

Migratory Bats on the Map

Bringing bats into the CMS Atlas of Animal Migration

Prof. Dr. Christian C. Voigt



Bat facts

Broad distribution

Bats occur almost everywhere,
except for the polar regions

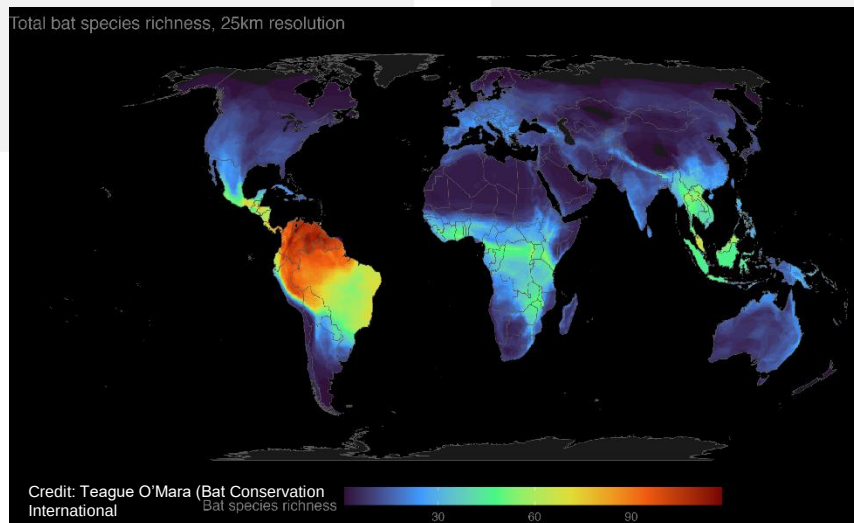
High Diversity

Bats are the second largest
mammal taxa 1,500 species, only
outnumbered by rodents

Peculiar traits

- Longevity
- Low reproductive rate
- High mobility

„Bats are large mammals trapped
in a small body“





Leibniz Institute for Zoo
and Wildlife Research
IN THE FORSCHUNGSVERBUND BERLIN E.V.



Bats migrate across borders, yet are often missed

**More than
3,500 km**

Seasonal flights recorded for Leislars' bats between north-east and south-west Europe

Bats migrate across borders, yet are often missed

**More than
3,500 km**

Seasonal flights recorded for Leislers' bats between north-east and south-west Europe

**Small &
nocturnal**

Most migrants weigh under 40 g and fly at night: hard to track, easy to overlook

Spot the bat in its natural habitat



Bats migrate across borders, yet are often missed

**More than
3,500 km**

Seasonal flights recorded for Leislers' bats between north-east and south-west Europe

**Small &
nocturnal**

Most migrants weigh under 40 g and fly at night: hard to track, easy to overlook



Billions

Massive migration of bats occurs worldwide, yet it is by and large overseen (unless species are large)



<https://www.cms.int/publication/>

Conducted for the straw-coloured fruit bat (Eidolon helvum)

A CMS framework to include bats

Under CMS, European bat populations are listed in the Annexes and covered by the EUROBATS Agreement



Discussing emerging threats and evidence-based conservation solutions



Outreach activities to inform the public (e.g., International Bat Night, lectures for UN International School)

Guidelines to improve the protection of migratory bats




Publication Series
No. **8**



Guidelines for consideration of bats in lighting projects

Revision will be launched on 18th of November

C.C. Voigt • C. Azam • J. Dekker • J. Ferguson • M. Fritze
S. Gazaryan • F. Hölker • G. Jones • N. Leader • D. Lewanzik
H.J.G.A. Limpens • F. Mathews • J. Rydell • H. Schofield
K. Spoelstra • M. Zagmajster

A CMS framework to include bats

Under CMS, European bat populations are listed in Appendix I and II and covered by the EUROBATS Agreement

*Guidelines to
improve the
protection of
migratory bats*

EUROBATS

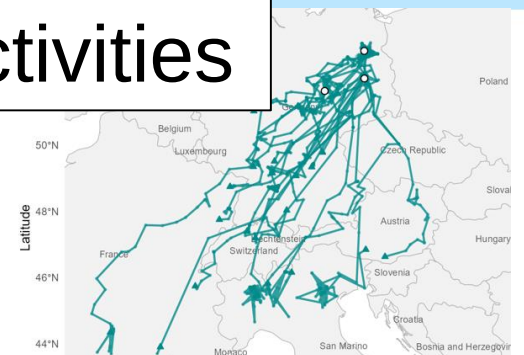
Publication Series
No. **14**

What we need: A global upscaling of these activities



*Discussing emerging threats and
evidence-based conservation solutions*

*Outreach activities to inform the
public (e.g., International Bat Night,
lectures for UN International School)*



**Movement ecology of
European bats**

To be launched in 2027

I. Budinski, ..., many co-authors, ..., ...,
..., Voigt, C.C.

The Atlas of Animal Migration: where bats fit

What the Atlas does

- Compiles and visualises movement data across taxa and regions
- Informs conservation planning, policy and infrastructure decisions
- Moves toward a single CMS Gateway giving practical access to all modules
- Can link to Key Biodiversity Areas to flag critical habitats



The bat gap

Existing modules cover birds and other mammals. Bats lack a dedicated module, so their routes, stopover sites and roosts remain largely invisible.

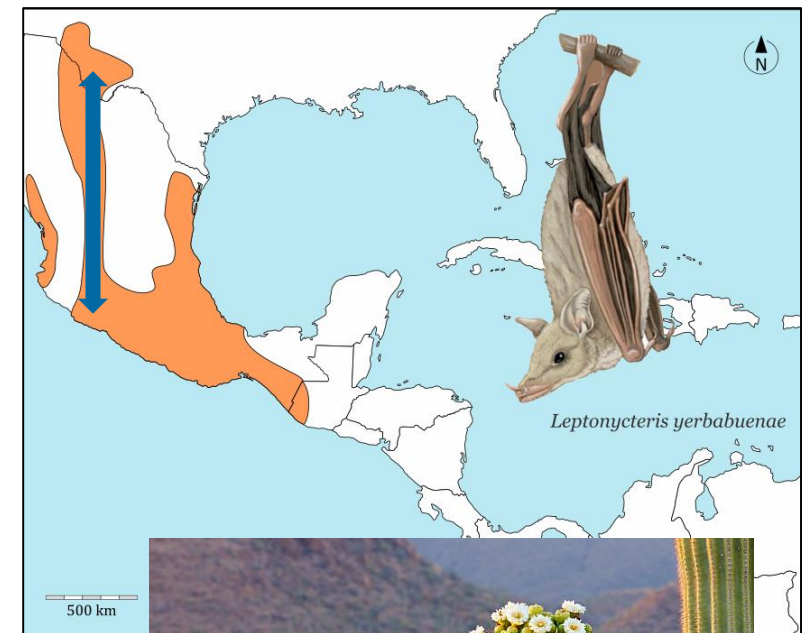
Three migration strategies to map



Long-distance latitudinal

Insectivorous and nectivorous
bats moving between summer
and winter ranges

Nathusius' pipistrelle, common
noctule, hoary bat, *Leptonycteris*
yerbabuenae



CHAPTER

11

Bat migration and
foraging: Energy-
demanding journeys on
tight budgets

Christian C. Voigt¹, Shannon E. Currie², Liam P. McGuire³

¹Leibniz Institute for Zoo and Wildlife Research, Berlin, Germany; ²Institute for Cell and Systems
Biology, University of Hamburg, Hamburg, Germany; ³Department of Biology, University of
Waterloo, Waterloo, ON, Canada



Credit: Getty Images/iStockphoto
copyright: Kenneth Cannin

Three migration strategies to map



Long-distance latitudinal

Insectivorous and nectivorous
bats moving between summer
and winter ranges

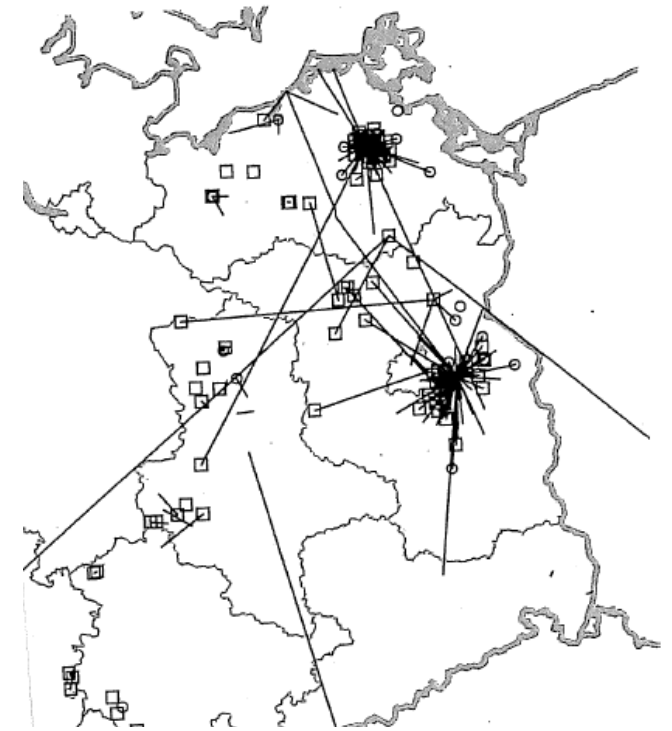
*Nathusius' pipistrelle, common
noctule, hoary bat, Leptonycteris
yerbabuenae*



Regional & seasonal

Shorter moves between
maternity roosts, swarming sites
and hibernacula

*Common pipistrelle, Greater mouse-
eared bat, Schreibers' bent-winged
bat, pond bat*



Movements of Common
pipistrelles from hibernacula

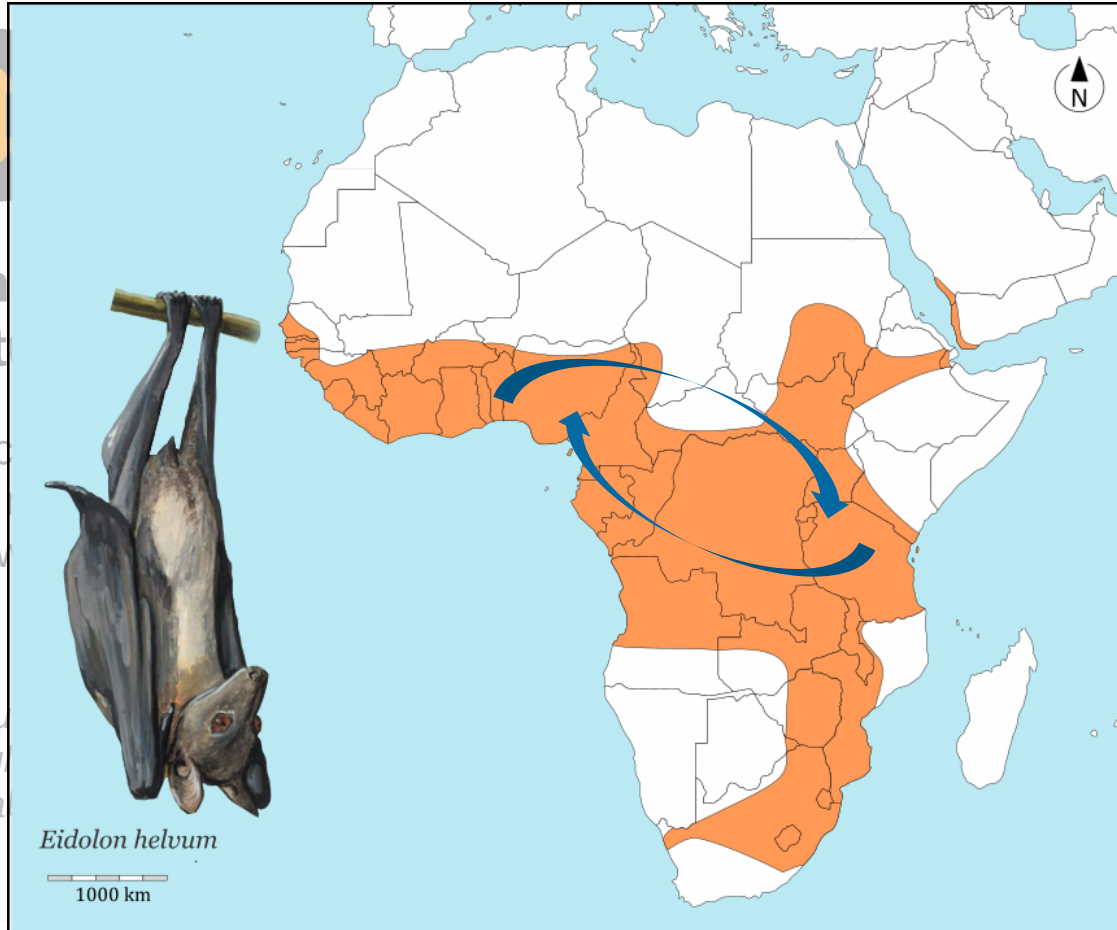
Three migration strategies to map



Long
latitudinal

Insectivorous
bats and v

Nathusius
noctua
yerba



Seasonal

between
farming sites

Greater mouse-
eared bat

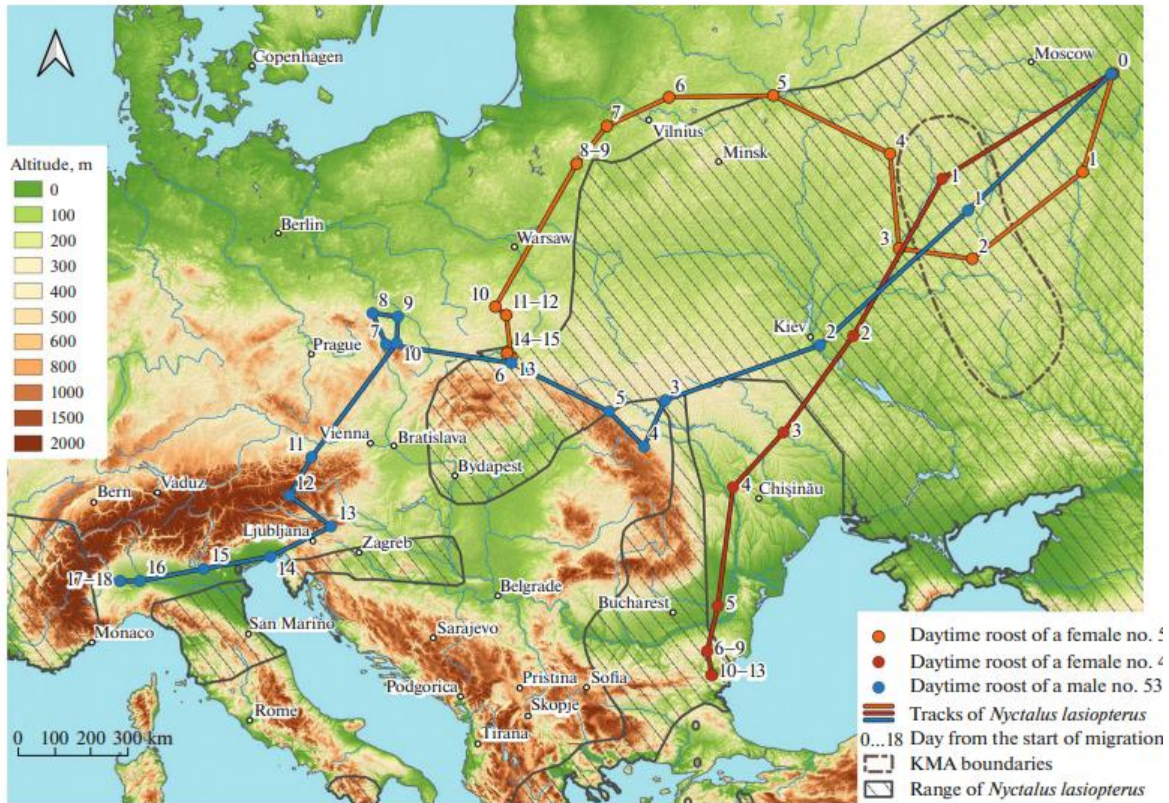


Nomadic frugivores

Tracking fruiting and flowering
across tropical landscapes

Straw-coloured fruit bat, flying foxes

And then there is the Eleanore's bat



Autumn Migration of Greater Noctule Bat (*Nyctalus Lasiopterus*):
through Countries and over Mountains
to a New Migration Flight Record in Bats

D. A. Vasenkov*, N. S. Vasiliev*, N. V. Sidorchuk*, and Academician V. V. Rozhnov***



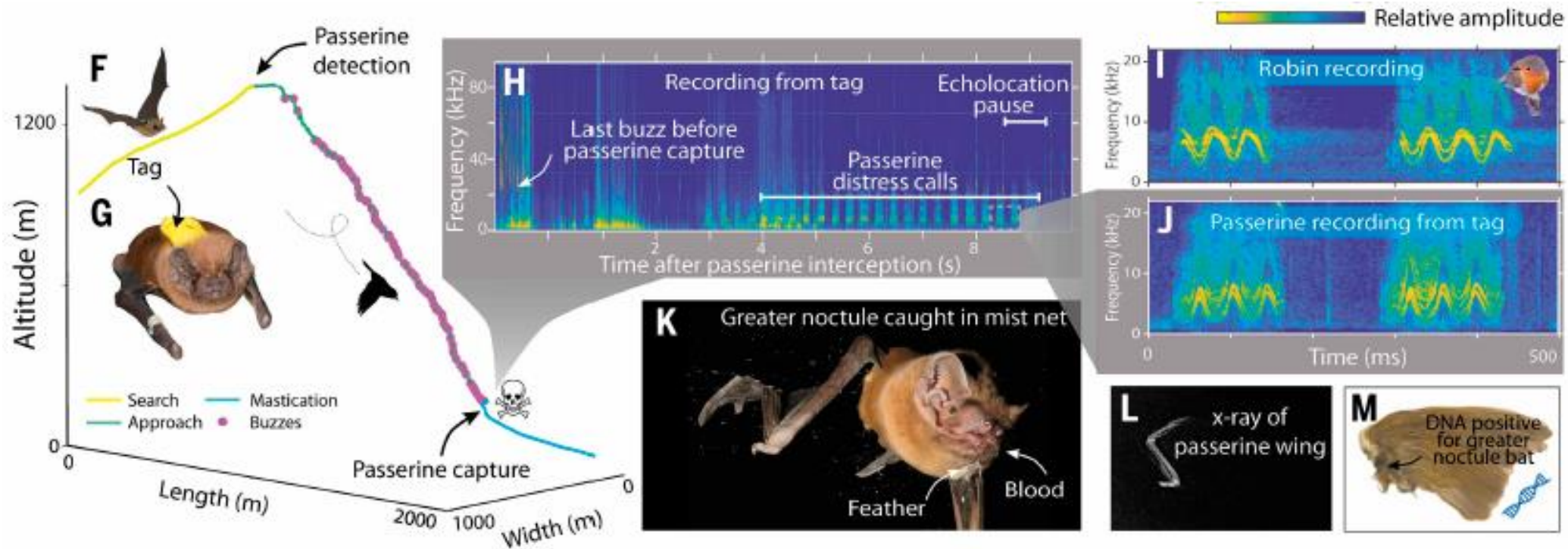
Leibniz Institute for Zoo
and Wildlife Research
IN THE FORSCHUNGSVERBUND BERLIN E.V.

Member of the
Leibniz
Leibniz Association

And then there is the Eleanore's bat



And then there is the Eleanore's bat



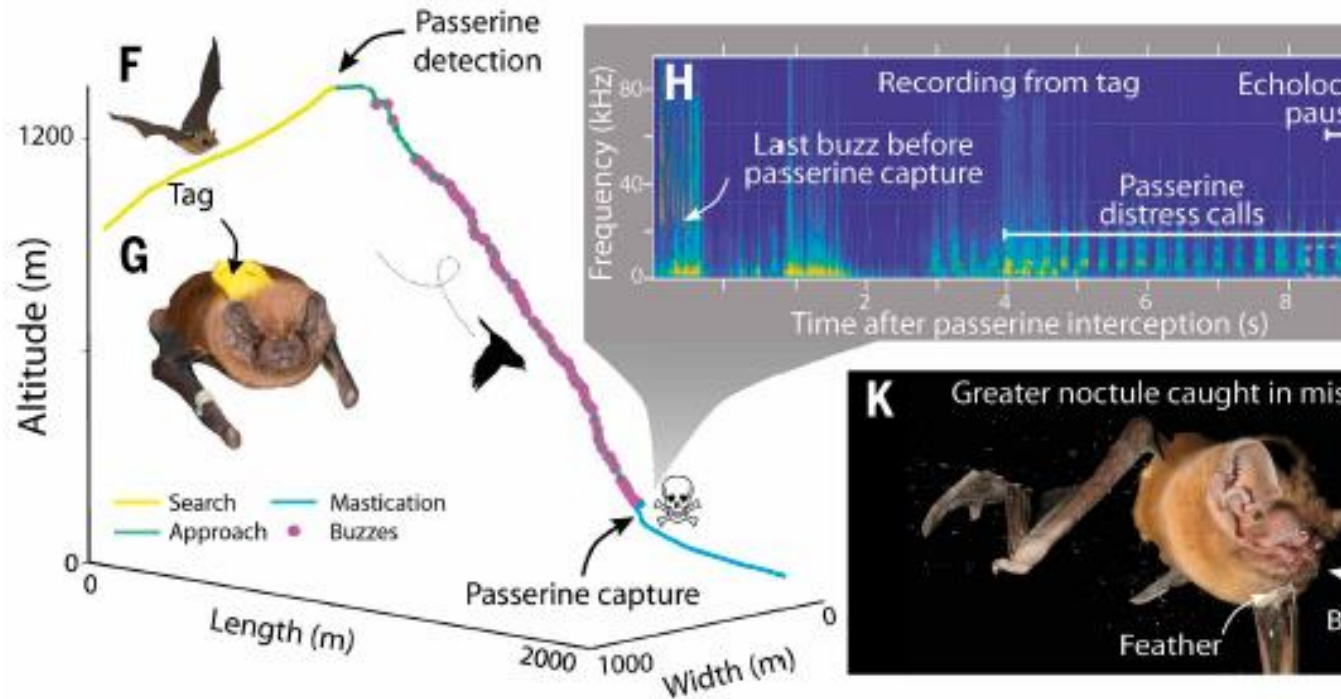
RESEARCH ARTICLES

PREDATION

Greater noctule bats prey on and consume passerines in flight

L. Stidsholt^{1,2,*}, E. Tena^{3,*}, I. Foskolos^{1,4}, J. Nogueras³,
I. de la Hera^{5,6,7}, S. Sánchez-Navarro³, J. L. García-Mudarra³,
C. Ibáñez³

And then there is the Eleanore's bat



RESEARCH ARTICLES

PREDATION

Greater noctule bats prey on and consume passerines in flight

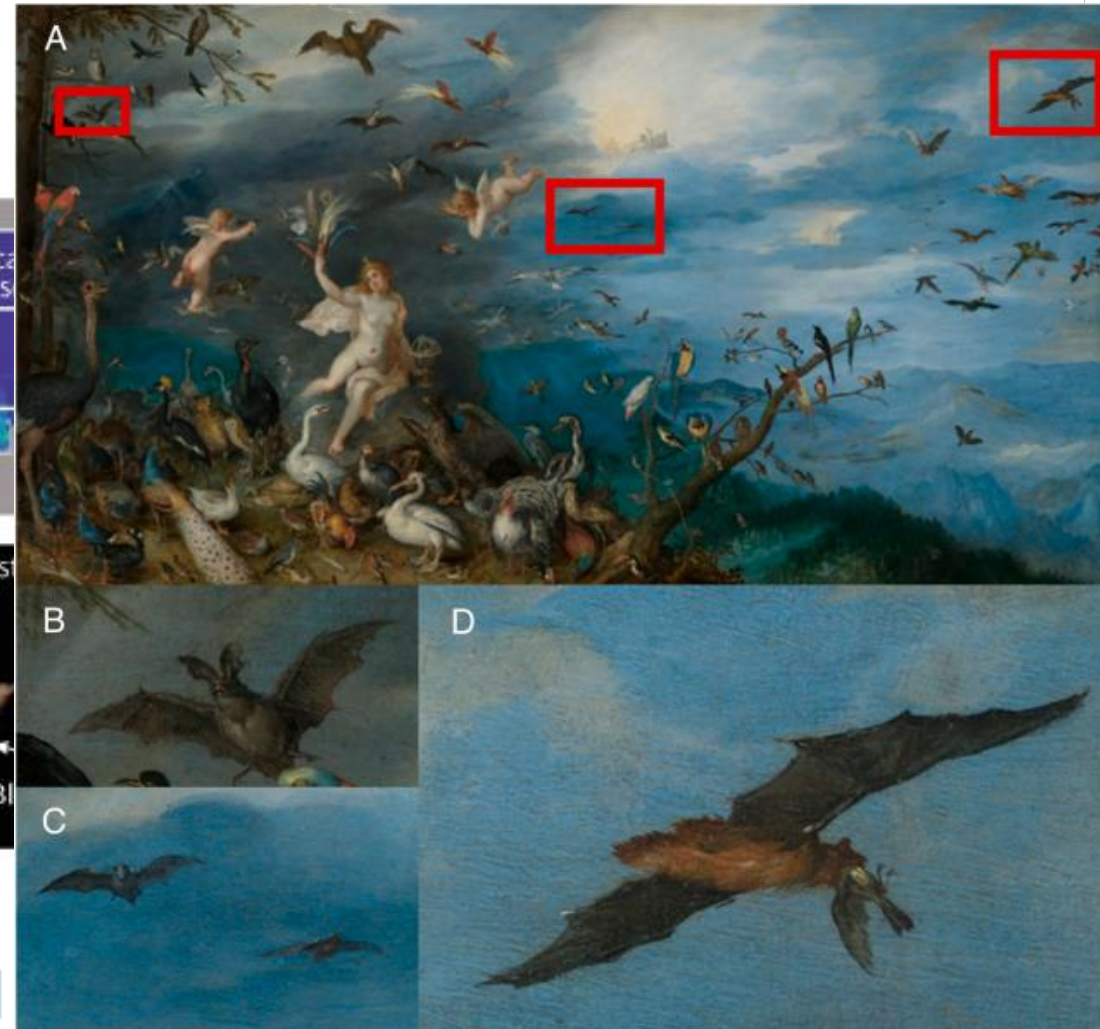
L. Stidsholt^{1,2,*}, E. Tena^{3,*}, I. Foskolos^{1,4}, J. Noguera³,
I. de la Hera^{5,6,7}, S. Sánchez-Navarro³, J. L. García-Mudarra³,
C. Ibáñez³

PNAS

BRIEF REPORT

Natural history on canvas: Brueghel knew about bird-eating noctule bats

Pedro Romero-Vidal^{a,1}, Sonia Sánchez-Navarro^b, Elena Tena^c, and Miguel Clavero^{a,1}



Threats concentrate along routes and at roosts



Wind energy

Collisions peak during autumn migration



Roost loss

Tree felling, renovation and cave disturbance



Artificial light

Disrupts commuting and migratory flight paths



Climate change

Shifts timing and food availability, heat waves



Habitat fragmentation

Breaks corridors such as river valleys and forests



Hunting & persecution

Bushmeat harvest of large fruit bats in parts of Africa and Asia



Threats concentrate along routes and at roosts



Wind energy

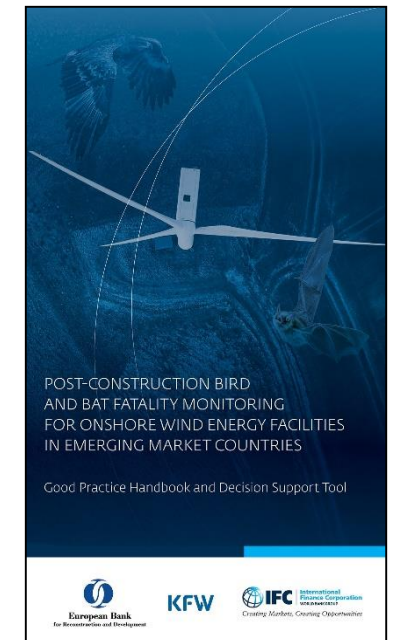
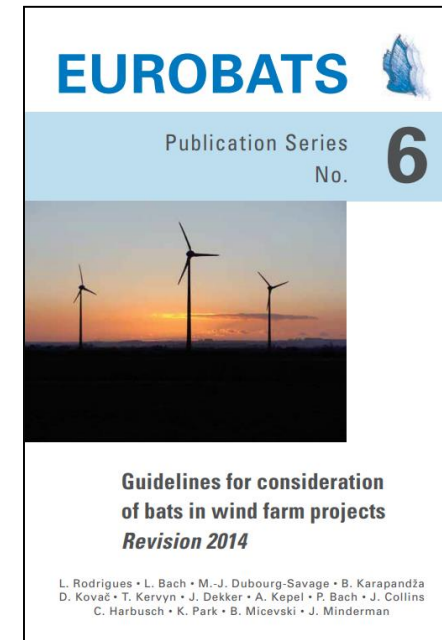
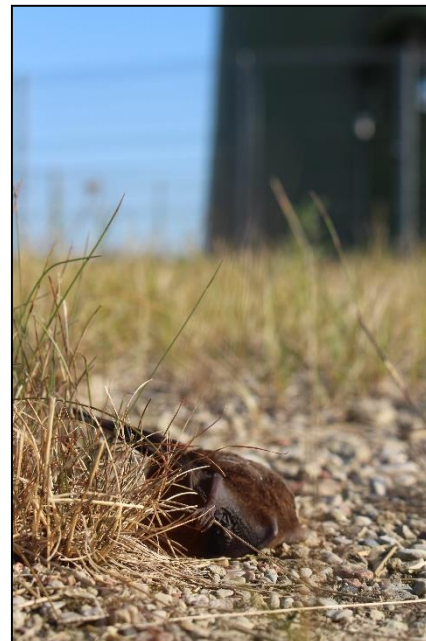
Collisions peak during autumn migration



In the temperate zone, wind turbines kill about 12-14 bats per year, i.e. 5-6 per MW produced

- >200.000 bats killed in Germany
- >1 Million bats killed in the US and Canada

Mitigation schemes are possible, but not practiced worldwide



BioScience, 2024, 0, 1–13

<https://doi.org/10.1093/biosci/biae023>

Advance access publication date: 0 2024

Forum

Toward solving the global green-green dilemma between wind energy production and bat conservation

Christian C. Voigt , Enrico Bernard , Joe Chun-Chia Huang , Winifred F. Frick , Christian Kerbiriou , Kate MacEwan , Fiona Mathews , Armando Rodríguez-Durán , Carolin Scholz , Paul W. Webala , Justin Welbergen  and Michael Whitby 

Lessons learned: how bat movement is measured

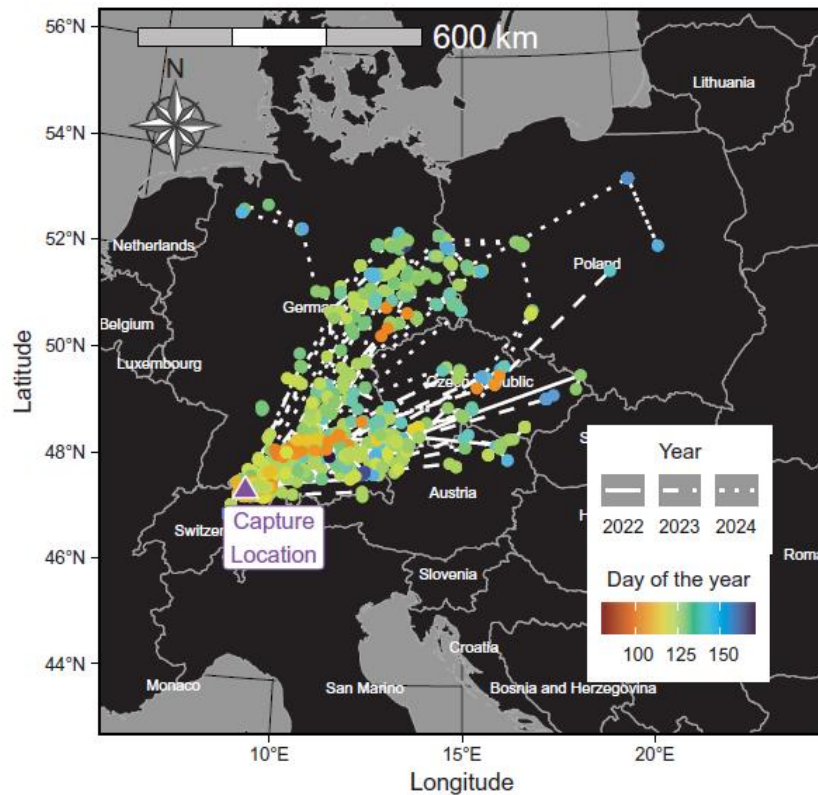
Method	Strength	Limitation
Ringling / banding	Long time series of recoveries	Very low recovery rates
Radio telemetry networks	Tags light enough for small species	Detection only near receivers
GPS / satellite tags	Full tracks for large fruit bats	Too heavy for most insectivores
Stable isotopes	Origin of bats found at turbines or roosts	Coarse spatial resolution
Acoustic & radar	Timing and intensity of passage	Species ID and direction uncertain



Tag mass is usually capped at about 5% of body weight, the key constraint for small migrants.

New technologies, new opportunities to track small and cryptic animals: Tracking with the Internet-of-things)

Spring migration of common noctule bats



RESEARCH

MIGRATION

Bats surf storm fronts during spring migration

Edward Hurme^{1,2,3,*}, Ivan Lenzi¹, Martin Wikelski^{1,2,3}, Timm A. Wild^{1,†}, Dina K. N. Dechmann^{1,2,3,†}

Challenges

Data deficiency for most species

Particularly for emerging markets, global south

Lack of funding

Lack of expertise

Lack of data sharing

Individual researchers, NGO members, bat experts may not be willing to share their data

Taxonomy

Outdated reference

Harmonise

Data structure is diverse

CMS platform missing

Commonly accepted and centrally administered via continuous funding

Lack of international pressure and legal obligation to put evidence-based solutions into practice

Migratory Bats on the Map

Bringing bats into the CMS Atlas of Animal Migration

Contact me at: voigt@izw-berlin.de

Prof. Dr. Christian C. Voigt

