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BATS OF LEBANON

STATE OF KNOWLEDGE AND PERSPECTIVES

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Cet article récapitule toutes les données disponibles sur les chauves-souris du Liban jusqu'à nos jours. Il présente particulièrement les données obtenues lors des excursions de terrain entreprises en 2006 et 2007 (au total, 332 données sur 20 espèces). Deux espèces, Blasii de Rhinolophus et Anatolicus d'Eptesicus, y sont signalées pour la première fois. L'article présente les spécificités des chauves-souris du Liban et propose des mesures de conservation comprenant une esquisse de projet de suivi des populations de chauves-souris des cavernes du Liban.

يلخص هذا البحث جميع البيانات المتوفرة حتى الآن عن الخفافيش في لبنان بالأخص المعلومات التي تم الحصول عليها اثناء الرحلات الميدانيه في عامي 2006 و 2007 (في المجموع 332 بيان من 20 نوعا). بريالنين منها Rhinolophus blasii و Eptesicus anatolicus. لأول مرة يعرض أيضا خصوصيات الخفافيش الموجودة في لبنان و يقترح طرقا للحفاظ عليها بما في ذلك مشروع مراقبة الخفافيش في المغاور اللبنانية .

ABSTRACT

The paper summarizes all hitherto available records of bats from Lebanon with particular attention to the records obtained during field excursions in 2006 and 2007 (in total 332 records of 20 species). Two species, *Rhinolophus blasii* and *Eptesicus anatolicus*, are reported for the first time. Specificities of Lebanese bat fauna are discussed and conservation measures are proposed including a draft of a project of monitoring bat populations in Lebanese caves.

INTRODUCTION

Bats, unique flying mammals, are throughout 50 Ma of their history closely associated with caves. They present undoubtedly one of the most important groups of cavernicolous animals. Guano produced by colonies of cave-dwelling bats is the essential energetic resource for troglobiont communities and continuous appearance of bats in a cave is a key prerequisite for maintenance of cave biota. In short, bats are nearly an indispensable component of cave environment. Throughout the world bats present a heraldic symbol of speleologists. Yet, in many countries the study of bats, including population monitoring and active protection presents a standard component of practical speleology. This article is intended to attract the attention of Lebanese speleologist to that topic. It will also provide a brief survey of current state of knowledge on Lebanese bat fauna and propose further steps in study and protection of Lebanese bats. The active protection of cave bats in Lebanon is particularly important as their abundances are surprisingly low perhaps due to active extirpations in some roosts. In bats which deliver just a single young per year and are strictly confined to their traditional roosts, such events can badly impact whole population for many years.

Lebanon with extreme diversity of its climatic conditions, habitat types and landscape patterns ranks undoubtedly among the most attractive regions of the Middle East at least from the biogeographic point of view. It exhibits specificities not appearing in neighbouring regions. The mountain ranges of Lebanon and the geomorphologic axis of the Levant region presents a precipitation trap to air masses of the Eastern Mediterranean, which supplies its western slopes with extreme humidity. After it's appearance in the Miocene, the Lebanese mountain ranges steadily provided that effect throughout at least the last 10 Ma, including dry period of the Messinian Salinity Crisis (5 Ma BP) and during glacial periods when the neighbouring regions were deficient both in tree vegetation and the animals depending upon it. The rapid uplift of the Lebanese mountain ranges not only dramatically enlarged the span of altitudinal gradients but also established a series of broad but deeply incised valleys steadily enlarging a spectrum of locally available conditions, and providing refugee for extra-zonal habitats, including variegated humid broadleaf woodlands (Blondel and Aronson 1999).

Thanks to its special conditions, Lebanon is extremely rich in caves which provide an immense potential of bat roosts and feeding grounds. Naturally, one would assume that such a region particularly rich in bats would attract a large number of

Figure 1
Rousettus aegyptiacus, part of a colony in the Mtal el Azrah Cave
(Photo by I. Horáček)

Figure 2
Rousettus aegyptiacus, a female with a week old baby, Beirut
(photo by I. Horáček)

bat studies and the resulted is a quite extensive information on Lebanese bat. Unfortunately, it has not been the case. The information and literary records on Lebanese bats are surprisingly scarce. Except for some early records: notes on *Rhinolophus euryale, Myotis myotis [s. l.], Myotis mystacinus [s. l.], M. emarginatus* and *Eptesicus serotinus* in The Fauna and Flora of Palestine (Tristram, 1884) and a report of *E. serotinus* and *Pipistrellus kuhlii* records in Shtora in a list of mammals collected in Palestine and Syria (Allen, 1915). The first reliable information appeared as late as 50 years ago. Then a series of collecting efforts was undertaken by R. E. Lewis and J. E. Stencel (from 1960 to 1964) mostly in caves at Aamchite and Antelias (the voucher specimens are deposited in the collections of the Biology Department, American University of Beirut). These results were summarised in the first checklist of Lebanese bats by Lewis & Harrison (1962) which reports 14 species for the country (Table 1). At the same time, the taxonomic analyses of the collected material revealed two new taxa of bats: *Myotis myotis macrocephalicus* (Harrison & Lewis, 1961), and *Nyctalus noctula lebanoticus* (Harrison, 1962). Harrison (1963) also reported *Rhinopoma microphyllum* from Lebanon for the first time. Harrison (1964) in his first edition of "Mammals of Arabia" summarised all these records and reports 15 species in Lebanon. Further, S. I. Atallah collected bats in Amchite and Anjaar (supposedly the Cellis Cave) in 1968 and reported two new species, *Myotis capaccinii* and *M. nattereri*, for the country. Then published two papers (Atallah, 1970 and Atallah, 1977) increasing the list of Lebanese bat species to 17. Most of this data were summarized in a book Les mammifères sauvages du Liban by Tohmé & Tohmé (1985), which provides a comprehensive survey of most of the available information at that time. Since then, only few further records of bats appeared with the exception of numerous observations undertook during speleological investigations. Unfortunately, most of them were not published.

It should be noted that important information partly relevant to Lebanese bats appeared also in the recent monographs on bats of neighbouring countries. Examples include Harrison & Bates (1991), Mendelssohn & Yom-Tov (1999), and in particular a monograph on the bats of Syria by Benda et al. (2006), which provides the most comprehensive summary of the present state of knowledge on the Middle Eastern bats including the taxonomical and distributional status of all individual species. Nevertheless, despite all these information, actual data on the distribution and status of Lebanese bat population remained quite scarce, particularly in comparison to some of the neighbouring countries Israel and Turkey or the European part of the Eastern Mediterranean (comp. Kryštufek et al., 1994; Uhrin et al., 1996; Benda & Horáček, 1998; Benda et al., 2003b & 2006, 2007; Hanák et al., 2001 and Horáček et al., 2000).

Fortunately, the situation changed during recent years and the respective data are briefly summarized in this paper. The paper is intended to provide a brief survey of the present state of knowledge on the Lebanese bats with particular emphasis on unpublished records including (i) the observations undertaken by members of the Spéléo Club du Liban and the American University Beirut, and (ii) results of several joint field excursions between the above mentioned Lebanese institutions, Departments of Zoology, Charles University Prague and National Museum Prague, in 2006 and 2007. During the excursions data on bat distribution at about 60 sites (see Table 2) were collected, including 30 caves (16 of them being inspected both in summer and winter time). Besides visual observations in roosts and bat detection netting in mist nets both at cave entrances and foraging grounds were applied. This allowed the gathering of biometric characteristics of particular species and collecting

Figure 3
Miniopterus schreibersii, winter colony of ca. 1000 individuals in the Er Roula Cave, winter 2007
(Photo by I. Horáček)

Figure 4
Miniopterus schreibersii, detail of the face
(photo by I. Horáček)

tissue samples for DNA analysis, from 357 individuals of 18 species, analyses in progress. In total 156 distributional records of 19 species were observed, and nearly 500 bats were handled and measured. The present list of the Lebanese bats covers thus 332 records of 20 species (Table 1), two of them reported in the country for the first time. This paper does not discuss taxonomical problems nor provide detailed descriptions of particular species except for brief characteristics which may help in field recognition. It briefly summarizes the results, supplement them with instant characteristics of particular species of Lebanese bats and provide a draft of further program on study of Lebanese cave bats.

A LIST OF THE BATS SPECIES HITHERTO RECORDED IN LEBANON

The lists of records collected during the recent excursions in 2006–2007 is presented in the form of site numbers (L-XX), explained in the Gazetteer below Table 2. The lists are supplemented with other records not systematically collected and not published.

EGYPTIAN FRUIT BAT, *ROUSETTUS AEGYPTIACUS* (GEOFFROY, 1810)

New records: L-01, L-04, L-11, L-12, L-14b, L-18, L-21, L-32, L-37, L-51, L-56.

Other data: a cave n. Bqerzia: a colony (leg. Mounir Abi-Said); – Al Kassarat Cave n. Antelias, 2006: a colony (leg. R. Karanouh); – Kenaan Cave n. Antelias, 2006: a colony, (leg. R. Karanouh); – Haska Cave (leg. S. Karkabi); – Jamhour Cave (leg. S. Karkabi); – Jeita Cave: a colony (leg. R. Karanouh); – Mgheret Mtall el Azrak n. Tripoli, 16 March 2003 and 2005: a colony (leg. H. E. Kassouf & R. Karanouh); – Ksairn sinkhole n. Sir el Dinneih, 2005: colony (leg. R. Karanouh); – Saleh Cave n. Amchit 2004: a colony (leg. R. Karanouh); – Wataweet Cave near Ed Dibbye, 2005: colony (leg. R. Karanouh); – Zawtar Cave, Nahr el Litani, 2005: a colony (leg. R. Karanouh).

The Egyptian fruit bat is a typical cave-dweller and its presence in a cave can be hardly overlooked. It forms large colonies conspicuous for its noise, guano and characteristic smell. It does not hibernate and stays active throughout the year. Perhaps it represents the most conspicuous member of Lebanese bats that can be easily distinguished from other species, even at a large distance, not only for its considerably larger body size but also for its large eyes with tapetum lucidum that shines in the light of reflectors.

Since the nineteen century, the fruit bat has been reported from the territory of the present Lebanon (Tristram 1884, Festa 1894), at least 12 sites of its occurrence were reported; Aamchit, Antélias, Beit-Meri, Beyrouth, Damour, Jamhour, Jounieh, Mt. Lebanon, Nahr Beyrouth E Hazmiyeh, Saida, Tripoli, and Tyre (Eisentraut, 1959; Lewis & Harrison, 1962; Harrison, 1964; Atallah, 1970 &1977; Tohmé & Tohmé, 1985; Harrison & Bates, 1991 and Bergmans, 1994). Until present, 11 caves were recorded as roosts for this species but the actual number is apparently much higher. In 2006–2007, the largest colony reported in the El Kassarat Cave in Antelias, was estimated to have 350 individuals. Other colonies were smaller than 100–200 individuals.

In these connections, it should be emphasized that those bat roosts are almost exclusively found in caves and other underground spaces, which means that its distribution can be quite precisely mapped by simple cave exploration techniques.

GREATER MOUSE-TAILED BAT, *RHINOPOMA MICROPHYLLUM* (BRÜNNICH, 1782)

This bat was not recorded by the recent survey. The only known record from Lebanon was published by Harrison (1963). An individual of this species was collected in a cave in the Litani Valley on 30 July 1962 by A. Khaikallah (Harrison, 1963). The specimen is deposited in the Museum National de Histoire Naturelle Paris (see Harrison 1964 and/or Benda et al. 2006 for its dimensions). Although the precise locality of this

Figure 5
Rhinolophus ferrumequinum, winter colony in the Afqa Cave, winter 2007 (Photo by I. Horáček)

Figure 6
Rhinolophus ferrumequinum, typical position of a hibernating individual (photo by I. Horáček)

species was not given, it could be expected to be present in the section of the Litani Valley between Marjaayoun and Aalmane.

GREATER HORSESHOE BAT, *RHINOLOPHUS FERRUMEQUINUM* (SCHREBER, 1774)

New records: L-10, L-14, L-14b, L-20, L-21, L-22, L-26, L-30, L-31, L-41, L-42b, L-43b, L-51, L-54, L-55, L-56, L-57, L-59.
Other data: a cave n. Bqerzia (leg. Mounir Abi-Said).

The Greater horseshoe bat is one of the most widespread cave-dwelling bat species in Lebanon, as well as in the Middle East, particularly in the Mediterranean habitats of the Levantine countries (Harrison & Bates 1991, Benda & Horáček 1998, Mendelssohn & Yom-Tov 1999, Benda et al. 2006). In Lebanon, its records are known from coastal regions, Mount Lebanon, the Bekaa Valley and adjacent slope of the Anti-Lebanon. The first report of this bat from Lebanon was published by Kolenati (1856) based on the unpublished findings made by F. Hemprich and C. Ehrenberg in 1824. Numerous records of the Greater horseshoe bat from Lebanon were made and reported mainly in 1960s (Harrison, 1964 & 1972 and Atallah, 1970 & 1977) in caves near Aanjar, Afqa Cave, Deir Mar Maroun S. of Hermel, Mogharet Saleh E. of Aamchite, Roman Aquaduct E. of Hazmiyeh, and Tripoli. Tohmé & Tohmé (1985) added the locations in Hrajel and Mogharet el-Tarrache. In 2006 and 2007 surveys most of these sites were visited and occurrence were confirmed (Aanjar, Afqa Cave, Deir Mar Maroun, Saleh Cave, Tripoli). Many new ones were also added (Grotte d'Adloun, Jezzine, Er Rouais Cave, Qadisha Cave, mines at Mrouje, Kfar Zabad II Cave, Mab'aj Cave, Jeita Cave, El Qana Cave, Seraaya Cave). Particularly during the winter census, the Greater Horseshoe bat species was the most frequently recorded. The El Qana Cave, situated at ca. 1600 m a.s.l., represents the highest record of this bat species in Lebanon (and most probably in the whole Levant).

LESSER HORSESHOE BAT, *RHINOLOPHUS HIPPOSIDEROS* (BORKHAUSEN, 1797)

New records: L-05, L-14b, L-09, L-16(?), L-18, L-20, L-21, L-22, L-29(?), L-31, L-37, L-40, L-54, L-55, L-57, L-59.
Other data: a cave near Bqerzia (leg. Mounir Abi-Said); – Ksam Cave n. Nabes es Soukar, January 2003: ca. 50 inds. (leg. H. E. Kassouf).

The Lesser horseshoe bat occurs mainly in the Mediterranean parts of the Middle East, including Turkey, Cyprus, Syria, Lebanon, however, it is rare or absent in the more arid regions (Harrison & Bates, 1991 and Benda & Horáček, 1998). It has been previously known from a few sites in south-central Lebanon (see the map by Benda et al. 2006). All the records are reported either from the southern section of the Bekaa Valley and Litani valleys and from the southern section of Mount Lebanon, south of Beirut. Examples include Ain Anoub, Beit el Dine, Marjayoun, Machghara, Mogharet el-Bzouz, Moukhtara (Lewis & Harrison, 1962; Harrison, 1964; Atallah, 1977; Tohmé & Tohmé, 1985). During the 2006 summer survey, the Lesser Horseshoe bat was observed on few localities in Aanjar, Jezzine, and Mar Bichay, while during the 2007 winter census, it was the second most frequently recorded bat species (after the Greater Horseshoe bat).

MEDITERRANEAN HORSESHOE BAT, *RHINOLOPHUS EURYALE* (BLASIUS, 1853)

New records: L-18, L-20, L-25, L-26, L-54, L-56.
Other data: a cave near Bqerzia (leg. Mounir Abi-Said); – Ksam Cave n. Nabes es Soukar, January 2003: ca. 50 inds. (leg. H. E. Kassouf).

Mediterranean horseshoe bat occurs in the Mediterranean parts of the Middle East. It has been recorded in Turkey, Iran and the continental Levant (Benda et al., 2006 & 2007). In Lebanon, its five known records come from the western slope of Mount Lebanon and the coastal areas: Araya, Mogharet

Figure 7
Rhinolophus ferrumequinum, detail of the face
(Photo by R. Lučan)

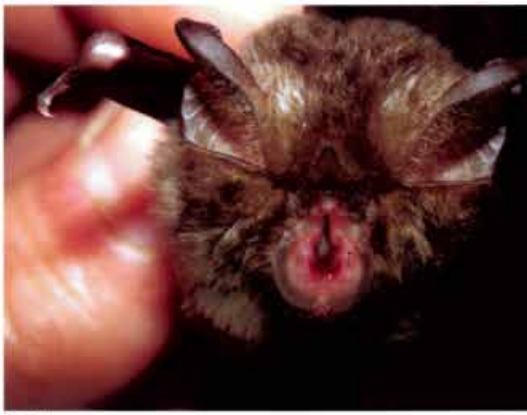

Figure 8
Rhinolophus hipposideros, detail of the face
(photo by I. Horáček)

Saleh E. of Amchite, Nammoura (Mgharet 'Biz es-Sigara'), Roman Aquaduct E. of Beirut, and Tyre (Tristram, 1884; Lewis & Harrison, 1962; Harrison, 1964; and Tohmé & Tohmé 1985). The Mediterranean horseshoe bat was found in eight sites in the 2--6 and 2007 excursions (one of them is represent by finding of bone remains only). Two new locations were discovered in the northern part of Lebanon in Musailha Castle and in Achou Cave. More important are the findings in the Bekaa Valley in Deir Mar Maroun, representing occurrence in different biozone of the country. The El Ruaiss Cave (at 1280 m a.s.l.) represents the highest situated site of this bat occurrence in Lebanon and most probably in the whole Levant.

BLASIUS' HORSESHOE BAT, *RHINOLOPHUS BLASII* (PETERS, 1866)
New record: L-42.

The Blasius' horseshoe bat is reported in Lebanon for the first time. A hibernating colony of 27 individuals is present in the Kfar Zabad I Cave in the western slope of the Anti-Lebanon. Blasius' horseshoe bat occurs in the Mediterranean parts of the Near East (Benda et al., 2006). It has been recorded in Turkey, Cyprus, Syria, Israel, Jordan and Iran. The new record from Lebanon fills the geographical gap between the numerous records in the northern Holy Land (Mendelssohn & Yom-Tov 1999, and Amr 2000) and the rather scarce ones in the northern regions of the Levant. This bat is very similar in size and external appearance to the previous species. Slight differences are in the shape and colour of the nose-leaf and dimensions of the wings, it can be well distinguished by means of several cranial and dental characters (see Benda et al. 2006).

GREATER MOUSE-EARED BAT, *MYOTIS MYOTIS* (BORKHAUSEN, 1797)
New records: L-31, L-54.

The Greater mouse-eared bat occurs in the western part of the Middle East Records are known from Turkey and the continental part of Levant, where it reaches eastern and southern margins of its distribution range (Spitzenberger 1996 & Benda et al., 2006). Harrison & Lewis (1961) described from Lebanon separate subspecies, *Myotis myotis macrocephalicus* (terra typica: a cave 2 km east of Amchite [= Mgharet Saleh Cave]), which uses to be considered a valid taxon for the Levantine populations (see Spitzenberger, 1996).
The Greater mouse-eared bat has been known from five different sites in Lebanon; Aanjar, Baalbek, Beirut, Mogharet Saleh E. of Amchite, Halba (Harrison & Lewis 1961, Lewis & Harrison 1962, Harrison 1964, Atallah 1970, Atallah 1977, Spitzenberger 1996). However, these limited records come from all main parts of the country, coastal side of the Mount Lebanon, western Anti-Lebanon slope and the Bekaa Valley. Only two new records were added during the 2006 and 2007 excursions, both referred in Table 1 to hibernation sites.

LESSER MOUSE-EARED BAT, *MYOTIS BLYTHII* (TOMES, 1857)
New records: L-07, L-11, L-21, L-43, L-50.

The Lesser mouse-eared bat occurs in the Mediterranean parts of the Middle East. It has been found commonly in Turkey, the Levant and mountainous parts of Iran (DeBlase, 1980 and Benda et al., 2006). In Lebanon, the Lesser mouse-eared bat has been known from three sites only, all lying in the central part of the country; Hrajel, Mogharet Saleh E of Amchite, and Natural Bridge SE of Faraya (Harrison & Lewis, 1961; Lewis & Harrison, 1962; Harrison, 1964; Atallah, 1970 & 1977; and Tohmé & Tohmé, 1985).Five sites were recorded to have bats of that species during the 2006 and 2007 excursions both during the summer and winter surveys. The site are present in southern Lebanon (Aalmane in the Litani Valley), in Anti-Lebanon (in Aarsal) and in the Bekaa Valley (in Baalbek). Grotte Raymond in Faraya (at ca. 1760 m a.s.l.) present in central Mount Lebanon represents the highest situated hibernation site throughout the Levant.

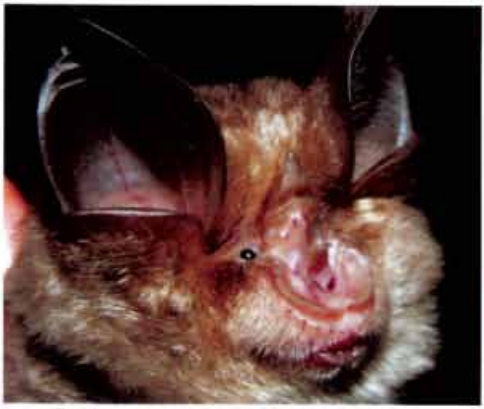

Figure 9
Rhinolophus euryale, detail of the face, Ras el Assi
(Photo by R. Lučan)

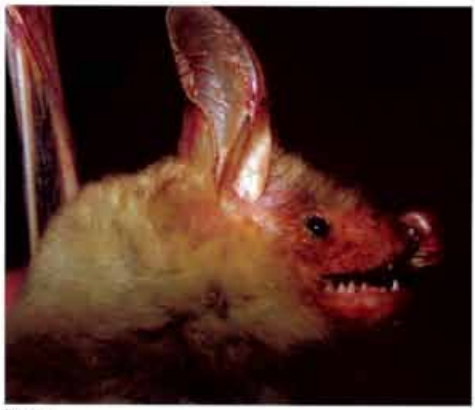

Figure 10
Myotis blythii, detail of the face, Baalbek
(photo by I. Horáček)

NATTERER'S BAT, *MYOTIS NATTERERI* (KUHL, 1817)
New records: L-14, L-16, L-18, L-18b, L-20.

In the Middle East, Natterer's bat occurs in a broad belt of Mediterranean coastal areas in southern Turkey and the Levant, includeing Cyprus (Benda et al., 2006). This bat has been previously recorded in Lebanon only once four individuals were collected in Mgharet Saleh Cave, east of Amchite on August 16, 1968 (Atallah, 1970). Natterer's bat was recorded during the 2006 and 2007 trips from four sites: along the Sadek Cave at Amchite, where it was collected already before, it was netted in a garden in urban habitats near Jbeil (Al Fidar), as a spring pool in Jezzine and at the mountainous cave of Er Rouaiss. All these records were gathered during the 2006 summer survey, while in the hibernation period no record was obtained.

GEOFFROY'S BAT, *MYOTIS EMARGINATUS* (GEOFFROY, 1806)
New records: L-14, L-14b, L-26, L-31.

Geoffroy's bat occurs in the Middle East in a coastal belt along the Mediterranean Sea extending from Turkey to Israel, including Syria and Cyprus (Benda et al., 2006). Only one record comes from Lebanon. Tristram (1884) reported it from tombs behind Tyre (Sour). Two old specimens deposited in the Natural History Museum, London, are labelled 'Jebal Palestine' (Harrison, 1964; and Atallah, 1977). This could refer also to Jbeil (Byblos) in Lebanon (see the discussions by Benda 1996 and Benda et al. 2006). Lewis & Harrison (1962) reported *M. emarginatus* from a cave 2 km east of Amchite (Mogharet Saleh Cave). The respective specimen deposited in the collection of American University Beirut was re-examined by Atallah (1970) as belonging to *Myotis capaccinii*.

Geoffroy's bat was recorded in Lebanon from three sites during the 2006 and 2007 excursions. This confirms its occurrence after some 120 years. The summer findings come from the southern part of the Mount Lebanon (Jezzine) and northernmost part of the Bekaa Valley (Deir Mar Maroun). The only winter record was obtained from an abandoned mine below El Mrouj (central Mount Lebanon, 1100 m a.s.l.).

STEPPE WHISKERED BAT, *MYOTIS AURASCENS* (KUZJAKIN, (1935)
New record: L-14.

The steppe whiskered bat represents one of the rarest bat species in the Levant. Only several recent records have been reported all coming from the Golan Heights (Mendelssohn & Yom-Tov 1999). Some of these records were found to be erroneously identified representatives of M. emarginatus (C. Dietz, in litt.). However, at least one correctly determined Levantine individual of *M. aurascens* is available from that area. An individual collected at Mt. Hermon is deposited in the collection of the Tel Aviv University (Benda & Karataş, 2005). From Lebanon, one historic record is available, though it species identity was long time considered dubious (Harrison, 1964 and Qumsiyeh, 1996). *Vespertilio mystacinus* (= *Myotis aurascens*) was reported from the 'Southern Lebanon' (southern part of the Mount Lebanon) by Tristram (1884). The records refers to a specimen, that was deposited in the British Museum (today Natural History Musuem, London) and later found and included in a catalogue by Dobson (1876). During the 2006 and 2007 trips whiskered bat was reported in Jezzine which confirmed the Tristram (1884) findings after more than 120 years.

LONG-FINGERED BAT, *MYOTIS CAPACINII* (BONAPARTE, 1837)
New records: L-04, L-07, L-11, L-12, L-20, L-30, L-31, L-45, L-54, L-56.

The Long-fingered bat inhabits large portion of the Mediterranean segment of the Middle East, from Turkey to

Figure 11
Myotis myotis, a cluster of hibernating individuals, Czech Republic
(Photo by I. Horáček)

Figure 12
Myotis nattereri, detail of the face
(photo by I. Horáček)

Israel and over to Syria, Iraq and Iran (DeBlase 1980, Benda et al. 2006). From Lebanon it was only mentioned from one site; Atallah (1970) found four individuals in Mogharet Saleh Cave, 2 km east of Amchite on August 16, 1968. He also re-examined the male specimen collected there on 25 September 1961 and published by Lewis & Harison (1962) as *M. emarginatus*, and found it to belong to *M. capaccinii*. During field excursion in 2006 and 2007 the Long-fingered bat was recorded from numerous sites lying in all parts of Lebanon, both to west and east of Mount Lebanon. It was confirmed from all parts of the Bekaa Valley (Baalbek, Deir Mar Maroun, Zahle), along the Mediterranean coast (Achou Cave, Jeita Cave, Nahr es Safa), the southern Litani Valley (Aalmane), and in mountainous habitats (El Mrouj mine, Er Rouais Cave). Most of the records come from the summer survey and only two findings were made during the winter census (Achou Cave, El Mrouj mine). In Jeitta Cave bone remains of this bat were found. The Er Rouais Cave (ca. 1280 m a.s.l.) represents the highest situated site of this bat occurrence in Lebanon (and most probably in the whole of Levant).

SEROTINE BAT, *EPTESICUS SEROTINUS* (SCHREBER, 1774)

New records: L-14b, L-20, L-21.

The Serotine bat occurs in the northern part of Middle East, in the Mediterranean habitats in countries of Turkey, Cyprus, Syria, Iraq and Iran. It was also found in the desert regions of Mesopotamia (Benda et al., 2006). From Lebanon only three record are available, two of them are rather historic ones. Tristram (1884) reported this species from Lebanon (Mount Lebanon) and Allen (1915) from Shtora (Chtaura). More recent finding was reported by Lewis & Harrison (1962) from Beirut. During field excursion in 2006 and 2007 Serotine was found in three sites in Afqa Cave, Er Rouais Cave, and Jezzine, all representing the mountainous habitats above 1000 m a.s.l.

ANATOLIAN SEROTINE BAT, *EPTESICUS ANATOLICUS* (FELTEN, 1971)

New records: L-14b, L-25, L-60.

Anatolian serotine bat, which has a separate species status, was only recently validated (Benda et al., 2006 & Mayer et al., 2007). It is here reported from Lebanon for the first time. This species has been know from the southern belt of the Mediterranean habitats in the Middle East, in Dodecanese Islands, southern Turkey, Cyprus, western Syria, northern Iraq and southern Iran (Benda et al., 2006 & 2007). From Syria, this bat is known from four sites in the southern Jabel an Nusariyah, adjacent to the Lebanese northern border.
In Lebanon, the Anatolian serotine bat was recorded at three sites, all representing synanthropic habitats. Two of which are mediaeval castles (of Jbeil and Musailha) and one a house in Jezzine.

SAVI'S PIPISTRELLE BAT, *HYPSUGO SAVII* (BONAPARTE, 1837)

New records: L-11, L-12, L-14, L-14b, L-15, L-20, L-21, L-22, L-23, L-25, L-25b, L-26, L-30, L-33, L-34, L-37, L-39, L-43, L-43b.

The Middle Eastern coverage of the Savi's bat covers most of the Mediterranean habitats of Turkey, western Iran and the Levant, including Syria and Israel (Harrison & Bates 1991, Benda et al. 2006). In Lebanon, it was found at one site only; three individuals were collected at Ainab in 1952 and 1960 (Harrison 1961). During this research this bat was recorded from numerous localities throughout the country. However, it was almost exclusively reported during the summer survey (both by netting and detecting, see Table 2). Only one hibernation site was found in the portal of the Afqa Cave. The abundant summer

Figure 13
Pipistrellus kuhlii
(Photo by R. Lučan)

Figure 14
Nyctalus noctula lebanoticus
(photo by I. Horáček)

records come from all parts of the country, including the Mediterranean coastal areas (Adonis Valley, Antelias, Musailha Castle, Nahr es Safa), slopes of the northern Bekaa Valley (Aarsal, Deir Mar Maroun), southern Litani Valley (Aalmane), and mountainous habitats of Mount Lebanon (Afqa Cave, Balaa, Jezzine, Er Raouis Cave, Qadisha Cave).

Savi's bat is a typical lithophilous bat that roosts in small colonies in rocky fissures and forages along surfaces of epilithic vegetation (Horáček & Benda 2004). It may appear also in rocky overhangs. During its night activity it visits spacious cave entrances situated in context of rocky walls. Because this species does not roost in caves or in urban habitats its records were until recently extremely rare. Savi's bat seems to represent one of the commonest bat species of Lebanon. Such a picture is completely different from the former ideas of distribution of this bat in the Levant, which report it as one of the rarest species (Harrison, 1961; Harrison & Makin, 1988; and Harrison & Bates; 1991).

COMMON PIPISTRELLE BAT, *PIPISTRELLUS PIPISTRELLUS* (SCHREBER, 1774)

New records: L-01, L-02, L-03, L-04, L-12, L-14, L-14b, L-15, L-16, L-20, L-21, L-23, L-25, L-26, L-30, L-33, L-34, L-43, L-44, L-46, L-46b, L-61.

The Common pipistrelle bat occurs in the Mediterranean parts of the Middle East from Turkey to Iran, and recently it was found also in Syria (Benda et al. 2003a, 2006). Two records have been known from northern Israel (Makin 1989, Mayer & von Helversen 2001) and two from Lebanon Lewis & Harrison (1962). In Lebanon Lewis & Harrison (1962) collected one male at Ammik Swamp in Bekaa Valley and another male in Machghara. They noted the following: "as indicated by the fact that only two specimens have been collected in the past two years, this is not a common bat in Lebanon". Our field experience is totally different. Common pipistrelle belongs to one of the most common bats. According to the number of records, 21 records during the 2006 summer survey (Table 1), it was the most frequently recorded bat during our survey, even though it was only recorded during the summer period.

According to the genetic analyses (Benda et al. 2003a, Hulva et al. 2004) and mainly according to field recordings of the echolocation calls, both in Lebanon and in surrounding countries, the continental part of Levant is relatively inhabited by *Pipistrellus pipistrellus* s. str. However, some call records have indicated that also the Pygmy pipistrelle bat, *Pipistrellus pygmaeus* (Leach, 1825) could be also present. *P. pipistrellus* and *P. pygmaeus* are typical cryptic species. It is impossible to distinguish them by morphologic characteristics, but they clearly differ in their echolocation calls. The terminal frequency of the P. pipistrellus call is about 45 kHz while that of P. pygmaeus about 55 kHz. They are also well marked by genetic distances.

P. pygmaeus was discovered in Cyprus and northern Iran (Benda et al. 2007, Hulva et al., unpubl.). Its occurrence in the Levant thus cannot be excluded. The call records at two sites in the Bekaa valley in Lebanon (L-03b, L-44) suggested possible presence of *P. pygmaeus,* however, this fact has not been confirmed by genetic analysis.

KUHL'S PIPISTRELLE BAT, *PIPISTRELLUS KUHLII* (KUHL, 1817)

New records: L-01, L-11, L-14b, L-16, L-26, L-30, L-33, L-39, L-46b, L-61.

Kuhl's pipistrelle, the species roosting and foraging particularly

Figure. 15
Rhinopoma cystops, typical roosting position, Libya
(Photo by A. Reiter)

in urban habitats, represents undoubtedly the most common bats in the Mediterranean region, including the Mediterranean parts of the Middle East (Mendelssohn & Yom-Tov, 1999 and Benda et al., 2006). In Lebanon the Kuhl's pipistrelle is one of the most common bats according to the published evidence.

The oldest record comes from Kolenati (1960) in Mount Lebanon who reported, similarly as in the case of *R. ferrumequinum*, the unpublished finding made by F. Hemprich and C. Ehrenberg in 1824. Allen (1915) reported a record of an individual in Shtora (Chtaura). Lewis & Harrison (1962) mentioned *P. kuhlii* from various localities in Lebanon. Atallah (1977) gave more precise distribution data and he found it in Aajaltoun, Amchite, Baalbek, Barja, Beirut, Halba, Ehden, Machghara, Saida, Tyre, and Zahle. The last published record comes from Tripoli and was found in the Catalogue of the Madrid Museum Collection (Ibáñez & Fernández, 1989).

Although the published data set is certainly the richest for P. kuhlii, among the records during the 2006 and 2007 excursions this bat is not too common. It was recorded in 10 sites mainly in the resident areas of Amchite, Aley, Beirut and Al Fidar. Other sites are scattered throughout the country such as Aalmane, Adonis, Deir Mar Maroun, Jezzine and Rachaya. Most of the sites come from rather low altitudes and the highest situated site lie at 1025 m a.s.l. in Jezzine.

NOCTULE BAT, *NYCTALUS NOCTULA* (SCHREBER, 1774)
New record: L-04.

The Noctule bat is not a common inhabitant of the Middle East. All the records known are concentrated in the northern Levant from Cilicia to the West Bank and possibly including Cyprus (Benda et al. 2007). From each of the countries of this region noctule is known from 1–2 sites, so the actual pattern of its distribution is not obvious.

From Lebanon a single record was reported by Lewis & Harrison (1962) from a Natural Bridge, 7 km SE Faraya, where four individuals were collected. On the basis of this small series, Harrison (1962) described a new subspecies, *Nyctalus noctula lebanoticus*. However, the actual taxonomic status of this form remains currently uncertain. Our new record found in Nahr es Safa River comes from its typical habitat, humid and relatively dense woodland combined with a rocky valley.

SCHREIBERS' BAT, *MINIOPTERUS SCHREIBERSII* (KUHL, 1817)
New records: L-18, L-20, L-25, L-26.

The Schreibers' bat is a strictly cave-dwelling species, commonly distributed over the Mediterranean region including the Middle East. Based on the number of records, it is a common bat species both in Turkey and in Israel (Benda & Horáček, 1998 and Mendelssohn & Yom-Tov, 1999). The previously known number of its records from Lebanon, a country rich in caves, is surprisingly low. Only three sites have been reported and only from one of them this bat has been mentioned in more than one occasion. Repeatedly this bat was found in Mgharet Saleh Cave east of Amchite (Lewis & Harrison, 1962 and Atallah, 1970 & 1977). Atallah (1970) found it near Aanjar and Tohmé & Tohmé (1985) found it in Rouways (Er Rouais Cave).

During field excursion in 2006 and 2007 the Schreibers' bat was reported from four sites only. Two sites during both the summer and winter surveys in Mgharet Saleh Cave and Er Rouais cave, both these caves are sites where this bat has been previously documented. Two new localities in north Lebanon one in Deir Mar Maroun where an individual was netted and one in the Musailha castle where a group of six Schreiber´s bat were found in a ceiling hollow in a ruined room. The latter record apparently does not refer to regular hibernacula; rather it represents a temporary shelter used perhaps during migration. The datum of the event, January 28, suggests that the course of hibernation in the Levant may differ from that in the northern Mediterranean or central Europe.

EUROPEAN FREE-TAILED BAT, *TADARIDA TENIOTIS* (RAFINESQUE, 1814)
New records: L-16, L-26, L-33, L-34, L-37, L-43.

The European free-tailed bat occurs in the whole Middle East; however with the exception of Isreal and Palestine its records are very scarce (Benda et al., 2006). In Isreal and Palestine it was reported as one of the most common faunal elements, particularly in the arid southern regions (Mendelssohn & Yom-Tov, 1999). Only two records have been known from Lebanon. Lewis & Harrison (1962) reported a collection of 13 individuals from the Natural Bridge near Faraya and Lewis & Harrison (1962) and Kock & Nader (1984) reported 2 females in the ruins of Baalbek.

During field excursion in 2006 and 2007 the European free-tailed bat was found at six sites, all the records are call recordings. No individual was netted or found in its roost. Most of the new records come from coastal zone of the country including Adonis Valley, Al Fidar and Antelias and two others come from slopes of the northern part of the Bekaa Valley in Aarsal

and in Deir Mar Maroun. In all these cases call recordings are mostly individual bats often flying at considerable height. The record in Balaa (Baatara) is of a different kind. A call recording of about ten individuals typically emitted when leaving a roost was documented. For that reason it is assumed that the rocky amphitheatre at Balaa (Baatara) is inhabited by a colony of this species. This conclusion corresponds quite well to its habitat requirements. It needs large rocky walls in semiarid environment, similarly as it was the case with the first Lebanese record near Faraya. In contrast to extreme abundance of such habitats in Lebanon the number of actual records is surprisingly low.

THE SPECIES EXPECTED TO OCCUR IN LEBANON BUT NOT RECORDED AS YET

LESSER MOUSE-TAILED BAT, *RHINOPOMA CYSTOPS* (Thomas, 1903)

The Lesser mouse-tailed bat is a species smaller than *R. microphyllum*, with relatively longer tail longer than the forearm about 45–62 mm long. It is distributed in North Africa and Arabia with the northernmost records in the Levant come from the Rift Valley of Israel and the Golan Heights (Mendelssohn & Yom-Tov 1999 and Benda et al., 2006). It is most likely to occur in Lebanon, particularly in arid habitats of southern part of the Litani Valley and/or southern Bekaa Valley.

NAKED-BELLIED TOMB BAT, *TAPHOZOUS NUDIVENTRIS* (CRETZSCHMAR, 1830)

The Naked-bellied tomb bat is a bat species that can be hardly misidentified. It is a very large (length 75–83 mm) and robust bat with a tail projecting from the dorsal surface of the membrane and with a short and sparse pelage and naked belly. It typically occupies fissure roosts in human constructions, rocky overhangs and entrances to spacious caves where it forms smaller and loosely integrated colonies. It is relatively common in the Rift Valley of Israel and was even recorded in SE Turkey (Benda et al., 2006). It seems quite probable that it occurs also in the southern regions of the Litani or Bekaa Valleys in Lebanon.

EGYPTIAN TOMB BAT, TAPHOZOUS PERFORATUS (GEOFFROY, 1818)

A bat generally very similar to the Naked-bellied tomb bat in its appearance and habitats, however, the Egyptian tomb bat is smaller (length 58–66 mm), darker and without the naked belly parts. It is a species rarely found in the Levant and it is known mainly from the Dead Sea area (Mendelssohn & Yom-Tov 1999). One of the last records is known from the Nahal Ammud of Israel, area close to the Lake Tiberias. It might be found in the Litani Valley.

EGYPTIAN SLIT-FACED BAT, *NYCTERIS THEBAICA* (GEOFFROY, 1818)

The Egyptian slit-faced bat is a small to medium-sized bat characteristic by long and broad ears and short and broad wings (length 40–50 mm). It has a particularly typical nose-leaf covering the medial slit in the nasal part of the head, which opens during flight. The ending of its tail bifurcated into a shape of the inverted 'T'.

It is a bat species occurring throughout the Levantine part of the Rift Valley where a dozen records are known (Mendelssohn & Yom-Tov 1999). The northernmost record in the Near East, as well as in the Palaearctic, comes from the northwestern bank of Lake Tiberias (Mendelssohn & Yom-Tov, 1999). It could be discovered in Lebanon particularly in the Litani Valley.

MEHELYI'S HORSESHOE BAT, *RHINOLOPHUS MEHELYI* (MATSCHIEI, 1901)

A medium-sized horseshoe bat slightly larger than *R. euryale* and *R. blasii*, but markedly smaller than *R. ferrumequinum*. It is a typical Mediterranean species distributed from Marocco to western Iran and Trascaucasia. It was found at six localities in Syria, in Hatay, in Mesopotamia, and in several sites in northern Israel and Palestine (Harrison & Bates 1991). It is greatly probable that *R. mehelyi* occurs also in Lebanon though but most probably quite rare.

TRIDENT LEAF-NOSED BAT, ASELLIA TRIDENS (GEOFFROY, 1813)

The Trident leaf-nosed bat resembles closely the medium sized horseshoe bat (forearm length 47–55 mm), but differs clearly by shape of the nose leaf and often with a rufous pelage coloration. It inhabits semi-desert habitats and roosts in caves or artificial underground spaces where it forms colonies of free-hanging individuals. It was recorded in localities in Syria and Israel including those in the Golan Heights just nearby the Lebanese border. Most probably it could be seen in the southern most parts of Lebanon such as in the Litani Valley.

BOTTA'S SEROTINE BAT, *EPTESICUS BOTTAE* (PETERS, 1869)

The Botta's Serotine bat is a small to medium sized bat (forearm length 41–47 mm), a bit resembling *Hypsugo savii* by contrasting coloration of the face, but much larger. It is a typical desert dweller with distributed in arid parts of the Middle East and Central Asia. It roosts in rocky fissures or buildings. It was reported from the southern Holy Land (Palestine) and central and eastern Syria (Benda et al., 2006). It can be expected to be present in the arid areas of the north-eastern part of the Bekaa Valley.

RÜPPELL'S PIPISTRELLE BAT, *PIPISTRELLUS RUEPPELLII* (FISCHER, 1829)

It is a small bat (forearm length 30–34 mm) specifically coloured. It has a dark brown to blackish face and contrasting silverish grey to brownish colour above the pelage and pure white below the pelage. It has been recorded on more than one occasion in Israel near Haifa (Tristram, 1884 and Mendelssohn & Yom-Tov, 1999). Its appearance in southern Lebanon is well possible.

HEMPRICH'S LONG-EARED BAT, *OTONYCTERIS HEMPRICHII* (PETERS, 1859)

This species can be easily recognised by combination of large body size (forearm length 56–67 mm), pale greyish coloration and extremely long but mutually separated ears (35–45 mm long). Its records are sporadic, but almost continuously dispersed, over whole rocky desert and steppe portions of Syria, Israel and Jordan. Its occurrence in Lebanon is expected at least in the desert regions of the Anti-Lebanon and/or in north-eastern part of the Bekaa Valley.

CAUCASIAN LONG-EARED BAT, *PLECOTUS MACROBULLARIS* (KUZJAKIN, 1965)

All the bats of this genus are characterised by a smaller or medium size (forearm 36–45 mm) and extremely long auricles mutually interconnected at frontal region. It roosts in rocky fissures and deserted building. The Caucasian long-eared bat is a species complex from the Mediterranean long-eared bat which where distinguished quite recently. The species was recorded in several localities in the Anti-Lebanon in Syria and in Mount Hermon (Benda et al. 2006). It is almost sure that it appears also in the Lebanese part of Anti-Lebanon.

OTHER SPECIES

The specific conditions of Lebanon particularly the continuous appearance of arboreal vegetation suggest a possibility, quite improbable, occurrence of relic populations of some West-Palearctic arboreal elements such as *Myotis bechsteini, Nyctalus leisleri* and *Nyctalus lasiopterus*. All these bats live in the south-western Turkey, the latter two also in Cyprus (see the review by Benda et al. 2007).

Last few species occurring in the southern desert regions of the Holy Land (Israel, Palestine and Jordan) but not extending more northwards with records situated close to the Dead Sea. These species rank among quite rare bats and it cannot be excluded that their ranges actually extend even up to the southern regions of Lebanon. Those include the Egyptian barbastelle, *Barbastella leucomelas* (Cretzschmar, 1830), Egyptian pipistrelle bat, *Hypsugo ariel* (Thomas, 1904) and *Nycticeinops schlieffeni* (Peters, 1859; Harrison & Bates, 1991; Mendelssohn & Yom-Tov, 1999; Amr, 2000; Yom-Tov, in litt.).

SUMMARY OF THE CURRENT STATUS OF BATS IN LEBANON

Until recently, 20 species of bats were recorded in Lebanon. Two of them are identified and presented for the first time, *Rhinolophus blasii* and *Eptesicus anatolicus*. Some of the recorded species are known from very limited number of records (*Rhinopoma microphyllum, Rhinolophus blasii, Myotis aurascens, Eptesicus anatolicus, Nyctalus noctula*). Six other species were not recorded in Lebanon but are most likely to occur in the country (*Rhinopoma cystops, Rhinolophus mehelyi, Asellia tridens, Taphozous nudiventris, Otonycteris hemprichii*, and *Plecotus macrobullaris*). Another four species can be expected to occur in Lebanon. Based on number of records, the following species can be regarded common in Lebanon *Pipistrellus pipistrellus, Hypsugo savii, Pipistrellus kuhlii, Rousettus aegyptiacus, Rhinolophus ferrumequinum, and R. hipposideros:* the following can be regarded regular *Myotis capaccinii, M. nattereri, Miniopterus schreibersii, Rhinolophus euryale, Myotis blythii, M. emarginatus, Eptesicus serotinus*, and *Tadarida teniotis* and all remaining are to be looked upon as rare or not recorded as yet.

In number of species the present picture of the bat fauna of Lebanon corresponds to the situation in neighbouring countries. There are 24 species in southern Turkey, 27 species in Syria and 31 species in Israel and Palestinian. However, in Lebanon it can be expected to be even more diversified due to enlarged beta-diversity of the country. Unfortunately, the maternity breeding colonies and seasonal aggregations of females that bear and rear their offspring's indicating a regularly reproducing population were recorded in 11 species only. Moreover mass winter assemblages were recorded in only two species.

In comparison to situation in Turkey (Benda & Horáček, 1998), Cyprus (Benda et al., 2007), Syria (Benda et al., 2006) and Israel and Palestine (Mendelsohn & Yom-Tov 1999) this work found relatively low densities in typical cave-dwellers but relatively very high density in some species which are otherwise rather rare in the Middle East. For instance, in 2006–2007, 46 checks of 30 caves revealed just a single colony of *Miniopterus schreibersii*, two colonies of *Rhinolophus ferrumequinum*, one colony of *Rhinolophus euryale* and one colony of *R. hipposideros*. The winter checks believed to provide a more optimistic picture. Hibernating bats were found in 18 of 26 inspected caves but the population numbers were much lesser than expected (Table 3). This was quit evident in species in which population are almost entirely dependent upon underground cave roosts in winter, such as horseshoe bats *(Rhinolophus spp.), Miniopterus schreibersii, Myotis myotis,* and *M. blythii,*. The same is valid, of course, also for the fruit bat, *Rousettus aegyptiacus* though its situation is a bit different. This species does not hibernate, and as observed, its population remains confined to the roosts occupied by breeding colonies. Similarly as in other cave-dwelling species the number of colonies as well as their sizes are considerably smaller than e.g. in Cyprus (Benda et al. 2007).

At first *Pipistrellus pipistrellus* was found to be the most common species by bat detecting technique. This species, similarly as *Hypsugo savii*, another very common species, appears quite rarely in cave interior but it may colonize fissure roosts in cave entrances (e.g. hibernating individuals in the entrance of the Afqa Cave). Surprisingly, low population density were also found for *Tadarida teniotis*, the bat roosting in deep crevices in high rocky walls, which presence can be discovered quite easily due to its loud low frequency echolocation calls when on prey (hear able even without any instrumental support). Six records per 28 detecting attempts at night suggest either a very low population density or a foraging mode different than that in neighbouring regions.

It is no an easy task to attribute specificities of Lebanese bat fauna to either the specific climatic and environmental conditions of the region and/or to a secondary phenomenon influenced by recent anthropogenic interferences. In these connections it should be reminded that, in contrast to the state recorded in 1960–1970 by Lewis and Atallah, who reported the large multi-

Table 1. Number of records of particular bat species reported in the major literary sources on Lebanese bats, those recorded during the field excursions reported in this volume ('2006/7', S-summer, W-winter), current number of records combining all available sources, and number of DNA samples obtained from Lebanese bats.

Species	Lewis & Harrison 1962	Atallah 1977	Tohmé & Tohmé 1985	2006/7 no. records S 06	W 07	Current total	DNA samples (no. inds.)
Rousettus aegyptiacus	+	2	8	9	5	26	63
Rhinopoma microphyllum	–	1	1	–	–	1	–
Rhinolophus ferrumequinum	+	7	7	8	13	30	57
Rhinolophus hipposideros	+	3	4	5	11	23	21
Rhinolophus euryale	+	5	3	4	2	12	10
Rhinolophus blasii	–	–	–	–	1	1	4
Myotis blythii	2	2	3	3	2	8	18
Myotis myotis	2	2	4	–	2	6	2
Myotis nattereri	–	1	1	5	–	6	5
Myotis emarginatus	–	1	–	3	1	5	10
Myotis capaccinii	(1)	1	1	7	1	11	10
Myotis aurascens	–	–	–	1	–	2	1
Eptesicus serotinus	(1)	1	2	3	–	6	11
Eptesicus anatolicus	–	–	–	3	–	3	7
Hypsugo savii	1	1	1	19	1	21	61
Pipistrellus pipistrellus	1	1	3	21	–	23	24
Pipistrellus kuhlii	+	+	10	9	2	23	1
Nyctalus noctula	1	1	1	1	–	2	1
Miniopterus schreibersii	1	2	3	3	3	9	61
Tadarida teniotis	1	1	1	6	1	8	–
Total spp.	14	17	16	17	13	20	18
records	ca. 20	32+	52	110	46	332	365

species bat colonies in several caves (e.g. at Aamchit and Antelias), during field excursions in 2006 and 2007 such type of assemblages at all and the colonies reported by Lewis and Atallah between1960–1970 apparently disappeared from the respective roosts completely. This is probably due to extensive collecting or other anthropogenic interferences.

Tentatively, the hypothesize that a direct effect of human activity, including perhaps killing of bats in roosts, may represent one of very pertinent causes of the observed population decline which until now has not been compensated.

PERSPECTIVES: MONITORING OF THE CAVE BAT POPULATIONS IN LEBANON – A Draft Project

The unique character of Lebanese bat fauna and a number of excellently educated and trained speleologists and zoologists in the country set up all the prerequisites for starting a long-term monitoring project of bat populations, corresponding to similar projects recently undertaken in many of European countries. For instance, in the Czech Republic, the monitoring of bat populations in underground spaces is performed since 1969. More than 600 caves are being controlled each winter. For many caves detailed information on dynamics of the bat populations is available as well as on the population dynamics of particular species in particular regions and in general. The project revealed a number of unexpected dramatic turnovers in population trends and specificities of individual species. The large amount of data enabled researchers to test the reliability of the results. It is believed that the monitoring of bat populations in the Lebanese caves will bring information of a similar quality quite soon. Such information would be of a considerable international importance as no similar data are available from any region of the Eastern Mediterranean and Middle East.

This work proposes to establish a program of long-term monitoring of bat populations in Lebanon which could be done by speleologists, zoologists and all other people interested to take part in it and willing to respect few essential rules of the project:

(a) The first step is to establish a list of caves which will be regularly inspected every year in a term of winter control (if possible every year at roughly the same time, best in January), and optimally also in at least one term in summer, prior disintegration of breeding colonies (i.e. in late June or July). The list can be further enlarged with new sites, but should not been reduced. Regularly repeated controls and a continuous sequence of records are essential prerequisite for reliability of the obtained information.

(b) Each control should be performed in the same way and should include all accessible spaces of the respective cave. The bats observed during the control should not been disturbed, except for the cases when extraction of a bat is necessary for its species identification. The bats, especially the clustered

Table 2. A brief list of the localities mentioned in the text and summer records of bats in 2006

Explanations: NET netted, DET identified with aid of a bat detector, OBS observed in a roost; the abbreviations of species names were created from the generic name initial and three initial letters of species name [*Rousettus aegyptiacus* = Raeg]

Locality		Coordinates		Altitude m a.s.l.	Date of control: result (summer 2006 only)
L-01	Beirut, AUB campus	33 54	35 29	45	18 Apr 06: DET Pkuh, Ppip, Raeg 22 Apr 06: NET 3 Raeg, DET Pkuh
L-03	Kadisha Valley, Mar Lichaa Monastery	34 15	36 00	1157	20 Apr 06: DET Ppip
L-03b	Kadisha Valley, small cave in the S slope	34 14	36 00		20 Apr 06: DET Ppyg(?)
L-04	Nahr es Safa, ca. 1 km above the junction with the Nahr ed Damour	33 42	35 29	46	21 Apr 06: NET 1 Raeg, 1 Ninoe DET Ppip, Mcap
L-05	Mar Elichay Monastery, a cave behind a chapel	34 17	35 57	1402	23 Apr. 06: OBS: 8 Rhip
L-06	Baalbek, necropolis	34 00	36 12	1142	24 Apr 06: negat.
L-07	Baalbek, main temple	34 00	36 12	1142	24 Apr 06: OBS 6 Mmyo, 1 Mcap
L-09	Aanjar, archaeological site, drainage tunnels under the ancient city	33 44	35 56	898	24 Apr 06: negat. 6 July 06: OBS 3 Rhip (incl 1 fl +j)
L-10	Adloun, Grottes d'Adloun	33 25	35 16	13	21 June 06: Rfer
L-11	Aahmme, Nahr el Litani, valley near Aalmane	33 19	35 27	100	21 June 06: NET 2 Mmyo, 2 Mcap, 1 Raeg DET Hsav, Pkuh
L-12	Nahr es Safa, river below a bridge, ca. 1 km below the junction with Nahr ed Damour	33 42	35 28	42	22 June 06: NET 3 Ppip, 1 Raeg DET Ppip, Hsav, Mcap
L-14	Jezzine, Pont Al Khalass, water spring	33 33	35 36	1034	23 June 06: NET 1 Maur, 1 Mnat, 1 Mema DET Ppip, Hsav
L-14b	Jezzine, Pont Al Khalass, house	33 32	35 35	1025	23 June 06: NET 4 Raeg, 1 Rhip, 1 Mema, 7 Eser, 2 Eana, 8 Hsav, 8 Pip OBS 1 Rhip, 1 Rfer, DET Pkuh
L-15	Jezzine, artificial tunnels near a bridge	33 33	35 35	643	23 June 06: DET Ppip, Hsav
L-16	Al Fidar, garden in a resident quarter	34 06	35 39	100	24 June 06: NET 1 Mnat 24–30 June 06: DET Pkuh 30 June 06: NET Pkuh, DET 1 Tten 3 July 06: DET Pkuh, Ppip, Rhip(?)
L-17	Aamchit, small caves below top of hill	34 09	35 40	200	negat. (droppings)
L-18	Aamchit, Saleh Cave	34 09	35 40	146	25 June 06: OBS 100–200 Raeg, 30–40 Msch, 3–4 Reur NET 13 Raeg, 15 Msch, 1 Mnat DET Rfer
L-18b	Aamchit, rocky overhang near Saleh Cave	34 08	35 39	135	25 June 06: NET 1 Mnat
L-19	Aamchit, a small cave at the bottom of valley	34 09	35 40	131	25 June 06: bones remains
L-20	Er Rouais Cave	34 07	35 55	1285	26 June 06: OBS 50–80 Msch, NET 1 Mnat, 1 Reur, 3 Mcap, 3 Hsav, 1 Eser, 6 Msch, 1 Ppip
L-21	Afqa Cave	34 04	35 54	1255	23 Apr 06: OBS 60–80 Rfer, 26 June 06: OBS 50 Rfer, NET 2 Raeg, 1Rfer, 1 Mmyo, 3 Eser, 5 Hsav, 6 Ppip 15 July 06: OBS 15–20 Rfer NET 1 Mbly, 1 Eser, 1 Hsav DET Ppip
L-22	Qadisha Cave	34 15	36 02	1723	27 June 06: NET 1 Hsav
L-23	a small water reservoir near the Qadisha cave	34 16	36 01	1772	27 June 06: NET 2 Hsav, 2 Ppip
L-25	Ras Nhach, Mussailha Castle	34 16	35 41	45	28 June 06: NET 1 Eana, 1 Reur, DET Ppip, Hsav
L-25b	Ras Nhach, gallery and small water reservoir	34 16	35 41	32	28 June 06: DET 20 Ppip, 2 Hsav
L-26	Ras el Assi, Deir Mar Maroun Monastery	34 21	36 22	720	29 June 06: NET 35 Rfer, 1 Rbla, 1 Reur, 6 Mema, 35 Hsav, 2 Pip, 1 Pkuh, 1 Msch, DET 6 Tten
L-29	El Hermel, small caves in a cliff near road bridge	34 23	36 24	593	29 June 06: OBS cf. Rhip
L-30	Ras el Assi, spring of the river and rocky habitats along	34 21	36 22	675	29 June 06: NET 1 Ppip, 2 Pkuh, 5 Hsav DET Mcap
L-31	El Mennji, mine below the town	33 35	35 45	1117	1 July 06: negat.
L-32	Anteliss, El Kassarat Cave (in a quarry)				1 July 06: OBS Raeg ca. 300 f + 40 j
L-33	Adonis, Nahr Ibrahim	34 05	35 44	272	1 July 06: NET 1 Ppip, DET Ppip, Hsav, Pkuh, Tten
L-34	Baliaa, rocky amphitheatre	34 10	35 52	1514	2 July 06: DET Ppip, Tten, Hsav
L-35	Tannourine, church crypt	34 11	35 54	1390	3 July 06: negat.
L-37	Anteliss, Kamam Cave	33 55	35 36	110	4 July 06: OBS Raeg colony ca. 100, NET Raeg 30, DET Hsav, Tten
L-38	Solmor, Nahr el Litani valey, cave and overhangs	33 31	35 41	792	5 July 06: negat.
L-39	Rachaya Al Wadi, bridge over a wadi	33 31	35 49	950	5 July 06: NET 1 Pkuh, DET 1 Hsav
L-40	Ain Zhalta, spacious artificial caves	33 45	35 41	988	7 July 06: negat.
L-41	Amjar, Celtis Cave	33 44	35 57	1175	7 July 06: OBS 1 Rfer
L-42	Kfar Zabad I Cave	33 47	36 01	1270	7 July 06: negat.
L-42b	Kfar Zabad II Cave (smaller 30 m above L42)	33 47	36 01	1280	7 July 06: OBS 1 Rfer
L-43	Aarsal, caverns and habitats in a rocky ridge above the road to	34 11	36 24	1260	7 July 06: NET 1 Ppip, 2 Hsav, 2 Mmyo DET Hsav, Tten
L-43b	Aarsal, unused industrial building	34 11	36 24	1230	7 July 06: OBS/DET 1 Rfer, 10 Hsav
L-44	El Yammoune, small fishpond to S of the village	34 07	36 02	1361	8 July 06: DET Ppip, Ppyg(?)
L-45	Zahle, underground chanel below the downtown	33 51	35 54	977	9 July 06: OBS 1 Mcap
L-46	Aley, Animal Encounter	33 48	35 36	895	9 July 06: DET Ppip
L-46b	Aley, gardens and water tanks (Said's family)	33 49	35 36	743	9 July 06: DET Pkuh, Ppip
L-50	Fiqiya, Grotte Raymond (= Nahar as Saqia Cave)	33 59	35 49	1770	see Tab. 3
L-51	Tripolis, Mtal al Azraq Cave	34 25	35 50	15	see Tab. 3
L-53	Huqel el Azime, a cave above the road	34 24	36 00	ca 700	see Tab. 3
L-54	Huqel el Azime, Achou Cave	34 24	36 01	710	see Tab. 3
L-55	Mish'aj Cave at St. Theresa	34 06	35 46	790	see Tab. 3
L-56	Jeitta Cave	33 57	35 38	70	see Tab. 3
L-57	Farayu, El Qana Cave	34 03	35 49	1602	see Tab. 3
L-58	Fariya, Bechara Cave	34 02	35 48	1483	see Tab. 3
L-59	Farayu, Semaya Cave	34 01	35 48	1440	see Tab. 3
L-60	Jbeil, crusader castle	34 07	35 38	28	13 July 06: OBS 6 Eana
L-61	Amchite, Camping Les Colombes	34 08	35 38	51	16 July 06: DET Ppip, Pkuh

Table 3: Results of 2007 winter census in Lebanese caves

LOCALITY	DATE	*Raeg*	*Min*	*Rhip*	*Rfer*	*Reur*	*Rhla*	*Mmyo*	*Mbly*	*Memo*	*Mcap*	*Huav*
L07 Baalbeck, citadelle	25 Jan	-	-	-	-	-	-	-	1	-	-	-
L09 Aanjar, tunnels in ancient city	24 Jan	-	-	-	-	-	-	-	-	-	-	-
L18 Amchit, Saleh cave	28 Jan	100	3	3	3	7	-	-	-	-	-	-
L20 Aqura, Er Rouis cave	22 Jan	-	1060	1	9	-	-	-	-	-	-	-
L21 Afqa cave	22 Jan	-	-	6	83	-	-	-	-	-	-	2
L22 Quadisha cave	23 Jan	-	-	8	14	-	-	-	-	-	-	-
L25 Ras Nhach, castle Musailha	28 Jan	-	6	-	-	-	-	-	-	-	-	-
L26 Ras el Assi, monastery	25 Jan	-	-	-	-	-	-	-	-	-	-	-
L26 Ras Nhach, gallery	28 Jan	-	-	-	-	-	-	-	-	-	-	-
L29 El Hermel, small caves	25 Jan	-	-	-	-	-	-	-	-	-	-	-
L30 Ras el Assi, cavern n. spring	25 Jan	-	-	-	1	-	-	-	-	-	-	-
L31 Marjaba-Mrouje, 7 galleries	19 Jan	-	-	16	10	-	-	1	-	1	1	-
L32 Antelias, El Kassarat cave	25 Jan	350	-	-	-	-	-	-	-	-	-	-
L37 Antelias, Kanaan cave	25 Jan	100	-	2	-	-	-	-	-	-	-	-
L40 Naba es Safa, spacious mines	29 Jan	-	-	1	-	-	-	-	-	-	-	-
L41 Aanjar, Cellis cave	24 Jan	-	-	-	1	-	-	-	-	-	-	-
L42 Kfar Zabad cave	24 Jan	-	-	-	-	27	-	-	-	-	-	-
L50 Faraya, Grotte Raymond =Nabaa al Saqia cave 1760 m	20 Jan	-	-	-	-	-	-	-	17	-	-	-
L51 Tripolis, Mtal el Azraq	21 Jan	200	-	-	4	-	-	-	-	-	-	-
L53 Haqel el Azime, cave	21 Jan	-	-	-	-	-	-	-	-	-	-	-
L54 Haqel el Azime, Achou cave = Arafa cave	21 Jan	-	-	6	7	2	-	2	-	-	1	-
L55 Maba'aj cave at St.Theresa	23 Jan	-	-	6	1	-	-	-	-	-	-	-
L56 Jeitta cave	26 Jan	150	-	-	4	*	-	-	-	-	*	-
L57 Faraya, El Qana cave	27 Jan	-	-	2	7	-	-	-	-	-	-	-
L58 Faraya, Bechara cave examined ca 40 m in entrance	27 Jan	-	-	-	-	-	-	-	-	-	-	-
L59 Faraya, Seraaya cave	27 Jan	-	-	3	17	-	-	-	-	-	-	-

colonies are quite sensitive to any disturbance. They avoid the place of disturbance in the future which may bias reliability of the census.

For the monitoring purpose, focused just on few cave-dwelling species, the identification of a bat can be quite easy as a rule and can be performed by a distant visual check. The numbers of each particular bat species should be registered during the control and written down. Particular attention should be paid to appearance of larger clusters. The very large clusters should be photographed and numbers of clustered bats repeatedly counted from the photograph.

(c) All the above mentioned information arising for a single control of a particular cave should be summarised in a form of a database record and stored in a common database (that could be yearly published for example in the web page of Spéléo Club Liban). A database record should then include the following information: (i) name of the cave (the supplementary information about the cave are expected to be included in the list of the monitored sites), (ii) date of the control, (iii) name of the investigator(s), (iv) list of the species recorded, and total number of each species, (v) number and size of clusters and their locations, and (vi) optionally, a supplementary comment (e.g. on activity of bats, on changes observed in the cave etc.).

PROTECTION OF BATS IN LEBANON – REASONS AND STRATEGIES

Why protect the Lebanese bats?

First, all Lebanese bats, except for *Rousettus*, are insectivorous and their enormous feeding capacity presents an important contribution to natural control of pest insects. The fruit bats present important agent in natural dispersal of plants which they forage, in the Middle East e.g. carob, the plant that is their predominant winter diet and which shows many adaptation to dispersal by bats (winter fructification, cauliflory etc.).

Besides these immediate economical regards, it should be remembered that bats are quite valuable as sensitive bio-indicators of long-term trends in various environmental currents, particularly with respect to specific ecological requirements of individual species. Continuous presence of bats and their droppings are among essential prerequisites for maintenance of invertebrate troglobionts and a key factor of diversity of cave ecosystems.

Last but not least bats are wonderful and generally harmful animals which are worth of humans' interest not only for their unique adaptations, specificities of their life history etc. (echolocation, heterothermy, unique features in reproductive and social biology) but also as an indispensable component of a natural humans' environment.

The bat colony inside Mgharet Mtal el Azrak
(photo by Issam Bou Jouade)

Bats colony inside Houat Kasim
(Photo by Issam Bou Jaoude)