Environmental acoustics research unit
(Université Gustave Eiffel-Cerema)

INTERNSHIP PROPOSAL 2026

Internship subject

Effects of wind farms and their associated noise on the movement ecology of the lesser kestrel (*Falco naumanni*)

Degree

☒Master (M2) ☐Master (M1) ☒Ingénieur / Engineer ☐Licence / *Bachelor* ☐Bac + 2

Skills required

Bac+5 level, knowledge of movement ecology, sensory ecology, and biologging data analysis (GPS, accelerometers), spatial analysis and GIS, basic knowledge of environmental acoustics, scientific programming (R, Python, or MATLAB).

Description

Context. *The rapid development of wind energy is a major lever for ecological transition, essential for limiting climate change. However, the growing number of onshore wind farms raises major challenges for biodiversity conservation (Bauer et al., 2025). For birds, the potential impacts of wind turbines include mortality from collisions, habitat fragmentation or avoidance of certain habitats, as well as more subtle behavioral disturbances (Bauer et al., 2025).*

Among the pressures on biodiversity associated with the development of renewable energies, the noise generated by wind turbines is a component that has not yet been sufficiently studied. Noise can disrupt sensory perception, communication, and spatial decision-making in animals (Kight and Swaddle, 2011) and, ultimately, affect their survival. In raptors, whose hunting strategies rely on the integration of visual and auditory information (Rice, 1981), noise could alter movement and space utilization behaviors, independently of the visual effects and structural changes to the habitat induced by noise-generating installations.

The lesser kestrel (Falco naumanni) is a particularly relevant species for addressing these issues. A common diurnal raptor in agricultural landscapes, it frequents heavily anthropized areas, including areas equipped with wind turbines. Its hunting ecology, characterized by hovering and small-scale movements, makes it particularly interesting for studying the influence of infrastructure and noise on movement decisions. The use of biologging devices (GPS, motion sensors, Figure 1) now makes it possible to analyze these behavioral responses with unprecedented spatial and temporal resolution.

Figure 1. *Example of movement data for an individual Falco naumanni. The white trajectory corresponds to GPS tracking, and the red markers indicate known wind farms. Sources: Géorisques (https://www.georisques.gouv.fr/), Google Earth Pro, ENGIE Green.*

Research question. *While the impact of wind turbines on bird mortality is relatively well documented, the behavioral mechanisms by which these infrastructures influence the use of space remain largely unknown (Marques et al., 2014). In particular, the specific role of wind turbine noise in movement decisions has been little addressed, and even less so at the individual level. The central question of this project is therefore: How do the presence of wind turbines and the noise they generate influence the trajectories, flight behaviors, and hunting strategies of the lesser kestrel?*

This project lies at the interface between movement ecology, behavioral ecology, and conservation, and aims to go beyond a descriptive approach to identify the processes underlying the observed responses.

Internship objectives. *The overall objective of the internship is to assess the combined influence of proximity to wind turbines and exposure to noise on the movements of kestrels, based on biologging data.*

The specific objectives are to:

- *Integrate multi-source data: combine GPS and animal-borne sensor data with wind turbine mapping and spatialized noise models (similar to approaches used to quantify human exposure to noise, e.g., Ecotière et al., 2022, Figure 2) in order to characterize individual bird exposure.*
- *Characterize behaviors and movements: identify different behavioral states (movement, hunting, hovering) from trajectories and sensor signals (accelerometers), and quantify space use based on distance from wind turbines and noise level.*
- *Test the effect of noise on movement decisions: analyze variations in trajectory, speed, and behavior along acoustic gradients, and compare the effect of noise to that of the physical presence of turbines alone.*
- *Discuss implications for conservation: interpret the results with a view to conciliating wind energy development and biodiversity, identifying management or planning options based on the behavioral mechanisms observed.*

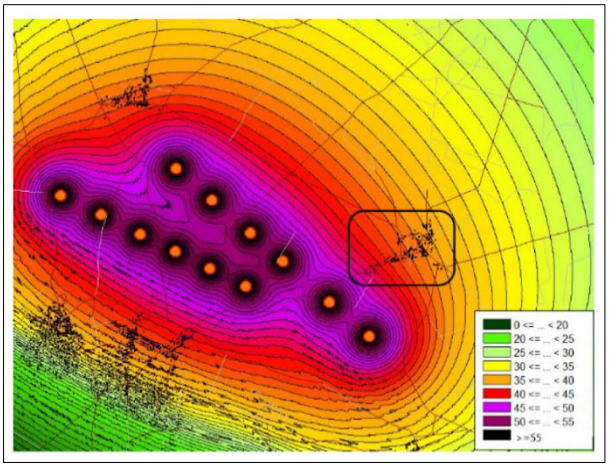

Figure 2. *Example of sound level (dBA) radiated by a wind farm (Ecotière et al., 2022)*

References

Bauer, S., Lancaster, L.T., Zimmermann, N.E., 2025. Towards a sustainable energy transition. J. Appl. Ecol. 62, 1570–1578. https://doi.org/10.1111/1365-2664.70075

Ecotière, D., Demizieux, P., Guillaume, G., Giorgis-Allemand, L., Evrard, A.-S., 2022. Quantification of Sound Exposure from Wind Turbines in France. Int. J. Environ. Res. Public. Health 19, 23. https://doi.org/10.3390/ijerph19010023

Kight, C.R., Swaddle, J.P., 2011. How and why environmental noise impacts animals: an integrative, mechanistic review. Ecol. Lett. 14, 1052–1061. https://doi.org/10.1111/j.1461-0248.2011.01664.x

Marques, A.T., Batalha, H., Rodrigues, S., Costa, H., Pereira, M.J.R., Fonseca, C., Mascarenhas, M., Bernardino, J., 2014. Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies. Biol. Conserv. 179, 40–52. https://doi.org/10.1016/j.biocon.2014.08.017

Rice, W.R., 1981. Acoustical localization of concealed prey by the diurnal harrier (Circus cyaneus) (PhD thesis). Oregon State University.

Location

☐ **Uni Eiffel, Campus Lyon** (25, avenue François Mitterrand, Case24, Cité des mobilités, F-69675 Bron Cedex)

☐ **Uni Eiffel, Campus Nantes** (route de Bouaye, CS4, F-44344 Bouguenais Cedex)

☒ **Cerema – Strasbourg** (11, rue Jean Mentelin, Strasbourg-Koenigshoffen, F-67035 Strasbourg)

Duration

Duration: 6 months

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