19	7.20	5.90
	± SD	0.8	1.7	1.5	1.0	0.3	0.8	1.4	0.7	0.5	0.7	1.1	0.5	0.6	0.9	0.8	0.3	0.6	0.5	0.20	0.16	0.12
	Min	7.5	50.7	27.3	14.2	2.8	34.1	34.5	14.1	13.8	5.2	33.7	11.7	9.3	21.7	10.0	3.4	10.6	5.7	3.82	6.94	5.63
	Max	10.0	57.0	33.4	17.6	3.7	37.5	38.7	16.2	15.6	7.4	37.3	13.4	11.2	24.8	12.4	4.4	12.7	7.8	4.47	7.49	6.10
	n=	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
♀♀	X	8.6	53.0	31.4	15.5	3.4	36.4	36.3	15.3	15.1	6.2	34.8	12.5	10.6	22.8	11.1	4.1	11.9	6.5	3.92	6.90	5.79
	± SD	0.9	1.9	2.0	0.7	0.4	0.6	1.2	0.6	0.7	0.5	1.1	0.6	0.7	0.8	0.7	0.2	0.8	0.5	0.08	0.21	0.11
	Min	7.0	50.7	28.5	13.8	2.9	35.5	34.7	14.0	14.0	5.4	33.3	11.5	9.3	21.4	9.7	3.7	10.3	6.0	3.78	6.53	5.58
	Max	10.0	57.7	34.7	16.6	4.3	37.6	38.4	16.3	16.4	7.1	37.1	13.4	11.6	24.2	12.4	4.5	12.9	7.7	4.06	7.18	6.09
	n=	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Mops condylurus																						
♂ (SAD)		23.0	69.2	36.0	18.4	3.4	48.5	51.1	22.9	21.1	9.3	48.9	18.0	14.6	34.1	14.0	5.3	16.8	11.0	5.74	9.38	7.51
♂		23.8	69.8	39.4	18.9	2.8	48.2	48.8	23.4	22.2	10.3	47.5	18.9	15.8	34.0	14.6	5.5	17.2	11.0	5.68	8.78	7.15
♀♀	X	24.8	67.6	39.6	18.1	3.0	46.6	48.3	22.6	22.0	9.4	47.0	18.1	15.7	32.8	13.5	5.5	16.6	10.8	5.34	8.82	7.35
	Min	23.5	66.6	37.5	17.5	2.8	45.3	47.5	21.7	21.9	8.2	46.3	17.2	15.2	32.0	13.4	5.2	16.2	10.6	5.15	8.74	7.14
	Max	26.0	69.4	42.5	18.6	3.2	48.4	50.2	23.3	22.2	10.6	48.4	18.6	16.3	33.6	13.7	5.8	17.1	11.2	5.55	9.05	7.53
	n=	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Mops demonstrator																						
♀		25.8	71.8	34.1	17.7	3.8	43.4	44.1	18.6	17.5	7.6	42.6	14.4	12.0	26.0	13.5	5.8	15.0	8.8	5.55	9.18	7.53
Mops midas																						
♀ AD (USNM 503956)			100	47	28	2	63.3											18.9	13.6	8.30	11.84	10.44

Table 11. Measurements of Molossidae from Burkina Faso.

Neoromicia guineensis (Bocage, 1889)

Neoromicia guineensis is present in almost all phytogeographic areas of Burkina Faso. It is widely distributed in the Sudanian zone with a few specimens in the North-Sahelian zone (Fig.10).

It is easily comparable to *N. somalica*. Although the weight (WB) of *N. guineensis* is greater than the weight of *N. somalica*, averages of body measurements (except Tail 3Ph1, 3Ph2, 3Ph3, 5Ph1, 5Ph2) of males from *N. somalica* are higher than those of males from *N. guineensis* and averages of body measurements (except Tail, 3Ph1, 3Ph2, 4Ph1, 4Ph2, 5Ph1, 5Ph2 and Tib) of females from *N. somalica* are higher than those of females from *N. guineensis*. The body measurements of males (except Bm and HB) from *N. somalica* and *N. guineensis* overlap, as well as those of females. Body measurements do not allow to distinguish them. However, the minimum cranial measurements of *N. somalica* are higher than the maximum cranial measurements of *N. guineensis* (Table 12). Only cranial measurements thus enable separating them. Averages of body measurements (except Ear, 3Ph2) and cranial measurements of females are higher than those of males.

Neoromicia nana (Peters, 1852)

Neoromicia nana is located in the South-Sudanian zone (Fig.10). The specimens have been captured in a gallery forest along a water stream, in the cliffs of Banfora, in a woody savanna along a rupicolous bar, next to a dam and along a stream at the end of the hills.

Neoromicia rendalli (Thomas, 1889)

It is located in the South-East in the South-Sudanian zone (Fig. 10). It seems to be essentially present in dry areas of Guinean, Sudanian and Sahelian open forests (Rosevear, 1965). The specimen has been captured in a woody savanna near a managed water point. It seems to be essentially present in dry areas of Guinea, Sudanian and Sahelian open forests (Rosevear, 1965). *Neoromicia rendalli* is easily distinguishable from other *Neoromicia* by the white color of its wings and its forearm which is longer than that of others present in Burkina Faso (Table 12).

Neoromicia somalica (Thomas, 1901)

Neoromicia somalica is less distributed than *N. guineensis*. This species is particularly located in the South-Sudanian zone (Fig. 10).

The averages of body measurements (except Tra, 3Ph1, 4Ph1, 4Ph2, 5Ph2 and HF) and cranial measurements (except CM) of females are larger than those of males. These are mainly measurements of the forearm and cranial measurements, especially those of the upper incisors show a slight difference between males which are slightly smaller than females (Table 12).

Genus *Nycticeinops* Hill et Harrison, 1987
Nycticeinops schlieffenii (Peters, 1859)

Nycticeinops schlieffenii is present in almost all phytogeographic zones (Fig.10). Although no specimen has been captured in the South-Sahelian zone, this small bat inhabits open woodlands and drier areas (Rosevear, 1965). Its presence in the North-Sahelian zone shows that it will therefore not be surprising to capture it in the South-Sahelian zone.

The averages of body measurements (except Tra, 3Ph3) and cranial measurements (except CM) of females are slightly higher than those of males (Table 12).

Genus *Pipistrellus* Kaup, 1829
Pipistrellus deserti Thomas, 1902

Pipistrellus deserti is located in the South-central zone in South-Sudanian area (Fig. 10). Only one specimen has been captured in Burkina Faso (Koopman et al., 1978). This species is rarely found in West Africa. Its presence was unexpected in Burkina Faso particularly because it is known to be a northern Sahara species (Horáček et al., 2000; Fahr et al., 2006).

Pipistrellus inexspectatus Aellen, 1959

Pipistrellus inexspectatus is located in the southwest in the South-Sudanian zone (Fig. 10). Only two specimens have been captured in a wooded savanna along a rupicolous bar and in a gallery forest in a protected forest.

Pipistrellus nanulus Thomas, 1904

Like *Pipistrellus deserti*, only one specimen of *P. nanulus* has been captured in Burkina Faso. It is located at the Centre in the North-Sudanian zone (Fig. 10).

It is more easily comparable to *P. rusticus* whose body measurements, in particular the measurements of the forearm do not help in the distinction. The best measurements to separate them remaining the cranial ones which clearly show that *P. nanulus* is smaller than *P. rusticus*. Indeed, the cranial measurements of *P. nanulus* are below the minimum measurements of *P. rusticus* (Table 12). It is the smallest *Pipistrellus* found in Burkina Faso.

Pipistrellus rusticus (Tomes, 1861)

Pipistrellus rusticus is located in the Southwest in the South-Sudanian area and at the center in the North-Sudanian zone (Fig. 10). The specimens have been captured near a pond, in the cliffs of Banfora, along a stream at the end of the hills and in an orchard.

Pipistrellus rusticus is smaller than *P. inexspectatus*. Only body measurements (HB, Tail, Ear, Tra, 3Ph3 and HF) of *P. inexspectatus* are below the maximum measurements of the body of *P. rusticus*. The other body measurements in particular measurement of the forearm and wings and cranial meas-

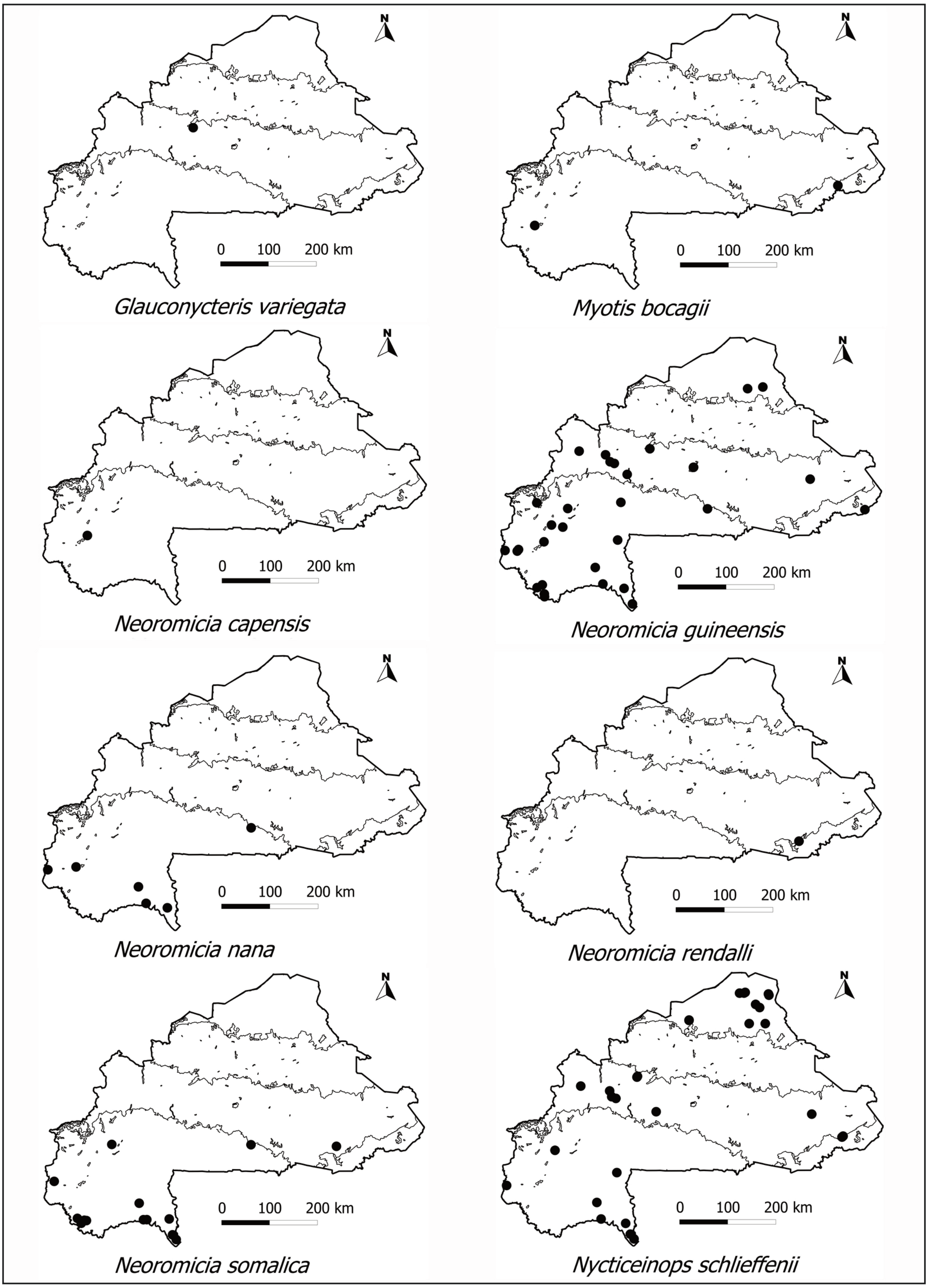

Figure 10/1. Distribution of Vespertilionidae in Burkina Faso.

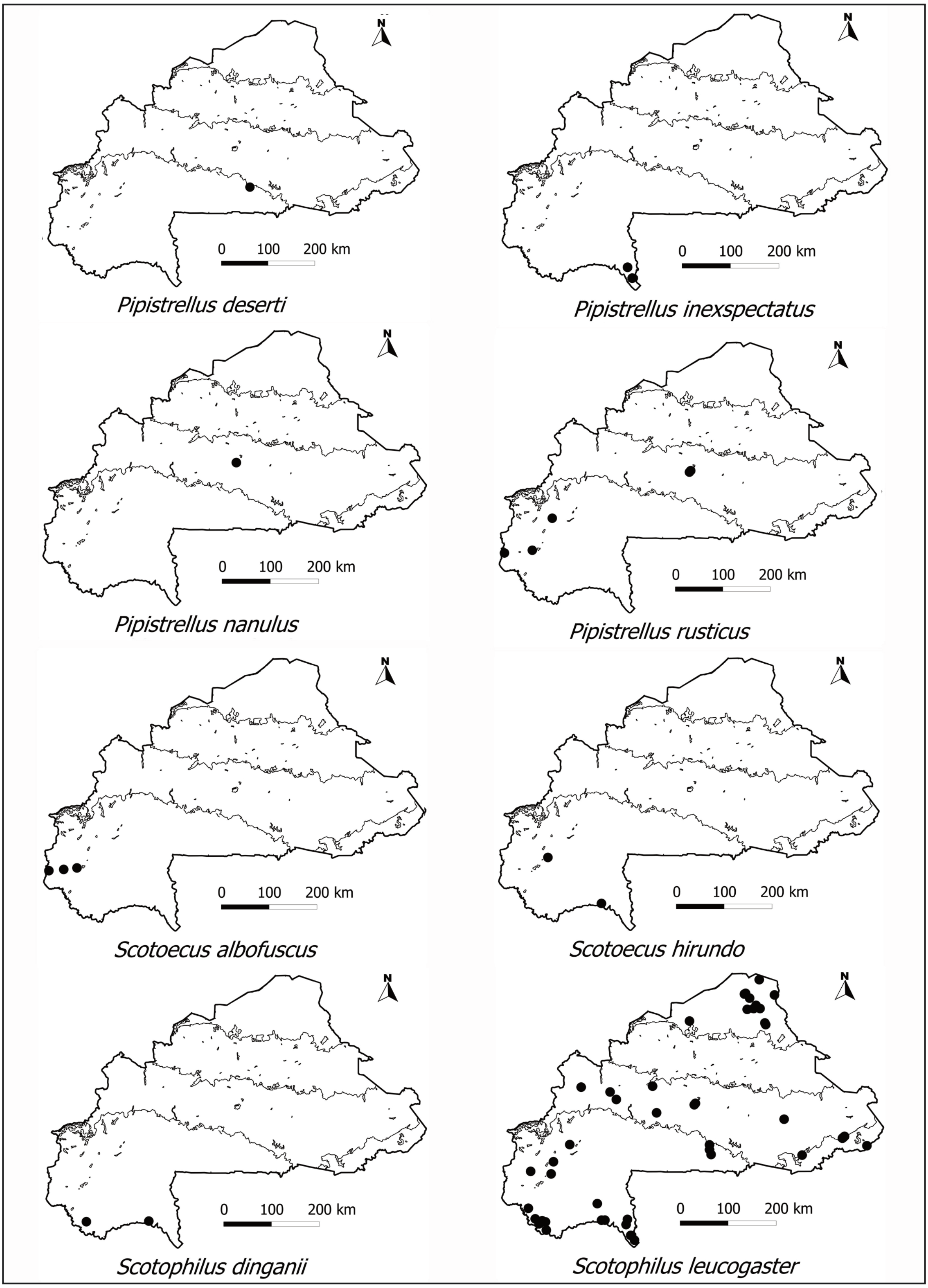

Figure 10/2. Distribution of Vespertilionidae in Burkina Faso.

Glauconycteris variegata																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♀ (SAD)		10.5	53.1	51.0	13.3	6.2	44.8	41.8	16.1	21.6	3.7	40.1	11.6	11.0	39.5	10.0	7.9	20.6	8.1	4.62	7.06	4.87
Myotis bocagii																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂		5.5	52.5	38.4	15.1	7.5	34.7	36.6	14.2	10.9	5.8	35.1	10.2	7.6	33.9	8.8	6.3	17.2	10.6	3.83	5.77	5.61
♀		6.5	53.1	39.2	14.2	7.2	37.7	37.0	15.7	10.8	6.1	37.6	11.6	7.7	34.4	10.1	6.7	18.6	10.9	3.98	5.87	5.78
Neoromicia capensis																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂		4.3	50.9	33.8	15.4	6.8	32.3	31.6	12.2	10.6	6.8	30.1	10.4	10.3	30.0	10.0	7.0	12.8	6.2	4.30	5.66	4.74
Neoromicia guineensis																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
	X	3.0	36.7	30.5	10.3	4.5	27.2	26.2	10.2	8.8	6.2	25.7	9.0	6.1	25.6	7.4	4.1	10.9	5.5	3.18	4.57	3.72
	± SD	0.3	1.4	1.8	0.8	0.4	1.4	1.0	0.5	0.7	0.5	1.0	0.5	0.3	1.1	0.5	0.4	0.7	0.4	0.11	0.15	0.09
♂♂	Min	2.5	34.5	25.5	8.9	4.0	25.4	24.4	9.2	7.5	5.2	24.3	8.2	5.2	23.7	6.6	3.1	9.8	4.6	2.99	4.36	3.53
	Max	3.5	39.2	35.5	12.0	5.2	31.2	27.8	11.4	10.8	7.1	27.8	10.3	6.7	27.6	8.4	5.0	13.5	6.6	3.39	4.92	3.87
	n=	24	24	24	24	24	25	24	24	24	24	24	24	24	24	24	24	25	25	25	25	25
	X	3.6	39.1	32.2	10.1	4.6	28.2	27.4	10.7	9.3	6.2	27.2	9.5	6.3	26.8	7.9	4.3	11.2	5.6	3.35	4.67	3.78
	± SD	0.3	1.7	2.0	0.4	0.3	0.7	1.2	0.4	0.5	0.6	1.3	0.6	0.5	1.2	0.5	0.4	0.6	0.5	0.14	0.14	0.10
♀♀	Min	3.0	36.0	28.5	9.4	3.9	27.0	25.2	9.9	8.3	5.2	25.5	8.5	5.4	24.3	7.0	3.5	9.8	4.4	3.13	4.47	3.61
	Max	4.3	42.1	35.6	10.9	4.9	29.6	29.4	11.5	10.0	7.2	29.3	10.4	7.1	28.5	8.5	4.9	12.0	6.3	3.61	4.95	3.95
	n=	11	12	12	12	11	14	12	11	11	11	12	11	11	12	11	11	14	14	14	14	14
Neoromicia nana																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
	X	3.3	38.0	29.9	9.7	3.6	27.6	26.8	8.7	7.4	4.6	26.5	7.3	5.2	26.0	6.4	3.5	10.0	5.6	3.25	4.37	3.62
	± SD	0.6	1.4	2.2	0.4	0.4	1.1	1.0	0.5	0.5	0.5	1.0	0.5	0.5	0.8	0.4	0.3	0.4	0.3	0.10	0.14	0.09
♂♀	Min	2.4	34.7	24.7	8.9	2.9	25.8	25.4	7.9	6.5	3.2	25.0	5.8	4.2	24.4	5.9	2.9	9.2	4.9	3.02	4.16	3.44
	Max	4.0	40.9	33.8	10.7	4.9	30.1	29.2	10.0	8.4	5.5	28.9	7.9	6.1	27.6	7.5	4.0	10.6	6.1	3.40	4.62	3.79
	n=	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Neoromicia rendalli																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♀ (SAD)		6.8	46.6	37.8	11.4	4.7	35.2	34.4	11.3	8.5	5.8	34.0	10.5	6.0	32.6	8.0	4.3	12.8	6.8	4.15	5.90	4.47
Neoromicia somalica																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
	X	4.4	43.9	27.8	11.3	5.2	28.2	27.1	10.1	8.6	6.2	26.5	9.2	6.3	26.7	7.0	4.1	10.8	6.1	4.00	5.36	4.45
	± SD	0.3	1.3	1.5	0.4	0.3	0.6	0.8	0.4	0.3	0.6	0.9	0.4	0.2	0.7	0.5	0.2	0.3	0.2	0.15	0.14	0.09
♂♂	Min	4.0	42.4	25.6	10.9	4.7	27.1	25.4	9.5	8.0	5.4	24.7	8.4	6.0	25.0	6.5	3.8	10.4	5.8	3.83	5.16	4.35
	Max	4.8	46.6	29.6	11.8	5.7	29.0	28.0	10.7	9.1	7.3	27.7	9.8	6.6	27.2	7.9	4.4	11.1	6.5	4.22	5.54	4.60
	n=	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	6
	X	5.3	45.9	30.0	11.4	4.9	29.3	28.4	10.0	8.7	6.4	27.9	9.2	6.3	27.9	7.3	3.9	10.9	5.8	4.09	5.39	4.41
	± SD	0.8	1.7	1.4	0.4	0.4	1.0	0.9	0.4	0.5	0.5	1.0	0.6	0.3	1.0	0.4	0.2	0.4	0.4	0.12	0.14	0.08
♀♀	Min	4.3	41.2	28.1	10.9	4.3	27.3	27.2	9.4	8.2	5.5	26.6	8.3	5.8	26.5	6.7	3.5	10.3	5.2	3.96	5.16	4.25
	Max	6.5	48.7	32.6	12.0	5.4	31.1	29.6	10.7	9.9	7.2	29.5	10.1	6.9	29.3	8.1	4.3	11.6	6.3	4.37	5.67	4.54
	n=	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Nycticeinops schlieffenii																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♂♂	X	5.1	44.1	30.9	11.3	4.7	30.8	30.5	11.6	9.4	6.3	30.1	10.2	6.5	30.0	7.5	4.5	12.2	6.3	3.94	5.43	4.36
	± SD	0.4	1.8	2.5	0.5	0.3	1.1	1.3	0.7	0.7	0.8	1.0	0.6	0.5	1.1	0.5	0.3	0.5	0.4	0.14	0.15	0.12
	Min	4.5	41.9	26.4	10.4	3.9	29.3	27.8	10.6	8.4	5.1	28.8	9.1	5.7	27.7	6.7	4.1	11.4	5.5	3.73	5.17	4.18
	Max	6.0	47.2	35.4	12.1	5.1	32.5	32.6	12.9	10.9	7.7	31.8	11.1	7.4	31.7	8.6	5.2	12.9	7.3	4.15	5.61	4.60
	n=	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
	X	5.7	46.3	33.3	11.5	4.6	31.9	31.4	12.0	9.8	6.2	30.9	10.8	7.1	30.6	8.0	4.7	12.8	6.6	3.98	5.48	4.32
	± SD	0.6	1.0	1.9	0.5	0.3	1.7	1.8	0.8	0.7	0.6	1.7	0.7	0.5	1.8	0.6	0.4	0.9	0.1	0.15	0.08	0.10
♀♀	Min	5.0	43.8	30.6	10.4	4.1	29.0	28.0	10.6	8.4	5.3	27.6	9.6	6.0	27.0	6.6	4.0	11.0	6.5	3.70	5.30	4.18
	Max	7.0	47.3	35.9	12.1	5.0	33.6	34.5	13.5	10.4	7.4	34.1	11.7	8.0	33.6	8.9	5.4	13.6	7.0	4.24	5.58	4.49
	n=	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Pipistrellus inexspectatus																						
Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
♀		5.3	46.8	35.1	11.9	4.8	32.6	31.6	12.1	11.4	5.2	30.4	10.8	8.8	30.1	8.0	6.4	13.3	5.6	3.98	5.32	4.42
♀		5.5	47.2	37.3	11.9	5.0	32.8	31.3	12.5	10.5	6.8	30.8	10.5	8.8	30.1	7.7	6.1	13.2	5.8	3.96	5.21	4.51

Table 12/1. Measurements of Vespertilionidae from Burkina Faso.

Sex		BM	TL	T	E	TR	FA	3Met	3Ph1	3Ph2	3Ph3	4Met	4Ph1	4Ph2	5Met	5Ph1	5Ph2	TB	HF	C-C	M^3-M^3	C-M^3
Pipistrellus nanulus																						
♂ (AD) USNM 454669		4.0	44	25	9		[26.4]											8.9	4.6	3.64	4.85	3.90
Pipistrellus rusticus																						
♂♀	X	4.0	42.0	31.1	10.9	4.8	27.5	27.3	9.9	7.8	5.5	27.0	9.0	6.2	26.5	6.5	3.6	10.1	5.5	3.80	5.09	4.04
	± SD		3.6	6.8	0.8	0.4	1.1	0.4	0.5	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.6	0.7	0.4	0.03	0.06	0.08
	Min	3.8	38.1	26.8	10.0	4.2	26.1	26.5	9.1	7.2	4.8	26.4	8.4	5.8	26.2	6.1	2.8	8.5	5.0	3.76	5.02	3.92
	Max	4.5	47.3	46.1	12.2	5.3	29.9	27.9	10.6	8.1	6.0	27.6	9.4	6.8	27.2	6.9	4.2	10.7	6.2	3.86	5.16	4.12
	n=	4	6	6	6	6	7	6	6	6	6	6	6	6	6	6	6	7	7	5	5	5
Scotoecus albofuscus																						
♂		8.0	60.6	32.9	11.7	4.9	31.7	32.6	11.9	8.5	6.0	32.1	10.9	6.3	31.0	6.8	4.4	11.9	8.5	4.79	6.47	4.97
♂		8.5	60.2	31.5	11.9	4.8	33.9	31.6	11.4	8.7	5.2	31.5	10.2	6.6	30.6	8.0	4.6	12.7	6.6	5.32	7.04	5.36
♀♀	X	7.6	56.4	33.6	11.6	4.4	30.5	30.4	11.5	8.7	6.4	30.2	10.6	6.9	29.0	7.9	4.4	11.9	7.3	4.54	6.46	4.75
	± SD	0.4	3.4	1.1	0.4	0.3	0.3	0.9	0.3	0.3	0.3	1.4	0.3	0.5	1.2	0.4	0.3	0.3	0.6	0.06	0.07	0.11
	Min	7.0	50.3	32.3	11.2	4.0	30.2	29.5	11.1	8.4	6.1	29.1	10.2	6.4	28.1	7.4	4.1	11.6	6.4	4.44	6.34	4.56
	Max	8.0	60.3	35.2	12.2	5.0	31.1	32.1	11.9	9.1	6.7	32.9	11.0	7.7	31.3	8.5	4.9	12.2	8.1	4.62	6.54	4.87
	n=	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Scotoecus hirundo																						
♂		10.8	51.4	35.8	13.8	5.2	33.7	32.1	12.0	9.3	6.4	32.0	11.4	6.8	31.8	7.4	5.1	12.7	8.0	4.65	6.82	5.59
♂		9.0	51.2	32.2	12.8	4.5	32.8	33.3	11.2	9.2	6.5	32.5	11.0	6.4	31.9	7.3	5.2	12.2	8.1	5.12	6.59	5.06
♀♀	X	10.7	51.8	32.5	13.0	4.8	32.2	31.6	11.3	8.7	6.3	31.2	11.1	6.8	30.3	7.4	4.9	11.7	7.7	4.86	6.57	5.07
	Min	9.5	50.0	32.5	12.7	4.4	30.9	30.8	11.2	8.2	5.7	30.5	10.8	6.0	30.0	7.2	4.3	11.3	6.6	4.71	6.44	4.98
	Max	11.8	52.6	32.6	13.5	5.2	33.3	33.0	11.5	9.0	7.1	32.1	11.4	7.3	30.8	7.5	5.5	11.9	8.4	4.94	6.84	5.13
	n=	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Scotophilus dinganii																						
♀		26.0	73.8	56.7	20.1	10.4	56.7	56.3	19.9	16.2	8.1	55.3	15.3	10.1	50.6	10.3	6.5	24.0	10.8	7.66	9.74	7.52
♀		27.5	74.6	61.4	18.5	7.7	55.7	56.4	20.8	15.8	8.2	50.9	15.4	10.8	49.9	9.7	7.9	24.7	13.0	7.72	9.98	7.41
Scotophilus leucogaster																						
♂♂	X	20.3	67.0	47.9	14.5	7.4	49.6	46.2	16.9	14.1	7.8	45.8	12.9	8.8	42.5	8.7	5.7	19.4	9.1	6.39	8.37	6.32
	± SD	1.4	2.1	2.6	0.9	0.5	1.1	0.9	0.7	0.7	0.4	0.9	0.5	0.8	1.0	0.5	0.7	1.1	0.5	0.19	0.20	0.18
	Min	18.0	62.9	43.1	13.2	6.2	47.7	44.4	15.5	12.3	7.2	43.4	12.0	7.2	40.6	7.9	4.5	17.4	8.6	6.06	8.05	6.03
	Max	22.5	70.8	51.6	16.1	8.2	52.0	48.3	18.4	15.4	8.5	46.8	13.9	11.1	44.4	9.6	7.0	20.8	10.2	6.73	8.80	6.66
	n=	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
♀♀	X	23.0	70.0	48.8	14.6	7.6	51.2	48.0	17.4	14.1	8.2	47.4	13.2	8.9	44.8	9.2	5.8	19.6	9.3	6.37	8.35	6.18
	± SD	3.2	3.2	3.0	0.8	0.4	1.4	1.5	0.6	0.6	0.5	1.6	0.5	0.6	1.5	0.5	0.7	1.0	0.6	0.15	0.17	0.15
	Min	18.3	63.1	42.9	13.1	6.8	48.1	45.9	16.3	13.2	7.3	44.0	12.3	7.9	42.7	8.5	4.4	18.2	8.2	6.10	8.09	6.00
	Max	33.0	80.2	54.3	15.8	8.3	54.2	53.0	18.5	15.8	8.9	51.9	14.5	11.1	49.2	10.3	7.5	21.6	10.5	6.69	8.83	6.58
	n=	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
Scotophilus viridis																						
♂♂	X	14.1	59.9	47.0	14.6	7.1	45.3	42.2	15.4	12.6	7.3	41.4	11.9	7.9	39.1	8.1	5.0	18.5	8.9	5.68	7.75	5.72
	± SD	3.2	1.9	2.1	0.6	0.4	1.0	1.7	0.5	0.7	0.6	1.4	0.7	0.5	1.6	0.5	0.6	0.5	0.9	0.16	0.20	0.11
	Min	10.0	57.1	43.1	13.8	6.5	43.6	40.0	14.1	11.0	5.8	39.2	10.4	7.0	37.1	7.3	4.1	17.4	7.3	5.40	7.37	5.55
	Max	23.5	64.5	51.1	15.6	7.9	47.4	46.8	16.3	13.6	8.0	45.2	12.9	8.9	43.1	9.3	6.1	19.3	10.2	6.01	8.06	5.91
	n=	17	17	17	17	16	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
♀♀	X	16.7	60.8	48.1	14.6	7.2	45.3	42.3	15.6	13.0	7.4	42.2	12.3	8.4	39.3	8.6	5.1	17.3	8.9	5.75	7.73	5.80
	± SD	2.6	1.9	3.0	0.7	0.4	1.1	1.7	0.7	0.4	0.6	1.9	0.4	0.8	1.6	0.4	0.5	1.0	0.8	0.10	0.14	0.14
	Min	11.0	58.4	43.4	13.9	6.3	43.5	40.5	14.2	12.3	6.7	40.1	11.5	7.0	37.7	8.1	4.5	16.3	8.1	5.65	7.52	5.56
	Max	20.3	63.2	52.4	15.7	7.6	46.4	45.6	16.8	13.7	8.3	45.4	12.8	9.6	42.6	9.1	6.0	19.2	10.4	5.90	8.00	6.05
	n=	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7

Table 12/2. Measurements of Vespertilionidae from Burkina Faso.

urements of *P. inexspectatus* are larger than the maximum measurements of *P.ructicus* (Table 12).

Genus *Scotoecus* Thomas, 1901
Scotoecus albofuscus (Thomas, 1890)

Scotoecus albofuscus is located in the extreme Southwest in the South-Sudanian zone (Fig.10). All specimens have been captured near rock formations and in the presence of water in the cliffs of Banfora, next to a water point near hills and in shrubby savanna between a mountain and a dam. Their presence seems to be linked to the topography and the presence of water.

Body and cranial measurements do not help to clearly separate males from females. Only the forearm and cranial measurements (CC and MM) of males is higher than the maximum values of females (Table 12).

Scotoecus hirundo (de Winton, 1899)

Scotoecus hirundo is located in the extreme Southwest in the South-Sudanian zone (Fig.10). The specimens have been captured in a gallery forest located along a stream and in a woody savanna in the protected forest of Peni. Like *S. albofuscus*, *S. hirundo* inhabits open woodlands (Hill, 1974).

Measurements of body and cranial measurements do not help to distinguish *S. hirundo* from *S. albofuscus* and cannot also help to distinguish males from females (Table 12). Nevertheless, the maximum values of cranial measurements (CC and CM) of female from *S. albofuscus* are below the minimum values of cranial measurements from *S. hirundo*. Especially the white wings of *S. albofuscus* contribute to distinguish them.

Genus *Scotophilus* Leach, 1821
Scotophilus dinganii (A. Smith, 1833)

Specimens have been captured in the extreme Southwest in the South-Sudanian zone (Fig. 10). Indeed, *Scotophilus dinganii* is found in most areas of savanna vegetation, from large forests until the beginning of Sahelian savannas (Robbins et al., 1985).

It is the largest *Scotophilus* fond in Burkina Faso. Measurements of the forearm reveal that it is larger than *S. leucogaster* and *S. viridis* (Table 12).

Scotophilus leucogaster (Cretzschmar, 1826)

Commonly encountered species, *Scotophilus leucogaster* is widespread and present in almost all vegetation zones except in the South-Sahelian zone (Fig. 10).

It is smaller than *S. dinganii*. The averages of body measurements (except 3Ph3) and averages of cranial measurements of *S. leucogaster* are below the measurements of *S. dinganii*. However, there is an overlap, because all the maximum values of *S. leucogaster* (BM, HB, 3Ph2, 3Ph3, 4 Met, 4Ph2, 5Ph1 and 5Ph2) are not inferior to the measurements of *S. dinganii*. However, all the maximum values of the forearm and cranial measurements of *S. leucogaster* are lower than the measurements of the forearm and cranial measurements of *S. dinganii* (Table 12). The measurement of forearm and cranial measurements are better suited to differentiate them. The averages of body measurements (except 3Ph2) of males are smaller than those of females. However, the averages of cranial measurements of males are higher than those of females. Among insectivorous bats this is the most widespread species in Burkina Faso.

Scotophilus viridis (Peters, 1852)

Scotophilus viridis is present in all areas of African savanna but absent or rare in the driest areas of Sudanian and Sahelian savannas (Robbins et al., 1985). Indeed, In Burkina Faso, it is present only in the Sudanian zone (Fig. 11). It is therefore less widespread than *S. leucogaster*.

It is the smallest of *Scotophilus* found in Burkina Faso (Table 12). The averages of body measurements (except Ear, FA, Tib and HF) and cranial measurements (except MM) of males are smaller than those of females. They do not really help to separate them. The averages of body measurements (except Ear) and cranial measurements of *S. viridis* are lower than those of *S. leucogaster*. However, only maximum values (FA, CC and CM) of males from *S. viridis* are below the minimum values of males from *S. leucogaster*. In addition, only the maximum values (FA, 3 Met, CC and MM) of females from *S. viridis* are below the minimum values of females from *S. leucogaster*. The measurement of the forearm remains the best measurement to separate the two species.

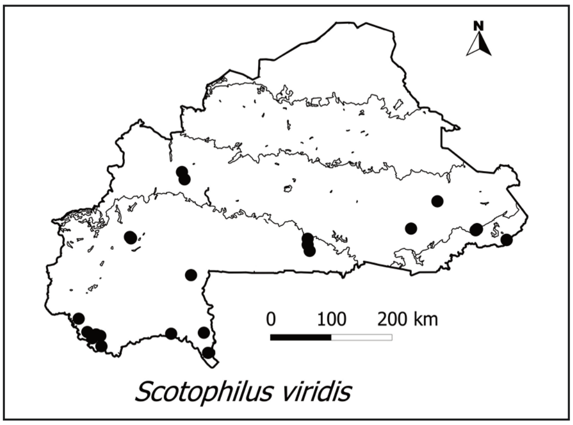

Figure 11. Distribution of *Scotophilus viridis* in Burkina Faso.

Distribution at the family level

The families Pteropodidae, Hipposideridae, Emballonuridae, Nycteridae and Molossidae were present in all phytogeographic areas in Burkina Faso. However, Rhinolophidae were absent in the North-Sahalian zone but present in the rest of the country. Similarly, Vespertilionidae were absent in the south-Sahelian zone but present in the rest of the country. Rhinopomatidae were only present in the extreme north and the extreme south of the country, while Megadermatidae were present in the Sudanian zone only. Of the 51 species found in Burkina Faso, only 3 species are exclusively located in the Sahelian zone against 32 in the Sudanian zone. The remaining 16 species are found both in the Sahelian and Sudanian areas (Table 13).

DISCUSSION

Of the 36 species already reported since the late 1980s, five species were not captured again and other 15 species have been identified for the first time in Burkina Faso (Kangoyé et al., 2012). Most specimens have been captured in the southern part of the country with a particular emphasis on the Southwest which had been under-sampled. Among the five species already reported in Burkina Faso

Species	Phytogeographic zones		Species	Phytogeographic zones		Species	Phytogeographic zones			
	Sudanian zone only			Sahelian zone only			Sahelian and Sudanian zones			
Pipistrellus nanulus	NSud		*Asellia tridens*	NSah		*Epomophorus gambianus*	NSah	SSah	NSud	SSud
Micropteropus pusillus	NSud	SSud	*Rhinopoma microphyllum*	NSah		*Hipposideros ruber*	NSah	SSah	NSud	SSud
Nanonycteris veldkampii	NSud	SSud	*Glauconycteris variegata*		SSah	*Nycteris macrotis*	NSah	SSah	NSud	SSud
Hipposideros jonesi	NSud	SSud				*Nycteris thebaica*	NSah	SSah	NSud	SSud
Hipposideros vittatus	NSud	SSud				*Chaerephon pumilus*	NSah	SSah	NSud	SSud
Lavia frons	NSud	SSud				*Eidolon helvum*	NSah		NSud	SSud
Rhinolophus fumigatus	NSud	SSud				*Chaerephon major*	NSah		NSud	SSud
Nycteris hispida	NSud	SSud				*Neoromicia guineensis*	NSah		NSud	SSud
Chaerephon nigeriae	NSud	SSud				*Nycticeinops schlieffenii*	NSah		NSud	SSud
Mops condylurus	NSud	SSud				*Scotophilus leucogaster*	NSah		NSud	SSud
Neoromicia somalica	NSud	SSud				*Taphozous perforatus*	NSah	SSah		SSud
Pipistrellus rusticus	NSud	SSud				*Hipposideros tephrus*		SSah	NSud	SSud
Scotophilus viridis	NSud	SSud				*Rhinolophus landeri*		SSah	NSud	SSud
Hypsignathus monstrosus		SSud				*Nycteris gambiensis*		SSah	NSud	SSud
Lissonycteris angolensis		SSud				*Rhinopoma cystops*	NSah			SSud
Rousettus aegyptiacus		SSud				*Taphozous nudiventris*	NSah			SSud
Hipposideros abae		SSud								
Hipposideros cyclops		SSud								
Rhinolophus alcyone		SSud								
Coleura afra		SSud								
Nycteris grandis		SSud								
Mops demonstrator		SSud								
Mops midas		SSud								
Myotis bocagii		SSud								
Neoromicia capensis		SSud								
Neoromicia nana		SSud								
Neoromicia rendalli		SSud								
Pipistrellus deserti		SSud								
Pipistrellus inexspectatus		SSud								
Scotoecus albofuscus		SSud								
Scotoecus hirundo		SSud								
Scotophilus dinganii		SSud								
32			3			16				

Table 13. Distribution of bats species by phytogeographic zone. Nsah: North-Sahelian, Ssah: South-Sahelian, Nsud: North-Sudanian, Ssud: South-Sudanian.

and which have not been captured during 2002 to 2009, two species of whom *A. tridens* and *R. microphyllum* are reported only in the North-Sahelian zone. *Hypsignathus monstrosus* although present in the South-Sudanian zone has not been captured. In addition, *M. midas* and *P. deserti*, two species captured previously next to the river Nazinon have not also been captured. *Pipistrelllus nanulus* although already collected by the Smithsonian Institution African Mammal Project and present at USNM, had yet been published later by African Chiroptera Report, 2006. Although it had not been captured during this study.

The 15 new species captured between 2002 to 2009 are: *N. veldkampii* and *R. aegyptiacus* (Pteropodidae); *C. afra* (Emballonuridae); *R. alcyone* (Rhinolophidae); *H. cyclops* (Hipposideridae); *C. nigeriae* and *M. condylurus* (Molossidae); *N. grandis* (Nycteridae); *G. variegata*, *N. capensis*, *N. rendalli*, *P. inexspectatus*, *S. albofuscus*, *S. hirundo* and *S. dinganii* (Vespertilionidae).

Hipposideros cyclops, *N. grandis* and *R. alcyone* are forest species. They are located in the extreme south-western Burkina Faso, where there are the wettest areas of the country. *Nanonycteris veldkampii*, is also a forest species that is found in Burkina Faso during rainy seasons only. Although *P. nanulus* is a forest species, the only specimen collected thus far comes from the Centre. *Roussetus aegyptiacus* and *C. afra* are cavernicolous species. They are both located in the South and have all been captured in rock formations that constitute their resting places. *Chaerephon nigeriae* and *M. condylurus*, although they are synanthropic species because of the fact that they are often found in homes have been only located in the South. *Neoromicia capensis*, *N. rendalli*, *P. inexspectatus*, *S. albofuscus*, *S. hirundo* and *S. dinganii* are species of moist savannas. They are all located in the Southwest in the South-Sudanian zone except *N. rendalli* which is located in the Southeast. As for *G. variegata*, also a species of humid savannas, it is present in the North-Sudanian zone.

After this study, a total of 51 species were found in Burkina Faso. And, compared with other countries, the diversity of bats in Burkina Faso can be described as being average. In countries like Ivory Coast, where we find 87 species of bats (J. Fahr unpublished data), Ghana, 86 species (Weber & Fahr, 2007) and Cameroon, 72 species (Bakwo, 2009) diversity can be explained by the fact that these countries are near the coast. In addition to the forest areas, these countries, also have the Guinean zone. And this Guinean zone is a transition zone that contains a wide variety of species (Fahr & Kalko, 2010). This study helped to collect many new pieces of information on the distribution of many species. However, studies using different capture methodologies are needed to obtain complete inventories of the diversity of bats (Kalko et al., 1996; Bergallo et al., 2003) and as already noted by Kalko (1997), insectivores are species which are difficult to capture and the combination of several methods particularly acoustic methods are used to identify them at the species level (Kalko & Handley, 2001). It would therefore not be surprising to capture other species in Burkina Faso so as to contribute more to a better understanding of the ecology of bats for better conservation approaches.

Epomophorus gambianus, *H. ruber*, *N. macrotis*, *N. thebaica* and *C. pumilus* are species that have a wider distribution across Burkina Faso, as they have been captured in all phytogeographic areas. These species are also widely distributed in West Africa (African Chiroptera Report, 2012).

Eidolon helvum, *T. perforatus*, *C. major*, *N. schlieffenii*, *N. guineensis* and *S. leucogaster* have atypical distributions. *Eidolon helvum*, *C. major*, *N. schlieffenii*, *N. guineensis* and *S. leucogaster* are present everywhere except in south-Sahelian zone. About *T. perforatus*, it is present everywhere except North-Sudanian zone. Seen how these species are distributed in Burkina Faso, they should all be present on the entire territory of Burkina Faso.

Hipposideros tephrus, *R. landeri* and *N. gambiensis* are located in all phytogeographic areas except in the North-Sahelian zone. It is in fact, species that are often encountered in savanna (Koch-Weser, 1984; Van Cakenberghe & De Vree, 1998).

Species located in two phytogeographic areas (*M. pusillus*, *N. veldkampii*, *H. jonesi*, *H. vittatus*, *L. frons*, *R. fumigatus*, *N. hispida*, *C. nigeriae*, *M. condylurus*, *N. somalica*, *P. rusticus* and *S. viridis*) are mainly present in the Sudanian zone except *T. nudiventris* and *R. cystops* which have been located in extreme north and extreme south of the country.

Most bats species present in Burkina Faso, 23 in total (*A. tridens*, *R. microphyllum*, *G. variegata*, *P. nanulus*, *H. monstrosus*, *L. angolensis*, *R. aegyptiacus*, *H. abae*, *H. cyclops*, *R. alcyone*, *C. afra*, *N.*

grandis, *M. demonstrator*, *M. midas*, *M. bocagii*, *N. capensis*, *N. nana*, *N. rendalli*, *P. deserti*, *P. inexspectatus*, *S. albofuscus*, *S. hirundo* and *S. dinganii*) are rarely captured. Probably these species have small populations and restricted distributions within the country because they are found in only one of the four phytogeographical areas. The majority of these species (19) is located in South-Sudanian zone against one in North-Sudanian (*P. nanulus*) area, one in the southern Sahelian zone (*G. variegata*) and two in the North-Sahelian zone (*A. tridens* and *R. microphyllum*). Above 60% of Burkina Faso is under the influence of Sudanian climate (Ministère de l'Environnement et de l'Eau, 1999) including the Centre and South. This can explain partly that 32 of the 51 species found in Burkina Faso, are exclusively recorded in the Sudanian zone. Nevertheless, favorable climatic conditions in South-Sudanian zone of Burkina Faso are the real reason of the higher species diversity in this area. Rough conditions in the Sahelian zone justify that only 3 species are exclusives of this area. Nevertheless 16 other species were found in this area (as well as in the Sudanian zone), proving that this area can provide suitable habitats, shelter, water and food for important diversity of bats species. Exclusive species indicated the importance in biodiversity conservation of this area, generally neglected in conservation programs.

This study has allowed us to highlight the geographical distribution of bats in Burkina Faso. Although bats were captured in all phytogeographic areas in Burkina Faso, distribution patterns change depending on species and even families. Results highlight the importance of each phytogeographic area as unique habitat for some species. It is then important, for conservation and management, to give equal consideration to each area. Habitats condition is likely the factor influencing the species distribution. A further step in bat studies in Burkina Faso could be the modeling of species distribution based on environmental variables, which could give some useful information for species management.

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