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# SURVEY OF MIGRATING AND FEEDING BATS AT HORNS REV I OFFSHORE WIND-FARM – NOTE: SPRING SURVEY 2025

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CONFIDENTIAL



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# WSP

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| Project name: | Bat monitoring Horns Rev I Offshore Windfarm |
| WSP Project no..: | 22005720 |
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# 1    BACKGROUND

Vattenfall operates the Horns Rev I Offshore Windfarm (HR1) and applied for a permit to extend the operational lifetime of the windfarm for 15 years. The application included a description of the existing windfarm and operation/maintenance activities needed to extend the windfarm's lifetime, and an appropriate assessment of protected species and habitats according to the Habitat directive.

All bats are protected under the Habitat directive, and several species are known to migrate between Northern Europe and Southwestern Europe. Their migration route may include the strait between Germany and Denmark (Figure 1).
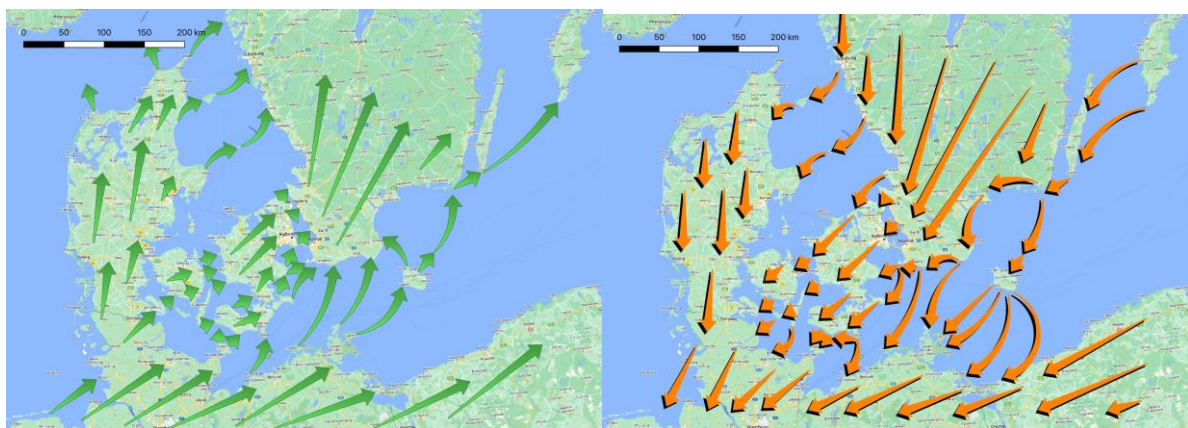


Figure 1 - Major migration route for bat through Denmark in spring (left) and autumn (right) (figure from Christensen & Hansen 2023).

Bats from the surrounding coastal areas will possibly feed over the sea during night with high temperature and low wind speed. The exact magnitude and extent of these feeding activities on the open sea are still only sparsely known.

The original environmental assessment for Horns Rev I Offshore Windfarm did not consider bats to be an issue and no survey was carried out in the area before the establishment of the windfarm. Therefore, the Danish Energy Agent asked Vattenfall to initiate surveys of bats to assess the potential conflict between the wind farm and bats feeding or on migration. The survey will be part of the approval process for the extension of the operational lifetime for the wind farm to 2042. The survey will cover at least two years to address variation between seasons.

# 2   METHODS

The survey of bat activity in Horns Rev I Offshore Windfarm consists of an offshore survey and a supplementary onshore survey.

## 2.1   OFFSHORE SURVEY – DETECTORS ON TURBINES

Detectors were first mounted on the service platform of ten selected wind turbines at Horns Rev I Offshore Wind farm in 2024 (Figure 2). The setup was similar to a setup on Kriegers Flak OWF 2022-2024 and Nysted OWF 2024-2026. The purpose is to gather information on the occurrence of bats around the turbines, as well as investigate whether the wind turbines attract bats migrating across the open sea.

The detectors were mounted at the base of the turbines (on the foundation) (Figure 3), which makes the results comparable with similar surveys where detectors are similarly placed, e.g., at Kriegers Flak and Nysted Offshore Windfarm. Further, investigations show that most migrating bats often fly relatively low and close to sea level when crossing offshore areas (see Brabant et al. 2020).

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**Figure 2 – Positions of bat detectors on ten turbines at Horns Rev I Offshore Windfarm**



**Figure 3 – Detector at Kriegers Flak 2022 (Figure from Christensen 2024).**

In 2025 the detectors were installed on 2$^{nd}$ April and collected/replaced on 15$^{th}$ July. A new set of detectors will monitor autumn until end of October. Vattenfalls service team were responsible for the installation and dismantling of equipment.

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## 2.2 DATA ANALYSIS

### 2.2.1 MEASUREMENT CONFIGURATIONS

Data collection for the offshore bat surveys was conducted using detectors, which all were based on Audio-Moth technology but enhanced with an external microphone and a large battery pack (Figure 2). All detectors were configured to record all bat activity from half an hour before sunset to half an hour after sunrise. Recordings were segmented into 5-second intervals, separated by 10-second pauses. The detector settings are presented in Table 1.

**Table 1 - Configuration of the detectors.**

| Parameter | Unit | Setting |
|---|---|---|
| SD card | GB | 256 |
| Sample rate | kHz | 192 |
| Gain | - | Medium |
| Cyclic recording | s | Recording 5 – pause 10 |
| Trigger type | | Amplitude |
| Minimum trigger frequency | kHz | 15 |
| Max duration | s | 5 |
| Compression | - | WAW |

### 2.2.2 POST PROCESSING

The initial analysis of all collected onshore and offshore bat detection data was performed using Wildlife Acoustics Kaleidoscope Pro software with the automatic identification algorithm enabled. Kaleidoscope analyzes all files for the presence of bat calls based on the signal parameters summarized in Table 2. Files that do not meet these parameters are labeled as noise and deleted by the software. The remaining output files are then analyzed by the Auto-ID function using a classifier library (Bats of Europe 5.4.0) containing calls of relevant bat species. The output files and their contents from Kaleidoscope are summarized in Table 3 .

**Table 2 – Signal parameters**

| Parameter | Unit | Settings |
|---|---|---|
| Minimum frequency | kHz | 8 |
| Maximum frequency | kHz | 120 |

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|---|---|---|
| Minimum pulse length | ms | 2 |
| Maximum pulse length | ms | 500 |
| Maximum inter-syllable gap | ms | 500 |
| Minimum number of pulses | ms | 2 |
| CF (cutoff frequency) noise filter maximum frequency | kHz | 0 |
| CF (cutoff frequency) noise filter maximum bandwidth | kHz | 0 |

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**Table 3 - Output files of the Auto-ID process.**

| Output file | Description |
|---|---|
| meta.csv | The meta.csv file is a catalog of the input recording files which were processed in the batch. |
| id.csv | The id.csv file contains a list of all input files and their Auto-ID analysis results. The file also contains extensive statistical information regarding the content of the input files including these main parameters:<br>- AUTO-ID – This field shows the automatic classification result<br>- MATCHING - Number of pulses matching the auto classification result<br>- MATCH RATIO - The ratio of MATCHING over PULSES<br>- MANUEL ID – Manuel identification |
| idsummary.csv | The idsummary.csv file provides a summary of which species were detected in the Auto-id analysis. |
| settings.ini | This file is a snapshot of every setting in Kaleidoscope Pro at the time of the Auto-ID for Bats batch process. The settings.ini file is additionally useful because it provides a record of any custom Button Labels in the Viewer |
| db-batch.wdb | This file contains no actual database records but defines the structure of the database. |

## 2.2.3    MANUAL ANALYSIS

Due to the varying success rates of the Auto-ID function in Kaleidoscope Pro, a manual review of files was conducted by personnel with bat identification expertise. Experience with Kaleidoscope Pro's Auto-ID indicates that the software achieves nearly 100 % accuracy with certain species, such as the Soprano pipistrelle, which performs acoustic output at levels of approximately 50 kHz. However, it has less accuracy with other species, such as the Common noctule, which performs acoustics at levels of approximately 20 kHz and are often misclassified due to background noise. Consequently, some Auto-ID suggestions are thoroughly checked, while others are reviewed only if the match ratios are low. Additionally, random samples were taken throughout the collected data as an additional quality assurance measurement.

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# 3 RESULTS

## 3.1 OFFSHORE DETECTORS

**Summary**

- Total number of detectors: 10

- Detector type: SeaBat 2.0

- Time of deployment: 2 April – 15 July 2025

- Total recording with bats: 0

- Average bat recording per detector: 0.0

No bats were recorded during spring and early summer in 2025. This supports the results from 2024 where only a single bat was recorded in the spring and early summer.

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# 4  DISCUSSION

The occurrence of bats in the area of Horns Rev seems to be almost exclusively in the late summer and autumn. Results from surveys in spring 2024 and 2025 show none or very few records in spring and based of these observations, and results from similar surveys in the Danish North Sea (DCE/Niras 2024), it indicate that bat occurrence in spring in the Danish part of the North Sea only happen rarely.

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# 5 REFERENCES

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