Tour du Valat
Research institute for the conservation of Mediterranean wetlands

PRESS RELEASE
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Birds change altitude to survive epic journeys across deserts and seas

New study reveals how wing shape and plumage color shape migration strategies

Every year, billions of birds undertake extraordinary migrations, crossing vast deserts and open seas with no place to stop, feed, or rest. A new international study published in iScience by a consortium of researchers from Tour du Valat, CEFE/CNRS, Muséum national d'Histoire naturelle and Swiss Ornithological Institute reveals that small migratory birds adjust how high they fly over these ecological barriers, and that their strategies depend on wing morphology and plumage color.

Using miniature multi-sensor tracking devices, researchers tracked 17 species of small migratory birds as they crossed two major barriers on their journey between Europe and sub-Saharan Africa: the Sahara Desert and large marine areas such as the Mediterranean Sea and the Bay of Biscay.

The results show striking differences in flight behavior.

Flying high over the Sahara, low over the sea

When crossing the Sahara Desert, birds typically flew at much higher altitudes than over the sea, often reaching 2,500 to 4,000 meters above sea level, especially during daytime. In contrast, sea crossings usually occurred at much lower altitudes, sometimes probably just a few dozen meters above the water surface.

According to Jocelyn Champagnon, a senior researcher at Tour du Valat and co-last author of the study, «These small birds fly almost exclusively at night, but they sometimes extend their night flights into the following day when crossing the desert. When the sun rises, we have found that they fly higher. This behaviour probably helps them avoid overheating by reaching cooler air at higher altitudes. Conversely, when crossing the seas, they descend, which puts them at risk of colliding with future offshore wind developments.»

Wing size and color matter

The study shows that physical traits help explain why species fly at different heights:

- Birds with larger wings tended to fly higher, likely because larger wing area provides more lift in thinner air.
- Darker-plumaged species flew higher during daytime desert crossings, probably to reduce heat absorbed from solar radiation.

- Species with shorter wing bones also flew higher during daytime flights, suggesting they may rely more on cooler air at altitude to dissipate heat during long journeys. In contrast, species with longer wing bones have a larger and more vascularised wing surface, which likely allows more efficient heat dissipation and better tolerance of high temperatures without needing to climb as high.

Together, these results demonstrate that migration strategies are closely linked to anatomy and thermal constraints.

Unexpected low-altitude sea flights

Over marine barriers, some species, particularly the Northern Wheatear, frequently flew extremely close to the sea surface, sometimes spending most of the crossing below 50 meters in altitude.

Flying low may reduce energy costs by exploiting calmer winds near the surface or aerodynamic effects close to the water, although further research will be needed to fully understand the benefits of this strategy.

Why are these results important?

Long distance migratory birds are declining. Ecological barriers such as deserts and seas represent some of the most dangerous stages of bird migration. The study highlights how finely tuned these crossing strategies are, and how sensitive they may be to environmental change.

The findings have implications for wind energy development in marine environments. Many migratory birds cross seas at low altitudes, sometimes flying close to the water surface, which may bring them into the range of offshore wind turbines during long-distance flights. Understanding when, where, and how high birds fly over marine areas can help improve the planning and operation of wind farms, reducing collision risks.

This study was funded by the Migralion (2021-2025) and Migratlane (2022-2027) French programmes, initiated in the context of offshore wind power development, to address the critical lack of data on seabirds and migratory birds, particularly in the Gulf of Lion and the Bay of Biscay, and the urgent need to acquire accurate knowledge about these species.

Dufour, P. et al. (2026). *Ecological barrier crossing strategies in small migratory birds depend on wing morphology and plumage color*. **iScience**, 29, 114466. https://doi.org/10.1016/j.isci.2025.114466

About Tour du Valat

The Tour du Valat is a research institute for the conservation of Mediterranean wetlands, founded 72 years ago by Luc Hoffmann. It has developed its research activities for the conservation of Mediterranean wetlands with a constant focus on reconciling humans and nature.
For many years, the Tour du Valat has been developing research and integrated management programs that promote exchanges between wetland users and scientists, mobilize a community of stakeholders, and promote the benefits of wetlands to decision-makers and socio-economic actors.

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