Accounting for varying spatial scales in the production of UK butterfly abundance estimates

Over the past four decades, three-quarters of UK butterfly species have declined in abundance, distribution or both. Butterflies respond quickly to habitat and climatic change, hence their population status is a valuable biodiversity indicator. Analysis of long-term butterfly monitoring datasets has provided some of the world's best evidence of the biological impacts of climate change, including major phenological and distribution shifts, evolutionary responses and the impacts of extreme events.

Long-term citizen-science count data allows for the estimation of abundance estimates in the UK. However, currently population trends are assessed only at the national scale, and it has been shown that there is spatial variation in flight periods within a species across the UK. We show how the current framework to produce abundance estimates, the generalised abundance index (GAI), developed by Dennis et al. 2016 (Biometrics), can be adapted to account for spatial variation in flight periods. Furthermore, we demonstrate the efficacy of varying spatial scales in producing robust estimates of abundance. The use of this model should allow for more strategic planning and land management across regions of the UK, and, at a smaller scale, for site managers at protected sites across the UK. We hope that this work will aid conservation of UK butterflies as well as then being used in a wider context for similar citizen-science datasets across Europe, to understand and mitigate butterfly declines.