

Bats & Wind Energy

Medegebruik en Ecologie workshop voor de energiesector



Photo René Janssen

Sander Lagerveld, 9 February 2023

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SUMMARY OF WIND TURBINE IMPACTS ON BATS – ASSESSMENT OF A CONFLICT

Lothar BACH & Ulf RAHMEI

WILEY

JOURNAL ARTICLE

Patterns of Bat Fatalities at Wind Energy Facilities in North America

Edward B. Arnett, W. Kent Brown, Wallace P. Erickson, Jenny K. Fiedler, Brenda L. Hamilton, Travis H. Henry, Aaftab Jain, Gregory D. Johnson, Jessica Kerns, Rolf R. Koford, Charles P. Nicholson, Timothy J. O'Connell, Martin D. Piorkowski and Roger D. Tankersley, Jr.

Bat mortality at wind turbines in northwestern Europe

Rydell, Jens ^{LU} ; Bach, Lothar ; Dubourg-Savage, Marie-Jo ; Green, Martin ^{LU} ; Rodrigues, Luisa and Hedenström, Anders ^{LU}
(2010) In *Acta Chiropterologica* 12(2). p.261-274

FRONTIERS IN ECOLOGY and the ENVIRONMENT

Review

Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses

Thomas H. Kunz , Edward B. Arnett, Wallace P. Erickson, Alexander R. Hoar, Gregory D. Johnson, Ronald P. Larkin, M. Dale Strickland, Robert W. Thresher, Merlin D. Tuttle

Wildlife and renewable energy: German politics cross migratory bats

Christian C. Voigt , Linn S. Lehnert, Gunars Petersons, Frank Adorf & Lothar Bach

European Journal of Wildlife Research 61, 213–219 (2015) | [Cite this article](#)

Bats Killed in Large Numbers at United States Wind Energy Facilities

Mark A. Hayes

BioScience, Volume 63, Issue 12, December 2013, Pages 975–979,
<https://doi.org/10.1525/bio.2013.63.12.10>




Biological Conservation

Volume 209, May 2017, Pages 172–177



Fatalities at wind turbines may threaten population viability of a migratory bat

W.F. Frick ^{a,b} , E.F. Baerwald ^{c,d}, J.F. Pollock ^b, R.M.R. Barclay ^e, J.A. Szymanski ^e, T.J. Weller ^f, A.L. Russell ^g, S.C. Loeb ^h, R.A. Medellín ⁱ, L.P. McGuire ^j

Impacts of Wind Energy Development on Bats: A Global Perspective

Edward B. Arnett , Erin F. Baerwald, Fiona Mathews, Luisa Rodrigues, Armando Rodriguez-Durán, Jens Rydell, Rafael Villegas-Patracá & Christian C. Voigt


Chapter | [Open Access](#) | [First Online: 08 December 2015](#)

32k Accesses | 52 Citations | 21 Altmetric

PLOS ONE

 OPEN ACCESS  PEER-REVIEWED
RESEARCH ARTICLE

Wind Farm Facilities in Germany Kill Noctule Bats from Near and Far

Linn S. Lehnert , Stephanie Kramer-Schadt, Sophia Schönborn, Oliver Lindeke, Ivo Niemann, Christian C. Voigt

Investigating the causes of death for wind turbine-associated bat fatalities

Steven M. Grodsky, Melissa J. Behr, Andrew Gendler, David Drake , Byron D. Dieterle, Robert J. Rudd, Nicole L. Walrath | [Author Notes](#)

Journal of Mammalogy, Volume 92, Issue 5, 14 October 2011, Pages 917–925,
<https://doi.org/10.1644/10-MAMM-A-404.1>

[Proc Natl Acad Sci U S A](#). 2014 Oct 21;111(42):15126–31. doi: 10.1073/pnas.1406672111.
Epub 2014 Sep 29.

Behavior of bats at wind turbines

Paul M Cryan ¹, P Marcos Gorresen ², Cris D Hein ³, Michael R Schirmacher ³, Robert H Diehl ⁴, Manuela M Huso ⁵, David T S Hayman ⁶, Paul D Fricker ⁷, Frank J Bonaccorso ⁸, Douglas H Johnson ⁹, Kevin Heist ¹⁰, David C Dalton ¹¹

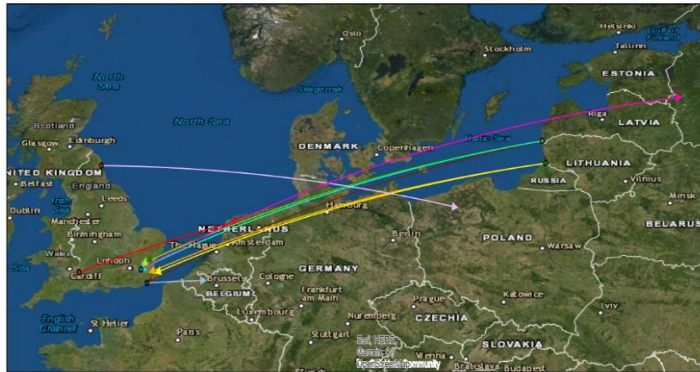
A Forensic Investigation Into the Etiology of Bat Mortality at a Wind Farm: Barotrauma or Traumatic Injury?

K. E. Rollins, D. K. Meyerholz , and S. S. Loew  | [View all authors and affiliations](#)

Volume 49, Issue 2 | <https://doi.org/10.1177/0300985812436745>

Bats & wind energy

- Open space foraging species
- Most fatalities occur late summer/early autumn
- Both resident as well as migratory bats
- Bat migration occurs over land **and** over sea



Source: www.bats.org.uk

How to prevent fatalities?

- Spatial planning of wind farms: avoid important flight routes and foraging areas (coastlines, along lakes and rivers, nature reserves, forests). Note that pre-construction bat activity is **not** a good predictor for post-construction mortality rates!
- Curtailment: avoid wind energy production when bats are most active
 - Triggered by real-time measured bat activity
 - Prediction model
 - Combination of both
- Deterrents

Effect assessment

- Population size and trends
- Life history characteristics
- Mortality rate
 - Occurrence in space and time
 - Movement patterns
 - Fatality risk

Bat research (relevant to effect assessment)

- Inventories: population size and trends
- Genetics: population size (?) and trends, population structure.
- Acoustics: presence/absence in space & time, population trends, habitat use
- Ringing: 'movements'
- Telemetry: movements and habitat use
 - Manual tracking: 'beeper' tags
 - MOTUS: stationary receivers and coded tags
 - GPS tags (only for larger species)
- Fatality research: mortality rate (on land)

Case study North Sea

Relevant species (KEC 1.0):

- Noctule (resident & migrant)
- Particolored bat (migrant)
- Nathusius' pipistrelle (migrant)



Numerous Knowledge gaps

Nature inclusive transitions

Impossible to assess actual mortality

Noctule – main results

- Individuals from coastal colonies in Noord & Zuid Holland perform occasional foraging trips over the North Sea
- Females show strong preference for terrestrial habitats, males and immatures probably likewise
- Limited number of acoustic records offshore, mainly during breeding season.
- Probably not at risk due to offshore wind developments in the Netherlands

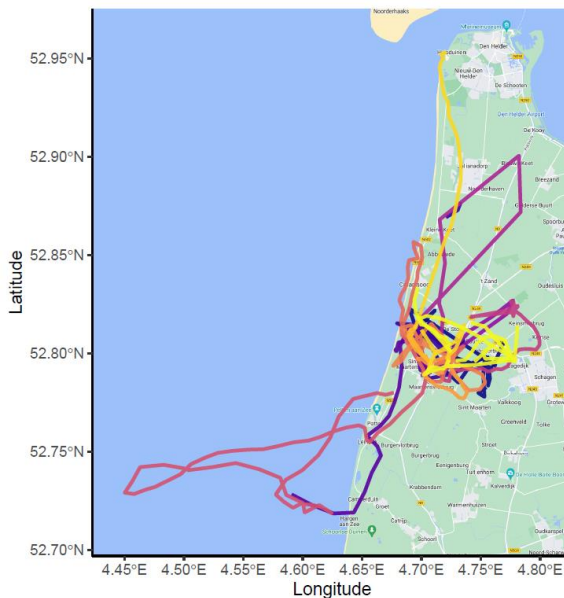


Photo Sander Lagerveld

Particolored bat – main results

- 'Ghost-like' coastal occurrence, apparently sometimes not uncommon
- Movements from south to northeast?
- Occasional acoustic records offshore
- Risk?
Too many unknowns..



Photo René Janssen



Nathusius' pipistrelle

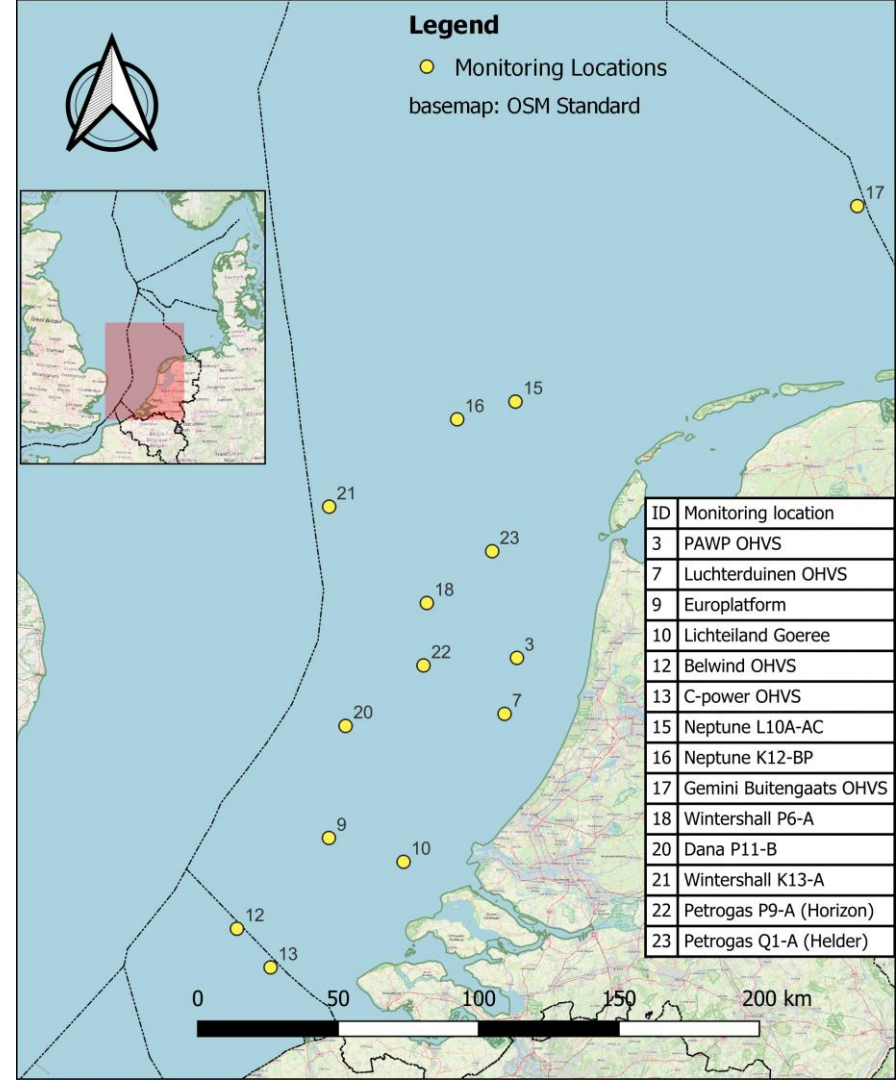
- Genetic analysis will produce information on the population structure, and likely/hopefully a rough estimate of the population size
- Occurrence in space and time by acoustic research
- Movements by telemetry research using MOTUS



Photo René Janssen

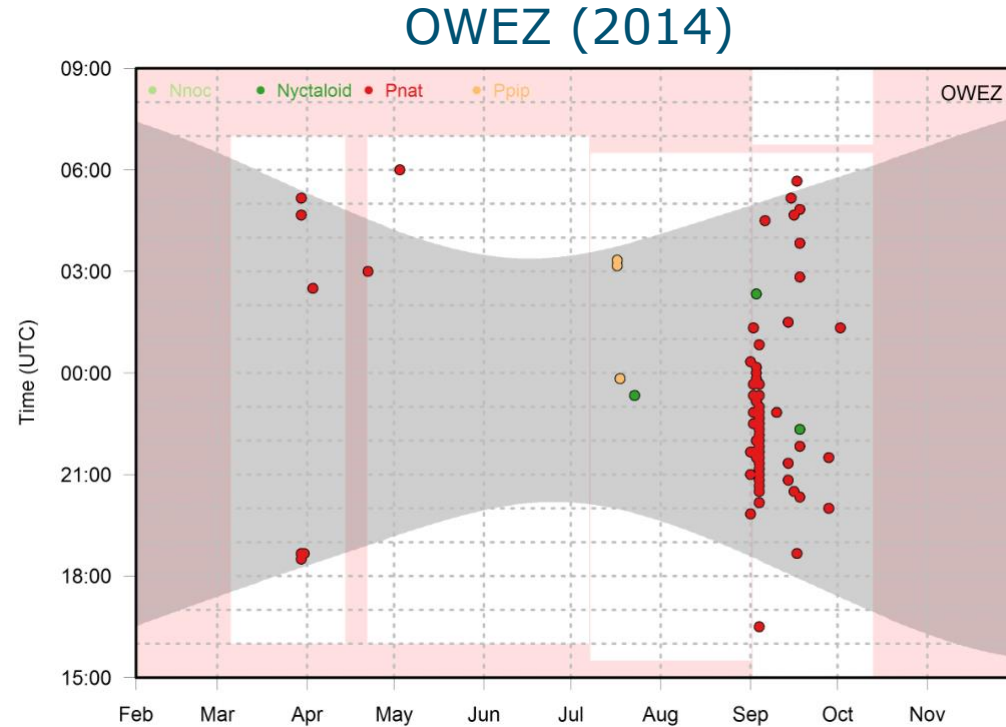
Acoustic research – aims:

- Species composition
- Occurrence in space and time
- Environmental conditions

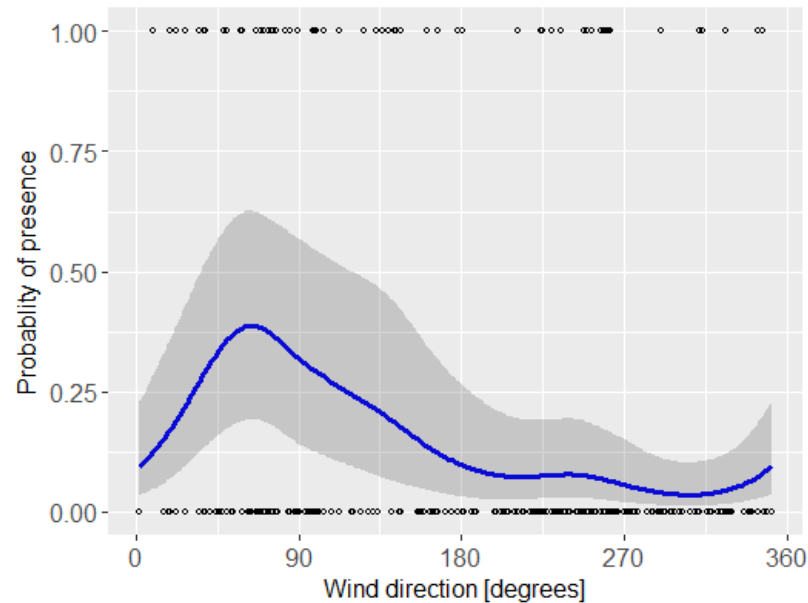
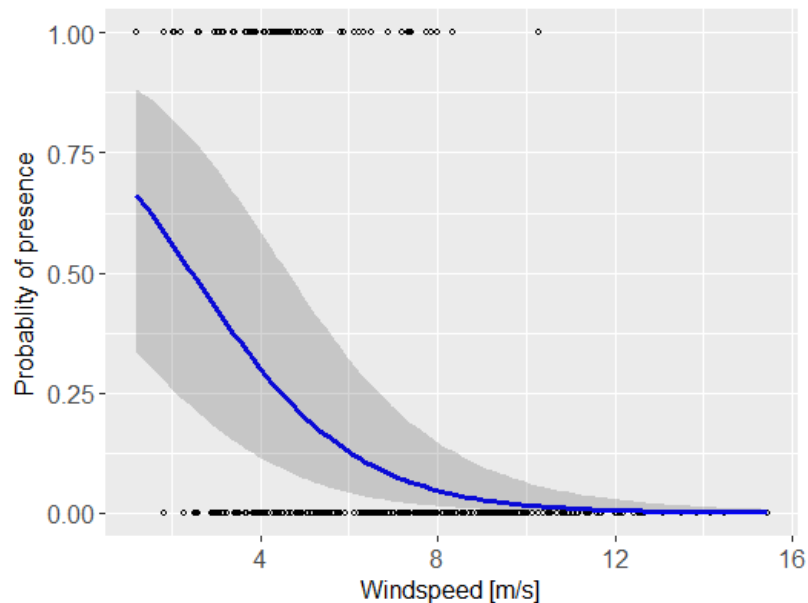


Acoustic research - results

- Nathusius' pipistrelle most frequently recorded bat offshore
- Much higher levels of acoustic bat activity in autumn
- Occasional recordings during daylight hours
- Diurnal stopovers



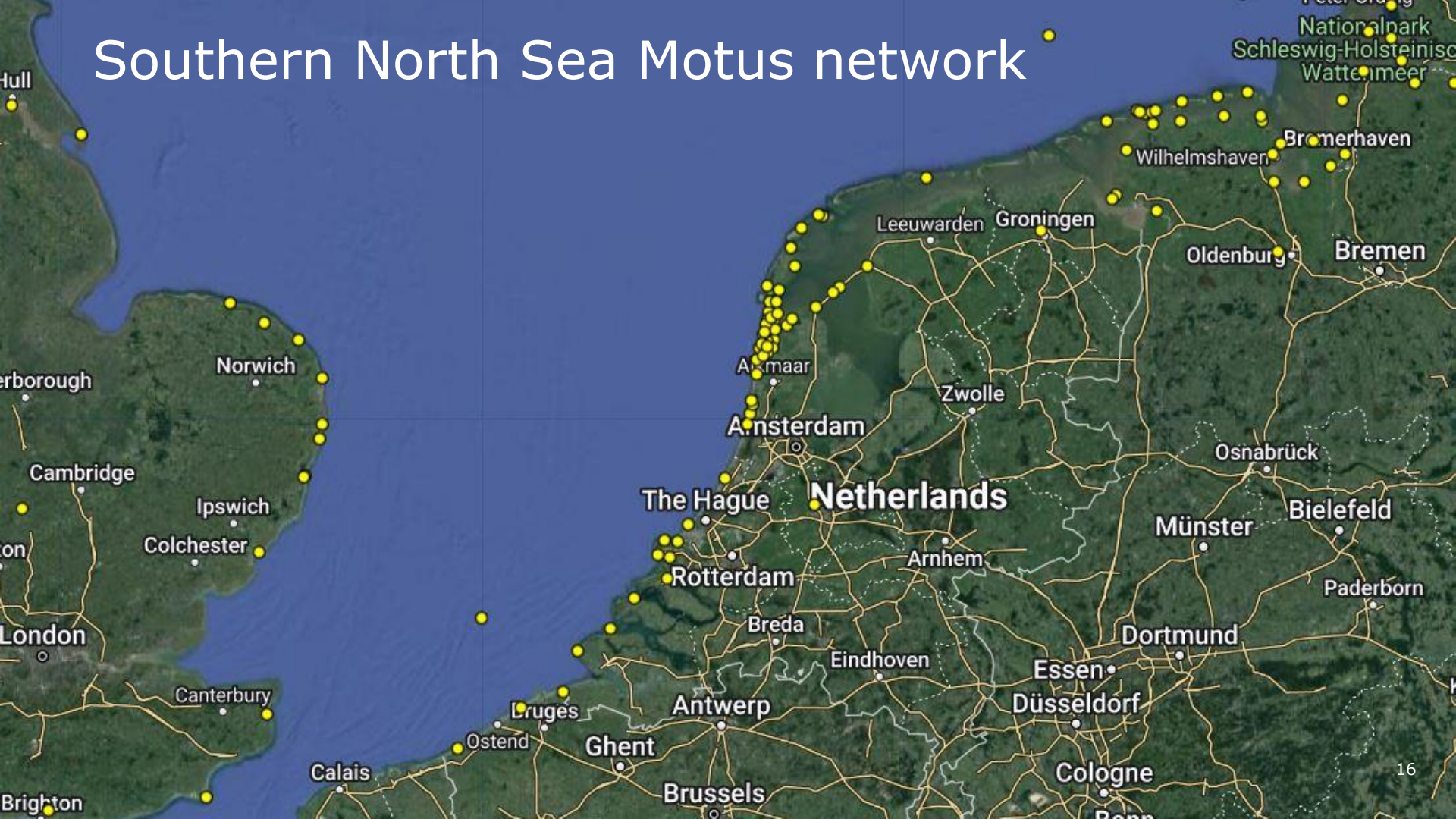
Autumn occurrence is mainly wind driven



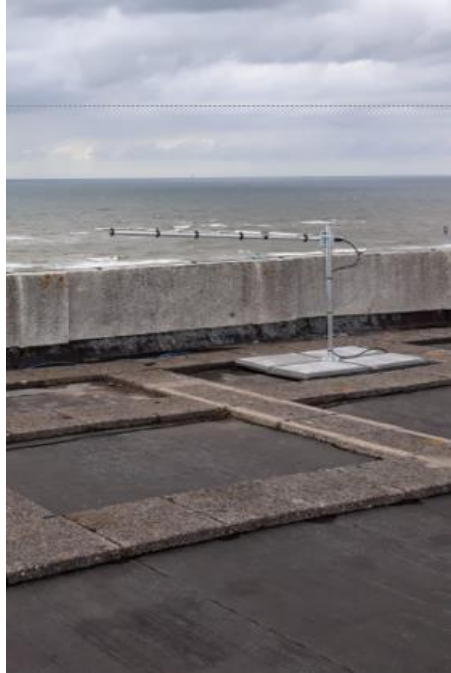
Telemetry research - aims

- Assess movements:
 - Migration directions
 - Proportion over land and over sea
 - Relation with environmental conditions
 - Flight/migration speed
 - Sex and age class differences
 - Comparison with bat detector results
- Behaviour in offshore wind farms

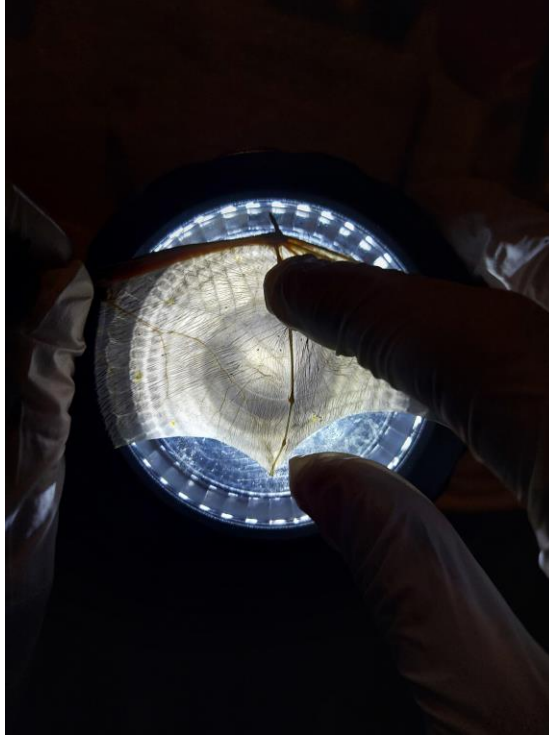
Southern North Sea Motus network



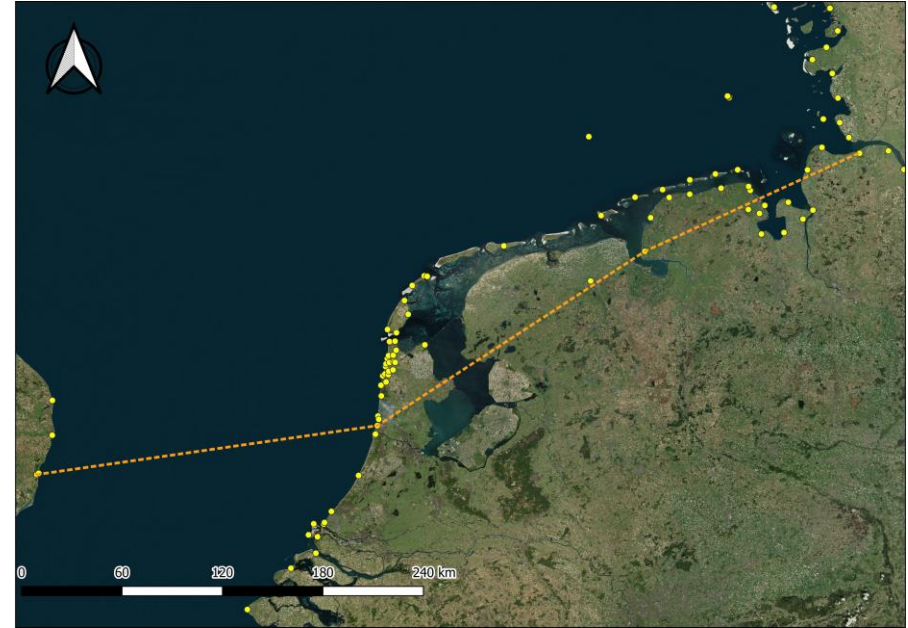
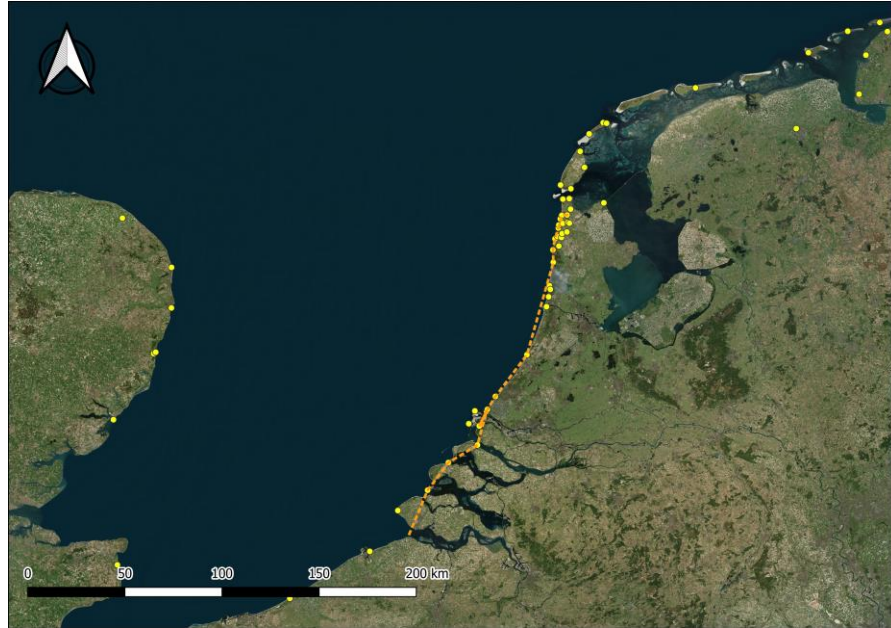
Receivers



Tagging



Observed flight paths



Telemetry - preliminary results

- Migration along the coast as well as over sea
- Much local movement prior to departures
- Migrating animals frequently fly >150 km per night with ground speeds > 40 km/h during moderate to strong tailwinds

Nathusius pipistrelle – main results

- Occurrence is strongly seasonal and likely predictable
- Differences in timing of occurrence acoustic research and telemetry
- Risk still not known



Photo René Janssen

Conclusions

- Offshore wind developments in the Netherlands likely do not affect local populations, only migratory populations are possibly affected
- WOZEP & LNV bat projects provided a lot of new information on the offshore occurrence of bats and the migration ecology of *Nathusius pipistrelle* in particular; and more to come in the next years
- This information is already implemented in the curtailment of offshore wind farms, and is used in the permits for future wind farms
- Remaining knowledge gaps should be investigated, in particular an assessment of the actual fatality risk is urgently needed, as well additional movement studies using both acoustics and telemetry

Project team

- Jan Boshamer & Daan Dekeukeleire
- René Janssen (Bionet Nature Research)
- Anne-Jifke Haarsma (Batweter)
- Jane Harris, Ewan Parsons & Sue Parsons (Norfolk & Norwich Bat Group)
- Martijn Keur, Sander Lagerveld, Bart Noort, Marinka van Puijenbroek, Cor Sonneveld, Karina Stienstra, Tamara Vallina, Hans Verdaat, Pepijn de Vries, Simon de Vries, Jan-Tjalling van der Wal & Tony Wilkes (WUR)

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Thanks for your attention!

Any questions?

sander.lagerveld@wur.nl

