

CWW 2019 Bats and Offshore Wind Workshop

Stirling, 27th August 2019

Synopsis of workshop discussion and suggestions for priority actions

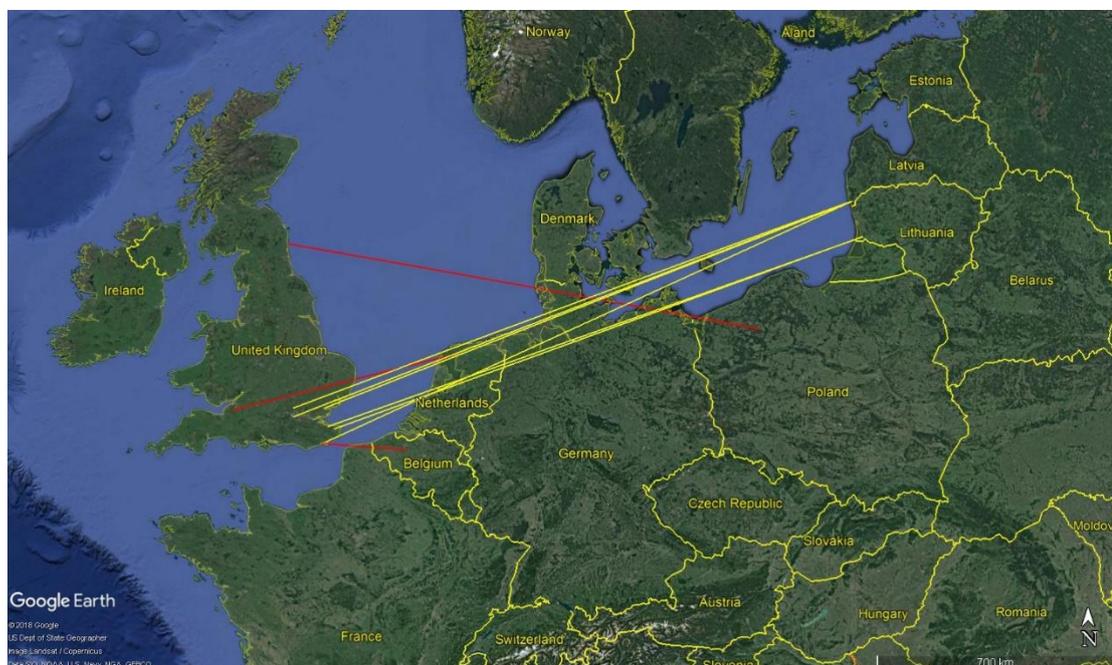
Robin Cox, Sander Lagerveld, Jan Collins

Introduction

This document provides a synopsis of the workshop discussion held during the Conference on Wind Energy and Wildlife Impacts (CWW) in Stirling on 27th August 2019. Suggestions are also made for next steps and priorities for action.

The workshop started with an introduction by Robin Cox and Sander Lagerveld to provide some background on evidence for bats using the offshore environment in the southern North Sea:

- Anecdotal records:
 - bats (*Nathusius*) recorded offshore on oil rigs and other platforms
 - records of bats on Orkney and Shetland islands
 - bird watchers observing bats flying ashore during autumn and spring
 - records of grounded bats on the coast in autumn.
- Ringing recoveries – first recovery in 2013, since then there have been 8 more recoveries of ringed bats between continent and UK (3 ringed in UK, 4 ringed in Latvia, 2 in Lithuania) confirming movement across North Sea¹:



¹ <https://www.bats.org.uk/our-work/national-bat-monitoring-programme/surveys/national-nathusius-pipistrelle-survey>

- Dutch government funded Offshore Wind Ecological Programme (Wozep²) – started 2012:

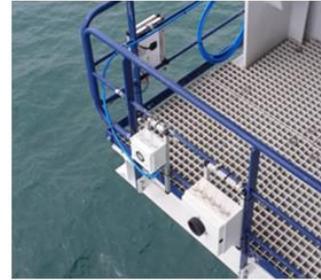
WOZEP - Bats

Population estimate *P. nathusii*

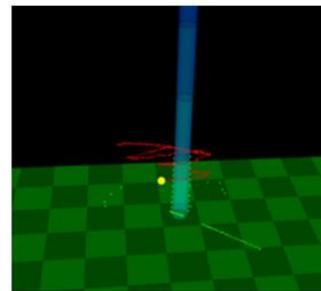
Telemetry



Batdetectors



Thermal imaging



Deployed detectors at offshore wind farms and immediately encountered bats. This caught the attention of Environment Ministry – bats missed in ecological impact assessment for offshore wind farms. Started research programme with four lines of research:

- What is the population size? Virtually nothing known about population sizes in Europe and, even then, what is the target population?
- Bat detectors – along the coast and offshore, around 14 offshore at the moment.
- Telemetry – 500 bats being tagged over 3 years (2018-2020). Tracked via Motus wildlife tracking system³. Receivers installed along Dutch and Belgian Coasts since 2018, and UK coast since 2019. Plan to have receivers at offshore wind farms next year – 2020.
- Feasibility study on Thermal Imaging for bats. Technically very complicated. Not currently happening.
- UK offshore wind projects – bats not generally considered as part of environmental impact assessment. We think they should be!

The following sections outline what was discussed under each of the relevant topic headings.

² <https://www.noordzeeloket.nl/en/functions-and-use/offshore-wind-energy/ecology/offshore-wind/>

³ <https://motus.org/>

How do we define relevant populations?

- Sander Lagerveld gave a brief overview of Limpens *et al* (2017) paper⁴. Herman Limpens of the Dutch Mammal Society developed a simple model. Took a country and considered immigration, emigration, reproduction rate and mortality rate. This was applied across Europe to develop population estimates for different countries in winter and summer and estimates of movements between. Came up with an estimate for Nathusius pipistrelle of quarter of a million to two million individuals. 40,000 could cross the N Sea. Large error margins.
- Use of acoustic data to infer numbers by defining interval between calls that can be assumed to be different bats, easier for stationary bats, more difficult for migratory species. Limitations to this approach, for example bats recorded on thermal images that are not recorded on detectors. In Denmark, acoustic data shows two peaks during the migration season.
- Use of genetics:
 - A previous study in US (Pylant *et al* 2016⁵) has looked at variation in mitochondrial DNA (collected from wind farm casualties) and the minimum population required to account for that variation. This technique could potentially be used by sampling genetic material (wing punches) from bats captured on migration.
 - There is also potential to use a technique called ‘close kin mark recapture’ (CKMR). This method is based on the principle that an individual’s genotype can be considered a “recapture” of the genotypes of each of its parents. Assuming the sampling of offspring and parents is independent of each other, the number of Parent-Offspring pairs genetically identified in a large collection of both groups can be used to estimate abundance.
- Monitoring frameworks:
 - North American Bat Monitoring Programme⁶. Detectors deployed over large parts of the continent. Uses probability of encounter. More robust framework using acoustics to understand populations. Can follow trends over time. Standardised index.
 - UK National Bat Monitoring Programme⁷.
- Radar. Can see bat echoes on the radar. Problem is to differentiate that from other echoes: insects, birds that migrate at same time and in a similar fashion. Can use a different type of radar that looks at wing beat frequency – tracking radar. But this focuses on a single target at a time so missing out on volume information. Would have to deploy a range of tools to see how many targets were there. In some respects, radar is a tool that could be utilised for bat study. Technology is developing and advancing. ROBIN radar Max system⁸ – demo at conference.
- Limitations of detection of existing technologies:
 - Acoustics – 75m
 - Thermal imaging – 140m
 - Radar – 1km
 - Telemetry – 10km.
- US DoE study in Gulf of Maine (Stantec study⁹) – nano-tagged bats and placed receivers on multiple coastal and offshore structures, some interesting trends in terms of activity patterns spatially and temporally.
- North Sea – lots of infrastructure and therefore lots of potential to record acoustic data e.g. phenology. Wozep have 14 detectors at sea. None in UK waters currently.

⁴ <https://www.noordzeeloket.nl/en/functions-and-use/offshore-wind-energy/ecology/offshore-wind/documents-wozep/bats/@166942/migrating-bats/>

⁵ <https://doi.org/10.1890/15-0541>

⁶ https://www.usgs.gov/centers/fort/science/north-american-bat-monitoring-program-nabat?qt-science_center_objects=0#qt-science_center_objects
<https://www.nabatmonitoring.org/>

⁷ <https://www.bats.org.uk/our-work/national-bat-monitoring-programme>

⁸ <https://www.robinradar.com/max-avian-radar-system>

⁹ <https://tethys.pnnl.gov/publications/long-term-bat-monitoring-islands-offshore-structures-and-coastal-sites-gulf-maine-mid>

What assumptions can be made about migration routes?

- In the Netherlands the bats follow the coast, but we want to find out when they continue to follow the coast or head west towards the UK. There is more activity in the northern part of the Dutch coast compared to further south.
- A study in France (Brittany) using acoustics found migrating bats crossed the land (a short cut) rather than going around the coast of Brittany.
- The Swedish population migrate through Denmark and probably avoid going over the North Sea. There is an assumption that some of the Norwegian population may migrate through Britain.
- Bats roost on oil rigs as shown by peaks in activity at dawn and dusk. Lots of insects at sea at this time of year (late summer).
- Any studies from other parts of the world? – Caribbean species that flies between the islands and Venezuela.
- Routes probably depend on weather conditions. In southern North Sea bats are probably responding to weather and more likely to cross with a weak tailwind – this has been seen at monitoring locations close to the coast.
- Can we use bird migration as a proxy for bats? Probably similar to song bird migration. US study supports this – e.g. birds cutting corners between two land masses.
- Use of stable isotope analysis to determine broad geographic origin of migrant bats.
- Ringing/banding bats – no worldwide ringing database, researchers working independently. Some data has recently been digitised.
- In the Netherlands, bats are present at sea from 20th August until mid-November but more scarce after 8th October. Spring season is more drawn out from late March to June.
- Collisions with aircraft – possible source of data for migration routes if this data is routinely recorded e.g. by military aircraft.

What Baseline Data Collection is Appropriate?

- Use existing offshore platforms for mounting devices.
- Very difficult to monitor in areas with no structures. Scandinavian study used boats, but this is expensive.
- Use of buoys e.g. LIDAR buoys are deployed at some sites and acoustic devices could be attached to these. Buoys have been used but there can be problems of moisture ingress as need to be in place for at least two months. Buoys are used to monitor marine mammals using acoustics.
- Met masts could be / have been used for acoustic devices.
- Could studies onshore be used as a proxy for nearshore sites – difficult to extrapolate to offshore.
- Is collection of baseline data useful to predict risk of collision offshore?
 - Difficulties in predicting risk from pre-construction surveys because activity changes in the presence of the wind farm.
 - This may be particularly relevant at sea – insects congregating around structures in otherwise hostile environment.
 - Depends on the question being asked – if looking for activity patterns in relation to weather, timing or altitude then pre-construction surveys will be useful.
 - Problem with offshore is understanding fatalities – not possible to search for carcasses beneath turbines.
- Is there much known about the altitude at which the bats are flying on migration?
 - Denmark – bat detectors at 2m and 65m – only three recordings at 65m.
 - Another example – 130m and 7m – amount of activity in rotor zone is just a fraction of that lower down.
 - Both onshore and offshore – bat activity greater lower down and lesser higher up.
 - Would seem to make more sense for the bats to migrate at higher altitude to exploit tailwinds (as passerines do). But if insects are a determinant then would expect more activity at nacelle height.

- Should be cautious in interpreting high activity as a greater number of bats because individual bats might be repeatedly passing detectors. However, it is possible to analyse acoustic data to quantify number of bats to a certain extent by using inter-lag interval between calls and also looking at calls cumulatively over numbers of nights
- Is there any confidence that bats are always echolocating when they are migrating? May get some data on this from US in next year. No extra energy used for echolocation during flight because muscles used are linked to flight muscles¹⁰. One study found that bats may spend periods of time not echolocating – probably to avoid signal jamming with conspecifics¹¹.
- Do bats migrate in large flocks as birds do. Sander has recorded multiple bats (up to three) travelling together. Peaks in bat activity at sea are usually concurrent at multiple sites suggesting that they wait near the coast for favourable conditions and then migrate en masse.
- What about telemetry as a baseline? In the US guidance is being developed for deployment of Motus at offshore wind farms as a standard. If bats are attracted to wind turbines it is challenging to interpret that data. At higher altitudes receivers can detect birds 20km away.
- Use of drones with acoustic devices:
 - UAVs have been used with microphone extended below the drone to avoid too much noise being picked up. Has the potential to provide more of a spatial assessment of bat activity and can be programmed to do transects. But battery life is short.
 - Potential permitting issues with flying at night and also with disturbing protected species. Special permit available in US. In the UK the pilot has to be within visual range of the drone when operating it and there are height limits.
 - Helium balloons/blimps have been used onshore but practical difficulties.
 - Marine remote operated vehicles/aquatic drones may also have potential.

Fatality Estimation

- Can we compare bat activity onshore and offshore and then make assumptions based on fatality measurements onshore?
- Post construction activity data seems to be better related to fatalities and it is also possible to record acoustic data in the right place – at height.
- Bats with high frequency calls tend to be the lower flying bats and vice versa. Is this the same offshore?
- Can thermal imaging cameras be used to record fatalities? This has been done onshore but generates terabytes of data that currently has to be manually analysed. Looking into automated analysis. Not possible to identify which bat species has been hit.
- Wozep study with thermal camera on ground looking up at rotor, and Wildlife Acoustics and Anabat detectors at the nacelle. Analysis of ten-minute intervals found that only 10% of the time a bat was recorded by all three sensors. Technology is better these days and that study is dated. Resolution on thermal cameras is greatly improved now. Cannot put Thermal Camera on wind turbine itself, needs to be used at the base looking upwards. On land need to look up with the cold sky as a background because ground is warm from the day and bats do not stand out against this background, but this may be different at sea.
- How will data be used? Is it a problem if one bat is killed? What will we do? In the context of climate change how do we see this affecting policy?
- In Netherlands a precautionary approach is applied for new offshore wind turbines. First mitigation measure used was nightly curtailment below 5 m/s wind speed between 15 August and 1 October. Based on Wozep data so far this has been refined to include wind direction (tailwinds between south-easterly and northerly).
- What about height? – wind speed will differ at different heights so how bats take advantage of the tailwind will change.

¹⁰ Speakman *et al* 1989 DOI: 10.1007/BF00610999

¹¹ Chiu *et al* 2008 DOI: 10.1073/pnas.0804408105

- Radar – current technology not likely to be useful to detect fatalities. It lacks the necessary resolution to detect that kind of event. A turbine will obstruct any echo from a biological target flying against that background.

Suggested Next Steps and Priorities

- Formation of working group to further discussions and actions
- Population – feasibility of using genetics to estimate population
- Updating existing bats and wind farm guidance to include offshore
- Development of European Motus network both onshore and offshore
- Migration routes – feasibility of using aircraft collision data