DYNAMICS IN SPATIAL USE OF ORCHARDS BY SMALL PASSERINES DURING THE BREEDING SEASON

case studies in UK and Spain

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INTRODUCTION

For birds the establishment of a home range can be thought of as a hierarchical process taking place at multiple spatial and temporal scales[1]. After selecting an area for living, they must decide constantly about the pattern of use of available resources, e.g. nesting sites or food sources, and react to changing circumstances (e.g. food availability) and the presence of predators[2]. Constancy in the use of space in the short term is supposed to be of advantage to small passerine species because of the high costs of establishing a new home range[1].

Using radio-telemetry, we studied the daily home ranges of birds using commercial citrus (Spain) and apple orchards (UK) before and after a broad-spectrum insecticide was applied. This provided the opportunity to gain insights in the dynamics of spatial use of habitats over a wide area in response to a sudden temporary decline in arthropod (i.e. food) biomass in the sprayed area. The focal species were the omnivorous Blackbird and the insectivorous Great tit which are both common in citrus and apple orchards.

MATERIAL & METHODS

A total of 34 birds were radio-tracked, and changes in bird behavior and/or location recorded to the minute:

- in Spain: 9 Blackbirds + 8 Great tits for 57 whole-day sessions
- in UK: 7 Blackbirds + 10 Great tits for 51 whole-day sessions.

Bird daily home range was estimated using Kernel Density method[3]. Home range size and overlap between consecutive sessions was calculated as well as the distance travelled within every session.

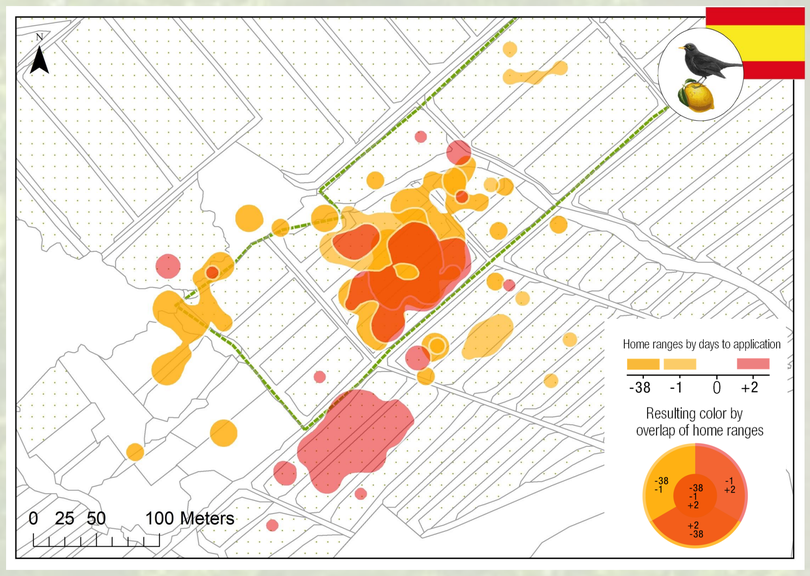
Analyses: two-way ANOVA and generalized linear mixed effect model GLMM for overlap data.

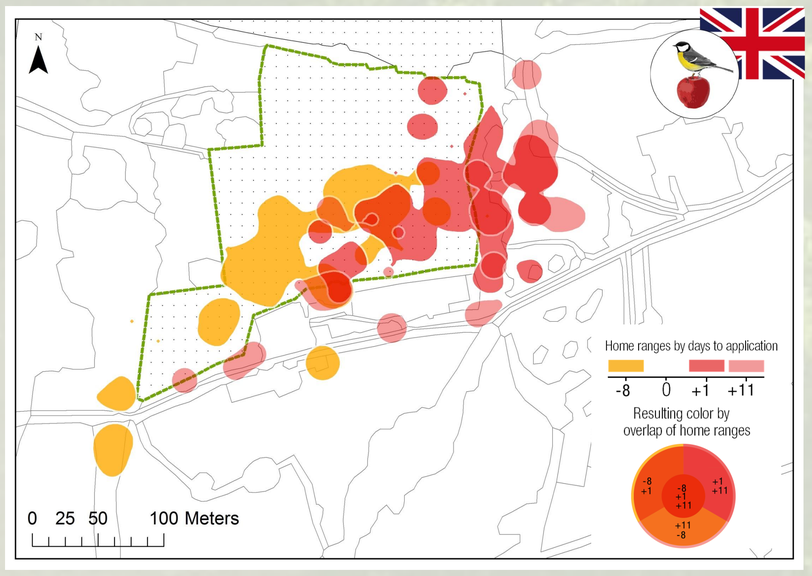
Results are compared *before* and *after* the application of the insecticide, and *between sites* (i.e. citrus-Spain versus apples-UK).

Figure 1:Aerial view of citrus orchards in Spain
Figure 2:Inside view of apple orchards in UK
Figure 3: Radio-tagged individual of Blackbird
Figure 4: Radio-tagged individual of Great tit
Figure 5: The radio-tracking procedure in the field

Commercially treated orchards are an important habitat for Blackbird and Great tit

Birds optimize the use of space by steadily varying parts of their daily home range within a constant area





Maps: Changes in home range and habitat use of two individual birds inside citrus and apple orchards

Habitat
Orchards
Study sites

RESULTS & DISCUSSION

- Great tits kept larger home ranges than Blackbirds (df 1, F 19.922, F >0.001) which should give them more flexibility to respond to changes in food availability. The daily home ranges of both species overlapped partially between consecutive sessions throughout the study period (Maps; mean 40%, range: 9–73%). The ratio of overlap was negatively correlated with the number of days between sessions (Fig.5, p 0.045) but not with the application (df 2, F 0.150, p 0.861). Interestingly also the size of bird daily home ranges remained stable regardless of the application (df 1, F 0.985, p 0.324).
- Following the application the insectivorous Great tit spend less time potentially foraging inside the treated area (Map & Fig.6; df 1, F 20.321, p >0.001). Also the proportion of treated area within the bird's home range decreased (df 1, F 11.035, p 0.001). The travelled distance was not affected by the application (df 1, F 2.062, p 0.157).
- After the application, the omnivorous Blackbird spent more time potentially foraging in the citrus orchard in Spain, (df 1, F 11.937, p 0.001). Contrarily, after application in the UK apple orchards blackbirds reduced their use of the orchard and the distance travelled increased (Fig.6).
- Differences in response to application between countries for Blackbirds might be due to the surrounding structure and the use of the orchards:
  - Overall, relative to use of surroundings, Blackbirds used apple orchards less than citrus orchards (df 1 F 17.034, p >0.0001). This might be because the *surroundings* of the citrus orchards were less attractive for feeding because of dry ground, compared with the moister conditions within the *drip-irrigated* citrus orchards themselves.
  - Only in citrus was the structure of trees suitable for Blackbirds as nesting sites (dense canopy). If nesting within an orchard, the birds might prefer to keep foraging areas within the close proximity of the nest[4].

Fig. 5: Individual daily home ranges are partially stable.

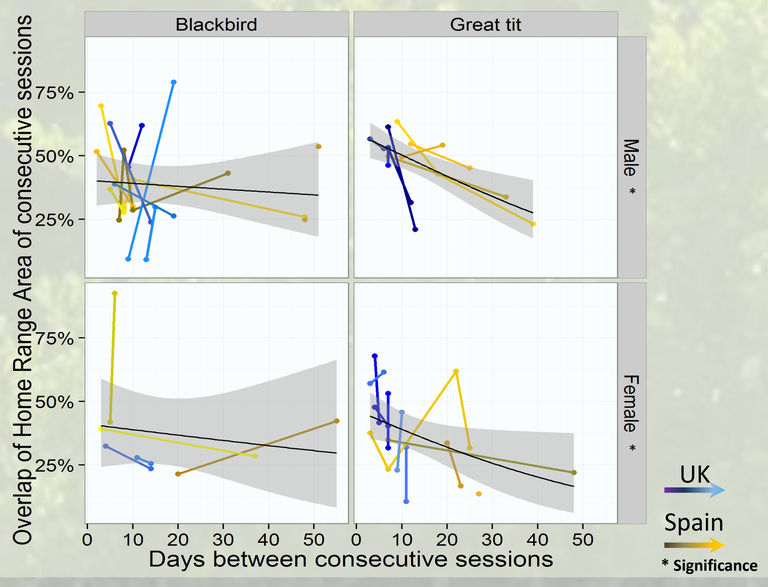
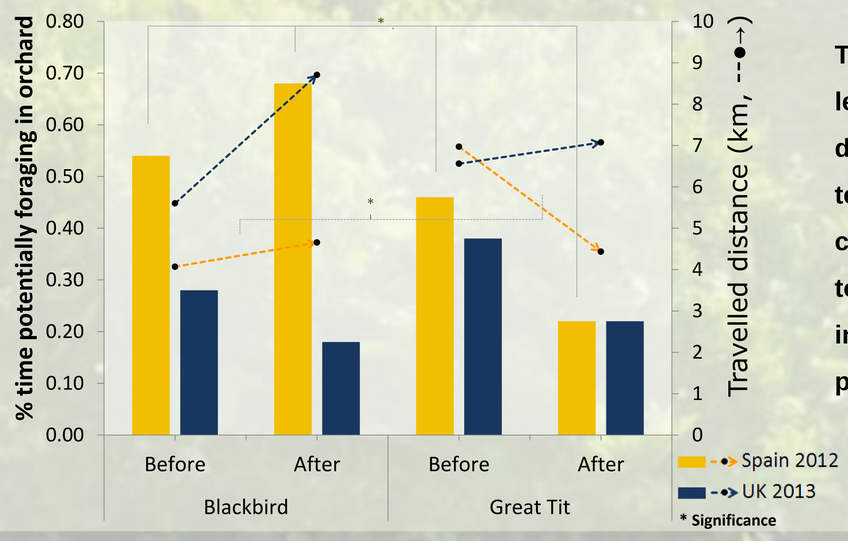


Fig. 6: After insecticide treatment Great tits spend less time foraging inside orchards; for Blackbird the response is country/crop specific.



CONCLUSION

The comparison of the home range use in time revealed two levels of interest within the living area. Birds use parts of their daily home ranges constantly whereas others are used only temporarily. This flexibility allows birds to react properly to changes in food availability, and hence enables them to adapt to a temporary reduction in arthropod biomass following insecticide applications (which are needed by the growers to protect the crops).

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