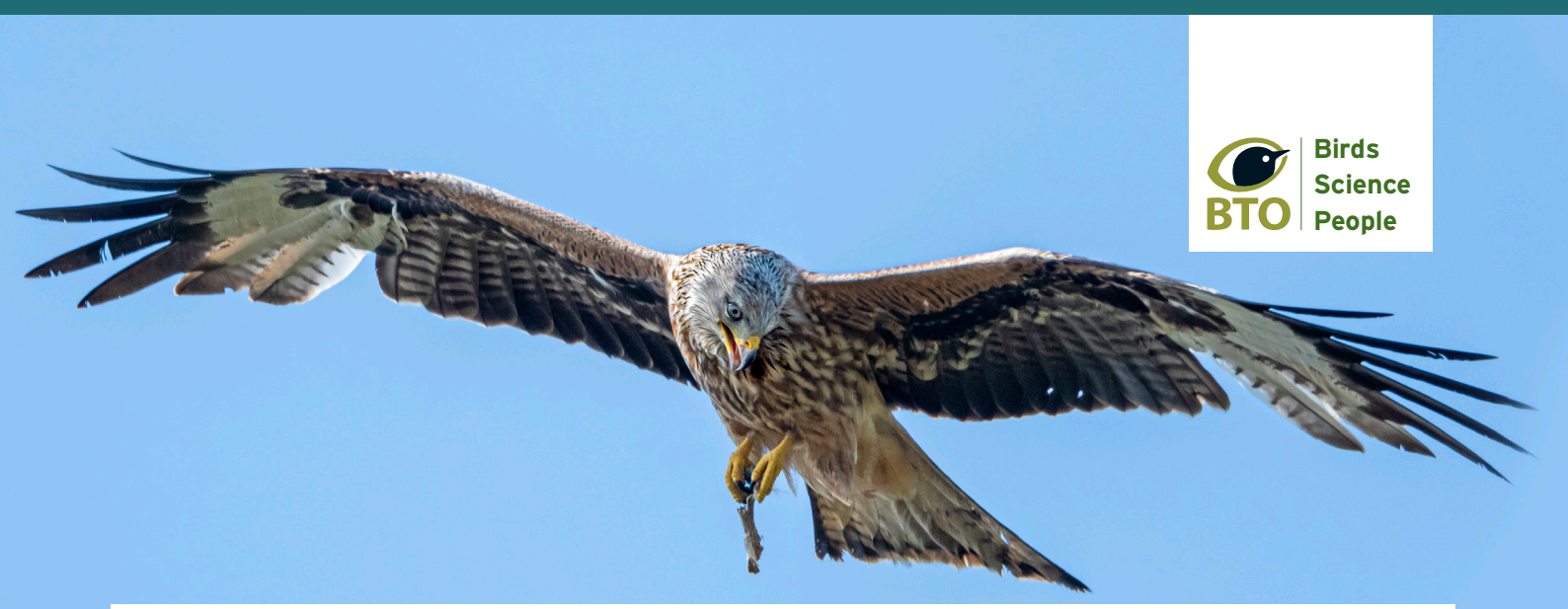

Red Kite, by Philip Croft / BTO

Modelling population-level impacts of wind farm collision risk on Welsh Red Kites: plain language summary and FAQs

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Introduction

- The Welsh Red Kite population is recovering after a historic decline (due to persecution) during the first half of the 20th century.
- The BTO/JNCC/RSPB Breeding Bird Survey (BBS) trends highlight rapid population growth over the past few decades.
- Nonetheless, the Red Kite is still of conservation concern, particularly around two Special Protection Areas (SPAs) designated for the species' conservation: the Berwyn SPA and the Elenydd–Mallaen SPA.
- Wind turbines represent a known threat to Red Kites, causing additional mortality through collisions.
- There are many wind farms at various stages of development in Wales (ranging from aspirational schemes to proposals under assessment), especially in Mid Wales, where Red Kites are at their highest density and where the Elenydd–Mallaen SPA is situated.

In this context, RenewableUK Cymru contracted BTO and BSG Ecology to undertake Population Viability Analysis (PVA) to model the potential impacts of current and proposed (including early concept) wind farm developments on the Welsh population of Red Kites.

Methods

- Welsh Red Kite population estimates were produced by combining data from: (i) *Bird Atlas 2007–11*, (ii) the BBS, and (iii) the Avian Population Estimates Panel (APEP).
- The demographic parameters (including survival, productivity, and breeding skip rate) required for the PVA were taken from published literature, reports, bird ringing and nest monitoring data, or calculated as part of the study.
- All possible combinations of demographic parameters were modelled. A 'rejection sampling' procedure was undertaken to retain a final 'baseline' model set whose range of population trajectories reflected the observed Welsh Red Kite population trend.
- Wind turbine collision mortality was applied to the baseline models, to predict the impact of each developer's proposed site(s) individually and their combined impact at various outcome scales: national (Wales), each of Natural Resources Wales' regional 'Area Statement areas' and for each of the two focal SPAs (including three different definitions for the 'SPA population', variously including or excluding birds breeding within a 2- to 4-km buffer zone around the SPA boundary).
- Model outcomes were assigned to five categories according to whether they predicted population decline, population stability, or three different levels of population growth.

Results

- Of 37,500 candidate models, 19,755 models were retained that reflected the observed recent population growth.
- At all spatial scales, all baseline models predicted population stability or increase. These models effectively include all existing wind turbines, but no future developments.
- Across virtually all combinations of future development scenarios and outcome scales, impacts are projected to be relatively small, with continued population growth predicted to be the most probable outcome compared to stabilisation or decline. Considering SPA populations, there was a small (but non-zero) probability of local population decline under the scenario where all currently-proposed developments are ultimately commissioned.
- Models of further scenarios that were more extreme than any future development scenario suggest that an additional 12–13% of the national population could die each year, on top of current mortality rates, before decline is more probable than continued growth in the Welsh Red Kite population. This analysis captures the possibility for other external factors besides wind turbines (e.g. avian influenza) to simultaneously cause additional mortality to Red Kites in the future.
- In general, modelled impacts were larger for spatially-smaller outcome scales with relatively high-density Red Kite populations, with the largest predicted impacts on the high-density Elenydd–Mallaen SPA population.

Key messages

- The results of this PVA suggest that whilst collisions with wind turbines may be a cause of mortality in Red Kites, this mortality alone is unlikely to prevent the continued recovery of the Red Kite population in Wales, even under the most extreme scenario where all new wind energy sites currently in development are ultimately commissioned.
- When the impacts of all proposed developments were modelled in combination, there was a small (but non-zero) probability of Red Kite population decline in each of the two SPAs designated for the species. This emphasises the importance of considering the impacts of multiple developments in combination as well as individually. Greater caution is therefore justified for developments in proximity to these SPAs.
- Small impacts on population growth rate may propagate into significant longer-term impacts on potential population size. Under some scenarios, population size in the year 2050 was predicted to be just half of the unimpacted baseline scenario. This result does not account for the possibility of a carrying capacity being reached prior to 2050, because there is a lack of evidence for what the carrying capacity of Red Kites in Wales would be.
- This study explores the implications of a conservation trade-off between the threat posed by wind turbine collisions to the Red Kite population, and the potential to mitigate the effects of climate warming by increasing renewable energy capacity. Our finding, that the risk to continued population growth in Welsh Red Kites is relatively low, may support decision-making in this sector.

FAQs

What is the significance of buffer zones around SPAs?

To understand the potential impacts of additional wind farms on the protected Red Kite populations of the Elenydd–Mallaen SPA and Berwyn SPA, it is necessary to define an 'SPA population' on which impacts can be modelled. One simple definition is that any bird nesting within the boundary of the SPA belongs to the SPA population. However, some birds nesting outside the SPA may forage within it, and therefore be functionally linked to it. For this reason, at the time of designation, the Elenydd–Mallaen SPA explicitly considered Red Kites nesting outside the SPA but within 2 km of its boundary to be part of the SPA population. More recent evidence suggests the median core range of a breeding Red Kite is 4 km (corresponding well with our own analyses for adult birds not using feeding stations), and this is therefore the distance currently used to determine whether a breeding pair outside the SPA boundary is functionally linked to the SPA. To aid interpretation, we modelled all three of the above definitions (with the 4 km definition included in a separate addendum).

What evidence underpins the models?

We combined data from the *Bird Atlas 2007–11*, the BTO/JNCC/RSPB Breeding Bird Survey, and the Avian Population Estimates Panel to estimate starting populations of Red Kites per tetrad in Wales, making the assumption that local population trends largely reflect national population trends. We cross-checked these predictions against data supplied by the Welsh Kite Trust and by Cofnod (the latter collated by Local Environmental Records Centres Wales). We sourced estimates for most Red Kite demographic rates from the published literature, except for breeding skip rate which we estimated using data provided by the Welsh Kite Trust. We estimated distances ranged by individual Red Kites using data from a long-running ringing and colour-marking project in Wales (led by A.V. Cross), finding a comparable ranging distance for adult birds to previous studies, but that

immature birds range further, as do both adults and immatures when visiting feeding stations. Finally, we calculated a value for 'average collision risk per exposed bird' using Collision Risk Model results for 15 current and proposed wind farms in Wales.

How were assumptions handled in modelling?

A number of assumptions were necessary in preparing our models. In general, we took conservative approaches to these assumptions, whereby our models should be more likely to overestimate impacts than to underestimate them. This was because underestimating impacts carries more risk into decision-making. For example, we assumed that all future developments are on open ground, where collision risk modelling typically predicts higher risk to Red Kites (compared to afforested locations).

A specific modelled assumption that is violated in this study is the assumption of a closed population (i.e. one without immigration or emigration). However, even though there is known to be exchange of individuals between the Welsh and English Red Kite populations, there is no evidence of imbalanced net migration in either direction that would lead us to doubt the modelled predictions.

What about other causes of additional Red Kite mortality, e.g. HPAI?

Our models assume that conditions in the future will apply exactly the same positive and negative pressures on a species as have been applied in the past. However, new and unforeseen pressures may act to change Red Kite demographic rates, leading the population trend to deviate from model predictions. In particular, cases of High Pathogenicity Avian Influenza (HPAI) have been detected in Red Kites in the UK, and have the potential to cause mass mortality events and/or reduce average survival rates. Our analysis of more extreme survival modifiers assesses this possibility, suggesting that an additional 12–13% mortality per year on top of current levels would lead to a population decline being more likely than continued growth. Although the context of this study is wind turbine collisions, this additional mortality could, in principle, come from any source or combination of sources.

Is there a 'ceiling' to Red Kite population growth in Wales?

If the Red Kite population in Wales continues to grow, it is likely to reach a 'carrying capacity', which is the maximum population size that can be sustained by available habitat and resources. There is a lack of evidence to suggest what the carrying capacity for Red Kite in Wales is likely to be, or how soon it might be reached, so we deemed it impossible to include in models. However, should the population reach its carrying capacity (i.e. be limited from further growth by constraints on survival or productivity that arise from high population density), additional mortality from wind turbine collisions is likely to be compensated by improved survival or productivity of the remaining individuals.

Why were models run up until 2050? Is this linked to carrying capacity?

This analysis was to project Red Kite numbers into the future in order to assess whether there would be a longer-term change in the population. 2050 was chosen arbitrarily on the basis that it is a round number and c. 25 years into the future, but the choice of this year is not related to any prediction about when carrying capacity might be reached, which (as above) is not predictable with current knowledge.

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