

The Greater Noctule (*Nyctalus lasiopterus*) in the middle of southern France

a 5-year study brings new insights on the ecology of the species

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Introduction

The Greater noctule bat (*Nyctalus Lasiopterus*) remains one of the most poorly known European bats. Considered as a Mediterranean and Eastern European species, its population is very patchy and limited to isolated records. Until now, **the species was thought to be sexually segregated**. In the northern part of Spain, males are present all the year while females appear only during the mating season. In central and southern Iberia, breeding populations seem to be separated from males only at the roost or at a regional scale, possibly with females located at lower elevations during breeding season. In eastern Europe, males are dominant in Greece and the Czech Republic while females are found in the Moscow region, Voronezh (RU) and NE Hungary. **This sexual segregation was supposed to be due to the difference in sex-specific thermoregulatory and energetic requirements**. Females should migrate to warmer locations which would be optimal for fetal development and milk production. While males are dominant in cooler regions because of lower energetic demands. But this hypothesis does not correspond with the discoveries realized in France during the last years...

Methods

Because of the difficulty to capture the Greater noctule, we experimented, since 2012, a new method involving a **network of ultrasonics recorders** (Batcorders) combined with different fieldwork teams (motorized or by foot) using acoustic manual tools (Petterson 240X) and **visual pursuits in the early morning**, when bats return to their roosts.

Once the forest used by the species was identified, we located tree roosts using visual (infrared cameras and light intensifiers) as well as acoustic informations (social calls emitted from roosts). We captured some individuals with a custom-designed tree harp-trap or nets set up in the canopy and followed them with radio-telemetry in order to find foraging places and additional tree



Figure 1. Tree harp-trap

Since 2014, we also used a high-speed infrared camera, combined with infrared projectors, to film the entrance of roosts and observe the behavior of the bats in slow-motion.



Figure 2. A mother carrying her pup out of the roost, filmed by infrared camera

Discussion

Our findings bring new insights onto the ecology of this poorly known species. The presence of breeding females in high altitudes and latitudes, especially in the site of Auvergne which is considered as a cold region, goes against the sex-segregation theory based on sex-specific thermoregulatory requirements. Their occurrence in the region could rather be **explained by a high density of tree roosts close from each other, and by suitable foraging grounds**.

Furthermore, our discoveries of male roosts close to breeding colonies goes against the hypothesis of large-scale sexual segregation. In Auvergne, we hypothesize that **young males could stay in the vicinity of their mother before their sexual maturity**.

Last but not least, the discovery of reproductive males with courtship behavior in Aveyron, at about 20 km from breeding places, brings **new questions about the large-scale sexual segregation, the migration and the hibernation of the species**.

References

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Results

Since 2012, we found a **new population of Greater noctule bat in a volcanic landscape of Auvergne region, rather wet and rich in insects, at approximately 1000m above sea level**. The roosts were found in beeches (*Fagus sylvatica*), in ancient lodges of black woodpeckers.

Another population was found almost at the same time about 200 km further south, in the departement of Aveyron, at about the same height by the team of Marie-Jo DUBOURG SAVAGE.

These two breeding populations were the first mentions of reproduction of the species in France.



Figure 3. Location of known populations

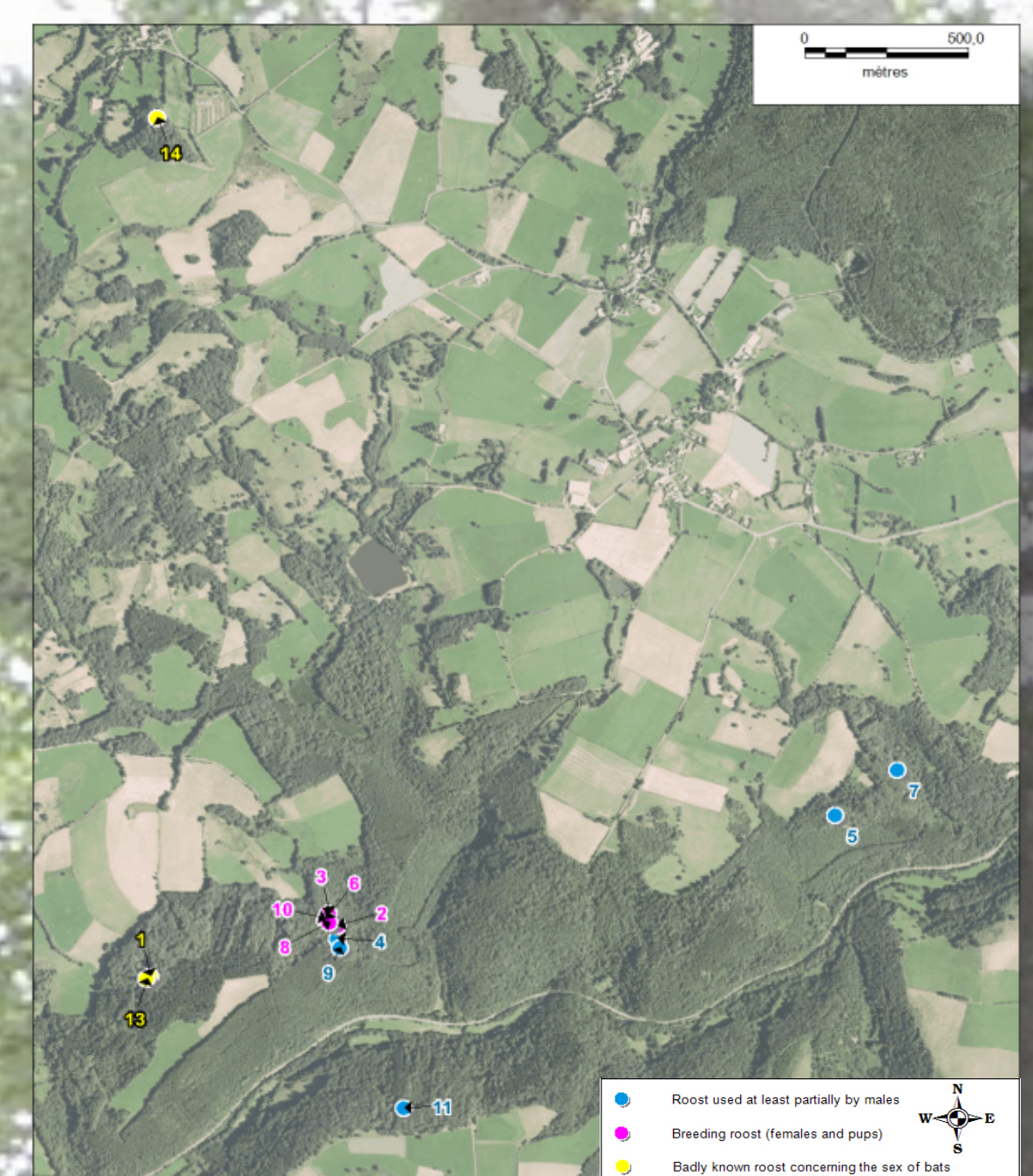
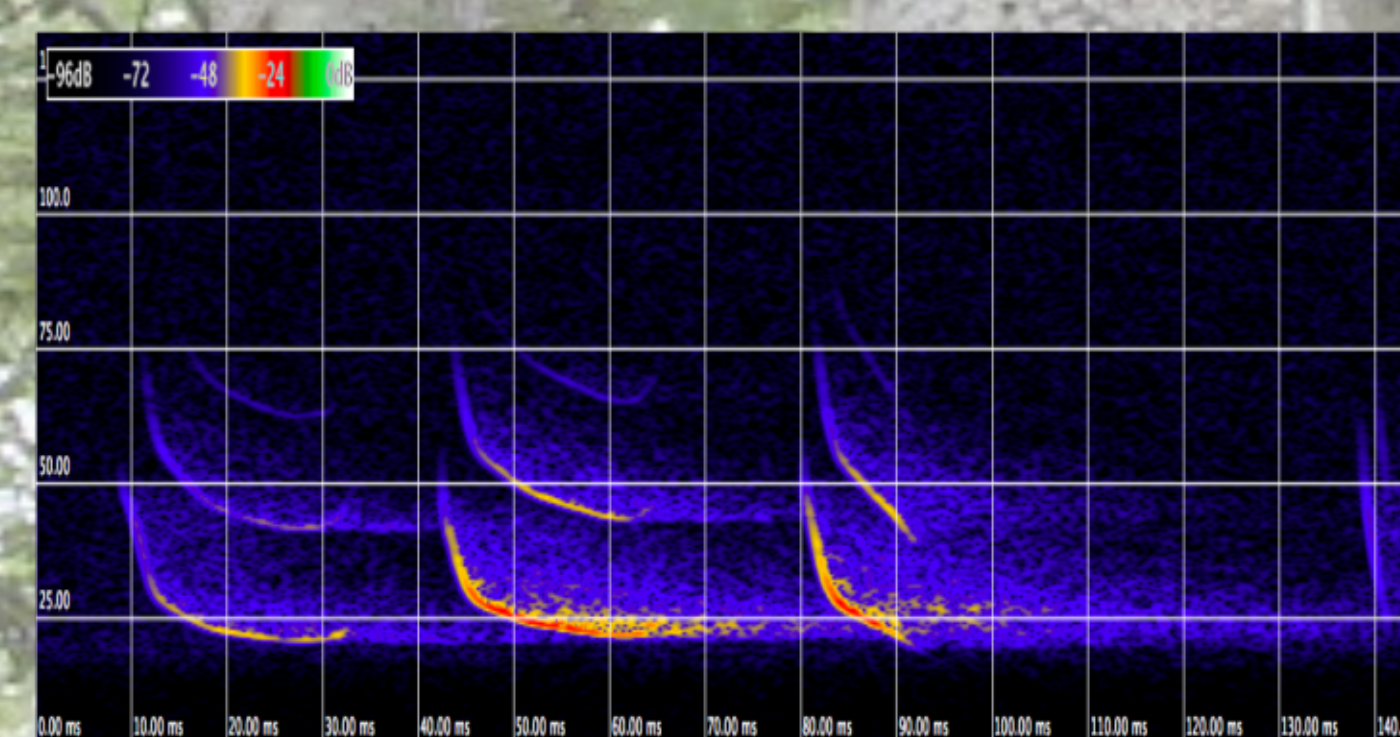


Figure 4. Location of males and females roosts in the Auvergne site

Since 2014, we discovered in Auvergne that **some young males were roosting in the same forest than females**. Maternity colonies of 15-50 females and juveniles were centered in the part of the forest with a high density of tree cavities and seemed to switch roosts regularly on low distances. Males seemed to exploit more dispersed satellite roosts but in a more stable manner, in parallel to partial use by females.

In 2016, a **small population of only adult and reproductive males was also found in the departement of Aveyron**, roosting in oaks of a deep valley. For the first time, we could study the **courtship behavior of males** in detail, including radio-tracking, video recording as well as acoustic recording of social calls in Autumn.



Figures 5 and 6. Type C and Type D social calls recorded close to the roosts.

