Hystrix It. J. Mamm. (n.s.) 22(1) 2011: 93-98

LONG-TERM MONITORING OF *NYCTALUS LEISLERI* AT AN ITALIAN MATING SITE

SIMONE VERGARI, GIANNA DONDINI

Centro Naturalistico e Archeologico dell'Appennino Pistoiese, Ecomuseo Montagna Pistoiese, Via Nazionale 100, I-51028 Campo Tizzoro (Pistoia)
E-mail: svergar@tin.it; gianna.dondini@tin.it

Received 25 August 2010; accepted 28 February 2011

ABSTRACT - A mating colony of *Nyctalus leisleri* has been monitored since 1994 through the periodic checking of 105 bat boxes set in a beech forest on the Apennines (Tuscany, central Italy). Both a general and a gender-specific trend was obtained from the monthly count of individuals. The general trend showed remarkable numerical fluctuations over the years, which were particularly evident in the number of females. The overall population showed a slight positive trend, which was significant for males. The abruptly fluctuating number of females observed throughout the years was worthy of notice. Such variations may find an explanation when more information on the continental migration patterns of the individuals recorded in this area become available.

Key words: Leisler's bat, abundance, population trend, Italy

RIASSUNTO - ***Monitoraggio a lungo termine di un sito di accoppiamento di* Nyctalus leisleri *in Italia***. Il monitoraggio di *Nyctalus leisleri* in un'area di accoppiamento è iniziato nel 1994 attraverso l'utilizzo di 105 bat box. L'area di studio si trova sull'Appennino Pistoiese (Toscana, Italia centro-settentrionale). Il conteggio numerico mensile ha permesso di evidenziare un andamento generale e di individuare un'elevata variabilità nel numero di esemplari (maschi e femmine) presenti. Non sono stati osservati cali numerici, anzi si evidenzia un piccolo ma significativo incremento soprattutto nei maschi. Le femmine appaiono soggette a notevoli fluttuazioni numeriche, che potranno essere comprese quando saranno disponibili informazioni sugli spostamenti a livello continentale degli esemplari presenti in questa area.

Parole chiave: Nottola di Leisler, abbondanza, trend della popolazione, Italia

DOI: 10.4404/Hystrix-22.1-4476

INTRODUCTION

Research at the population level is necessary in order to understand the workings of communities and ecosystems (O'Shea and Vaughan 1999). Bats make up a large component of mammal biodiversity at every geographic scale and their trophic role as arthropod predators grants them a key position in various ecosystems (Fenton 2003; Cleveland et al. 2006). In Europe, the great changes caused by human activities on natural ecosystems have caused the sharp decline of many species of bats (Hutson et al. 2001;

Temple and Terry 2007). Many species are listed as endangered (Hutson et al. 2001) and, consequently, detailed information on their distribution and abundance is needed (Hutson et al. 2001; O'Shea and Bogan 2003). In particular, the numerical consistency of populations, at both a local and European scale, must be monitored over time in order to obtain reliable information on the trend of each species. Moreover, there being many migratory bat species, including *Nyctalus leisleri*(Hutterer et al. 2005), conservation strategies cannot be worked out on a local scale, but must be integrated in trans-national programs (Eurobats 2009). Monitoring consists of repeated and standardised observations of abundance over time, using methods that enable changes in numbers to be detected (Hellawell 1991). In the case of bat populations, this entails a host of methodological difficulties which are often hard to overcome, especially in environments where roosts are particularly scattered, hard to detect and often transient, as in the case of forests (Gannon and Willig 1998).

The main aim of our study was to gather some preliminary data on the population trends of *N. leisleri* in central Italy, soas to integrate those derived from monitoring activities carried out in the European countries where the species is recorded as stable. This will result in more efficient conservation strategies for this species and its habitats.

MATERIALS AND METHODS

The study was carried out between 1994 and 2009 in a 100 year old beech forest in the Pian degli Ontani Nature Reserve (Pistoia, Tuscany, 44° 06’ 27’’N, 10° 41’ 33’’E). In total, 105 bat boxes (74 "2F Universal" and 16 "2FN Special", by Schwegler, Germany and 15 bat boxes 2F Universal similar, from WWF Piedmont) were placed in six circular areas, each with a radius of about 50 m. The six areas were 200-300 m apart and located between 1200 and 1400 m a.s.l. Each area included 14 - 18 boxes arranged in pairs, hung to a tree about 5 m above ground and randomly oriented. Checks were scheduled with a monthly or fortnightly frequency according to the season. At each check, all individuals were counted and sexed. The evaluation of numerical variations was achieved by comparing rectified variation coefficients (Variation Coefficient (VC) = standard deviation/mean*100; rectified Variation Coefficient (rVC) = VC+VC/4n) based on the maximum numbers of males and females recorded throughout the years (Vannini 1990). The statistical comparison was performed according to Lewontin’s method (see Vannini 1990). The numerical trend over time was assessed by means of a linear regression, using as input the 16 highest yearly values reached in the study period (n).

RESULTS AND DISCUSSION

The general trend shows remarkable numerical fluctuations over the years (Fig. 1). This variation is particularly evident in the number of females ($F=4.7$, $P<0.01$, $df=15,1$; see Tab. 1).

Overall, an increase in the number of individuals over time ($r^2 = 0.25$, $P = 0.02$; Fig. 2) is detectable only if the maximum value recorded in the first year of study, which was monitored starting only from September, is considered. If, on the other hand, we consider the data from the second year of research onwards, the trend is not significant ($r^2=0.24$, $P = 0.061$).

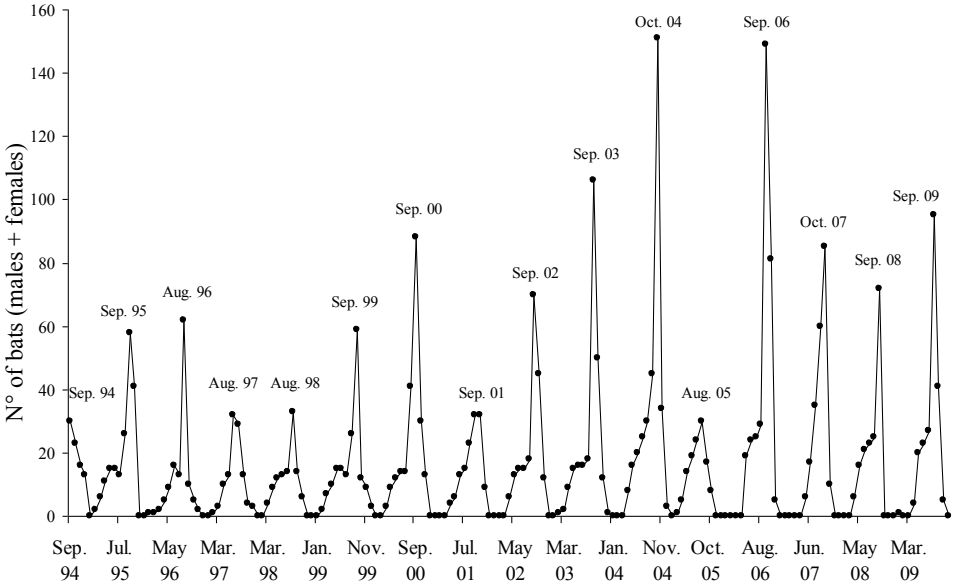

Figure 1 - Number of individuals (males + females) recorded from 1994 to 2009.

Table 1 - Parameters of male and female variability based on the maximum values of presence between 1994 and 2009; rVC%: percentage of variation coefficient.

	Mean	SD	No. of years (n)	rVC%
Males	26	8.6	16	33.9
Females	46.5	32.5	16	70

Between 1995 and 2009 a slight but significant increase in the number of males was recorded, (r^2 = 0.29, P = 0.03; Fig. 3), whereas the sharp fluctuations in the number of females did not allow a meaningful trend to be determined (r^2 = 0.16, P = 0.138; Fig. 3).

Medium to long term monitoring is a basic instrument in assessing the status of a species, detecting any negative demographic trend and drafting appropriate conservation plans. Unfortunately, many species of bats pose significant difficulties when it comes to monitoring their presence over large geographic areas, particularly, elusive, forest-dwelling Leisler's bats (Meschede and Heller 2003). Our population was relatively stable throughout the study period. Nonetheless, we found evidence of remarkable variation in female numbers. No data are currently available on the long range migration patterns of the individuals of *N. leisleri* monitored in Italy (Hutterer et al. 2005).

Unfortunately, compared with other European countries, few bats ringed by

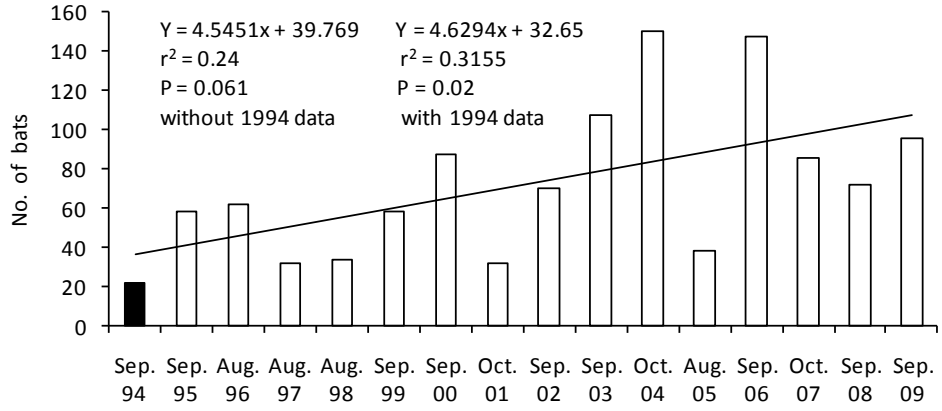

Figure 2 -. Maximum abundances (yearly peak values) recorded in the study area between 1994 and 2009. The line represents the linear trend estimate, calculated excluding the first year (1994).

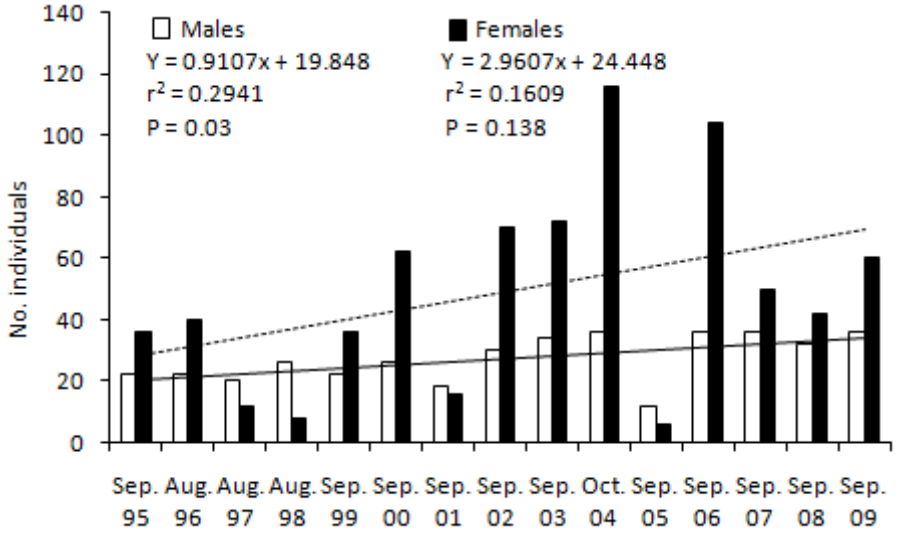

Figure 3 - Numeric abundance trend estimate for males and females. the two lines represent the linear trend for males (continuous line) and females (dashed line).

us since 1996 (Dondini and Vergari 2009) have been recaptured for several years in the same area (with a record of 10 years and 5 months for a male) (in prep.), but never outside it.

Females arrive in our study area in late August - early September, while males dwell there from March to November. It may be assumed that females come to the study area from other European countries after weaning their young, and their numerical variation may be explained by local factors connected with their breeding sites (Hoch et al.

2005). Although available data are still scarce, it may be confidently stated that any study on the demographic patterns of this species, as also conservation strategies, are better set in a continental context (see Hutterer et al. 2005).

ACKNOWLEDGEMENTS

We would like to thank the Tuscany branch of the WWF for providing the bat-boxes used in this research. We also thank the Pistoia Biodiversity Office of Corpo Forestale dello Stato (the Italian Forestry Police), in particular Dr. Raffaella Pettinà, for the lasting support. We are very grateful to Giulia Fusco for the English revision and two anonymous referees for their critical revision of our manuscript. We are grateful to Claudio Prigioni. A special thanks to Bettino Lanza for his stimulating advice.
The research was carried out under license from the Italian Environment Ministry (Ringing and catching license no. DPN/2D/2006/00179).

REFERENCES

Cleveland C.J., Betke M., Federico P., Frank J.D., Hallam T.G., Horn J., López Jr J.D., McCracken G.F., Medellín G.A., Moreno-Valdez A., Sansone C.G., Westbrook J.K., Kunz T.H. 2006. Economic value of the pest control service provided by Brazilian free-tailed bats in south-central Texas. Front. Ecol. Environ. 4(5): 238–243

Dondini G., Vergari S. 2009. Harem size and male mating tactics in *Nyctalus leisleri* (Kuhl, 1817) (Chiroptera, Vespertilionidae**).** Hystrix It. J. Mamm. (n.s.) 20(2): 147-154.

EUROBATS 2009. Guidelines produced by the Agreement on the Conservation of Populations of European Bats. Available from:http://www.eurobats.org/documents/lists_of_documents/List_of_documents_AC14.htm

Fenton M.B. 2003. Science and conservation of bats: where to next? Wildl. Soc. Bull. 31: 6-15.

Gannon R.M., Willig M.R. 1998. Long-term monitoring protocol for bats: lessons from the Luquillo experimental forest of Puerto Rico. In: Dallmeier F., Comiskey J.A. (Eds.). Forest biodiversity in North, Central and South America, and the Caribbean. Research and Monitoring. UNESCO; pp. 271-291.

Hellawell J.M. 1991. Development of a rationale for monitoring. In: Goldsmith, F.B. (Ed.) Monitoring for Conservation and Ecology. Chapman & Hall, London, pp. 1-14.

Hoch S., Zambelli N., Moretti M., Roseli M. 2005. Zwei weitere Fernfunde von im Kanton Tessin (CH) und in Fürstentum Liechtenstein markierten Kleinabendseglern (*Nyctalus leisleri*). Nyctalus 10: 288-294.

Hutson A.M., Mickleburgh S.P. Racey P.A. 2001. Microchiropteran Bats: Global Status Survey and Conservation Action Plan. IUCN/SSC Chiroptera Specialist Group.

Hutterer R., Ivanova T., Meyer-Cords C., Rodrigues L. 2005. Bat migrations in Europe: a review of banding data and literature. Natur. Biologische Vielfalt 28: 162 pp.

Jones G., Jacobs D.S., Kunz T.H., Willig M.R., Racey P.A. 2009. *Carpe noctem*: the importance of bats as bioindicator. End. Species Research 8: 93-115.

Meschede A., Heller K.G. 2003. Ecologie et protection des chauves-souris en milieu forestier. Le Rhinolophe 16: 1-248 pp.

O'Shea T. J., Bogan M. A. 2003. Monitoring trends in bat populations of the United States and territories: problems and prospects. U.S. Geological Survey, Biological Resources Division, Information and Technology Report. Washington, D.C.

O'Shea T.J., Vaughan T.A.. 1999. Population changes in bats from central Arizona:

1972 and 1997. Southwestern Naturalist 44: 495-500.

Schorcht W., Bontadina F., Schaub M. 2009. Variation of adult survival drives population dynamics in a migrating forest bat. J. Anim. Ecol. 78: 1182-1190.

Temple H.J., Terry A. 2007. The status and distribution of European mammals. Luxembourg: Office for Official Publications of the European Communities, 48 pp.

Vannini M. 1990. Lezioni di statistica. Università di Firenze, 216 pp.