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Report of the Intersessional Working Group on Autecological Studies for Priority Species

(submitted by Dr. Stéphane Aulagnier, convenor of the IWG)

In accordance with Resolution 4.12, the current work being carried out on autecological studies of the Priority List of species (*Rhinolophus euryale*, *Myotis capaccinii* and *Miniopterus schreibersii* should be updated by the Advisory Committee and should be made public.

1. Questionnaire on roost choice

As part of this task, a questionnaire on roost choice by the three species has been prepared by the Intersessional Working Group. This questionnaire intends to fulfil one research priorities: "investigating the microclimate of roosts (temperature, humidity) along the seasons in order to identify bat choices" (Doc. EUROBATS.AC11.17).

Parties and range states were requested to answer this questionnaire by giving the number of known roosts for each category of the main topics in the three different "bat" seasons (summer, winter and transit). The deadline was 15 April 2008.

The EUROBATS Secretariat and the convenor received contributions from 20 countries (table 1). Some of these answers are qualitative (Azerbaijan, Bosnia and Herzegovina), or do not account for all the sites (France, Greece, and probably Italy, Romania).

On this basis it seems still useless to analyse the answers, and we do expect a real effort to obtain data that could provide valuable information over the European range of the three species. We warmly thank the colleagues who already sent information and urge focal points of the other countries to fulfil the questionnaire by the next weeks.

Table 1: Number of roosts per country used by the three species of the Eurobats Priority list according to the answers to the questionnaire of the Intersessional Working Group (- : absence of the species, + : qualitative data, # : number of known roosts, * data still totally lacking).

	Rhinolophus euryale			*Miniopterus schreibersii*			*Myotis capaccinii*		
	N	H	T	N	H	T	N	H	T
Albania *									
Armenia	+	+	-	+	+	+	-	-	-
Austria	-	-	-	-	-	-	-	-	-
Azerbaijan	-	-	-	-	-	+	-	-	-
Bosnia and Herzegovina	+			+					
Bulgaria *									
Croatia	13	7	0	18	5	0	11	4	0
Cyprus	-	-	-	4	-	-	-	-	-
France	34	39	46	38	44	84	2	3	3
Georgia	6	2		2	3		-	-	-
Gibraltar	-	-	-	-	-	1	-	-	-
Greece				11	2	10	1	0	1
Hungary	3	3	11	6	4	8	-	-	-
Italy	8	5	5	22	15	24	13	2	12
Macedonia	7	-	-	3	-	-			
Malta	-	-	-				-	-	-
Montenegro *									
Portugal	3	11	11	12	16	31	-	-	-
Romania	9	9	-	48	48	-	7	7	-
Russia	1	1	0	2	8	8	-	-	-
San Marino *							-	-	-
Serbia *									
Slovakia	5	2	1	1	2	1	-	-	-
Slovenia	4	2	0	3	3	1	1	3	0
Spain *									
Switzerland	-	-	-				-	-	-
Turkey *									

2. References of papers and reports dealing with autecological studies

Parties and range states are also reminded to send to Stéphane Aulagnier (convenor of the IWG) references of all papers and reports dealing with foraging areas (using radiotelemetry or other suitable techniques) and diet (faecal analyses), as well as studies of population structure, including metapopulation structuring (using genetic analyses, morphometrics or echolocation calls) and dispersal (flying paths when commuting from the roost to the foraging areas and when moving between seasonal roosts).

3. Studies on population structure, including dispersal.

Rhinolophus euryale

Whitaker J.O. & Karatas A., 2009. Food and feeding habits of some bats from Turkey. *Acta Theriologica*, 11(2): 393-403.

Goiti U., Garin I., Almenar D. *et al*., 2008. Foraging by Mediterranean horseshoe bats (*Rhinolophus euryale*) in relation to prey distribution and edge habitat. J*ournal of Mammalogy*, 89(2): 493-502.

We studied the effect of habitat type and prey availability on the foraging decisions of the Mediterranean horseshoe bat (*Rhinolophus euryale*), a species specialized for cluttered environments. We modeled seasonal habitat selection using radiotelemetry in relation to prey availability in a heterogeneous landscape, determined seasonal diet and prey selection, and used geographic information system data to characterize the landscape surrounding 10 breeding colonies in order to assess the radiotracking results at the population level. Although *R. euryale* typically has been associated with woodland, our results suggest that the existence of edge habitat, created by semicluttered structures such as hedgerows and woodland edges, was a significant factor in the choice of foraging areas by these bats. Edge habitat was associated with meadows and pastures, creating a landscape highly suited to moths, the preferred prey of *R. euryale*. In the study area, however, moths were evenly distributed among habitat types; therefore, distribution of moths cannot explain the preference of these bats for semicluttered habitats. The results of our study are consistent with the presumed origin of *R. euryale* in an edgerich ecosystem (i.e., the savannahs of northern Africa) and establish a new paradigm for how this species uses habitat. This new paradigm, which might also apply to other members of the genus in Europe, should prompt reconsideration of the presumed habitat requirements for this species, and should be incorporated into the conservation policies for the Mediterranean horseshoe bat.

Myotis capaccinii

Papadatou E., Butlin R.K., Pradel R. *et al*., 2009. Sex-specific roost movements and population dynamics of the vulnerable long-fingered bat, *Myotis capaccinii*. *Biological Conservation*, 142(2): 280-289.

The roosts of many IUCN-listed cave-roosting bat species are under threat from tourist development in SE Europe and other regions of the world. Much-needed conservation strategies require, among other information, an understanding of their roost movements and population dynamics, which can now be obtained relatively quickly using advanced models. We have studied the long-fingered bat, *Myotis capaccinii*, an obligate cave-dweller, in Dadia National Park, Greece. The species formed colonies of up to a few thousand individuals and was highly mobile, frequently switching summer roosts up to 39 km apart, even during late pregnancy. The bats migrated to distant hibernacula including a cave in Bulgaria 140 km NW of the Park. Adult recapture probabilities varied with season and sex: low female recapture rates in autumn, relative to spring and summer, indicated non-random temporary emigration following nursery colony dispersal. The opposite pattern was seen in males: increasing recapture rates in the autumn suggest that males gather in these roosts to mate with females in transit. Adult survival (0.86-0.94) was similar in females and males, similar in winter and summer, and comparable to recent estimates for other bats based on similar modelling techniques. Sex-based differences in juvenile recapture suggest female philopatry and male-biased dispersal. Our work shows that protection of M. capaccinii roosts must extend beyond the Park's and indeed the country's boundaries: its conservation requires large-scale, trans-national integrated conservation plans. Our results will apply to many other warm-temperate species with similar life history cycles.

Aihartza J., Almenar D., Salsamendi E. *et al*., 2008. Fishing behaviour in the long-fingered bat *Myotis capaccinii* (Bonaparte, 1837): an experimental approach. *Acta Theriologica*, 10(2): 287-301.

To study the fishing behaviour of *Myotis capaccinii*, we performed an experiment in a flight tent containing an artificial pond. We recorded the behaviour of two groups of bats - eight individuals from two different roosts - using IR video camcorders and ultrasound detectors, and evaluated diet by analyzing faeces. Nightly, increasing amounts of fish were released in the pond. Our data show that *M. capaccinii* is able to exhibit fishing behaviour when fish occur in high densities in shallow waters, gaffing live fish from the water using their hind feet. They were attracted neither by dead fish floating, nor by ripples made by fishes feeding on the water surface. Bats showed a specific fishing behaviour with two main foraging patterns: i) long series of circular flights, skimming along the water and dipping in softly twice or three times in each roundabout; ii) long figure-eight loops with bats flying faster and higher, swooping down oil the centre of the pond, where they snapped their hind feet hard into the water. Compared with the echolocation calls used to catch insects from the water's surface in the wild, terminal buzzes were incomplete during the dips made to fish. Buzz II were always lacking, and buzz I had much longer inter-pulse intervals. This suggests that they were not pursuing specific targets but dipping randomly. We propose a scenario in which fishing behaviour occurs in the wild, linked to the seasonal drought of small ponds, marshes, or channels where large numbers of small fish become readily available and thus a profitable resource.

Almenar D., Aihartza J., Goiti U. *et al*., 2008. Diet and prey selection in the trawling long-fingered bat: *Journal of Zoology*, 274(4): 340-348.

The diet of the long-fingered bat *Myotis capaccinii* is poorly known, and there is no previously recorded information on this species' prey preferences. To investigate these subjects, we captured 51 individuals at a nursery cave in the Iberian Peninsula, from pre-breeding to post-lactation seasons. Each bat's diet composition was assessed by faecal content analysis and its foraging places (rivers, pools and channels) identified by radio-telemetry. To estimate prey availability, we sampled arthropods in the individual bats' identified foraging places and also emulated the bats' hunting technique. The bats' diet comprised of arthropods, dominated by small insects with aquatic larvae and flying adult phases. The most consumed taxon was Nematocera (mainly Chironomidae), including adults and pupae, which were also found to be the most abundant prey over water. Other frequently consumed prey were brachycerans, lepidopterans, arachnids, trichopterans and neuropterans. Diet proportions were compared with prey availability to infer a rank of preferences. The preferred prey were lepidopterans and arachnids, both having a terrestrial life cycle and a bigger size than any other taxa consumed. Without discarding the possible underestimation of prey's aerial availability, the observed preference pattern seems to be a consequence of selection for size more than for specific taxa. Apparently *M. capaccinii* efficiently exploit water-related prey according to availability when the bats hunt low over the water's surface, and are also able to take more profitable prey found higher in the air.

Papadatou E., Butlin R.K. & Altringham J.D., 2008. Seasonal roosting habits and population structure of the long-fingered bat *Myotis capaccinii* in Greece. *Journal of Mammalogy*, 89(2): 503-512.

The long-fingered bat *Myotis capaccinii* (Bonaparte, 1837) is considered rare and is listed as vulnerable on the IUCN Red List of Threatened Species (2007). It remains one of the least studied bats in Europe. Protection of roosts is fundamental to bat conservation but, for it to be effective, knowledge about roosting ecology is required, We evaluated roosting habits, colony structure, and colony composition of M. capaccinii in the National Park of Dadia-Lefkimi-Soufli in Greece during 2002-2004 at 6 underground sites. We report results from regular capture of marked individuals and measures of roost microclimate. Individuals formed large maternity colonies in spring. Parturition began in April and by the end of May all captured females had given birth. The 1st volant young appeared in late June and almost all were weaned by the end of July. Summer colonies were sexually segregated; few males were present in the nursery roosts. Adult females began to disperse in August and the proportion of males increased through September and October. Young born in the year remained in the roosts after the females had left. *M. capaccinii* selected summer roosts with a wide range of temperatures, tolerating temperatures as low as 11.2°C, probably because of the thermoregulatory benefits of aggregating in single- and multispecies clusters. Few individuals remained in these sites during the winter. The majority of females appeared to reach sexual maturity in their first autumn and most males did so in their second year. Body mass of males increased steadily from spring through to autumn, whereas mass of females only increased in the autumn before hibernation, except for the additional weight of the fetus during pregnancy, implying that reproduction imposes energetic constraints on females

Biscardi S., Russo D., Casciani V. *et al*., 2007. Foraging requirements of the endangered long-fingered bat: the influence of micro-habitat structure, water quality and prey type. *Journal of Zoology*, 273(4): 372-381.

Myotis capaccinii is one of the most endangered Mediterranean bats. We radio tracked 21 adult individuals to assess foraging range and analyse micro-habitat selection around a nursery roost in central Italy. Habitats were characterized by development of riparian vegetation, distance between banks, degree of water clutter and levels of water pollution (expressed by macro-benthic bioindicators). Diet was also analysed to see whether prey rarity might account for species decline. *Myotis capaccinii* proved highly mobile: the maximum straight line distance between roost location and the farthest foraging fix recorded on one night was c. 21 km, whereas this variable averaged 7.5 km for the entire study. In general, the species preferred calm waters bordered by well-developed riparian vegetation and large (> 5 m) inter-bank distances. Such factors determined the overall quality of foraging sites. Although diet was dominated by pollution-tolerant insects such as *Chironomus* midges, bats preferred less polluted waters. Our study also confirmed the occurrence of piscivory in this bat. Of the factors potentially responsible for species endangerment, the most likely are general habitat degradation, that is alteration of riparian vegetation and pollution, and cave roost loss. Given the large ecological niche overlap, increasing *Myotis daubentonii* may be outcompeting *M. capaccinii*. The most urgent actions to preserve M. capaccinii are extensive restoration of riparian vegetation and strict roost protection. Our study offers indications about where, and how, restoration of riparian vegetation may translate into best conservation results.

Davy C.M., Russo D. & Fenton M.B., 2007. Use of native woodlands and traditional olive groves by foraging bats on a Mediterranean island: consequences for conservation. *Journal of Zoology*, 273(4): 397-405.

We recorded bat activity on Zakynthos island (Greece) to test the hypotheses that (1) olive (*Olea europea*) groves and native woodlands provide comparable foraging habitat for insectivorous bats, (2) lower foraging activity occurs in olive groves treated with insecticide chemicals. We acoustically sampled bat activity (passes per minute) in four wooded habitats (organic and non-organic olive groves, oak woodland (*Quercus ilex* and *Quercus coccifera*) and pine (*Pinus halepensis*) woodland from June to August 2005. Habitat type did not affect overall bat activity. A single application of insecticide chemicals annually did not affect activity over traditional olive groves. Habitat use on the island differed in several ways from that reported in studies at mainland sites. Most strikingly, pine woodland supported higher bat activity than expected relative to other habitat types, and we recorded unexpectedly high levels of *M. capaccinii* activity in woodland habitats. We suggest that traditional olive groves buffer some bat species from the effects of deforestation. Conservation plans for Mediterranean bats should consider the biodiversity value of these groves along with the need to conserve small woodland patches. Finally, understanding island-specific patterns of habitat use is essential to bat conservation on small off-shore islands.

Miniopterus schreibersii

Rodrigues L., Pereira M.J.R., Rainho A. et al., 2010. Behavioural determinants of gene flow in the bat *Miniopterus schreibersii*. *Behavioral Ecology and Sociobiology*, 64(5): 835-843.

Dispersal and migratory behaviours are often important determinants of gene flow in wild species, and we have studied their role using ringing-recapture data in the Portuguese population of *Miniopterus schreibersii*, a cave-dwelling bat that forms large maternity colonies. Juvenile dispersal, usually a major agent of gene flow, appears to be negligible, as young females never settled to give birth in foreign colonies. Likewise, there was virtually no dispersal of adult females to foreign maternity colonies. This strong philopatry virtually eliminated female-mediated gene flow, but we found a great potential for male-mediated gene flow among colonies, as regional migrations temporarily joined both sexes from different colonies in the same roosts, during the mating season. In fact, females from some colonies were more likely to mate with males from foreign colonies than from their own, thus potentially bringing home genes of foreign males. In spite of this abundant gene flow, we found a pattern of isolation by distance and even strong barriers to gene flow, which is explained by the fact that migrations were usually too short to allow direct flow among distant colonies. We concluded that potential gene flow is influenced by the distance between colonies and the availability of mating roosts between them. In addition, we found this flow to be asymmetrical, with a dominant direction from the largest to the smallest colonies. Our ringing-recapture estimates of potential gene flow based on dispersal and migratory behaviour are compatible with the genetic structure of the population for both nuclear and mitochondrial DNA. Our conclusions have implications for the conservation of bats with a spatial behaviour similar to that of *M. schreibersii*. Colonies should be managed individually because strict female philopatry not only promotes their isolation but also minimises the contribution of immigration in rescuing declining colonies. Furthermore, the results underline the importance of preserving mating roosts to maintain gene flow among colonies.

Pereira M.J.R., Salgueiro P., Rodrigues L. et al., 2009. Population structure of a cave-dwelling bat, *Miniopterus schreibersii*: Does it reflect history and social organization? *Journal of Heredity*, 100(5): 533-544.

Many colonial bat species make regional migrations, and the consequent gene flow may eliminate geographic genetic structure resulting from history of colonization. In this study, we verified that history and social organization have detectable impacts on the genetic structure of *Miniopterus schreibersii*, a cave-dwelling bat with high female philopatry. After studying all known nursing colonies in Portugal, we concluded that there is a significant geographic structure and that the overall pattern is similar for mitochondrial and nuclear DNA. Both pairwise Phi(ST) and F-ST were significantly correlated with geographical distance, suggesting that isolation by distance is relevant for both mitochondrial and nuclear markers. However, structuring of mitochondrial DNA was much more marked than that of nuclear DNA, a consequence of the strong female philopatry and a bias for male-mediated gene flow. Wintering colonies were more genetically diverse than nursing colonies because the former receive individuals from distinct breeding populations. Haplotype diversity of the northern colonies, the more recent according to population expansion analyses, is only about half of that of the central and southern colonies. This is most likely a consequence of the colonization history of *M. schreibersii*, which presumably expanded northward from the south of the Iberian Peninsula or North Africa after the last glacial age

Lourenco S. & Palmeirim J.M., 2008. Which factors regulate the reproduction of ectoparasites of temperate-zone cave-dwelling bats? *Parasitology Research*, 104(1): 127-134.

We studied the factors which regulate the reproduction of ectoparasites of temperate-zone cave-dwelling bats, using the Schreiber's bat (*Miniopterus schreibersii*) and its ectoparasites as a model. For this, we searched 969 bats during 2003 and 2004 at important stages of the bat yearly cycle and found four ectoparasite species regularly occurring on them: two nycteribiids (*Nycteribia schmidlii* and *Penicillidia conspicua*), one wing mite (Spinturnix psi), and one hard tick (*Ixodes simplex simplex*). These parasites were present throughout the yearly cycle, but their

reproductive activity greatly fluctuated seasonally. Also, we found that sex, age, and reproductive status of the host strongly influenced the reproductive activity of parasites. Overall, the four parasite species had a similar reproductive pattern, reproducing more intensively during the pregnancy and nursing seasons of *M. schreibersii*, mainly on pregnant and juvenile bats. Moreover, parasites greatly reduced reproductive activity during winter, while bats were in deep torpor or hibernating. We conclude that reproduction in ectoparasites of *M. schreibersii* and of many other temperate cave-dwelling bats is mostly regulated by the reproductive cycle of their bat hosts, but also limited by roost temperatures during winter. The fact that the reproductive cycle of parasite species of such distinct taxonomic groups are similarly adjusted to that of their bat host suggests that this adjustment is a highly adaptive trait.

Lourenco S.I. & Palmeirim J.M., 2008. How do ectoparasitic nycteribiids locate their bat hosts? *Parasitology*, 135(10): 1205-1213.

Nycteribiids (Diptera: Nycteribiidae) are specific haematophagous ectoparasites of bats, which spend nearly all their adult lives on hosts. However, females have to leave bats to deposit their larva on the walls of the roosts, where they later emerge as adult flies. Nycteribiids had thus to evolve efficient sensorial mechanisms to locate hosts from a distance. We studied the sensory cues involved in this process, experimentally testing the role of specific host odours, and general cues such as carbon dioxide, body heat, and vibrations. As models we used two nycteribiids (*Penicillidia conspicua* and *Penicillidia dufourii*) and their primary bat hosts (*Miniopterus schreibersii* and *Myotis myotis*, respectively). Carbon dioxide was the most effective cue activating and orientating the responses of nycteribiids, followed by body heat and body odours. They also responded to vibration, but did not orientate to its source. In addition, sensory cues combined (carbon dioxide and body heat) were more effective in orientating nycteribiids than either cue delivered alone. Results suggest that nycteribids have some capacity to distinguish specific hosts from a distance, probably through their specific body odours. However, the strong reliance of nycteribiids on cues combined indicates that they follow these to orientate to nearby multispecies bat clusters, where the chances of finding their primary hosts are high. The combination of sensory cues seems therefore an effective strategy used by nycteribiids to locate bat hosts at a distance

Bilgin R., Karatas A., Coraman E. *et al*., 2008. Regionally and climatically restricted patterns of distribution of genetic diversity in a migratory bat species, *Miniopterus schreibersii* (Chiroptera : Vespertilionidae). *BMC Evolutionary Biology*, 8: 209.

Background: Various mechanisms such as geographic barriers and glacial episodes have been proposed as determinants of intra-specific and inter-specific differentiation of populations, and the distribution of their genetic diversity. More recently, habitat and climate differences, and corresponding adaptations have been shown to be forces influencing the phylogeographic evolution of some vertebrates. In this study, we examined the contribution of these various factors on the genetic differentiation of the bent-winged bat, *Miniopterus schreibersii*, in southeastern Europe and Anatolia. Our results showed differentiation in mitochondrial DNA coupled with weaker nuclear differentiation. We found evidence for restriction of lineages to geographical areas for hundreds of generations. The results showed that the most likely ancestral haplotype was restricted to the same geographic area (the Balkans) for at least 6,000 years. We were able to delineate the migration routes during the population expansion process, which followed the coasts and the inland for different nested mitochondrial clades. Hence, we were able to describe a scenario showing how multiple biotic and abiotic events including glacial periods, climate and historical dispersal patterns complemented each other in causing regional and local differentiation within a species

Garin I., Aihartza J., Agirre-Mendi P.T. et al., 2008. Title: Seasonal movements of the Schreibers' bat, *Miniopterus schreibersii*, in the northern Iberian Peninsula. Italian *Journal of Zoology*, 75(3): 263-270.

The movements of the Schreibers' bat, *Miniopterus schreibersii*, in the regions of Navarre, La Rioja, and the western Basque Country were studied on a seasonal basis by means of ringing and recapture data. A total of 3014 bats were ringed in the study area, with recaptures accounting for 198. We found only three breeding colonies and no hibernacula in the study area. Distances between capture sites averaged 77km (range 0-258km) and varied seasonally. Distances between spring colonies and between autumn colonies were the shortest, whereas distances between spring and breeding colonies and between breeding and autumn colonies were the longest, as many bats moved to and from nursery roosts located outside of and far from the study area. The bats in the study area are part of a larger population that, at a minimum, extends over the central northern half of the Iberian Peninsula. Presumably individuals from different subpopulations mixed in the nursery roosts, returning to their respective quarters from autumn to spring. Both males and females joined the common breeding colonies, although a high proportion of males remained sedentary.

Rodrigues L. & Palmeirim J.M., 2008. Title: Migratory behaviour of the Schreiber's bat: when, where and why do cave bats migrate in a Mediterranean region? *Journal of Zoology*, 274(2): 116-125.

Regional migrations are important elements of the biology of bats, but remain poorly understood. We obtained a large dataset of recoveries of ringed *Miniopterus schreibersii* to study the patterns and drivers of migration of a Mediterranean cave-dwelling bat. In spite of the mildness of Mediterranean winters, in average years bats hibernated, and few movements were recorded during this period. After hibernation, females migrated to spring roosts, and again to maternity roosts just before parturition. This late arrival at nurseries could be a strategy to avoid a harmful build-up of parasites. Soon after the juveniles were weaned, the mothers migrated to the roosts where they spent autumn and sometimes also winter. Juveniles remained in the warm nurseries longer, presumably because high roost temperatures speed up growth. The pattern of migration of males was similar to that of females, but they left hibernacula later and remained more mobile during the maternity season. They also arrived at the hibernacula later, possibly because they needed time to build up fat stores after the energetically costly mating season. Maternity colonies spent the yearly cycle in well-defined home ranges (mean=19 030 km^2), which overlapped greatly. Bats were furthest from the maternity sites during hibernation, but even then 80% remained within 90 km of them. Each hibernaculum attracted bats from multiple nurseries, from within a mean range of 10 770 km^2. We tested two potential drivers for migration - temperature in the roosts and at the foraging areas - but our results supported only the first one. Bats migrated to reach the roosts most thermally suited for each phase of their life cycle, indicating that roost temperature and associated metabolic advantages are key drivers for regional migrations of cave-dwelling bats

Lourenco S.I. & Palmeirim J.M., 2007. Title: Can mite parasitism affect the condition of bat hosts? Implications for the social structure of colonial bats. *Journal of Zoology*, 273(2): 161-168.

Ectoparasitism may be recognized as one of the main costs of coloniality, but little is known about how it affects the fitness and social structure of bats, the most gregarious of mammals. We studied these issues using the colonial bat *Miniopterus schreibersii* and its haematophagous parasitic mite *Spinturnix psi* as a model. Body condition is an important indicator of individual fitness that is potentially affected by ectoparasitism. Thus, we measured host body condition and mite loads in a total of 969 bats throughout the annual cycle. Mites were rare while hosts hibernated, increased in abundance in spring and peaked during nursing season of bats, when they were particularly abundant on lactating females and young bats. This strong seasonal variation in mite loads is related to the reproductive cycle of mites, which in turn appears to be synchronized with the reproductive cycle of their hosts. Mite loads and the condition of bats were negatively correlated, and information available suggests that this may be due to an effect of parasitism, although other possible causes for this trend cannot be excluded. However, a negative correlation was only observed during the bat's nursing season, when mites were most abundant, and heavily parasitized bats lost about 10% of their weight. Mite parasitism did not seem to be a significant disadvantage of coloniality, except in nurseries, where it might impose some costs. However, as females and young usually aggregate in these colonies, we presume that for them such costs are probably offset by advantages of group living. Adult males, however, are usually absent from nurseries, which may be a strategy to minimize mite parasitism. Overall, the results suggest that ectoparasitism may play a role in determining the social structure of *M. schreibersii* and of many other temperate bats that have similar life cycles and ectoparasitic loads.

Amengual B., Lopez-Roig M. & Serra-Cobo J., 2007. First record of seasonal over sea migration of *Miniopterus schreibersii* and *Myotis capaccinii* between Balearic Islands (Spain). *Acta Chiropterologica*, 9(1): 319-322.

Annex 1 : Roost choice of Rhinolophus euryale

1. Number of roosts per roost types

Type	N	**H**	**T**	**Remarks (not necessary)**
Cave	39	22	19	
Artificial underground shelter	4	10	7	
Overground shelter (*building, attic, other – please specify*)	2		2	Building (2N, 1T), bridge (1T))
Total	*45*	*32*	*28*	

2. Number of individuals per roost

Count	**N**	**H**	**T**	Remarks
10 - 100	31	18	16	
100 – 500	9	9	7	
500 – 1.000	1	2	2	
1.000 – 10.000	4	2	2	
> 10.000				

3. Counting methodology

Counting methodology	**N**	**H**	**T**	**Remarks**
Direct count	31	13	11	
Surface estimation (m^2)	6			
Multiply up from sample count	3		4	
Tally counters at cave entrance				
Photo	8	6		
Digital video camera / IR / nightvision	4	2		
Capture/mark/ recapture			1	

4. **Roost substrate** (natural caves and mines)

Stone type	**N**	**H**	**T**	**Remarks**
Limestone	31	15	11	
Volcanic rocks	1	1	1	
Sandstone	1			
Other *(please specify)*				

5. Influence of external climate

Distance from the cave entrance	**N**	**H**	**T**	**Remarks**
At the entrance (influence of light)	10		1	
In the part influenced by ext. climate	13	9		
Deep in the cave/mine (stable conditions)	11	5	10	

6. Habitat around the roosts

Altitude	**N**	**H**	**T**	**Remarks**
0 – 200 m asl	25	9	6	
200 – 800 m asl	20	23	18	
> 800 m asl	1	4	3	
Distance from water bodies	**N**	**H**	**T**	**Remarks**
0 -100 m	20	14	9	
100 – 1000 m	12	6	1	
> 1000 m	5	7	12	
Vicinity of forest	**N**	**H**	**T**	**Remarks**
In forest	22	11	10	
Close to forest	7	4	1	
Far from forest	6	1		

7. Microclimate measurements

Method	**N**	**H**	**T**	**Remarks**
Continuous/ dataloggers/ thermohygrograph or similar	5	5		
Basic pocket equipment (*how many times per year*)	6	3		
Other (thermal camera, laser) (*how many times per year*)	3	1	11	

8. Other species present in the roosts *(with more than 10 individuals)*

Species	**N**	**H**	**T**	**Remarks**
Rhinolophus ferrumequinum	7	10	2	
Rhinolophus hipposideros	4	10	4	
Rhinolophus blasii		2		
Rhinolophus mehelyii	+	+	+	
Miniopterus schreibersii	14	3	2	
Myotis myotis	1	2	2	
Myotis blythii	9	1	1	
Myotis emarginatus	9	1		
Myotis capaccinii	8	1		
Myotis nettereri	+		+	
Eptesicus serotinus				
Pipistrellus pipistrellus		1		

9. Sites with current threats

Type	**N**	**H**	**T**	**Remarks**
Caves	10	6	12	
Artificial underground shelters	2	4	3	
Overground shelter (*building, attic, other – please specify*)	1		1	

10. Number of roosts per roost types

Type	N	**H**	**T**	**Remarks (not necessary)**
Cave	19	36	42	
Artificial underground shelter	5	3	1	
Overground shelter (*building, attic, other – please specify*)	10		3	Attic, indust. building, sleeping room, church
Total	*34*	*39*	*46*	

11. Number of individuals per roost

Count	**N**	**H**	**T**	Remarks
10 - 100	13	22	29	
100 – 500	19	9	13	
500 – 1.000	8	5	3	s
1.000 – 10.000	3	3	1	
> 10.000				

12. Counting methodology

Counting methodology	**N**	**H**	**T**	**Remarks**
Direct count	10	7	14	
Surface estimation (m^2)		1		
Multiply up from sample count				
Tally counters at cave entrance	6			
Photo	2	3		
Digital video camera / IR / nightvision				
Capture/mark/ recapture				

13. Roost substrate (natural caves and mines)

Stone type	**N**	**H**	**T**	**Remarks**
vLimestone	12	11	12	
Volcanic rocks				
Sandstone				
Other *(please specify)*				

14. Influence of external climate

Distance from the cave entrance	**N**	**H**	**T**	**Remarks**
At the entrance (influence of light)	4	1		
In the part influenced by ext. climate	6	3	5	
Deep in the cave/mine (stable conditions)	4	8	6	

15. Habitat around the roosts

Altitude	**N**	**H**	**T**	**Remarks**
0 – 200 m asl	12	11	18	
200 – 800 m asl	21	27	24	
> 800 m asl				
Distance from water bodies	**N**	**H**	**T**	**Remarks**
0 -100 m	19	8	17	
100 – 1000 m	13	16	18	
> 1000 m	1	8	6	
Vicinity of forest	**N**	**H**	**T**	**Remarks**
In forest	15	28	27	
Close to forest	17	7	15	
Far from forest	1	2	2	

16. Microclimate measurements

Method	**N**	**H**	**T**	**Remarks**
Continuous/ dataloggers/ thermohygrograph or similar	2	1	1	
Basic pocket equipment (*how many times per year*)	6	6	6	
Other (thermal camera, laser) (*how many times per year*)				

17. Other species present in the roosts *(with more than 10 individuals)*

Species	**N**	**H**	**T**	**Remarks**
Rhinolophus ferrumequinum	4	5	1	
Rhinolophus hipposideros	1	2		
Miniopterus schreibersii	7	5	7	
Myotis myotis	5	4	+	
Myotis blythii	1		1	
Myotis emarginatus	2	2		
Myotis capaccinii	1		1	

18. Sites with current threats

Type	**N**	**H**	**T**	**Remarks**
Caves	6	5	6	
Artificial underground shelters				
Overground shelter (*building, attic, other – please specify*)	2			