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SURVEYING FOR THE RARE BECHSTEIN'S BAT (*MYOTIS BECHSTEINII*) IN NORTHERN IBERIAN PENINSULA BY MEANS OF AN ACOUSTIC LURE

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ABSTRACT - In the Araba province (Basque Country, Iberian Peninsula) we surveyed for the rare Bechstein's bat (*Myotis bechsteinii*) using a recently developed method based on an acoustic lure, the Sussex AutoBat. We surveyed 16 deciduous woodlands, an irrigation pool and a cave, a total of 45 sites. The synthesized calls were played behind mist nets following an established protocol. In total, we captured 32 bats representing 6 genera and 10 species; among these, 6 *M. bechsteinii*, 3 *M. daubentonii*, 4 *Nyctalus leisleri*, 5 *Plecotus auritus*, 1 *P. austriacus*, and 1 *Barbastella barbastellus* were caught using the acoustic lure. Two of the Bechstein's bats were lactating females. By radiotracking one of them, we found the third known breeding colony for this rare species in the Iberian Peninsula. The acoustic lure proved to be a promising method for improving the trapping success of this species.

Key words: *Myotis bechsteinii*, acoustic lure, trapping effort, Spain

RIASSUNTO - ***Indagine sul Vespertilio di Bechstein* (Myotis bechsteinii) *in Spagna mediante emissioni sonore***. Il monitoraggio del Vespertilio di Bechstein (*Myotis bechsteinii*), specie rara di chirottero nella provincia di Araba (Paesi Baschi, penisola iberica), è stato effettuato mediante l'utilizzo di emissioni ultrasonore per attrarre gli animali (Sussex AutoBat). Sono stati monitorati 45 siti, distribuiti in 16 differenti boschi a latifoglie, un bacino utilizzato per scopi irrigui e una grotta. In ciascun sito sono state utilizzate reti *mist net* di varia lunghezza e sono stati emessi richiami ultrasonori in prossimità delle reti stesse, secondo una procedura standardizzata. In totale, grazie all'utilizzo delle emissioni sonore sono stati caturati 32 pipistrelli appartenenti a 10 specie, tra cui 6 *M. bechsteinii*, 3 *M. daubentonii*, 4 *Nyctalus leisleri*, 5 *Plecotus auritus*, 1 *P. austriacus*, e 1 *Barbastella barbastellus*. Due esemplari di Vespertilio di Bechstein erano femmine in allattamento. L'applicazione di un radiocollare ad una di queste femmine ha consentito di identificare mediante *radiotracking* la terza colonia riproduttiva nota nella penisola iberica per questa specie. L'uso di "esche acustiche" si è dimostrato una tecnica particolarmente efficace, in particolare nel caso di specie rare o poco contattabili.

Parole chiave: *Myotis bechsteinii*, emissioni sonore, sforzo di cattura, Spagna

INTRODUCTION

The Bechstein's bat (*Myotis bechsteinii*) shows a relatively wide distribution, ranging from Portugal to the Caucasus, Turkey, and Iran, and as far north as southern England, southern Sweden, and central Poland (Schlapp, 1999). However, it is reported to be a scarce and rare bat elsewhere, abundant only locally (DeBlase, 1980; Cerveny and Bürger, 1989; Haensel, 1991; Schlapp, 1999; Schofield and Morris, 2000; Meschede and Heller, 2003). The species is regarded as a typical woodland bat and its presence has been linked to well-preserved, mature, deciduous woodland (Schlapp, 1990; Ibáñez, 1998; Schofield and Morris, 2000; Fitzsimons *et al*., 2002; Kerth *et al*., 2002; Meschede and Heller, 2003), although breeding has also been confirmed in a few coniferous forests (Albrecht *et al*., 2002; Meschede and Heller, 2003). Summer colonies are typically located in tree holes (Cerveny and Bürger, 1989; Taake and Hildenhagen, 1989; Meschede and Heller, 2003) and rarely in buildings (Schofield and Morris, 2000; Urcun J.P., pers. comm.). In recent decades, the setting of bird and bat boxes in the forests of central Europe has considerably increased the number of *M. bechsteinii* records, particularly of breeding colonies, offering an incomparable opportunity for research (Bauer and Walter, 1977; Wolz, 1988; Schlapp, 1990; Kerth and König, 1996, 1999; Kerth *et al*., 2000 and 2001; Albrecht *et al*., 2002; Meschede and Heller, 2003). Bechstein's bats have been found hibernating in caves and underground sites (Haensel, 1991; Buchen, 2006), but due to the low numbers of individuals in such places, tree holes and rock crevices are believed to be the main hibernacula (Haensel, 1991; Cerveny and Bürger, 1989).

Compared to continental Europe, the species seems to be scarcer in the southern European peninsulas of Iberia and Italy, and in the Balkans (Vergari et al. 1998; Schlapp, 1999; Hanák *et al*., 2001; Benda *et al*., 2003). This may correspond to a lack of intensive searching, a smaller area of deciduous woodland, and the less common siting of bat boxes in southern Europe. In the Iberian Peninsula there are few but widespread records of the species, most localities corresponding to mountainous areas of the northern half (Benzal *et al*., 1991; Ibáñez *et al*., 1992; Agirre-Mendi, 1998; Alcalde and Gosá, 1998; Ibáñez, 1998; Aihartza, 2001).

The small number of records of *M. bechsteinii* throughout its range reflects the difficulty of detecting this species due to the aforementioned use of trees as their basic year-round shelter, and to the faint ultrasound calls emitted by this bat (Ahlén, 1990). Considering the probable bias caused by these drawbacks in population estimates, the use of an acoustic lure, the Sussex AutoBat, has been presented by Hill and Greenaway (2005).

The aim of our study was to investigate the distribution of *M. bechsteinii* in the southwestern Basque Country (Iberian Peninsula) using this new methodology, with a particular interest in the detection of breeding colonies. The species presence was first reported in the Basque Country by Aihartza (2001), with two captures at two

localities separated by 20 km: a male mist-netted in riparian woodland in the Ebro Valley and another individual entering a cave.

STUDY AREA AND METHODS

The survey was carried out in the province of Araba (Basque Country) during June and July 2004, 2005 and 2006. This mountainous province lies between 300 and 1,400 m a.s.l., averaging between 500–600 m a.s.l. Although covering 3,209 km^2, Araba shows a dramatic climatic cline over a distance of 60 km, from the humid Atlantic in the north to the continental Mediterranean in the south. This climatic variability is reflected in a varied landscape and in a vegetation cline, ranging from the humid meadows and pedunculate oak (*Quercus robur*) woodlands of the north to the xeric *Q. rotundifolia* forests and semi-steppe areas of the south. Agriculture is locally important: although some areas are profoundly altered by the presence of croplands and vineyards, woodland still covers large areas. Some plantations of the exotic *Pinus radiata* are largely restricted to the Atlantic climatic area of the province.

Surveys were conducted in some of the largest or oldest broadleaved woodlands, dominated by pedunculate oak, beech (*Fagus sylvatica*), or Pyrenean oak (*Q. pyrenaica*), and in riparian woodlands of poplar (*Populus nigra*). During 2004 we surveyed 11 different woodlands, totaling 13 sites and a cave where a male *M. bechsteinii* had previously been trapped (Agirre-Mendi, 1998); during 2005 we sampled 32 woodland sites in 6 woods and an irrigation pool; during 2006 we surveyed 3 sites, corresponding to 2 woods. Capture trials were situated at least 100 m apart from the nearest one (Hill and Greenaway, 2005).

At each sampling site, mist nets were set to form a line, varying between 7 and 100 m, depending on any obstacles (e.g., undergrowth thickness). The nets were kept open for 5 hours, starting at dusk. For each sampling site, captures were carried out both with and without the support of the acoustic lure, with the exception of the Abornikano and Ugalde woods, where captures were always made using the lure, because the well developed and dense undergrowth prevented the setting of a net longer than 3 m. The three different acoustic stimuli were played according to the protocol of Hill and Greenaway (2005). The original model calls were recorded from wild animals. Output was through a pair of ultrasound transducers mounted back to back and maintained at 1.5–2 m above ground while playing. Each of the three calls was played for 40 seconds with a 30-second interval among repetitions. The period of the night when the lures was used varied from site to site. To examine the effectiveness of the Sussex AutoBat in bat capture, we ran an analysis of covariance (ANCOVA) using the net length as covariate. Considering only those woods where *M. bechsteinii* was trapped, the chi square test (χ^2) was used to compare capture success with and without using the lure.

Additionally, one of the *M. bechsteinii* males captured in 2005 and a lactating female captured in 2006 were fitted with a radio-transmitter (0.45 g PipII; Biotrack Ltd., Dorset, UK) and radio-tracked using receivers (1000-XRS, Wildlife Materials, Carbondale, USA) and three element Yagi antennas, in order to locate their roosts. Finally, we conducted a video recording under infrared light in order to count the bats forming the breeding colony where the lactating female roosted.

RESULTS

In total we surveyed 16 woodlands, a cave, and a pool, yielding 45 different non-repeated sites, and we captured 32

bats, representing 6 different genera and 10 species (Tab. 1). Twelve bats of 7 species were mist-netted without the use of the Autobat, whereas 20 bats (6 species) were caught using the acoustic lure (Tab. 1).

Table 1 - Sites where the Sussex AutoBat was used. The dominant tree species, total length of mist-nets used, number of bats captured, species, sex, and reproductive condition of females at each location. Rows with bat captures in bold indicate bats were caught while using the Sussex AutoBat lure. Species abbreviations: Bb - *Barbastella barbastellus*, Mb – *Myotis bechsteinii*, Md – *M. daubentonii*, Me – *M. emarginatus*, Mn – *M. nattererii*, Nl – *Nyctalus leisleri*, Paur – *Plecotus auritus*, Paus – *P. austriacus*, Ppi – *Pipistrellus pipistrellus*, Rf – *Rhinolophus ferrumequinum*; Qp = *Quercus pyrenaica*, Qr = *Quercus robu*r Pn = *Populus nigra*, Fs = *Fagus sylvatica*, reproductive condition: * pregnant; ** lactating.

Survey site	Date	Woodland type	Mist net length (m)	Bat species	Number	Sex
Izki	21/6/04	Qp	70	-	-	-
Ebro	22/6/04	Pn	100	-	-	-
Urizaharra I	23/6/04	Fs	100	Me	1	M
Urizaharra II	23/6/04	Fs	100	Ppi	1	M
Montoria	**23/6/04**	**Qp**	**50**	**Mb**	**1**	**M**
San Leon	**23/6/04**	**Fs**	**30**	**Paus**	**1**	**M**
San Leon cave	23/6/04	-	3	Mb	1	M
San Leon cave	23/6/04	-	3	Mn	1	M
Narbaja	24/6/04	Qp	50	-	-	-
Barria	24/6/04	Qp	80	-	-	-
Elgea	**24/6/04**	**Qp**	**90**	**Md**	**3**	**M**
San Pedro	25/6/04	Qr/Qp	75	Rf	1	M
San Pedro	25/6/04	Qr/Qp	75	Paur	1	M
San Pedro	**25/6/04**	**Qr/Qp**	**75**	**Nl**	**1**	**M**
San Pedro	25/6/04	Qr/Qp	75	Nl	1	M
San Pedro	25/6/04	Qr/Qp	75	Mn	1	M
Zarate	**25/6/04**	**Qp**	**90**	**Paur**	**1**	**F***
Apellaniz I	26/6/04	Qr/Qp	100	-	-	-
Apellaniz II	**26/6/04**	**Qr/Qp**	**50**	**Nl**	**1**	**M**
San Leon I	27/6/05	Fs	12	-	-	-
San Leon II	27/6/05	Qp/Fs	7	-	-	-
Montoria I	27/6/05	Qp/Fs	18	Paur	1	F
Montoria I	27/6/05	Qp/Fs	18	Paur	1	F
Montoria II	27/6/05	Qp/Fs	12	-	-	-
Montoria III	27/6/05	Qp/Fs	10	-	-	-
Montoria IV	**28/6/05**	**Qp/Fs**	**18**	**Mb**	**1**	**M**

Tab. 1 continues

Survey site	Date	Woodland type	Mist net length (m)	Bat species	Number	Sex
Montoria V	**28/6/05**	**Qp/Fs**	**12**	**Nl**	**1**	**M**
Montoria V	**28/6/05**	**Qp/Fs**	**12**	**Bb**	**1**	**F****
Montoria VI	**28/6/05**	**Qp/Fs**	**10**	**Paur**	**1**	**M**
Montoria VI	**30/6/05**	**Qp/Fs**	**10**	**Paur**	**1**	**M**
Montoria VII	**30/6/05**	**Qp/Fs**	**18**	**Mb**	**1**	**M**
Montoria VIII	**30/6/05**	**Qp/Fs**	**12**	**Mb**	**1**	**M**
Montoria IX	28/6/05	Qp/Fs	18	-	-	-
Montoria X	28/6/05	Qp/Fs	12	-	-	-
Sagarrota I	28/6/05	Fs	12	-	-	-
Sagarrota II	28/6/05	Fs	10	-	-	-
Sagarrota balsa	28/6/05	-	18	-	-	-
Altube I	29/6/05	Qp/Fs	12	-	-	-
Altube II	29/6/05	Qp/Fs	10	-	-	-
Altube III	29/6/05	Qp/Fs	18	-	-	-
Altube IV	29/6/05	Qp/Fs	18	-	-	-
Altube V	29/6/05	Qp/Fs	36	-	-	-
Altube VI	29/6/05	Qp/Fs	18	-	-	-
Altube VII	30/6/05	Qp/Fs	19	-	-	-
Lagran I	30/6/05	Fs	7	-	-	-
Lagran II	30/6/05	Qp	12	-	-	-
Abornikano I	12/7/05	Qp/Fs	3	-	-	-
Abornikano II	12/7/05	Qp/Fs	3	-	-	-
Abornikano III	12/7/05	Qp/Fs	3	-	-	-
Abornikano IV	12/7/05	Qp/Fs	3	-	-	-
Abornikano V	12/7/05	Qp/Fs	3	-	-	-
Abornikano VI	**13/7/05**	**Qp/Fs**	**3**	**Mb**	**1**	**F****
Abornikano VII	**12/7/06**	**Qp/Fs**	**3**	**Mb**	**1**	**F****
Abornikano VII	**12/7/06**	**Qp/Fs**	**3**	**Paur**	**1**	**F****
Abornikano VII	**12/7/06**	**Qp/Fs**	**3**	**Paur**	**1**	**M**
Ugalde I	**12/7/06**	**Qp**	**3**	**Nl**	**1**	**M**
Ugalde II	12/7/06	Qp	7	Ppi	2	M

Regarding *M. bechsteinii* in particular, 6 bats were captured in two woods (Montoria and Abornikano) – all while using the Sussex AutoBat – and another one while entering a cave used as night shelter at 1,170 m a.s.l. (San Leon). In Montoria we caught four Bechstein's bats, all males. This is a

diverse wood dominated by Pyrenean oak and beech, showing a heterogeneous understory with bare, extremely thick and grassy patches, and located at an altitude of 860 m a.s.l. In Abornikano (560 m a.s.l.), two lactating Bechstein's bat females, showing swollen nipples with bare skin around them, were mist-netted with the aid of the lure. The capture site was dominated by large pedunculate oak with an extremely thick understory dominated by hawthorn (*Crataegus monogyna*) and blackthorn (*Prunus spinosa*). The Sussex AutoBat acoustic lure proved to be an efficient method that significantly increased bat capture success (ANCOVA: $F_{1, 45} = 15.397$, $P < 0.001$), whereas net length had no effect (ANCOVA: $F_{1, 45} = 1.358$, $P = 0.25$). Considering only the woods (Montoria and Abornikano) where *M. bechsteinii* was captured, the lure method was more efficient in capturing this species than the nets alone ($\chi^2 = 4.0$, $P < 0.05$, d.f. = 1).).

The radio-tracked *M. bechsteinii* male captured in the Montoria wood in 2005 day-roosted on two non-consecutive days in the same pedunculate oak of 28 cm diameter at breast height (DBH), in a small hole formed by the breaking of a branch at a height of 5 m. The hollow faced downwards and the bat was visible within it. The lactating female captured in 2006 in the Abornikano wood was tracked to a large pedunculate oak of 70 cm DBH (over 100 years old), the signal coming from a woodpecker hole 12 m above ground and facing northeast. The oak was relatively close to the edge of the forest and the large trees around it formed an open park-like area with an understory grazed by horses. This female was also radio-tracked during foraging, which was centered in the woodland part with the densest undergrowth and close to the capture site. The infrared video recording conducted during bats emergence at this female roost revealed the presence of a breeding colony of 27 bats.

DISCUSSION

As Bechstein's bats are considered the rarest European bat species (Schlapp, 1999), the opportunity to improve their trapping success using a non-invasive method, such as a lure, is certainly welcomed. The efficient use of the new AutoBat lure has been demonstrated to date in England (Hill and Greenaway, 2005). The device was successful for the capture of this species in our study area as well, all but one Bechstein's bats having been caught while using the AutoBat. It must be emphasized that in three regions of the Basque Country (including Araba), Aihartza (2001) has conducted one of the most thorough bat surveys to date, including, in an area of 7,482 km^2, a total of 1,017 sites, among which were 774 potential roosts and 243 foraging areas. In that survey, using conventional methods (direct visits to roosts, mist-netting, harp-trapping, use of bat detectors), the author found only two isolated individuals of Bechstein's bat in two localities.

An additional six bat species responded to the calls of the AutoBat, some of which are only occasionally captured, such as the barbastelle (*Barbastella barbastellus*) and the lesser noctule (*Nyctalus leisleri*). The captured

barbastelle, a lactating female, represents the first evidence of breeding for this species in the Basque Country (Aihartza, 2001).

Both woods where Bechstein's bats were captured in the present study were mature, non-managed woods of diverse species and structure. All our findings concur with what has already been found about roosts and woodland type in other European countries of similar climate and with the accordingly proposed conservation measures (Cerveny and Bürger, 1989; Schofield and Morris, 2000; Fitzsimons *et al*., 2002; Kerth *et al*., 2002; Meschede and Heller, 2003).

In the present study we report evidence of breeding and the location of the third documented breeding colony of Bechstein's bat in the Iberian Peninsula (Palmeirim, 1990; Carro, 2002). The species had already been cited in only three localities in the Basque Country, all corresponding to isolated individuals (Agirre-Mendi, 1998; Aihartza, 2001). The nearest report of breeding by Bechstein's bat corresponded to a lactating female captured in oak woodland in the neighboring region of Navarre (Alcalde and Gosá, 1998), but the location of the colony was unknown.

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