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### REVIEW

#### CURRENT STATUS, DISTRIBUTION AND CONSERVATION STATUS OF ALGERIAN BATS (MAMMALIA: CHIROPTERA)

Mourad Ahmim

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## CURRENT STATUS, DISTRIBUTION AND CONSERVATION STATUS OF ALGERIAN BATS (MAMMALIA: CHIROPTERA)

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**Abstract:** Algeria is the largest country in Africa (2,381,741km<sup>2</sup>), with 85% of the area consisting of the Sahara opening on to the Mediterranean (1,200 km coastline). Initially, 26 species of microbats were reported, and no comprehensive study has been undertaken since 1991. The advent of genetic molecular studies has revealed some species to be the same (*Pipistrellus deserti* and *Pipistrellus kuhlii*) while others have had their nomenclature changed (*Eptesicus isabellinus* instead of *Eptesicus serotinus*, *Plecotus gaisleri* instead of *Plecotus austriacus*, *Rhinopoma cystops* instead of *Rhinopoma hardwickei*). *Miniopterus schreibersii* is now classified in the new family of Miniopteridae. These changes have corrected the number of Algerian bat species to 25, belonging to seven different families. All species are threatened globally and are protected at the national level by Decree 12-135.

**Keywords:** Algeria, Chiroptera, conservation, distribution, historical knowledge, taxonomic notes.

**French Abstract:** L'Algérie est le plus grand pays d'Afrique avec 2 381 741 km<sup>2</sup> dont 85% de la superficie est occupée par le Sahara, elle s'ouvre sur la Méditerranée sur un littoral de 1 200 km de littoral. A l'origine, 26 espèces de microchiroptères y ont été signalées et aucune étude approfondie n'a été entreprise depuis 1991. L'avènement des études de génétique moléculaire a révélé que certaines espèces étaient les mêmes (*Pipistrellus deserti* et *Pipistrellus kuhlii*) tandis que d'autres ont changé de nomenclature (*Eptesicus isabellinus* au lieu de *Eptesicus serotinus*, *Plecotus gaisleri* au lieu de *Plecotus austriacus*, *Rhinopoma cystops* au lieu de *Rhinopoma hardwickei*), et *Miniopterus schreibersii* est maintenant classé dans la nouvelle famille des Miniopteridae. Ces changements ont fait passer le nombre d'espèces de chauves-souris algériennes à 25, appartenant à sept familles différentes. Toutes les espèces sont menacées et protégées au niveau national par le décret 12-135.

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## INTRODUCTION

Although bats have been studied in some countries of North Africa such as Morocco (Laurent 1937; Panouse 1951, 1953, 1955; Strinati 1951, 1953; Brosset 1955, 1960; Hill 1964; Dieuleveut et al. 2010), Tunisia (Deleuil & Labbé 1955; Aellen & Strinati 1969, 1970; Baker et al. 1974), and Libya (Hufnagel 1972; Benda et al. 2004), Algeria is an exception and no comprehensive study was undertaken until 1991 by Kowalski and Rzebik-Kowalska. Laurent (1944) first banded bats in North Africa in 1942 in a cave in the vicinity of Algiers, and Anciaux de Faveaux (1976) established a major study of Algerian bats. He recorded 23 species belonging to five families, some of which are rare and the taxonomic classification of two remains problematic. This list was supplemented by Gaisler (1983), who worked mainly in the northern part of the country and first pointed out the presence of *Myotis nattereri* in Algeria, and the reappearance after an absence of nearly a century of *Pipistrellus pipistrellus* and *Myotis capaccinii*. In their publication "Mammals of Algeria", Kowalski & Rzebik-Kowalska (1991) reported the existence of 26 species of bats, and confirmed Kowalski's data (Kowalski 1979) and that of Gaisler (1983). Furthermore, Kowalski (1984) reported data on the cavernicolous bats of Algeria.

In view of the paucity of data on the current status of bats of Algeria, we have attempted in this paper to highlight the need for a thorough study of the order Chiroptera and provide actual information about Algerian Chiroptera for the scientists and bat conservation organizations in the world to be aware of this important heritage.

## MATERIALS AND METHODS

The data used on this study are extracted from literature and we have reviewed all the publications on Algerian bats.

### Study area

Algeria is located in northwestern Africa, and is part of the Maghreb. It has an extensive (1,622km) Mediterranean coastline, and is bordered on the north-east by Tunisia (965km) and to the west by Morocco (1,559km). Algeria has also borders with Libya (982km) to the east, Niger (956km) to the south-east, Mali (1,376km), western Sahara and Mauritania (463km) to the south west.

Being a large country with contrasting relief, Algeria

offers a wide variety of climates that vary with distance from the sea, becoming increasingly hotter and drier. The rainfall increases from west to east and is concentrated between September and May. It is the largest country in Africa and is tenth in the world by area (2,381,741km<sup>2</sup>), of which 85% is situated in the Sahara.

### Geography

The country is divided into five distinct districts, along a north-south axis characterized by different climate (Fig. 1).

**The littoral zone:** A large 80–190 km wide coastal strip, which includes lowlands and the richest diversified ecosystem territories of the country. The climate is Mediterranean. Sometimes the sirocco brings the heat and sand of the Sahara to the coastal cities. The eastern part of this zone is formed by the mountains of Kabylia and Constantine is the wettest.

**Chains of the Tell Atlas:** This is located between the littoral zone and the high plains and extends over nearly 7,000km<sup>2</sup> (highest point: Mount Lala Khadija: 2,308m). This area contains watershed forests of olive trees and oaks and is densely populated.

**The High Plains and plateaus:** These immense steppe plateaus extend from east to west, from 600–1,000 m with some depressions called Chott. The climate is semi-arid and allows cereal crops without irrigation. Semi-desert in appearance, these areas have long been places of nomadic movement in Saharan Africa.

**The Saharan Atlas Mountains:** This southern succession of mountains marks the boundary of the arid climate and limits the north and the Sahara culminating with Mount Chelia in the Aures, at 2,328m.

**The Sahara and its massive mountains (Hoggar and Tassili):** Covering a large part of southern Algeria, the Algerian Sahara, with its two million square kilometers, accounts for a quarter of the entire desert. It is a dry and arid desert landscapes with varied ergs (= kind of land in the Sahara made up of great sandy areas), dry valleys, arid plains and sand dunes. It includes the massive volcanic Hoggar Mountains with the highest mountain in Algeria (Tahat reaches 2,918 meters above sea level) and the Tassili massif. Average temperatures range from 36°C during the day to 5°C at night.

## RESULTS AND DISCUSSION

The species of Chiroptera living in Algeria are recorded in Table 1.

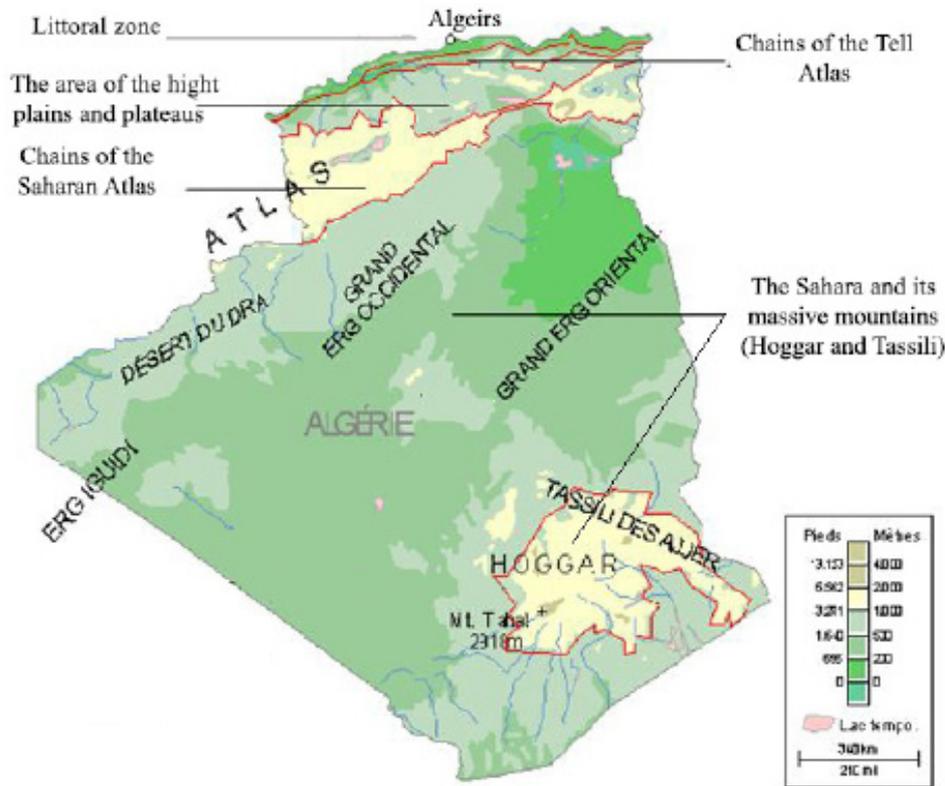


Figure 1. Geographical map of Algeria

**Taxonomic notes**

***Pipistrellus desertii* Thomas, 1902**

For Kowalski & Rzebik-Kowalska (1991) it is possible that the specimens found in southern Algerian oases, e.g., Tamanrasset and El Golea, described as *Pipistrellus kuhlii* belong to *P. deserti*. According to Gaisler et al. (1972) the earliest available name for the pale desert form of *P. kuhlii* is *P. k. marginatus* (Cretzschmar, 1830). *Pipistrellus deserti* occurs in the most arid parts of the Sahara, in Morocco, Algeria, Libya, Egypt, and the Sudan, and marginally also in sub-Saharan Africa. Although most authors consider *P. deserti* as a full species, others regard it as a subspecies, or even as a junior synonym of *Pipistrellus kuhlii*. Benda et al. (2014) analysed topotypical material of *P. deserti* from Libya and compared them with samples from other Saharan countries and with *P. kuhlii* from all around the Mediterranean. The Libyan samples of *deserti* are morphologically very similar to other populations from arid parts of North Africa (Morocco, Algeria, Egypt, Sudan), but differ markedly in the size of most skull dimensions when compared to *P. kuhlii* sampled in more mesic areas. Phylogenetic reconstructions however indicate that mitochondrial haplotypes of typical *P. deserti* from Libya and those from Morocco do not form a monophyletic group but are fully embedded

**Table 1. Species richness of Algerian bats**

Family	Number of species	Species
Rhinopomatidae	1	<i>Rhinopoma cystops</i> Thomas, 1903
Emballonuridae	1	<i>Taphozous nudiventris</i> Cretzschmar, 1830
Rhinolophidae	6	<i>Rhinolophus blasii</i> Peters, 1866 <i>Rhinolophus clivosus</i> Cretzschmar, 1828 <i>Rhinolophus euryale</i> Blasius, 1853 <i>Rhinolophus ferrumequinum</i> (Schreber, 1774) (Image 1) <i>Rhinolophus hipposideros</i> (Bechstein, 1800) <i>Rhinolophus mehelyi</i> (Matschie, 1901)
Hipposideridae	1	<i>Asellia tridens</i> (É. Geoffroy, 1813)
Vespertilionidae	13	<i>Eptesicus isabellinus</i> (Temminck, 1835) <i>Hypsugo savii</i> (Bonaparte, 1837) (Image 2) <i>Myotis capaccinii</i> (Bonaparte, 1837) (Image 3) <i>Myotis emarginatus</i> (É. Geoffroy, 1806) (Image 4) <i>Myotis nattereri</i> (Kuhl, 1817) (Image 5) <i>Myotis punicus</i> Felten, 1977 (Image 6) <i>Nyctalus leisleri</i> (Kuhl, 1817) <i>Nyctalus noctula</i> (Schreber, 1774) <i>Otonycteris hemprichii</i> (Peters, 1859) <i>Pipistrellus kuhlii</i> (Kuhl, 1817) (Image 7) <i>Pipistrellus pipistrellus</i> (Schreber, 1774) <i>Pipistrellus rueppelli</i> (Fischer, 1829) <i>Plecotus gaisleri</i> Benda, Kiefer, Hanák & Vieth, 2004 (Image 8)
Miniopteridae	1	<i>Miniopterus schreibersii</i> (Kuhl, 1817) (Image 9)
Molossidae	2	<i>Tadarida aegyptiaca</i> (É. Geoffroy, 1818) <i>Tadarida teniotis</i> (Rafinesque, 1814)

within the larger radiation of *P. kuhlii* from Africa and Europe, rendering this species paraphyletic. Limited nuclear information (five microsatellite loci) also failed to provide evidence of significant differences between the two morphotypes, as these pipistrelles are instead grouped by geographic origin. Altogether, the genetic data suggest that the morphological uniqueness of *P. deserti* may result from recent adaptations to arid habitats, rather than reflect a long independent evolutionary history (Benda et al. 2014). In the absence of more compelling evidence of barriers to gene flow, we therefore suggest *Pipistrellus deserti* to be considered a junior synonym of *P. kuhlii*.

### ***Myotis punicus* Felten, 1977**

Traditionally, three species of *Myotis*, *M. myotis* (Borkhausen, 1797), *M. punicus* Felten, 1977, and *M. blythii* (Tomes, 1857) were recognized to occur in the Maghreb, but Castella et al. (2000) definitely proved the presence of only *M. punicus* in Algeria, where it has no known distributional overlap with the two other species that might not even occur in Africa at all (Arlettaz et al. 1991). Originally, the Maghrebian Mouse-eared Bat was described as a subspecies of the little Mouse-eared Bat (*M. blythii*), which was long considered to be synonym of the Greater Mouse-eared Bat (*M. myotis*). The most recent genetic molecular work (Ruedi & Mayer 2001 - on cytochrome *b* and microsatellites) separated *M. punicus* from the other two species, and confirmed its status as a valid species.

### ***Myotis nattereri* (Kuhl, 1917)**

Horáček & Hanák (1984) studied the variability of *Myotis nattereri* (originally described from Germany) over its entire distribution range. They stated that the Asiatic populations differ from the European ones, but did not consider the African population as separate subspecies. They note, however, that "...worth mentioning are specimens of NW-Africa (particularly that of Algeria), whose dimensions fall out of the variation range of the remaining European material." *Myotis nattereri* is a very rare species in North Africa, where it reaches the southern limit of its distribution. It is mentioned from six locations across the Maghreb, including three in Morocco (Benda et al. 2004), and three in Algeria: one in the littoral zone and two others in the Tell Atlas. Its presence in Algeria was first recorded by Gaisler (1983) who captured a specimen in the cave of Aokas, and by Kowalski et al. 1986. The other records are from Ain fezza near Tlemcen (Kowalski et al. 1986), Yakouren near Azzazga (Gaisler 1984; Kowalski et al. 1986). Kowalski



Image 1. *Rhinolophus ferrumequinum*



Image 2. *Hypsugo savii*



Image 3. *Myotis capaccinii*

& Rzebik-Kowalska (1991) reported further specimens from Aven Yebdar. Using acoustic monitoring, Disca et al. (2014) reported the presence of this species in North Africa (Morocco).

#### ***Myotis blythii* Tomes, 1857**

Earlier scholars, beginning with Duvernoy & Lereboullet (1842) listed this species under the name *Vespertilio murinus* or *Myotis murinus*. Later it was a long time an open question if the large Mouse-eared Bat *Myotis myotis* Borkhausen, 1797 or the Lesser Mouse-eared Bat (*M. blythii*) were represented in Africa. Felten (in Felten et al. 1977) described a new subspecies of the Lesser Mouse-eared Bat from Tunisia, *M. blythii punicus*. According to him and to later authors (Gaisler 1983; Vesmanis 1985) this subspecies is present in the whole of the Maghreb, including Algeria. It has slightly larger dimensions than the other populations of this species from Europe.

#### ***Plecotus gaisleri* Benda, Kiefer, Hanak & Veith, 2004**

Based on both morphological and genetic evidence, Spitzenberger et al. (2001) revised the genus *Plecotus* and concluded that *P. kolombatovici* (Dulic, 1980) contained four subspecies of which two occurred in Africa: *P. k. gaisleri* in Cyrenaica and as yet undescribed subspecies in the Maghreb. Benda et al. (2004) working on the long-eared bats of the genus *Plecotus* indicated that they are widespread over most of temperate Eurasia, marginally reaching the African continent and Macronesia. Previously, all African populations were assigned to one species, *P. auritus*, and later to *P. austriacus*. Based on morphological evidence they recognised four well-defined allopatric populations in northern Africa, which differ in fur coloration, skull and bacular morphology. The molecular data supports a division of the African populations into at least three well-separated evolutionary lineages. With a combination of these data, they defined three species of *Plecotus* occurring in Africa (incl. the Canary Islands) and described a new subspecies: Small, very pale greyish-brown Egyptian Long-eared Bats (*P. christii* Gray, 1838) inhabit desert and semi-deserts habitats of eastern Sahara (Libyan Desert, Nile Valley of Egypt and northern Sudan). Smaller to medium-sized, dark brown Ethiopian Long-eared Bats (*P. balensis* Kruskop & Lavrenchenko 2000) inhabit the Ethiopian highlands above 2,000m. This form represents the only Afro-tropical species of *Plecotus*. Large, dark greyish Canarian Long-eared Bats (*P. teneriffae teneriffae* Barret-Hamilton, 1907) occur on the three western islands of the Canary Archipelago.



Image 4. *Myotis emarginatus*



Image 5. *Myotis naterreri*



Image 6. *Myotis punicus*

A medium-sized greyish-brown Gaisler's Long-eared Bat, *P. teneriffae gaisleri* Benda, Kiefer, Hanak & Veith, 2004, was described from the Mediterranean region of Cyrenaica, northeastern Libya. Due to the lack of substantial morphological differences they preliminarily considered the Maghrebian population of long-eared bats to be con subspecific with *P. teneriffae gaisleri*. Populations of *Plecotus* from the Maghreb in northwestern Africa and Cyrenaica in northeastern Libya were identified as *P. auritus* and then considered to represent a subspecies of *P. austriacus* (Kingdon et al. 2013). Genetic evidence confirmed that the Maghrebian and Cyrenaican population are distinct (Juste et al. 2004). More recently, based only on material from Cyrenaica, Mayer et al. (2007) raised *P. gaisleri* to specific status.

### ***Rhinopoma cystops* Thomas, 1903**

Hulva et al. (2007) presented a phylogenetic analysis of the Rhinopomatidae and found deep divergences in the *Rhinopoma hardwickii* Gray, 1831 lineage, and suggested to split this species to two separate species; Afro-Arabian *R. cystops* Thomas, 1903 and Irano-Indian *R. hardwickii* sensu stricto.

### ***Eptesicus isabellinus* (Temminck, 1835)**

*Eptesicus isabellinus* was originally described as *Vespertilio isabellinus* by Temminck (1835). Unfortunately, this original description did not include any cranial measurements and as a result the precise affinities of this bat have been uncertain ever since. Setzer (1957) in his review of Libyan mammals, treated *E. isabellinus* as a distinct species and stated that it had not been taken since Temminck's description. He noted that Zavattari (1934) listed it as *Vespertilio serotinus isabellinus*. Allen (1939) also listed it as a subspecies of *E. serotinus*, whereas Ellerman & Morrison-Scott (1951) treated *E. isabellinus* as a distinct species on the grounds that the measurements given by Tate (1942) were too small for *E. serotinus* for northern Africa.

### ***Miniopterus maghrebensis* (Puechmaille, Allegrini, Benda, Bilgin, Ibañez & Juste, 2014)**

Puechmaille et al. (2014) used an integrative approach combining cranio-dental characters, mitochondrial and nuclear data and acoustic data to show the presence in the genus *Miniopterus* of a cryptic species from the Maghreb region, which they described as *Miniopterus maghrebensis*. Being a cryptic species, it was previously considered as *Miniopterus schreibersii* (Kuhl, 1817). This new species can be distinguished from *M. schreibersii* sensu stricto on the basis of cranial characters and

from mitochondrial DNA and microsatellite evidence. Although slight external morphological and acoustic differences were also noted between the two species. Based on the specimens identified morphologically and/or genetically, the distribution range of *M. maghrebensis* extends from northern Morocco to south of the High Atlas Mountains and northern Tunisia. The new cryptic species is found in sympatry with *M. schreibersii* sensu stricto near coastal regions of northern Africa. *Miniopterus maghrebensis* has not been observed or mentioned yet in Algeria, more field work for searching this species is needed to confirm its presence.

### **Habitat and distribution**

According to Anciaux de Faveaux (1976), and some of our observations, the bats of Algeria can be divided according to the habitat they occupy, into four main groups. We found species that fit in two or more groups:

- troglomorphic species
- lithophilic species
- phytophilic species
- synanthropic species.

### **The troglomorphic species**

These are species that overwinter underground in caves and artificial cavities. During the summer breeding season, they seek warmer shelters such as attics, roofs of houses and mosques, ruins and rock crevices. They are represented by 15 species belonging to six families (Table 2).

### **The lithophilic species**

These are species that usually roost in rocky crevices and cracks in walls. There are four species belonging to two families (Table 3).

### **The phytophilic species**

These roost in the foliage of trees and under tree bark. All five species belong to the family Vespertilionidae (Table 4).

### **The synanthropic species**

These species roost under the roofs and against the internal walls of human dwellings, under bridges in towns or cities, and hunt around electricity street lights in the city (Table 5).

### **Distribution by roost type**

A summary by roost type is shown in Table 6. In this table a same species can belong to one, two or more groups. The most represented family is Vespertilionidae

**Table 2. Troglomorphic species of bats in Algeria**

Family	Species	Habitat
Rhinopomatida	<i>Rhinopoma cystops</i>	In caves, basements of mosques
Emballonuridae	<i>Taphozous nudiventris</i>	In dry caves
Rhinolophidae	<i>Rhinolophus blasii</i> <i>Rhinolophus clivosus</i> <i>Rhinolophus euryale</i> <i>Rhinolophus ferrumquinum</i> <i>Rhinolophus hipposideros</i> <i>Rhinolophus mehelyi</i>	In caves In caves In caves In caves In caves In caves
Miniopteridae	<i>Miniopterus schreibersii</i>	Old aqueducts, caves
Hipposideridae	<i>Asellia tridens</i>	In man-made tunnels
Vespertilionidae	<i>Myotis capaccinii</i>  <i>Myotis emarginatus</i> <i>Myotis nattereri</i> <i>Myotis punicus</i> <i>Plecotus gaisleri</i>	In caves, cracks in the pillars of bridges In caves In caves In caves Winter in caves and was in the attic of houses, cracks in trees and minarets

**Table 3. Lithophilic species of bats in Algeria**

Family	Species	Habitat
Vespertilionidae	<i>Otonycteris hemprichii</i> <i>Hypsugo savii</i>	Wall cracks in underground cavities especially in the Saharan oases In rock crevices and hollow trees in mountainous region
Molossidae	<i>Tadarida aegyptiaca</i> unknown <i>Tadarida teniotis</i>	In old bridges, aqueducts, cracks of rocks

because its 13 species occupy four roost types. It is also apparent that troglomorphic species are the most numerous (15 species), belonging to six families with all the six species of the Rhinolophidae. One family (the Molossidae) has no troglomorphic species. There are four lithophilic species, belonging to two families (Vespertilionidae and Molossidae). The latter family only contains lithophilic species. Five species of Vespertilionidae are phytophilic in Algeria, and two other species of this family are synantropic. In conclusion we note that the family whose species occupy the four biotopes is the family Vespertilionidae. One family (Molossidae) is lithophilic, and the remainder from other families (Rhinopomatidae, Hipposideridae, Emballonuridae, Miniopteridae and Rhinolophidae) are all troglomorphic.

**Zoogeography of Algerian bats**

The Chiroptera reported from Algeria belong to the Palaearctic region, whose boundaries were drawn by Corbet (1978). This area is described as starting in the west, at the islands of Spitsbergen, the Azores, Madeira,

**Table 4. The phytophilous species of bats in Algeria**

Family / Species	Habitat
<b>Vespertilionidae</b> <i>Eptesicus isabellinus</i> <i>Nyctalus leisleri</i> <i>Nyctalus noctula</i> <i>Pipistrellus kuhlii</i> <i>Pipistrellus rueppelli</i>	In trees and between leaves and branches of trees In oases In trees, hibernating in cracks of rocks In trees and between leaves and branches of trees In oases

**Table 5. The synantropic species of bats in Algeria**

Family / Species	Habitat
<b>Vespertilionidae</b> <i>Pipistrellus kuhlii</i> <i>Pipistrellus pipistrellus</i>	Cracks of bridges and houses

**Table 6. Families assembled by habitat**

Family /habitat	Troglomorphic species	Lithophilic species	Phytophilous species	Synantropic species
Rhinopomatida	1			
Emballonuridae	1			
Rhinolophidae	6			
Hipposideridae	1			
Vespertilionidae	5	2	5	2
Miniopteridae	1			
Molossidae		2		
Total	15	4	5	2

and include the Canaries, but not the Cape Verde Islands. In Africa, the western limit starts at 21°30'N between the western Sahara and Mauritania, through Algeria and Libya, to Egypt. Niger, Chad, and Sudan are excluded. The Hoggar Mountains are included and the entire Arabian peninsula is also included. The Asian limit extends to the frontier between Pakistan and Iran, Afghanistan and continues to central China.

We also found species of African region in Algeria. This region covers the geographic area of the African continent and adjacent regions, including Madagascar, and other surrounding islands in the Indian and Atlantic oceans. The Arabian Peninsula is included shared with the African continent (ACR 2015). The African species are *Rhinopoma cystops*, *Rhinolophus clivosus*, *R. euryale*, *R. blasii*, *R. hipposideros*, *Taphozous nudiventris*, *Asellia tridens*, *Tadarida teniotis*, *Hypsugo savii*, *Otonycteris hemprichii* and *Pipistrellus rueppellii*. Working on three major climatic areas, as defined by Ochoa (1979), Gaisler (1983) stipulated that seven species are characteristic of northern Algeria (the Mediterranean area), where the climate varies from sub-humid to

Table 7. Distribution of bat species based on five geographical Algerian districts

Family	Species	Districts				
		The Littoral zone	Chains of the Tell Atlas	High plains and plateaus	Chains of the Saharan Atlas	Sahara and massive mountains
<i>Rhinopomatidae</i>	<i>Rhinopoma cystops</i>				X	X
<i>Emballonuridae</i>	<i>Taphozous nudiventris</i>					X
<i>Rhinolophidae</i>	<i>Rhinolophus blasii</i>	X			X	X
	<i>Rhinolophus clivosus</i>					X
	<i>Rhinolophus euryale</i>	X	X			
	<i>Rhinolophus ferrumequinum</i>	X	X	X	X	
	<i>Rhinolophus hipposideros</i>	X	X	X	X	
<i>Rhinolophus mehelyi</i>	X	X	X	X		
<i>Hipposideridae</i>	<i>Asellia tridens</i>				X	X
<i>Vespertilionidae</i>	<i>Eptesicus isabellinus</i>	X	X	X	X	X
	<i>Myotis capaccinii</i>	X	X			
	<i>Myotis emarginatus</i>	X	X			
	<i>Myotis nattereri</i>	X	X			
	<i>Myotis punicus</i>	X	X	X	X	
	<i>Nyctalus leisleri</i>	X				
	<i>Nyctalus noctula</i>	X				
	<i>Otonycteris hemprichii</i>				X	X
	<i>Pipistrellus kuhlii</i>					X
	<i>Pipistrellus pipistrellus</i>		X	X	X	X
	<i>Pipistrellus rueppelli</i>	X	X	X	X	
	<i>Hypsugo savii</i>	X				X
<i>Plecotus gaisleri</i>		X	X			
<i>Miniopteridae</i>	<i>Miniopterus schreibersii</i>	X	X	X	X	
<i>Molossidae</i>	<i>Tadarida aegyptiaca</i>					
	<i>Tadarida teniotis</i>	X			X	X
		16	14	10	14	12

semi-arid (*Pipistrellus pipistrellus*, *Myotis punicus*, *M. capaccinii*, *M. emarginatus*, *M. nattereri*, *Miniopterus schreibersii* and *Nyctalus leisleri*). The second area is the middle of Algeria with an arid climate, except for of some mountainous regions, including the Saharan Atlas, where the climate is semi-arid. The third area is the southern zone, represented by the Sahara desert. The most prominent species of northern Algeria, according to this division are *Pipistrellus pipistrellus*, *Myotis punicus*, *Myotis schreibersii*, and the rarer *Myotis capaccinii*, *Myotis emarginatus*, *Myotis nattereri* and *Nyctalus leisleri*.

Following Kowalski & Rzebik-Kowalska (1991), we have retained the five major geographical districts in Algeria. Data from Gaisler (1983), Hanák & Gaisler (1983), Gaisler (1984), Gaisler & Kowalski (1986), Kowalski & Rzebik-Kowalska (1991), Ruedi & Mayer (2001), Benda et al. (2004) are assembled in Table 7. This reveals that 16 of the 25 species (64%) of Algerian bats live in the littoral zone, which represents less than 10% of the total land area. This is followed by the two Atlas mountain ranges—the Sahara Atlas and the Tell Atlas which both have 56% of Algerian bat species.

The areas least populated by bats are in the high plains and plateaus and the Sahara and massive

mountains respectively with 40% and 48%. These last two areas account for more than 70% of the land area of Algeria. These results may reflect the fact that the sampling effort is very biased, because according to the literature, the majority of studies and surveys have been carried out in the northern part of the country: the littoral zone and the Tell atlas.

#### Conservation status

The conservation status of bats in Algeria at national and international level is given in Table 8. Bats of Algeria are protected by the Algerian executive Decree No. 12-235 of 24 May 2012 establishing the list of protected non-domestic animal species. At the global level we find one species as Endangered (*Plecotus gaisleri*). There are two Vulnerable species (*Rhinolophus mehelyi* and *Myotis capaccinii*) and three species are considered Near Threatened (*Rhinolophus euryale*, *Myotis punicus* and *Miniopterus schreibersii*). The 19 other remaining species are categorized as Least Concern. At the regional level, one species is Endangered (*Plecotus gaisleri*), three are Vulnerable (*Rhinolophus euryale*, *R. mehelyi* and *Myotis capaccinii*), five are Near Threatened (*Rhinolophus ferrumequinum*, *R. hipposideros*, *R. blasii*, *Myotis punicus* and *Miniopterus schreibersii*), and one

Table 8. Heritage status of Algerian bats (2015)

Family	Species	Global IUCN Redlist category	Regional IUCN Redlist category	Protection status in Algeria
Rhinopomatidae	<i>Rhinopoma cystops</i>	LC	LC	Protected
Emballonuridae	<i>Taphozous nudiventris</i>	LC	LC	Protected
Rhinolophidae	<i>Rhinolophus clivosus</i>	LC	DD	Protected
	<i>Rhinolophus ferrumequinum</i>	LC	NT	Protected
	<i>Rhinolophus hipposideros</i>	LC	NT	Protected
	<i>Rhinolophus blasii</i>	LC	NT	Protected
	<i>Rhinolophus euryale</i>	NT	VU	Protected
	<i>Rhinolophus mehelyi</i>	VU	VU	Protected
Hipposideridae	<i>Asellia tridens</i>	LC	LC	Protected
Myotis	<i>Myotis capaccinii</i>	VU	VU	Protected
	<i>Myotis emarginatus</i>	LC	LC	Protected
	<i>Myotis nattereri</i>	LC	LC	Protected
	<i>Myotis punicus</i>	NT	NT	Protected
	<i>Pipistrellus kuhlii</i>	LC	LC	Protected
	<i>Pipistrellus rueppelli</i>	LC	LC	Protected
	<i>Pipistrellus pipistrellus</i>	LC	LC	Protected
	<i>Hypsugo savii</i>	LC	LC	Protected
	<i>Eptesicus isabellinus</i>	LC	LC	Protected
	<i>Otonycteris hemprichii</i>	LC	LC	Protected
	<i>Nyctalus leisleri</i>	LC	LC	Protected
	<i>Nyctalus noctula</i>	LC	LC	Protected
	<i>Plecotus gaisleri</i>	EN	EN	Protected
Miniopteridae	<i>Miniopterus schreibersii</i>	NT	NT	Protected
Molossidae	<i>Tadarida teniotis</i>	LC	LC	Protected
	<i>Tadarida aegyptiaca</i>	LC	LC	Protected

is Data Deficient (*R. clivosus*). The other 15 remaining species have the status of Least Concern. There are five species whose regional status is more critical than their global status, which suggest that they need specific protection measurements. *Rhinolophus clivosus* that is Data Deficient might require further investigations into the status, distribution, population trend and structure.

## CONCLUSION

With 25 identified species, bats represent the second largest group of mammals in Algeria after rodents. Only a limited number of studies have been undertaken on Algerian bats, which make it impossible to comment on population trends and conservation status. In view of the results of the distribution of bats in five major geographical areas of Algeria, it is clear that bat survey efforts have been concentrated in the north of the

country and that the south has not been well explored. Therefore inventories are required throughout the country, in order to map preferred bat habitats and to establish conservation priorities.

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Image 7. *Pipistrellus kuhlii*

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Image 9. *Miniopterus schreibersii*Image 8. *Plecotus gaisleri*

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