

**New ecological data on the noctule bat**  
**(*Nyctalus noctula* Schreber, 1774)**  
**(Chiroptera, Vespertilionidae) in two towns of Spain**

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*Summary.* – The Iberian Peninsula represents the South-western limit of distribution of the noctule bat (*Nyctalus noctula*) in Europe. We present here new ecological and behavioural data for the noctule bat in parks of two towns of Navarra (Northern Spain) which demonstrate its continuous presence throughout the year. Between 1995 to 1998, 148 individuals have been marked and located in 56 shelters. Groups mainly consisted of sedentary males ; there were very few females in April-August but they were quite common living in harems during the mating season (September-November). The unusual scarcity of females in relation to males found during autumn 1997 is also commented.

*Résumé.* – La Péninsule ibérique représente la limite méridionale de répartition de la noctule commune en Europe. Nous présentons des nouvelles données écologiques du comportement de cette espèce dans des parcs de deux villes de Navarre (Nord de l'Espagne) qui prouvent sa présence continue toute l'année. Entre 1995 et 1998, 148 individus ont été bagués et 56 refuges ont été localisés. Les groupements observés sont composés de mâles sédentaires ; d'avril à août, on a trouvé peu de femelles ; en revanche, pendant l'accouplement (septembre à novembre) elles sont assez communes et se réunissent en harems. On montre aussi la rareté des femelles par rapport aux mâles en automne 1997.

## INTRODUCTION

The common noctule is a bat with a large distribution in the Palearctic region. It is found from the Iberian Peninsula (and possibly North Africa) to Japan and the south-east of Asia (Lanza and Finotello 1986). It has a great capacity of flight and is able to undertake migratory movements of several hundred of kilometres. Migratory patterns registered in Western Europe were essentially limited to NE-SW movements (Sluiter and Van Heerdt 1966 ; Strelkov 1969 ; Gaisler *et al.* 1979 ; Roer 1984 ; Aellen 1984). Nevertheless, some European colonies made up of sedentary males have also been registered (Stutz and Haffner 1986 ; Kronwitter 1988 ; Spitzenberger 1992), suggesting that migratory behaviour may affect only part of the populations in some cases.

In Western Europe, breeding colonies of noctule bat are generally found to the north of the Alps while hibernation sanctuaries have been recorded not only in this area but also further south, i.e. southern France and Germany, Austria and Switzerland (Sluiter and Van Heerdt 1966 ; Stutz and Haffner 1986 ; Kronwitter 1988 ; Spitzenberger 1992 ; Roer 1997 ; Strelkov 1997).

In the Iberian Peninsula, this bat reaches its meridional limit of distribution and appears to be very rare. In Portugal, it has been cited only once back in the beginning of this century (Palmeirim 1990). In Spain, although it has been mentioned in more than ten occasions (Benzal *et al.* 1991 ; SECEMU 1996 ; Ruedi *et al.* 1998) ; most of records are old and based on doubtful identifications (Benzal *et al.* 1991 ; Ibáñez *et al.* 1992 ; Ruedi *et al.* 1998). In fact, for the last 30 years, the common noctule has been reliably recorded only in four places in Spain (Fig. 1) : Guadalajara in 1989 (Benzal *et*

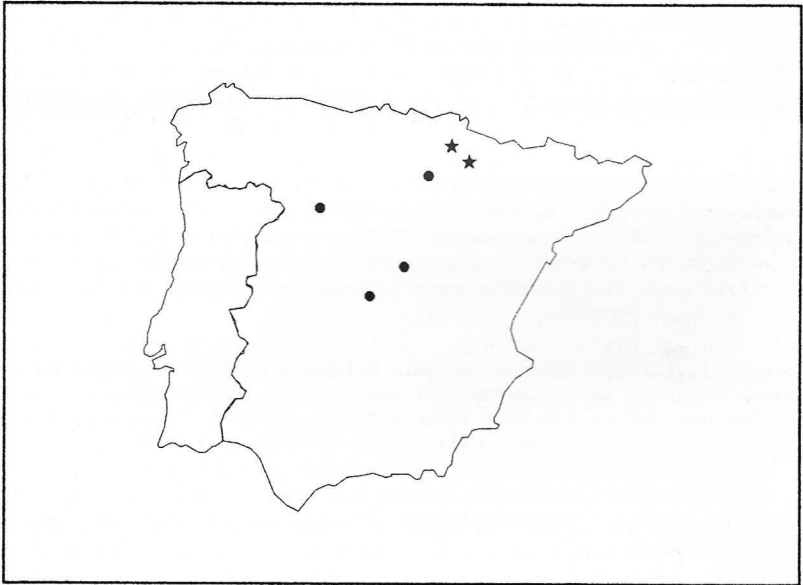


Fig. 1. – Iberian references of *Nyctalus noctula* in the last 30 years.

• : Bibliographic references. \* : New data.

*al.* 1991) ; San Román de Hornijos, Valladolid in 1983 (Ibáñez *et al.* 1992) ; Ribafrecha, La Rioja in 1994 (Agirre-Mendi 1996) ; and Aranjuez, Madrid in 1997 (Ruedi *et al.* 1998). These scarce data and the migratory behaviour of this species elsewhere in Europe suggested that these individuals might be seen sporadically in the Iberian Peninsula due to the seasonal migration (Ibáñez *et al.* 1992 ; Agirre-Mendi 1996). The presence of two apparently subadult females found in Spain (without exact location) and conserved at the Natural History Museum of London, raised the possibility of the common noctule bat to breed in its Spanish grounds (Ibáñez *et al.* 1992), as it has recently been proved (Ruedi *et al.* 1998). The aim of this paper is to further substantiate the presence of the common noctule as a permanent species inhabiting Northern Spain and give additional ecological data about these marginal populations.

## MATERIAL AND METHODS

Bats have been searched in the parks of the most important towns in Navarra (Northern Spain), within the area included in a circle of a 100 km radius from Pamplona. These towns included Sangüesa, Tudela, Buñuel, Estella, Tafalla, Irurzun, Alsasua, Lodosa and Ochagavía. Since colonies and shelters were only found in Pamplona and Sangüesa, subsequent observations were made essentially in these two cities.

Pamplona is located 480 m a.s.l. on the river Arga and the smaller stream Elorz. Pamplona has several parks with plenty of aged trees (horse chestnuts, black poplars, poplars, ashes, etc.). Sangüesa is a small town located 400 m a.s.l. and 50 km to the SE of Pamplona. Old poplars are found on both sides of the river Aragón flowing through the city. Both areas belong biogeographically to the Eurosiberian region but, the region but Pamplona is located in the Atlantic Province, while Sangüesa is in the Submediterranean Province.

The research has been carried out during the years 1995-1998. Bats were primarily localized using an ultrasound detector (Ultrasound Advice Ltd., S-25) tuned at 20-24 kHz. Prospections of the parks before sunrise or even during the hottest days in late summer and autumn allowed the detection of shelters just by listening the powerful social sounds emitted by the noctules (Sluiter and Van Heerdt 1966; Gaisler *et al.* 1979; Kronwitter 1988; Limpens and Bongers 1991; Weid 1994). Since the greater noctule bat (*Nyctalus lasiopterus*) emits echolocation calls similar to that of the common noctules and lives in the same area, suspected occurrence of *Nyctalus noctula* were confirmed by subsequent captures or direct observation of bats inside their shelters and in flight. The animals were either mistnetted in the parks, or were captured with small harp traps similar to the ones used by Gaisler *et al.* (1979). These traps were placed in front of the exit holes to the tree cavities. Some specimens were incidentally found by the Public Garden Service during logging activities. All animals captured alive were ringed and released the same day on the place of capture. None of the recaptured bats had any injuries in the forearm due to the ring.

## RESULTS

Two major colonies of the common noctule bats have been found in the forested areas of Pamplona and Sangüesa (Fig. 1). A total of 146 living specimens (104 males and 42 females) have been captured, plus two males, which accidentally died after cutting the old trees where they lodged. Of these observations, 118 were made in Pamplona and 30 in Sangüesa. Twenty-nine of 177 captures were recaptured animals. The number of individuals captured each year is shown in table 1. As males are territorial

TABLE 1. - Number of noctule bats captured annually during this study.

	1995	1996	1997	1998	TOTAL
♂♂	5	7	80	14	106
♀♀	5	17	10	10	42
<b>Sex ratio</b>	1	0.41	8	1.4	<b>2.52</b>
<b>TOTAL</b>	<b>10</b>	<b>24</b>	<b>90</b>	<b>24</b>	<b>148</b>

during the mating season, and exclude other males from their cavity (Gaisler *et al.* 1979), the same individual was sampled several times in the same tree. To the contrary, periodical sampling at the same trees produced different females, as they may visit several males.

Most animals were trapped between April and November, during their annual period of activity. During the hibernation (December-March) only two specimens were captured, both were torpid bats from holes of cut trees (Table 2). Males were more frequently captured than females except from September to November when the females outnumbered the males due to the formation of harems.

TABLE 2. – Number of noctule bats captured in each period.

	<b>Dec.-March</b>	<b>April-May</b>	<b>June-Aug.</b>	<b>Sept.-Nov.</b>	<b>TOTAL</b>
♂♂	2	47	39	18	<b>106</b>
♀♀	0	6	6	30	<b>42</b>
<b>TOTAL</b>	<b>2</b>	<b>53</b>	<b>45</b>	<b>48</b>	<b>148</b>

The ringing of the captured specimens allowed identifying 22 different individuals among the 29 recaptures. Two males were recorded throughout the year. Eight noctules were found one year after their ringing, and one was found two years after initial capture. Only three females have been sighted more than once. One of them was captured in September and recaptured in April of the following year. Another one was ringed in September 1996 and recaptured in October 1998.

Most of the 56 shelters of noctule bats (48 in Pamplona and eight in Sangüesa) were cavities in trees, except seven, which were crevices in a big wall. Along with common noctules, this wall housed some common pipistrelles (*Pipistrellus pipistrellus*) and Leisler's bats (*Nyctalus leisleri*), although the different species never occupied the roost at the same time in the same fissure. The trees used as shelters by the noctules belong to different species: 14 shelters were in horse chestnut (*Aesculus hippocastanum*), 14 in white poplar (*Populus alba*), 12 in common ash (*Fraxinus excelsior*), five in poplar (*Populus nigra*), two in tree of Heaven (*Ailanthus altissima*), one in sycamore maple (*Acer pseudoplatanus*) and one in London plane (*Platanus hispanica*). The 74,5 % of occupied shelters were located near streams and river banks. During the period of study at least 12 old trees that had noctule bats have been cut.

In Sangüesa all the shelters were situated in white poplars growing in a park near the Aragón River. In Pamplona, however, shelters were more varied and were distributed among several wooden areas of the town (Fig. 2).

At least 25 of the shelters were used by males emitting powerful social sounds during the mating season both cities. Such roosts were located in 1995, 1996 and 1998, but in 1997, we failed to find such roosts because no calling males were heard. All 15 mating groups were harems made up by one adult male and one to six adult females (mean = 2.3 females; SD = 1.6). These harems were seen between mid August and early November. During this time 18 solitary males were also captured.

Five other trees were used as temporary roosts during the April-August period. The number of animals found in these temporary roosts oscillated between ten and 82

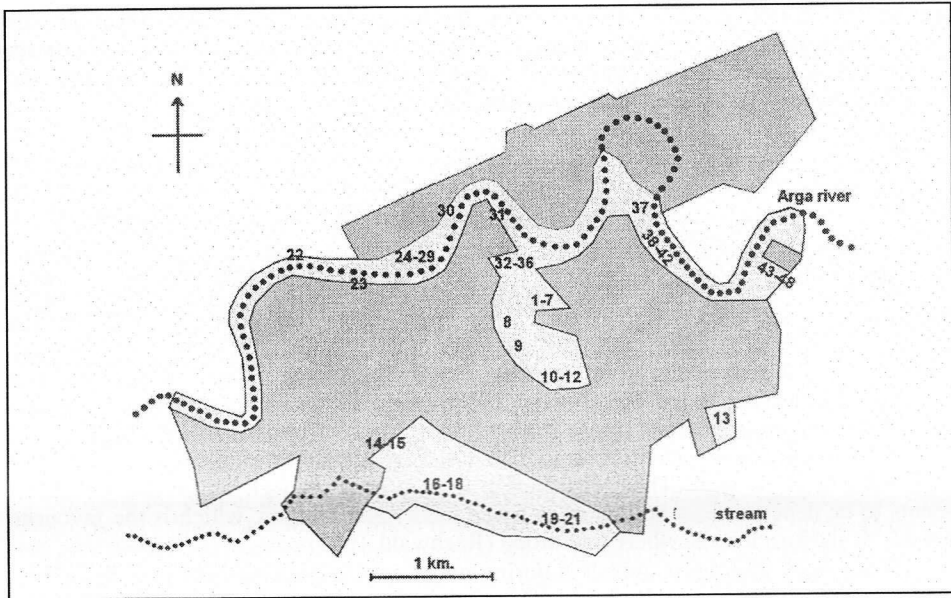


Fig. 2. – Location of the shelters found in Pamplona. Areas with buildings are marked in dark grey and forested areas are marked in light grey. Numbers 14, and from 43 to 48 are fissures in buildings, the others are tree cavities. Trees 1, 2, 3 and 37 are colony shelters.

(Table 3). In four occasions, some noctules have been captured to check the sex ratio and their reproductive status ; males were always more abundant than females in these groups. In tree number 3, many social sounds were heard during the warm winter days (1997), suggesting the presence of a hibernation colony and also bat activity in this

TABLE 3. – Multimale colonies recorded in this study. Number of males and females found in the samples are shown within brackets.

Roost	Species	Number of noctules	Date
Tree n.1 (Pamplona)	Horse chestnut	10(5♂♂, 1♀)	26-5-97
		30	27-5-97
Tree n. 2 (Pamplona)	Horse chestnut	32(4♂♂, 1♀)	18-6-97
		35	4-8-97
Tree n. 3 (Pamplona)	Horse chestnut	82(36♂♂, 6♀♀)	25-4-97
Tree n. 37 (Pamplona)	Poplar	33	20-5-97
Tree n. 45 (Sangüesa)	White poplar	21(20♂♂)	22-7-97
		12(8♂♂, 2♀♀)	9-8-97

period. No breeding colonies have been found so far in the study area, but the 18.6.1997, a pregnant female (weight: 30.5 g) was captured in Pamplona along with four males. Later on during the same year (9.8.1997), two post-breeding females and eight males (with scrotal testes) were found together in Sangüesa.

## DISCUSSION

The presence of noctule bats in the Iberian Peninsula has been considered up to now as sporadic (Benzal *et al.* 1991; Ibáñez *et al.* 1992; Agirre-Mendi 1996), but the recent finding of a breeding colony in the centre of the Peninsula has raised new questions about the real status of this species in Spain (Ruedi *et al.* 1998). Our data demonstrate the year round presence of the common noctule bats in the area of Pamplona. An important number (more than a hundred) of specimens live in the parks of this town. They use tree cavities as shelters although sometimes they may roost in crevices of a wall as well. Their distribution in this area, as well as in Central Spain, seems to be dependent on hollow trees found near water courses, which is the favourite habitat of the species elsewhere in Europe (Rachwald 1992).

From April to August, which is during pregnancy to post-weaning periods in noctule bats, the number of males exceeds that of females, which are almost absent in the sample (Table 2). However, during mating season of September through November, more females than males were detected in harems found in mating roosts. Similar patterns of occurrence of both sexes are found in Switzerland (Stutz and Haffner 1986), Austria (Spitzenberger 1992) and in southern Germany (Kronwitter 1988) where females are rarely found in spring and summer but are more abundant from August or September onwards. Most of the known breeding colonies are found further north and north-east of Spain. Only one small breeding colony is known in the Iberian Peninsula (Ruedi *et al.* 1998), which suggests that most of the females observed in Navarra come from other areas. According to Sluiter and Van Heerdt (1966) and Gaisler *et al.* (1979) noctule females are easier to detect than males during the reproductive period because the later live in small groups, or alone. Thus as no definitive evidence of breeding colonies have been found in Pamplona or Sangüesa during our survey, it is probable that they do not normally reproduce in the area.

Cranbrook and Barrett (1965) noticed a drop in the number of females in a colony from England (Suffolk) at the beginning of October. Hence they suggested that the female had a dispersing behaviour in Autumn. Sluiter and Van Heerdt (1966) and Gaisler *et al.* (1979) further confirmed an important decrease in the number of females in Holland (Utrecht) and in Slovakia and the Czech Republic (Bohemia and Moravia) at the end of August and in September respectively. Postbreeding dispersal of the females also suggest that they move to other areas for mating, where males are in rut. Sluiter and Heerdt (1966) also report migratory movements of some young females between Holland (Utrecht) and the south of France (Bordeaux) at the end of August. Ketterson and Nolan (1983) observed that partial migration in birds is a characteristic of species that have to compete for some resources in their mating or reproductive areas. Such a competition would favour at least part of the population to stay in the same area the whole year round, and avoid risky migrations. If this theory applies to noctules bats as well, then the patterns of occurrence of these bats in northern Spain suggest that the majority of females observed in Pamplona after August come from breeding colonies

found elsewhere (probably further north or north-east), while males, competing for mating refuges, would be sedentary, as observed in the present study or in Switzerland, Austria or Germany.

The scarcity of captures of females in 1997 contrasts with the prospective effort made to find the animals during this year and the knowledge of many roosts. The concomitant increase in the number of captured males makes us think that most of the females were not present in the area. The typical and powerful social sounds emitted by males were not heard and from August to November they didn't disperse to the usual mating shelters. The absence of territorial behaviour of males thus further substantiates that females were away from the area. There are no data to explain this unusual phenomenon, so it is necessary to carry out further investigations to determine what kind of factors (climatic, demographic, or any other) could affect the change of the migratory behaviour.

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#### BIBLIOGRAPHY

- AELLEN, V., 1984. – Migrations de chauve-souris en Suisse. *Bonner Zoologische Beiträge*, 34 : 3-27.
- AGIRRE-MENDI, P.T., 1996. – Presencia de tres nuevas especies de mamíferos silvestres (Clase Mammalia, subtipo Vertebrata) en la comunidad autónoma de La Rioja. *Zubia*, 14 : 9-21.
- BENZAL, J., O. DE PAZ and J. GISBERT, 1991. – Los murciélagos de la Península Ibérica y Baleares. Patrones biogeográficos de su distribución. Pp. 37-92, in : *Los murciélagos de España y Portugal*. Ed. BENZAL *et al.*, ICONA, Madrid.
- CRANBROOK, EARL of and H.G. BARRET, 1965. – Observations on noctule bats (*Nyctalus noctula*) captured while feeding. *Proceedings of the Zoological Society, London*, 144 : 1-24.
- GAISLER, J., V. HANAK and J. DUNGEL, 1979. – A contribution to the population ecology of *Nyctalus noctula* (Mammalia : Chiroptera). *Acta Sc. Nat. Brno*, 13 : 1-38.
- IBÁÑEZ, C., A. GUILLÉN, R. FERNÁNDEZ, J.L. PÉREZ and S.L. GUERRERO, 1992. – Iberian distribution of some little known bat species. *Mammalia*, 56 : 433-444.
- KETTERSON, E.D. and Jr.V. NOLAN, 1983. – The evolution of differential bird migration. Pp. 357-402, in : *Current Ornithology, volume 1*. Ed. JOHNSTON, Plenum Press, New York.
- KRONWITTER, F., 1988. – Population structure, habitat use and activity patterns of the noctule bat, *Nyctalus noctula* Schreb., 1774 (Chiroptera : Vespertilionidae) revealed by radio-tracking. *Myotis*, 26 : 23-85.
- LANZA, B. and P.L. FINOTELLO, 1986. – Biogeografia dei Chiropteri italiani. *Museo Regionale di Scienze Naturali Bolletino (Torino)*, 3 (2) : 389-420.
- LIMPENS, H.J.G.A. and W. BONGERS, 1991. – Bats in dutch forests. *Myotis*, 29 : 129-136.
- PALMEIRIM, J.M., 1990. – Bats of Portugal : Zoogeography and Systematics. *The University of Kansas Museum of Natural History, Miscellaneous Publication*, 82 : 1-53.
- RACHWALD, A., 1992. – Habitat preference and activity of the noctule bat *Nyctalus noctula* in the Białowieza Primeval Forest. *Acta Theriologica*, 37 (4) : 413-422.

- ROER, H., 1984. – Zum Herbstzug des Abendseglers (*Nyctalus noctula*) im Europäischen raum. *Myotis*, 20 : 53-57.
- ROER, H., 1997. – Erfahrungen mit einem Anlockkasten für Abendsegler (*Nyctalus noctula*) im Rheinland. *Myotis*, 35 : 41-48.
- RUEDI, M., Y. TUPINIER and O. DE PAZ, 1998. – First breeding record for the noctule bat (*Nyctalus noctula*) in the Iberian Peninsula. *Mammalia*, 62 : 301-304.
- SECEMU, 1996. – Avance del atlas de distribución de los quirópteros de España. Unpublished paper.
- SLUITER, J.W. and P.F. VAN HEERDT, 1966. – Seasonal habits of the noctule bat (*Nyctalus noctula*). *Archives néerlandaises de Zoologie*, 16 : 423-439.
- SPITZENBERGER, V.F., 1992. – Der Abendsegler (*Nyctalus noctula* Schreber, 1774) in Österreich. *Nyctalus*, 3 : 241-268.
- STRELKOV, P.P., 1969. – Migratory and stationary bats (Chiroptera) of the European part of the Soviet Union. *Acta Zoologica Cracoviensia*, 14 : 394-439.
- STRELKOV, P.P., 1997. – Nursing area and its position in range of migratory bats species (Chiroptera, Vespertilionidae) in East Europe and adjacent territories. Communication [in russian]. *Zool. Zh.*, 76 : 1073-1082.
- STUTZ, H.P. and M. HAFFNER, 1986. – The reproductive status of *Nyctalus noctula* (Schreber, 1774) in Switzerland. *Myotis*, 23-24 : 131-136.
- WEID, R., 1994. – Sozialrufe männlicher Abendsegler (*Nyctalus noctula*). *Bonner Zoologische Beitrage*, 45 : 33-38.