

INVESTIGATING THE MAIN MORTALITY REASONS OF THE EUROPEAN RED KITE POPULATION BY HIGH-RESOLUTION GPS TELEMETRY TRACKING

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INTRO

The LIFE EUROKITE project aims to reduce the anthropogenic causes of mortality of the red kite. To effectively protect European species such as the red kite, a detailed understanding of anthropogenic and non-anthropogenic influences, especially the causes of mortality, is required. Within the inter-European LIFE EUROKITE project, we study the anthropogenic causes of mortality by applying high-resolution GPS telemetry tracking that allows fast and exact locating of dead birds.

METHODS

Information to determine these causes is however complex, which calls for a standardized approach. We introduce the LIFE EUROKITE Assessment Protocol (LEAP), a framework for determining timing, locations and causes of mortality in GPS-tagged birds. LEAP is a multifaceted approach that integrates: (1) GPS tracking data, (2) evidence from the mortality location (site investigation), and (3) necropsy results to derive the mortality cause (Figure 1).

By 12/02/2025 data of 3,185 tagged red kites from 16 European countries is currently available in the LIFE EUROKITE data base through data exchange with (cooperation-) partners of the project. GPS tracking of 2,346 red kites throughout their continental European range allowed detection of 979 mortality events between 2013 – 2022 (Figure 2).

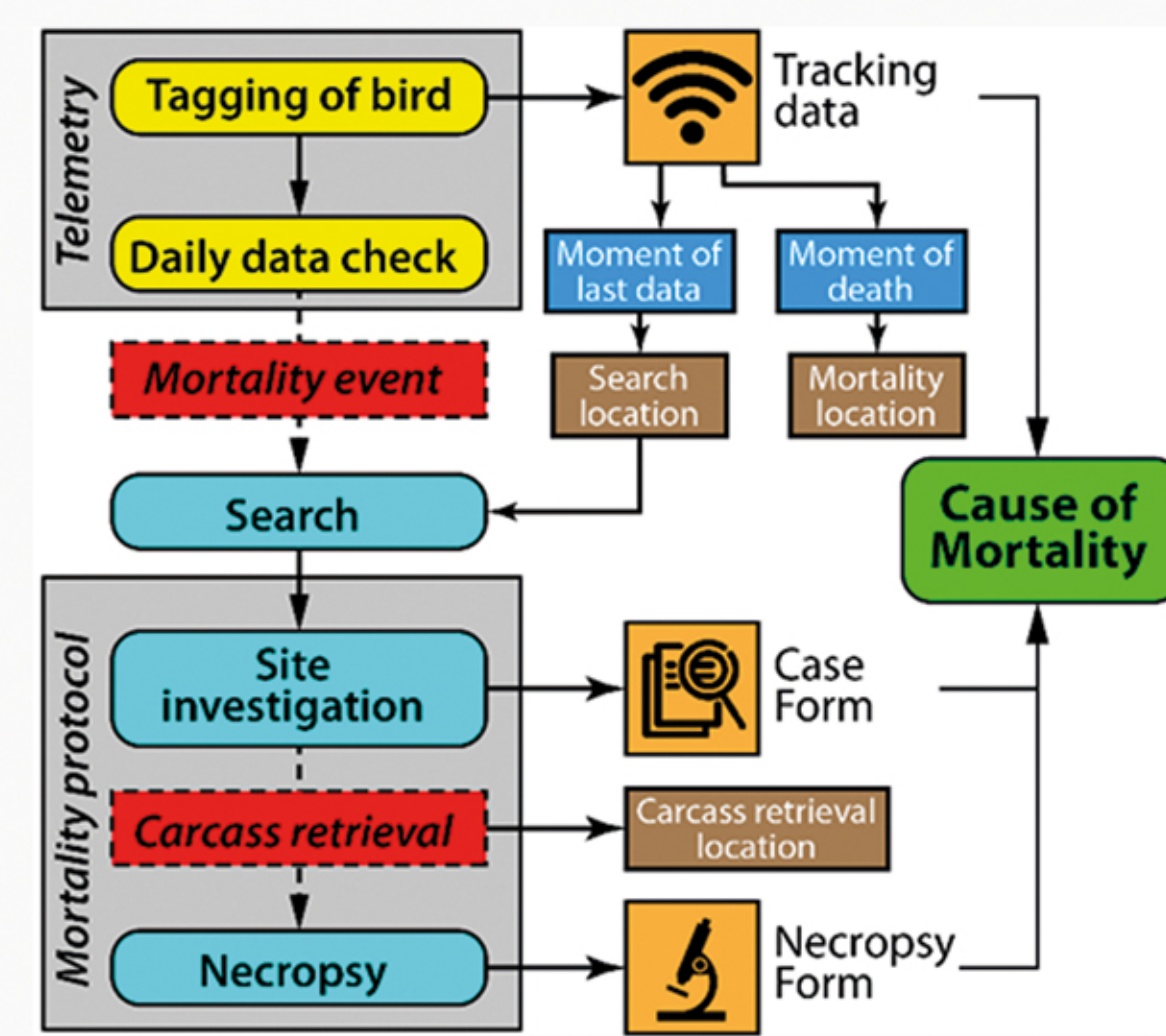


Figure 1: Schematic representation of the process to determine the cause of mortality of GPS-tagged red kites as part of the LIFE EUROKITE assessment process (LEAP). (Panter et al. 2025)

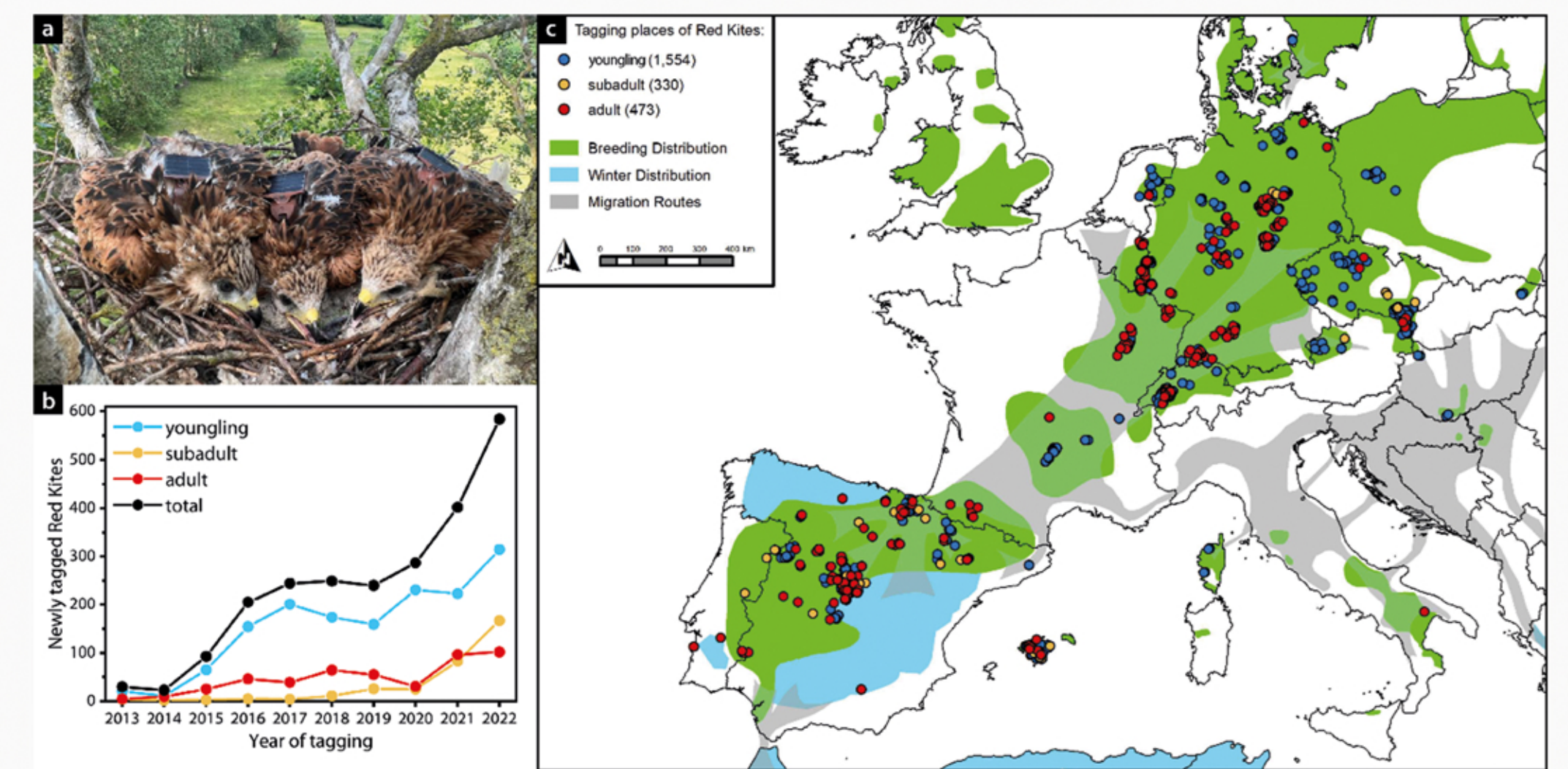


Figure 2: (a) Red kite nestlings fitted with solar-powered GPS tags. (b) Number of kites tagged 2013–2022, totalling 2,346 individuals. Different colours according to age classes at tagging. (c) Tagging locations (points). The breeding distribution (green) and wintering distribution outside of the breeding distribution (blue) and migration routes (grey) based on Mattsson et al. Black lines represent country borders and coastlines (OpenStreetMap). (Panter et al. submitted)

RESULTS

- Between 2013–2022: 2,346 red kites were tagged across 14 European countries.
- Mortality causes: 48 identified, grouped into 13 categories (8 anthropogenic, 5 natural).
- Conclusive deaths (n=624): 69% due to human causes.
- Top anthropogenic causes:
 - Poisoning (25.2%)
 - Road collisions (10.9%)
 - Power lines (9.9%)
 - Illegal shooting/trapping (8.7%)
 - Trains (5.4%)
 - Wind turbines (3.8%)
- Country differences:
 - Poisoning higher in AT/CZ/SK/HU and FR vs. DE (+32.1%, +30.8%)
 - Power line deaths lower in DE vs. ES (-16.6%)
 - Rail collisions higher in DE vs. ES (+9.1%)

These results show the high level of human footprint currently imposed on wild predators (Figure 3).

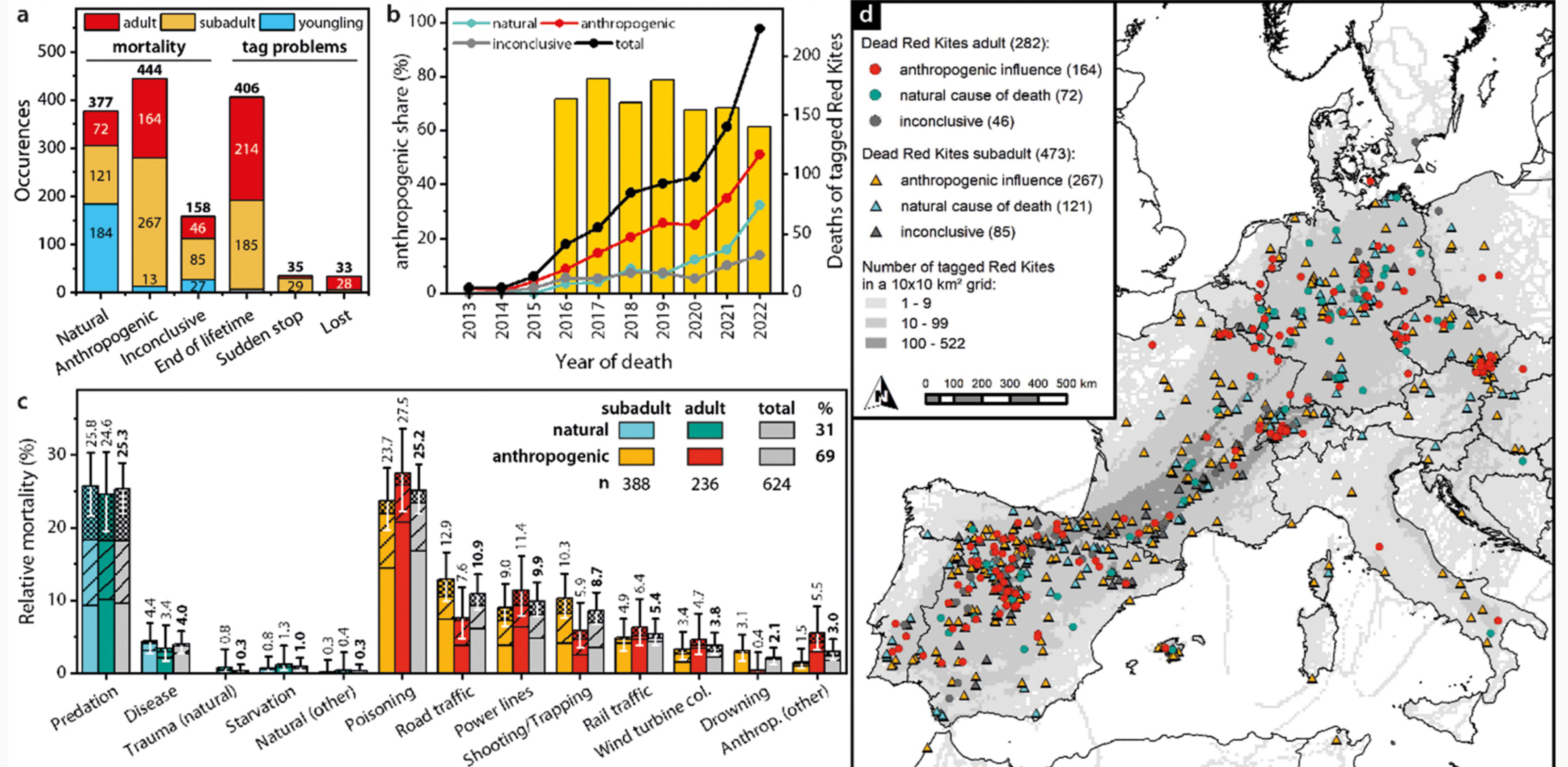


Figure 3: Mortality distribution of red kites: (a) data 307 summary ('mortality' and 'tag problems'). (b) Number of mortality events (lines) for subadults and adults, and the proportion of anthropogenic causes between 2013–2022 (barplots). (c) Proportion of different mortality categories for different age classes. Within bar pattern shows certainty (solid: 'certain', hashed: 'probable', grated: 'possible'). Numbers indicate the total proportion, error bars are 95% confidence intervals. (d) Locations of mortality events for subadults and adults. Grey areas show the density of tracked individuals in this study at a 10 km² resolution. (Panter et al. submitted)

CONCLUSION

We found that human activities have a significant impact on an indicator species, with distinct variation of mortality causes between countries that likely reflect differences in national law, its enforcement and local traditions in hunting and agricultural practices. Our results have broad implications for species conservation beyond red kites, as similar risks of anthropogenic mortality threaten other wildlife species across Europe. Anthropogenic mortality accounted for 69% of total red kite deaths in Europe. Poisoning and shooting together were responsible for more than one third of all mortality events for red kites in Europe. Energy infrastructure, excluding traffic, caused 14% of red kite deaths, with power lines contributed 9.9% and wind turbines 3.8%. In Germany, electrocution on power lines was not a significant issue due to effective legal regulations. Their implementation in other countries and enhancing legislation via joint international effort will greatly benefit red kite populations, and more widely, wildlife in Europe.

References:
 Mattsson B.J. et al. (2022). Enhancing monitoring and transboundary collaboration for conserving migratory species under global change: the priority case of the red kite. *J. Environ. Manag.* 317, 115345, 2022.
 Panter et al. (2025). A LEAP forward in wildlife conservation: a standardized framework to determine mortality causes in large GPS-tagged birds. DOI:10.1002/ece3.70975
 Panter et al. (submitted). High human-caused mortality in GPS-tracked red kites across Europe. Submitted to *Communications Biology* 05/2025.

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