

# Large-scale long-term passive-acoustic monitoring reveals spatio-temporal activity patterns of boreal bats

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## Abstract

The distribution ranges and spatio-temporal patterns in the occurrence and activity of boreal bats are yet largely unknown due to their cryptic lifestyle and lack of suitable and efficient study methods. We approached the issue by establishing a permanent passive-acoustic sampling setup spanning the area of Finland to gain an understanding on how latitude affects bat species composition and activity patterns in northern Europe. The recorded bat calls were semi-automatically identified for three target taxa; *Myotis* spp., *Eptesicus nilssonii* or *Pipistrellus nathusii* and the seasonal activity patterns were modeled for each taxa across the seven sampling years (2015–2021). We found an increase in activity since 2015 for *E. nilssonii* and *Myotis* spp. For *E. nilssonii* and *Myotis* spp. we found significant latitude -dependent seasonal activity patterns, where seasonal variation in patterns appeared stronger in the north. Over the years, activity of *P. nathusii* increased during activity peak in June and late season but decreased in mid season. We found the passive-acoustic monitoring network to be an effective and cost-efficient method for gathering bat activity data to analyze spatio-temporal patterns. Long-term data on the composition and dynamics of bat communities facilitates better estimates of abundances and population trend directions for conservation purposes and predicting the effects of climate change.

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