Infilling development is worse for *Myotis* than urban sprawl

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Introduction

Urban growth is expected to result in a **50% reduction in local species richness** by 2100[1].

Bats can be used as **bioindicators of ecosystem health**, but understanding of their response to urban growth is limited[2].

Urban extent and urban agglomeration can have **negative effects on the presence of *Myotis***[3-5].

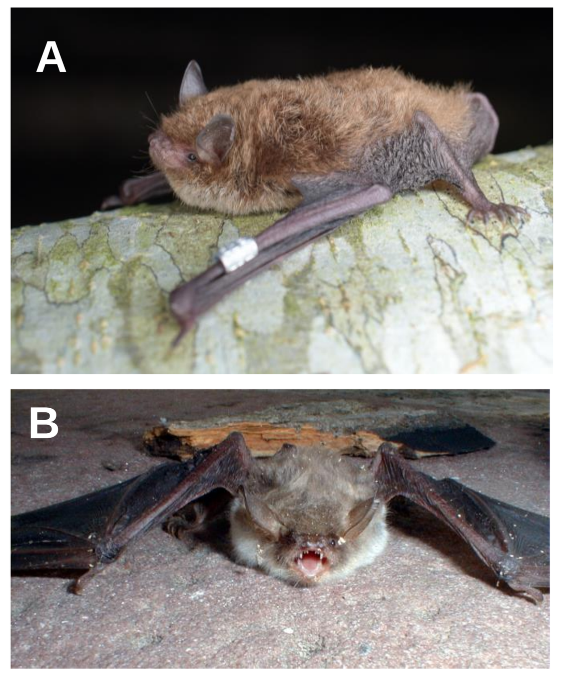

Figure 1: Two of seven *Myotis* species present in the UK. A) *M. daubentonii* (Daubenton's bat); B) *M. nattereri* (Natterer's bat).

Methods

Observations of *Myotis* were collected between 1980 and 2023.

Absences were simulated from observations of non-*Myotis* genera.

Measures of landscape composition were calculated from UKCEH 25 m land cover rasters[7].

Yearly urban growth was classified into one of three types[8] (Fig. 3).

Generalised linear mixed models (GLMMs) were used to investigate the effects of growth.

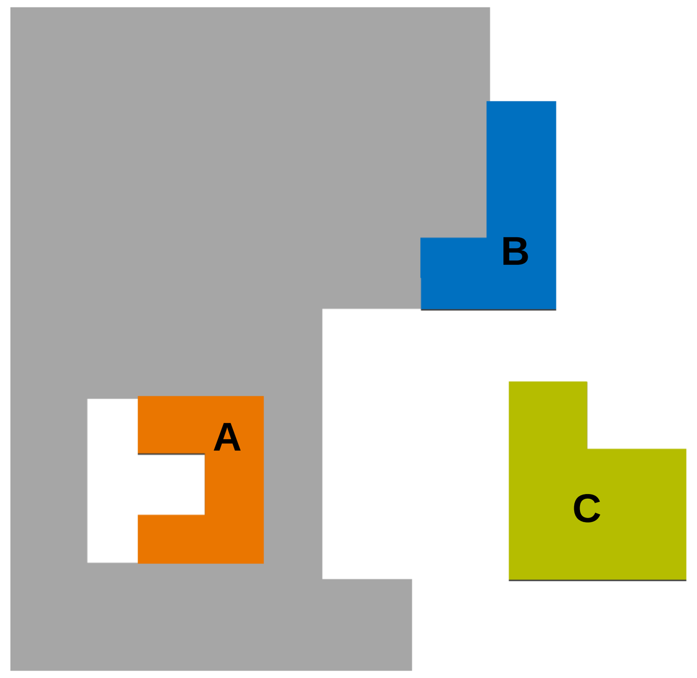

Figure 3: Urban growth pattern relative to existing extent (grey). A) infilling; B) edge expansion (urban sprawl); C) outlying development.

Discussion

Size of contiguous urban area may explain the difference in findings of urban exploitation between this and previous studies[3].

Myotis may be **opportunistic exploiters** when urban areas form part of a mosaiced landscape. This trend may be driven by more abundant species (Fig. 6).

Increased infilling may reduce populations by reducing the number of useable fragments (Fig. 7).

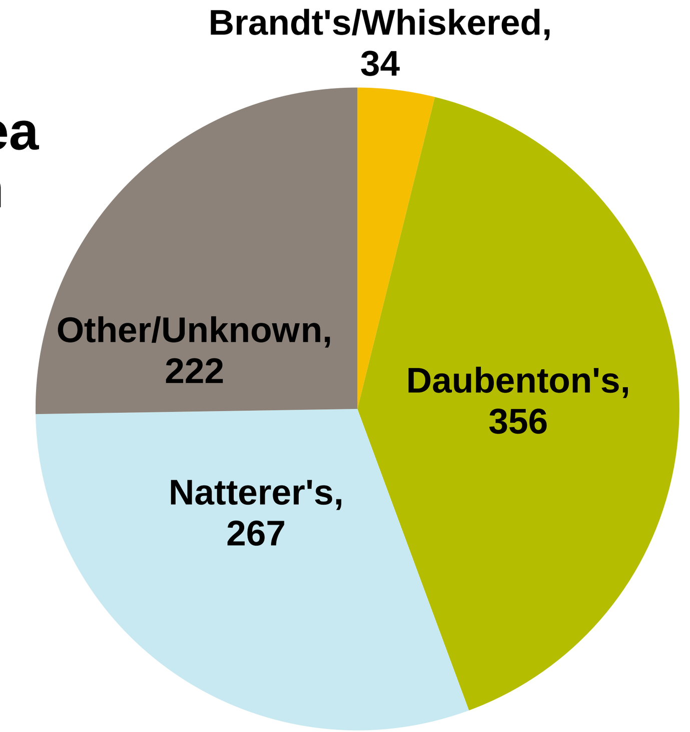

Figure 6: Composition of *Myotis* records. 'Other/Unknown' includes Alcathoe (n=2), Bechstein's (n=2), and observations not identified to species-level (n=218).

Figure 7: Proposed mechanism driving effect of urban growth pattern on *Myotis*.

The Study Area

Between 1990 and 2015, urban area in Kent, UK increased by 136 km^2, the greatest increase of any UK county[6].

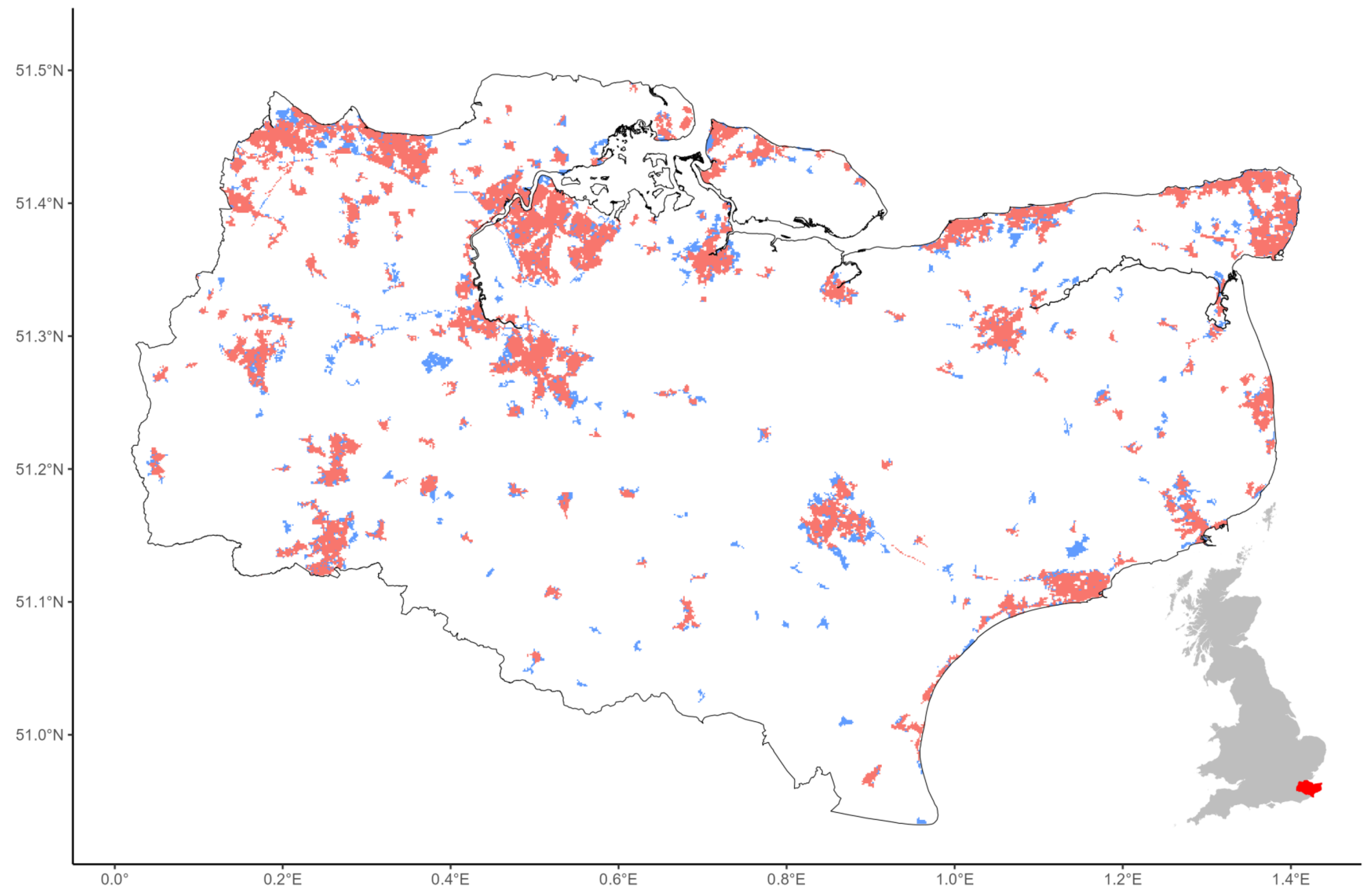

Figure 2: Urban growth in Kent, UK between 1990 (pink) and 2023 (blue). Only built-up areas over 20 ha are shown. Inset shows the location of Kent within the UK.

Results

Myotis were positively associated with deciduous woodland and semi natural grassland.

Urban area positively affected odds of presence in *Myotis spp.* (OR = 1.15, 95%CI [1.05,1.25]) (Fig. 4).

Infilling growth was linked to lower odds of presence than edge expansion (Fig. 5).

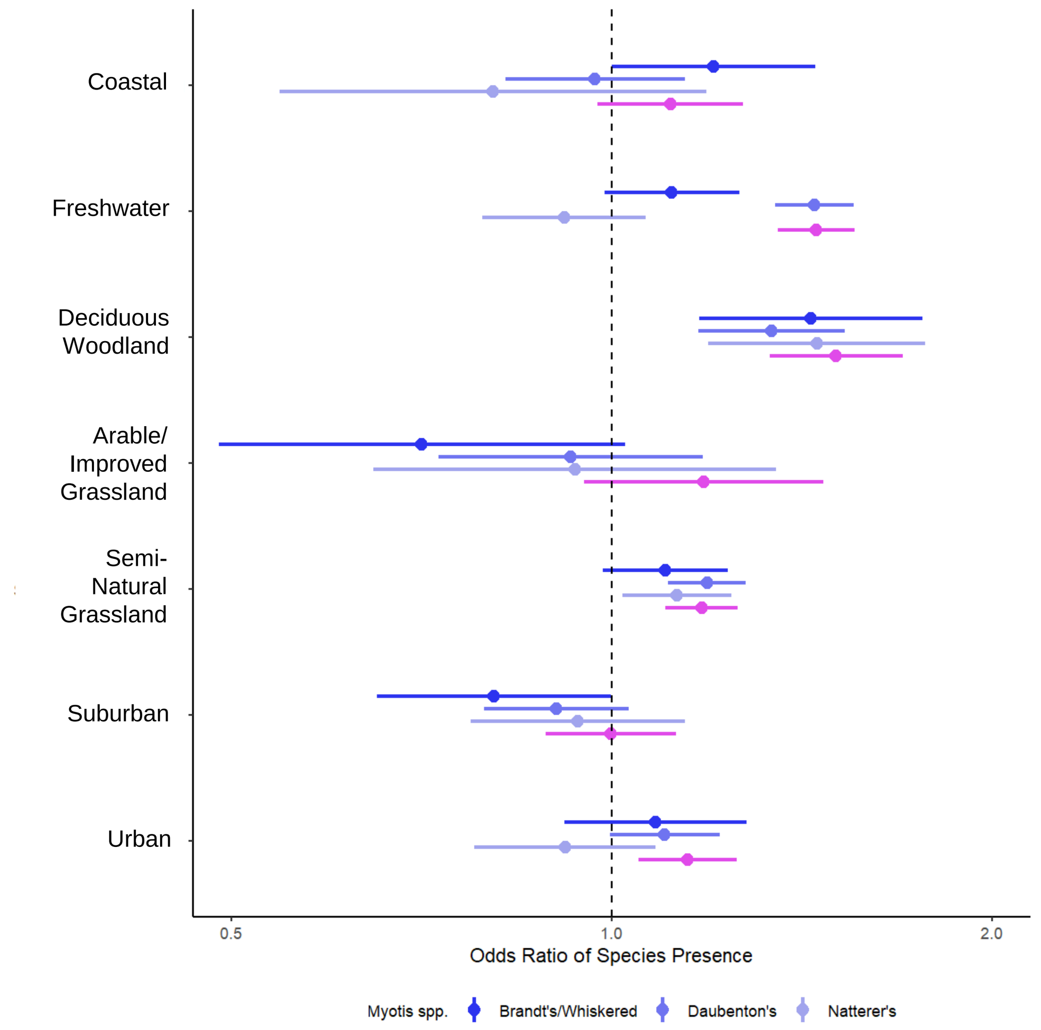

Figure 4: Results of GLMMs for three *Myotis* species and the combined genus. Values above 1 represent higher odds of presence with a 1 s.d. increase in area of land cover class.

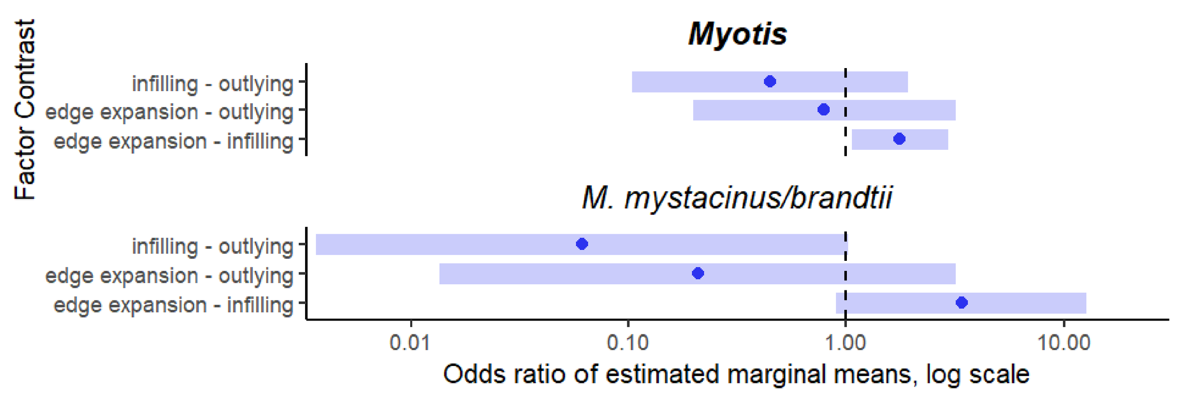

Figure 5: Results of pairwise comparison of patterns of urban growth. Urban growth models were run on a truncated dataset (2017-2023).

Conclusions and Future Directions

More species may be able to exploit urban areas than previously thought, provided that urban area is a) close enough to other necessary habitat types, and b) sufficiently fragmented.

Loss of green space within urban areas through infilling may have **more negative effects than the encroachment of urban area** into the surrounding landscape.

Results are biased towards frequently recorded species (Daubenton's, Natterer's) and should not be generalised across the genus.

Expanding the range to cover a wider urban-rural gradient and accounting for variation in detection rates would improve the study.

Kent Bat Group

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