Assessing the impact of climate-mediated mismatch on blue tits

Supervisors
Albert Phillimore, Institute of Evolutionary Biology (Biological Sciences)
Jarrod Hadfield, Institute of Evolutionary Biology (Biological Sciences)
Graham Stone, Institute of Evolutionary Biology (Biological Sciences)

Email: albert.phillimore@ed.ac.uk

Project Background
As spring temperatures increase many temperate species have advanced their phenology via phenotypic plasticity. However, as different species may respond to subtly different cues and vary in the steepness of their plastic response, not all species are responding at the same rate. For instance, there is strong evidence that secondary consumer species are advancing their phenology by less than the primary consumers and primary producers down the food chain [1]. Less well evidenced in comparison are the impacts of such trophic mismatch on fitness [2].

This project extends the widely studied food chain from tree -> caterpillar -> tit into a spatially replicated study system that spans several woodland types. The advantages of spatial replication are two-fold. First, replication of sites of a particular woodland composition across temperatures can be used to infer how species interactions and blue tit fitness may respond to changing spring temperatures in the long-term [3]. Second, replication of different woodland types allows us to examine whether the impacts of mismatch on tit fitness that have been identified in oak-dominated woodlands [4] apply equally in the other woodland types used by these generalist species.

Key Research Questions:

1. What is the impact of mismatch versus food abundance on nestling fitness?
2. Does the impact of mismatch on fitness vary among woodland types?
3. How well does plasticity allow populations to track geographic variation in optimum conditions?

Methodology
In 2014 we starting monitoring a 40 site transect (Fig. 1), taking in a range of woodland habitats, elevations, and spanning > 200km. We are using this transect to investigate the phenology-mediated interactions between trees, invertebrates and birds. The PhD will involve statistical analyses of data already collected and fieldwork on the transect. Fieldwork involves visiting each site on alternate days during the spring to monitor the phenology of marked trees, the abundance of invertebrates and the nesting phenology and success of nest-box populations of blue tits. There may also be opportunities to design experiments that can be replicated along the transect.

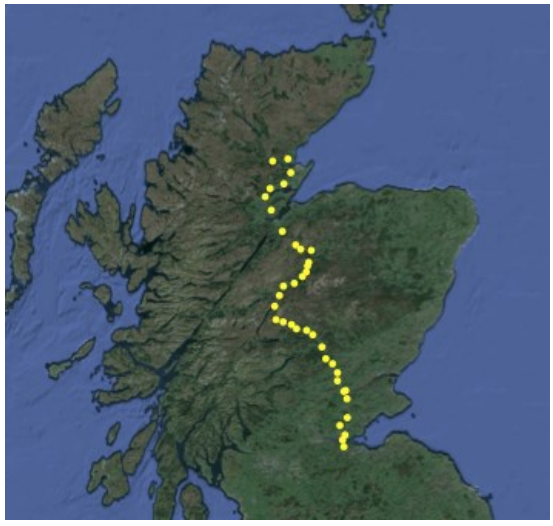

Figure 1. Map of transect field sites

Training
A comprehensive training programme will be provided comprising both specialist scientific training and generic transferable and professional skills. Specialist training will include bird ringing and advanced statistics. There may also be an opportunity for training and experience in inferring blue tit diet via next generation fecal meta-barcoding.

Requirements:

1. A first class undergraduate degree or MSc in ecology or evolution is desirable, and you will need to have an aptitude for statistics.
2. Driving license essential.

3. Bird handling and ringing experience, with a BTO C or A permit a great advantage.
4. Willingness to work long hours with few days off (2 days in 10) during the field seasons, and to drive for approximately 100 miles per day.

References

1. Thackeray, S.J., et al., *Trophic level asynchrony in rates of phenological change for marine, freshwater and terrestrial environments.* Global Change Biology, 2010. **16**: p. 3304-3313.
2. Both, C., et al., *Climate change and population declines in a long-distance migratory bird.* Nature, 2006. **44**: p. 81-83.
3. Phillimore, A.B., et al., *Plasticity may be sufficient to track temperature-mediated shifts in passerine optimum lay date.* Global Change Biology, 2016. **22**(10): p. 3259-3272.
4. Reed, T.E., S. Jenouvrier, and M.E. Visser, *Phenological mismatch strongly affects individual fitness but not population demography in a woodland passerine.* Journal of Animal Ecology, 2013. **82**: p. 131-144.

Project Summary

How well does the timing of blue tit nesting track variation in the peak food resource in space and in time and across different habitats?