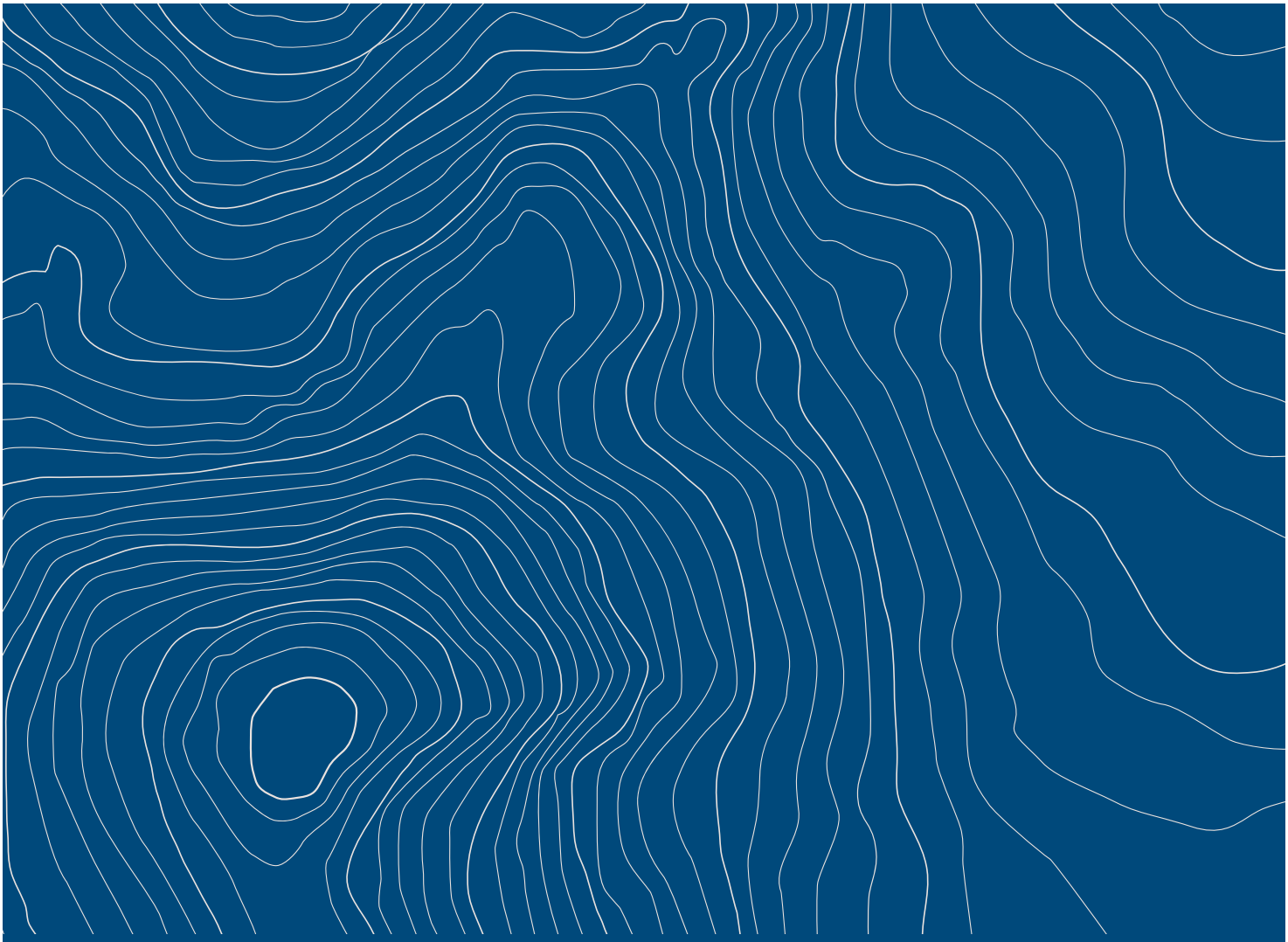

DublinArray
Generation for generations

EIAR Volume 4: Offshore Infrastructure Technical Appendices Appendix 4.3.7-1: Offshore Bats Technical Baseline Report

Kish Offshore Wind Ltd

RWE SLR GoBe APEM Group

www.dublinarray-marineplanning.ie

Dublin Array Offshore Wind Farm

Environmental Impact Assessment Report

Volume 4, Appendix 4.3.7-1: Offshore Bats Technical Baseline Report

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Glossary

Term	Definition
Array Area	That part of the maritime area specified by MAC Reference 2022-MAC-003 and 004 within which it is proposed to locate the wind turbine generators (WTGs) and Offshore Substation Platform (OSP).
Bat Pass	A sequence of bat echolocation calls detected by monitoring equipment, indicating the presence of a bat.
Call Parameters	Characteristics of bat echolocation calls, such as frequency, duration, and intensity, used for species identification.
Dublin Array	Dublin Array Offshore Wind Farm. Where the context so provides within the EIAR, references to Dublin Array refer to all geographical areas of the proposed development, i.e. both offshore, onshore and including the proposed O&M Base.
Echolocation	The use of sound waves and echoes to determine the location of objects, used by bats for navigation and hunting.
Environmental Impact Assessment (EIA)	Assessment of the likely significant effects of a proposed project on the environment. The EIA will be carried out by An Bord Pleanála in this instance.
EIA Report (EIAR)	As defined in the Planning and Development Act 2000, as amended: "environmental impact assessment report" means a report of the effects, if any, which proposed development, if carried out, would have on the environment and shall include the information specified in Annex IV of the Environmental Impact Assessment Directive.
Feeding Buzz	A rapid series of echolocation calls emitted by a bat as it closes in on prey.
Foraging	The act of searching for and exploiting food resources.
Habitat Suitability Modelling	A method used to predict the distribution of species based on environmental conditions and habitat preferences.
Lidar	A technology that measures distance by illuminating a target with laser light and analysing the reflected light, used for wind speed measurements.
Maritime Area Consent (MAC)	State consent which grants the holder a right to occupy a specific part of the maritime area for the purposes of a proposed maritime usage as set out in the MAC and subject to such conditions (if any) as may be attached.
Migration	The seasonal movement of animals from one region to another.
Quasi Constant Frequency (QCF) Call	A type of bat echolocation call with a relatively constant frequency, used for species identification.
Static Bat Detectors	Devices used to monitor bat activity by recording their echolocation calls.
Telemetry	The process of recording and transmitting the readings of an instrument, often used for tracking animal movements.

Term	Definition
Wind turbine generators (WTG)	All the components of a wind turbine, including the tower, nacelle and rotor.

Acronyms

Term	Definition
DNA	Deoxyribonucleic Acid
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
GSM	Global System for Mobile Communications
MCIEEM	Member of the Chartered Institute of Ecology and Environmental Management
MISE	Mammals in a Sustainable Environment
MYO	Myotis genus
NRW	Natural Resources Wales
NYCLEI	Nyctalus leisleri
PIPNAT	Pipistrellus nathusii
PIPPIP	Pipistrellus pipistrellus
PIPPYG	Pipistrellus pygmaeus
PLEAUR	Plecotus auritus
QCF	Quasi Constant Frequency
UK	United Kingdom

1 Introduction

1.1 Overview

1.1.1 This report presents the findings of offshore bat activity surveys conducted to inform the Environmental Impact Assessment Report (EIAR) for the Dublin Array Offshore Wind Farm (Dublin Array). The primary objective of these surveys was to assess potential impacts on bats within the study area, focusing on bat activity from the shoreline at Sorrento Point to Kish Bank Lighthouse, extending up to 12 km offshore. The results provide important baseline data to evaluate the presence, behaviour, and seasonal patterns of bats in the offshore environment, contributing to the overall impact assessment for Dublin Array.

1.2 Experience

Consultancy

1.2.0 SLR is a multidisciplinary technical consultancy providing services to public and private sector clients in several sectors including energy, infrastructure and waste. SLR is a registered Environmental Impact Assessor Member of the Institute of Environmental Management and Assessment (IEMA) and holds the IEMA Environmental Impact Assessment Quality Mark. Further information on SLR can be found on its corporate website at www.slrconsulting.com.

Lead author

1.2.1 This baseline report has been written by Nicola Faulks (BSc, MSc, CEcol, MCIEEM) Ecology.

1.2.2 Nicola is a chartered ecologist with eighteen years of consultancy experience. She has worked on bat and wind farm projects worldwide for over thirteen years. Nicola designed survey methodologies for wind farm surveys and analysed the resulting data. She has used bat analysis software, such as Kaleidoscope Pro, for the last five years but has manually analysed bat calls for over ten years. Nicola has written EIA reports, including assessment of impacts on bats, for more than 15 wind farms in the UK and abroad.

2 Methodology

2.1 Approach

2.1.1 Currently there is no UK, Irish or Pan-European guidance document specifically for offshore surveys assessing the risk to bats from offshore wind farms. To date, only Germany has developed formal guidance for offshore bat study and impact assessment. Other European countries adopted a survey approach based on the EUROBATS publication Guidelines for Consideration of Bats in Windfarm Projects (EUROBATS, 2014). This publication primarily focuses on bat conservation and does not fully address the specifics of surveying bats in an offshore environment, particularly for species likely to migrate or forage at sea, such as Nathusius' pipistrelle (*Pipistrellus nathusii*), soprano pipistrelle (*Pipistrellus pygmaeus*) and Leisler's bat (*Nyctalus Leisleri*) (Arnett et al., 2015).

2.1.2 The bat studies presented in this report were conducted using two approaches:

- Desk study: contacting local bat groups and conducting a literature review; and
- Static monitoring study: using remote automated 'static' bat detectors.

2.1.3 To inform the offshore bat impact assessment, the baseline studies aimed to gather information from the coast at Sorrento Point to Kish Bank Lighthouse, adjacent to the Dublin Array area, to answer the following questions:

- Do bats forage offshore?
- Will bats forage up to 12 km offshore?
- Do some species fly further offshore than others?
- Is bat activity offshore seasonal?
- Are there any signs that bats are migrating from Britain to Ireland across the Irish Sea?
- Does windspeed affect offshore foraging/migration?

2.1.4 In this study, the term 'offshore' refers to distances of at least 1 km from the coast. The offshore survey environment encompasses an area of 1 – 12 km from the mainland (Sorrento Point).

2.1.5 Various techniques and activities were evaluated when determining the methodology. For instance, installing static bat detectors on ferries to record bat activity was considered; however, this option was not viable as all ferry services out of Dublin operated only during the day within 50 km of the Dublin Array. The feasibility of placing static bat recorders on mooring buoys within the Dublin Array area was also assessed. However, due to the changeable sea state and the risk of corrosion or salt ingress to the microphones, this approach was deemed neither cost-effective nor practical for bat monitoring.

2.2 Study area

2.2.1 The primary aim of this baseline study was to assess offshore bat activity to generate robust data for the impact assessment. The study area was designed to account for potential bat flight paths to the proposed wind farm. In the absence of published guidance or studies to determine the study area for bats in the marine environment, the survey study area has considered where bats are likely to fly from (land), if they are flying out as far as the array area (sea). The survey study area therefore stretched from the shoreline of the mainland (Sorrento Point) out to Kish Bank Lighthouse, located adjacent to the array area (Annex 1).

2.2.2 Additionally, the desk-based study covered a broader region, incorporating data provided from relevant data holders across counties and provinces bordering the Irish Sea (Table 1).

2.3 Desk study

2.3.1 The initial stage of the desk study focused on gathering information from bat groups and other data holders around the Irish Sea. The objective was to identify records suggesting that bats had either crossed the Irish Sea or were preparing to do so. For this study, records located within 1 km of the coastline and/or recorded during daylight1 hours were considered likely indicators of bats engaged in, or about engage in, sea crossings.

2.3.2 Table 1 outlines the bat groups and data providers contacted, along with their response status. All data requests were sent via email in February 2021. The contact list was developed in consultation with Sam Dyer (Natural Resources Wales) and John Haddow (Auritus Wildlife Consultancy and an active bat ecologist in southwest Scotland) to identify key holders of relevant data.

[1] Anecdotal evidence may suggest that when bats migrate across the North Sea or English Channel, they are recorded arriving on land during daylight hours or are picked up on shore having grounded. Northumberland Bat group has records of bats picked up on links golf courses and Adrian Bicker (a bat ecologist) has records of bats arriving in daylight hours on the Isle of Wight and Portland Bill (pers. Com. 2021).

2.3.4 All individuals and groups were asked to provide records that could indicate migratory activity across the Irish Sea. Potential migratory behaviour was identified through:

- Records of drowned bats found along the coastline;
- Static detector records of bats active during daylight hours;
- Visual observations of bats during daylight hours; and/or
- Reports of bats landing on boats or lighthouses.

Table 1 Data sources considered in the development of the offshore bat baseline

Group/data provider	Response
Irish Bat Monitoring Programme	Data received in the Irish Bat Monitoring Programme 2018-2021 report.
Welsh Nathusius Project – Sam Dyer	Provided a paper on Mammals in a Sustainable Environment – Detectors on ferries
BSG Ecology – undertaken studies of bats on the Irish sea	Report on Pembrokeshire Islands Bat Surveys
Natural Resources Wales – Sam Dyer	Provided a report: Bat Migration Project Report (2017 – 2018)
Northern Ireland Bat Group Records officer	Holds no relevant records
Jon Russ (undertook PhD in Ireland)	Holds no relevant records
Dumfries and Galloway Bat group	Holds no relevant records
John Haddow - Auritus Wildlife Consultancy	Holds no relevant records
Keith Cohen – Ridgeway Ecology	Holds no relevant records
Gwynedd Bat Group	Hold no relevant records
Manx Bat Group	Response not received
Department of Housing, Local Government and Heritage.	Provided “All-Ireland Nathusius’s Pipistrelle Bat Project: Updating The Distribution and Status of The Nathusius’s Pipistrelle (Pipistrellus Nathusii) In Ireland: Phase 5 (2021)”.

2.3.5 A literature review was conducted to identify relevant information on bat migrations to and from the UK, including Ireland. This involved searching open-source materials available online. All referenced publications and sources consulted are listed in the reference section of this report.

2.4 Site specific surveys

Background

2.4.1 Due to the absence of specific published guidance on bat surveys for offshore wind farm impact assessments, the survey was designed to determine whether bat migration across the Irish Sea intersects the proposed Dublin Array array area.

2.4.2 Static bat detectors were progressively installed from Sorrento Point to Kish Bank Lighthouse, 12 km offshore. These were mounted on manmade structures, islands, and lighthouses at a minimum height of 5 m above sea level to protect the equipment from the saline environment. The locations are listed in Table 2 and shown on Figure 2.

Table 2 Static bat detector locations

Location	Coordinates	Distance from shore	Detector type
Sorrento Point	53°16.23'N 006°05.54W	Onhsore	SM4BAT Full Spectrum Ultrasonic recorder
Dalkey Island	53°16.23'N 006°05.05W	0.21 Nm = 0.39 km	Batlogger C static
Muglins Lighthouse	53°16.52'N 006°04.58W	0.61 Nm = 1.13 km	Batlogger C static
Kish Bank Lighthouse	53°18.67'N 005°55.55W	6.42 Nm = 11.89 km	Batlogger C static

Equipment

2.4.1 Batlogger C static detectors (Photographs 1, 3, and 4) were selected for their built-in GSM module, which enabled daily SMS updates on device status, including location, memory usage, and battery voltage. Their IP67 waterproof rating made them suitable for use in the marine environment. To ensure continuous operation, the detectors were connected to solar panels, eliminating the need for mains power or battery replacements.

2.4.2 At Sorrento Point, a publicly accessible location, SLR deployed a smaller, more discreet unit to minimise the risk of theft or damage. A SM4BAT Full Spectrum Ultrasonic Recorder by Wildlife Acoustics, paired with an SMM-U2 microphone, was used (Photograph 2). This setup allowed the recorder to be placed at ground level while positioning the microphone off the ground within a tree for optimal detection.

Data collection

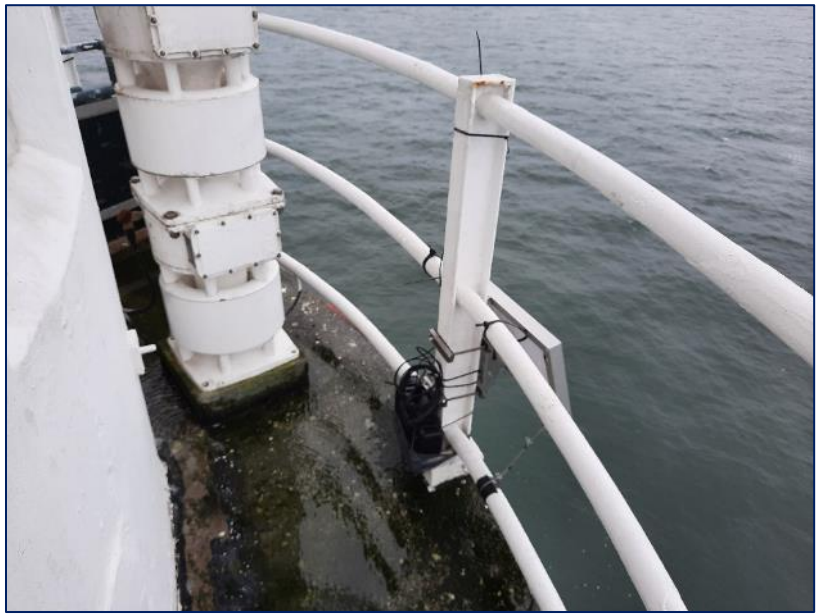
2.4.3 Each detector was deployed in late spring and retrieved in autumn. A mid-season visit to all offshore locations was carried out to collect bat data by replacing memory cards and to conduct a visual inspection of the equipment, as detailed in Table 3.

2.4.3 At Sorrento Point, the unit was inspected at least monthly. During these checks, batteries were replaced, and memory cards were swapped to retrieve data. However, the detector was stolen in September 2021, with the final data recorded up to 20th September 2021 (which has been used as the deployment end date in Table 3).

Table 3 Dates of detector deployment, battery changes and/or SD card change

Location	Deployment start	Battery and/or SD card changed	Deployment end
Kirsh Bank Lighthouse	28th May 2021	27th August 2021	04th November 2021
Muglins Lighthouse	28th May 2021	27th August 2021	04th November 2021
Dalkey Island	28th May 2021	27th August 2021	04th November 2021
Sorrento Point	27th May 2021	10th June 2021	07th October 2021 Stolen by 3rd party, therefore the last data received was dated 20th September 2021 (date of previous battery and SD card change).
		01st July 2021	
		14th July 2021	
		23rd July 2021	
		19th August 2021	
		20th September 2021	

Photograph 1: Batlogger C on Dalkey island	Photograph 2: SM4 Bat detector Sorrento Point
	

Photograph 3: Bat Logger C, Kirsh Bank Lighthouse	Photograph 4: Bat Logger C, Muglins Lighthouse
	

Data analysis

2.4.4 The digital bat recordings were analysed using Kaleidoscope Pro software using the Bats of Europe filter 5.4.0, then manually verified, where necessary, by an ecologist experienced in bat sonogram analysis (Nicola Faulks CEcol, MCIEEM).

2.4.5 The Kaleidoscope Pro (version 5.4.2) filters for Leisler's bat and Nathusius' pipistrelle can be unreliable due to overlap in call parameters with noctule and common pipistrelle bats (Nicola Faulks, pers. obs.). However, since noctules are absent and Nathusius' pipistrelles are rare in Ireland, this issue is not significant for the Irish context. All noctule calls were reclassified as Leisler's bats. Nathusius' pipistrelle records were manually checked, and identification was confirmed if a Quasi Constant Frequency (QCF) call was detected with a peak frequency between 35 and 40 kHz (as per Russ, 2012).

2.4.6 Although Kaleidoscope Pro attempts to filter Myotis species, all data were collectively assigned to the Myotis genus due to identification challenges and the low-risk status of these species concerning wind turbines (Scottish Natural Heritage et al. 2019). Notably, no Myotis species were detected within 7 km of the turbines or beyond Dalkey Island in the offshore areas, minimizing impact on the overall assessment.

2.4.7 Kaleidoscope Pro provides an estimate of bat activity, but faint or poor-quality calls may be missed due to noise filters, although this is unlikely to significantly affect overall activity measures. The software assigns one species label per sound file, even if multiple species are present. In such cases, files were manually reviewed, and species were separately labelled to ensure accurate counts of bat passes.

2.4.8 A bat pass consists of two or more calls representing a single bat flying towards and away from the microphone. Passes can vary from two to 40 calls and are counted as a single bat pass. This measure reflects bat activity, not individual bat numbers; for example, 100 passes could result from 100 bats passing once or one bat passing 100 times.

2.4.9 Files labelled as No-ID were manually checked. Typically, these contained noise or simultaneous calls from multiple species. Such records were labelled accordingly and duplicated to include data from both species. Faint calls that could not be confidently attributed to bats were labelled as "noise" and excluded from the analysis.

2.4.4 Following the data analysis output from kaleidoscope Pro, all files labelled No-ID were also checked manually. Generally, these calls were either noise and rejected as such or contained simultaneous calls from two different bat species. They were labelled, and the record duplicated so that data from both species could be included. Where two faint calls were recorded in a No-ID file that were likely from a bat but could not be confidently determined, these were labelled 'noise' and discounted.

Wind data

2.4.5 Wind speed data recorded at Kish Bank Lighthouse was provided by RWE in Excel format. The data includes parameters such as temperature, pressure, humidity and wind speed, recorded at ten-minute intervals, representing an average of the preceding ten minutes.

2.4.10 Wind data was incorporated into the bat activity analysis to investigate any relationship between bat activity and wind speed. The analysis used average wind speeds recorded between 7 pm and midnight, as this period aligns with the typical time bats leave their roosts and begin offshore activity (30 minutes to 2 hours after sunset) (Russ, 2012).

3 Results

3.1 Desk study

3.1.1 The desk study respondents provided no data for either drowned bats on any of the shores surrounding the Irish Sea or any bat activity occurring during the daytime.

3.1.2 A summary of the three reports which were reviewed as part of the desk study is presented below.

- BSG Ecology (2014): Automated bat detectors were deployed on Skomer, Ramsey and Skokholm islands along the Pembrokeshire coast to monitor migratory species. Peaks in bat activity were observed in late summer/autumn for Leislers' and Nathusius' bats, known long-distance migrants in Europe. However, the data could not confirm migrations within the UK or between the UK and Ireland, only indicating that such bat migrations may occur.

- MISE Project (2015): Anabat Express static bat detectors were installed on ferries between Dublin and Holyhead, and Rosslare and Fishguard, as well as on Bardsey Island and South Stack, Anglesey. The project recorded very few bat passes, with no offshore recordings. Two Leislers' bat passes were recorded in Rosslare Harbour and in Dublin harbour; a further single bat pass in Fishguard harbour. At South Stack, Nathusius' pipistrelle bat passes were detected twice, with more bat passes being recorded on Bardsey Island. Again, while the two target species were recorded, there was insufficient data to provide evidence that bat migration was taking place.

- NRW Bat Migration Project Report (2017 to 2018): Detectors were placed at Bardsey Island, South Stack, Treginnis Farm, Ramsey Island, and Wooltack Point, Skomer Island. The study recorded one Leislers' bat pass and a number of Nathusius' bat passes, indicating presence but not conclusive evidence of migration. The studies were put on hold during the Covid-19 pandemic.

3.1.3 Several published papers were also reviewed. While none directly addressed bat migration across the Irish sea, they provided evidence of bats foraging up to 14 km offshore in suitable weather conditions (Ahlen, 2009). Studies on wind farms off the coast of Holland found Noctule bats foraging within a wind farm 15 km from shore, and Nathusius' pipistrelle foraging and potentially transiting through wind farms 23 km offshore (Poerink, 2013).

3.1.4 Bach (2017) studied offshore bat migrations in the German North and Baltic Sea in the autumn of 2016. Detectors were placed on an unmanned research platform 45 km north of Borkum and on Heligoland, a deep-sea island 57 km northwest of Cuxhaven. Nathusius' pipistrelle was the most recorded species, along with Leislers', Noctule, soprano pipistrelle, and Northern bat *Eptesicus nilssonii.* As the surveys were undertaken in the autumn (late August to November) it has been assumed that the bats were migrating rather than foraging. It is also worth stating that the numbers of bats recorded were also low, with 148 registrations on microphone 1 at Heligoland.

3.1.5 Wageningen University and Research have been studying bat migratory patterns as part of their Wozep Programme (Wageningen 2021). They use advance telemetry to track bats such as Nathusius' pipistrelle along their migration routes past wind turbines. Due to the tags, surveyors know exactly which bat flies past which telemetry station, and on this basis, they can reconstruct the route travelled. Preliminary results show that bats migrate both by sea and along the coast.

3.1.6 A recent paper titled Offshore Occurrence of a Migratory Bat, *Pipistrellus nathusii,* Depends on Seasonality and Weather Conditions (Lagerveld 2021) found that wind spees, direction, and temperature are important factors for bat migration over the North Sea. Monitoring from 2012 to 2016 on 480 nights showed that migration is strongest in early September with east-north easterly tailwinds, wind speeds < 5 m/s, and temperatures > 15 ◦C. Lunar cycle, cloud cover, atmospheric pressure, atmospheric pressure change, rain, and visibility were not evaluated.

3.2 Bat activity monitoring

Summary results for total survey period

3.2.1 Five species were recorded and one species group:

- NYCLEI – *Nyctalus leisleri* – Leisler's bat;
- PIPNAT – *Pipistrellus nathusii* – Nathusius' pipistrelle;
- PIPPIP – *Pipistrellus pipistrellus* - Common pipistrelle;
- PIPPYG – *Pipistrellus pygmaeus* – Soprano pipistrelle;
- PLEAUR – *Plecotus auritus* – Brown long-eared bat; and
- MYO – Myotis genus – likely to be *Myotis daubentonii*[2].

3.2.2 A summary of the total number of bat passes recorded at each location across the survey period (28th May – 04th November) is given in Table 4. Please note that for Sorrento Point, due to theft of the detector, the survey period runs from 28th May – 20th September 2021.

[2] The bat conservation Ireland website lists three Myotis bats as present in Ireland: Daubenton's bat, whiskered bat *Myotis mystachinus* and Natterer's bat *Myotis natteri.* The Dubenton's bat is described as the water bat, so the location at Sorrento point and Dalkey Island would seem appropriate, albeit sea and not fresh water. In addition to this, the Daubenton's call shape can be more easily recognisable than other Myotis species when it displays a slight bend or "kink" at 40-45kHz (Russ 2021).

Table 4 Total number of bat passes by each species at each location

Species	Sorrento Point	Dalkey Island	Muglins Lighthouse	Kish Lighthouse
NYCLEI	11,422	2,481	321	246
PIPNAT	136	127	7	1
PIPPIP	7,140	6,864	797	1
PIPPYG	75	101	29	0
PLEAUR	9	3	0	0
MYO	1	1	0	0
Total bat passes	**18,783**	**9,577**	**1,154**	**248**

3.2.3 To allow for a direct comparison of data, accounting for differences in data losses at Sorrento Point, Table 5 presents the results as the average number of bat passes per night over the recording period. The figure is derived by dividing the total number of bat passes by the total number of nights that recording successfully took place at each location.

3.2.4 Since no bat activity was detected at Kish Bank Lighthouse after the 07th September 2021, and the data for Sorrento Point only runs up to 20th September 2021, the comparison period for bat activity has been set from 28th May – 20th September, a period of 115 days.

Table 5 Average bat pass count per night for each species at each location

Species	Sorrento Point	Dalkey Island	Muglins Lighthouse	Kish Bank Lighthouse
NYCLEI	102.63	21.57	2.79	2.14
PIPNAT	1.21	1.10	0.06	0.01
PIPPIP	63.00	59.69	6.93	0.01
PIPPYG	0.69	0.88	0.25	0.00
PLEAUR	0.09	0.03	0.00	0.00
MYO	0.01	0.01	0.00	0.00
Average bat pass per night all species	**167.63**	**83.28**	**10.03**	**2.16**

3.2.1 Table 4 and Table 5 show that for most species the highest bat activity was at Sorrento Point on the mainland, with over 167 bat passes per night. The lowest activity was recorded at Kish Bank Lighthouse, where only three species were recorded; Nathusius' and common pipistrelle each recorded once, and Leisler's bats with an average of 2.14 bat passes per night.

3.2.2 The results of the average bat pass count per night are shown on Figure 1. The drop-off in activity levels is clearly visible between Sorrento Point (on the mainland) to Kish Bank Lighthouse, 11.89 km offshore.

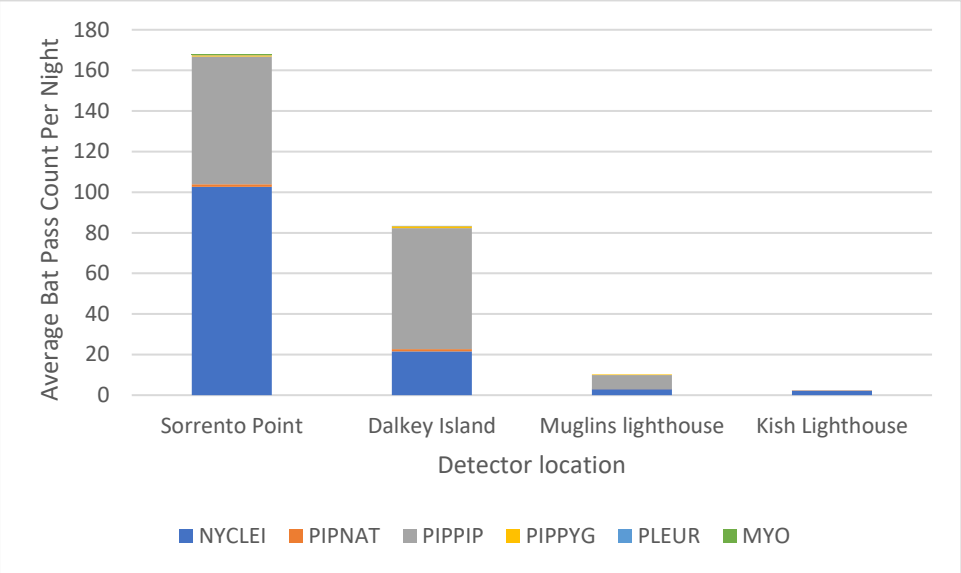


Figure 1 Average bat pass count per night for each species at each location

3.2.3 Table 6 presents the first and last bat recording made at each location and the number of nights during which bats were recorded.

Table 6 Summary information of bat records at each location

Location	First bat record	Last bat record	Number of nights with bats recorded/total nights	Percentage of nights with bat activity
Sorrento Point	28th May 2021	20th September 2021*	105/115	91.30
Dalkey Island	28th May 2021	04th November 2021	135/160	84.38
Muglins Lighthouse	06th June 2021	26th October 2021	84/143	52.25
Kish Bank Lighthouse	14th June 2021	07th September 2021	21/160	13.13

Nightly activity

3.2.5 During the nights when bat activity was recorded at Kish Bank Lighthouse, all bat passes occurred between sunset and sunrise. Figure 2 shows that all bat activity took place between 21:00 hrs and 05:00 hrs, with the highest levels of activity between 23:00 hrs and 01:00 hrs. Bat activity dropped off towards sunrise.

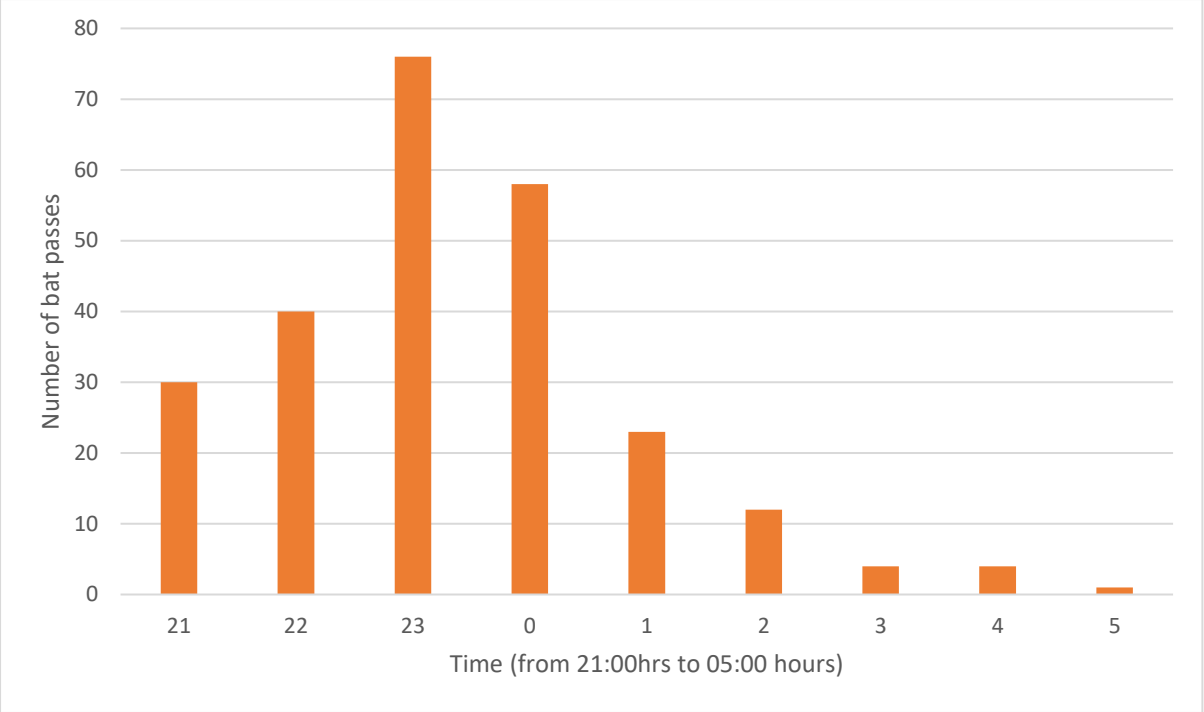


Figure 2 Bat activity by hour at Kish Bank Lighthouse

3.2.6 The pattern of nightly activity at each location was reviewed for comparison (Figure 3). The key difference between locations is that Kish Bank Lighthouse has a single pre-midnight peak in activity and no records of bats during daylight. In contrast, all other locations show two peaks in bat activity, one before and one after midnight, with some bat passes recorded during daylight hours (albeit at very low levels).

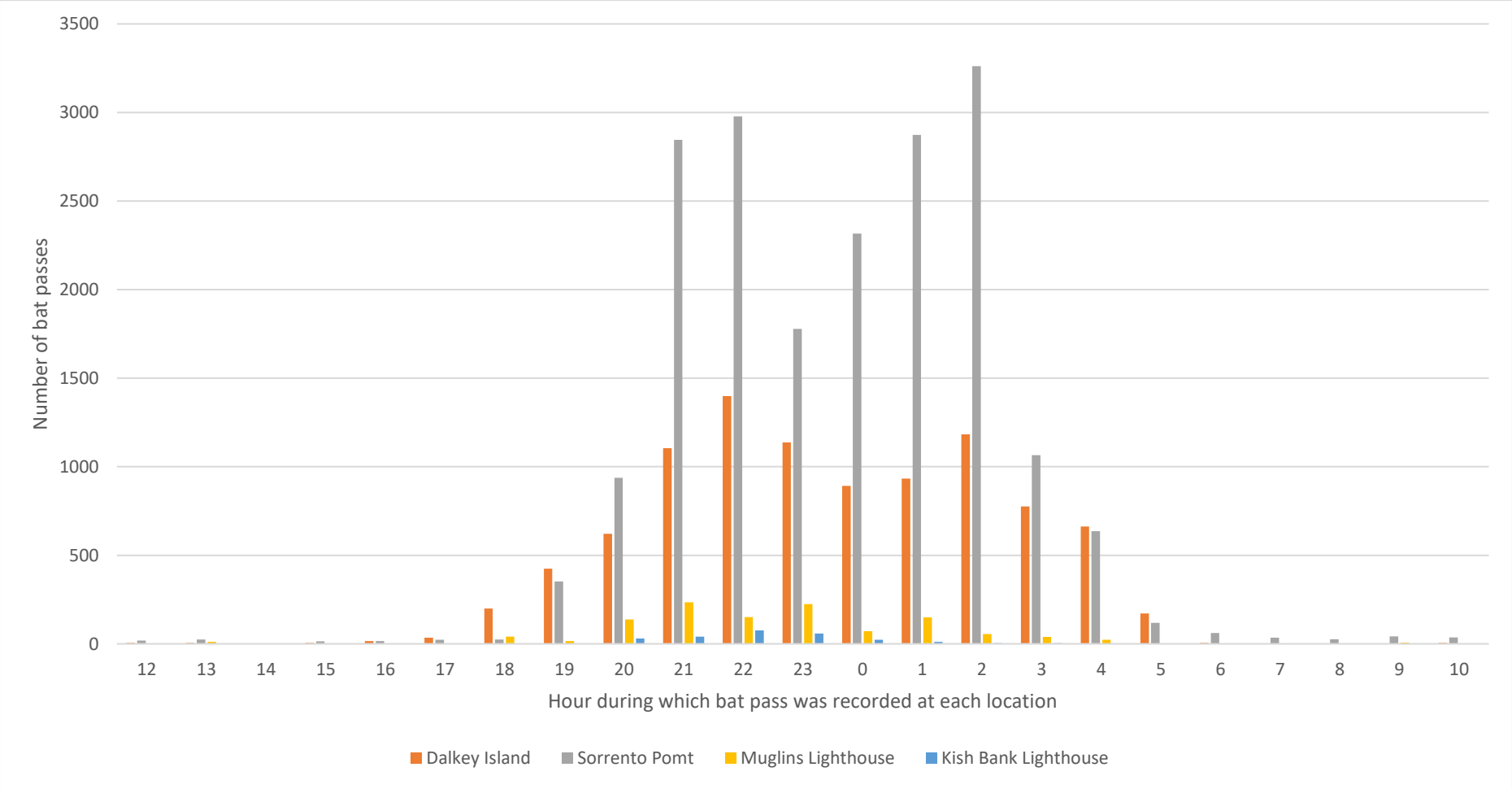


Figure 3 Bat activity by hour across all recording locations

3.2.7 The two peaks in bat activity have also been observed in other studies. Wildlife Online (2022) states that common pipistrelles spend much of the night foraging for insects during May and June, returning to their roosts between midnight and daybreak. From June to August, pipistrelles adopt a bifurcated feeding activity pattern, with a peak just after sunset and another before dawn, with intermittent feeding between these peaks.

Bat activity at Kish Bank Lighthouse

3.2.8 Data gathered at Kish Bank Lighthouse has undergone additional analysis since it was collected from the closest point to the proposed array area, making it potentially the most relevant for assessing bat presence at the proposed site.

3.2.9 Three species of bat were recorded at Kish Bank Lighthouse: Leisler's bat, common pipistrelle and Nathusius' pipistrelle. The two pipistrelle species were each only recorded once, with Leisler's bat being the most frequently recorded species.

3.2.10 The data was analysed based on the dates on which the bat passes were recorded. Figure 4 shows the full nights on which bats were recorded. For example, 8.23pm to midnight on 27th August and midnight to 6.23am on 28th August counts as one night, representing the continuous period between sunset and sunrise. Figure 4 represents the bat activity data as the count of bat passes per night during the recording period. The dates shown are only those nights on which activity was recorded.

3.2.11 The data showed site usage of the Kish Lighthouse area by bats on 21 nights from the 13th of July to the 7th of September. Of this data over 70% of the records were after midnight – which would be beyond the peak foraging period. Similarly, over 60% if the records were between the 22nd of August and the 28th of August. With a peak of activity on the 27th of August with over 70 records spanning the night.

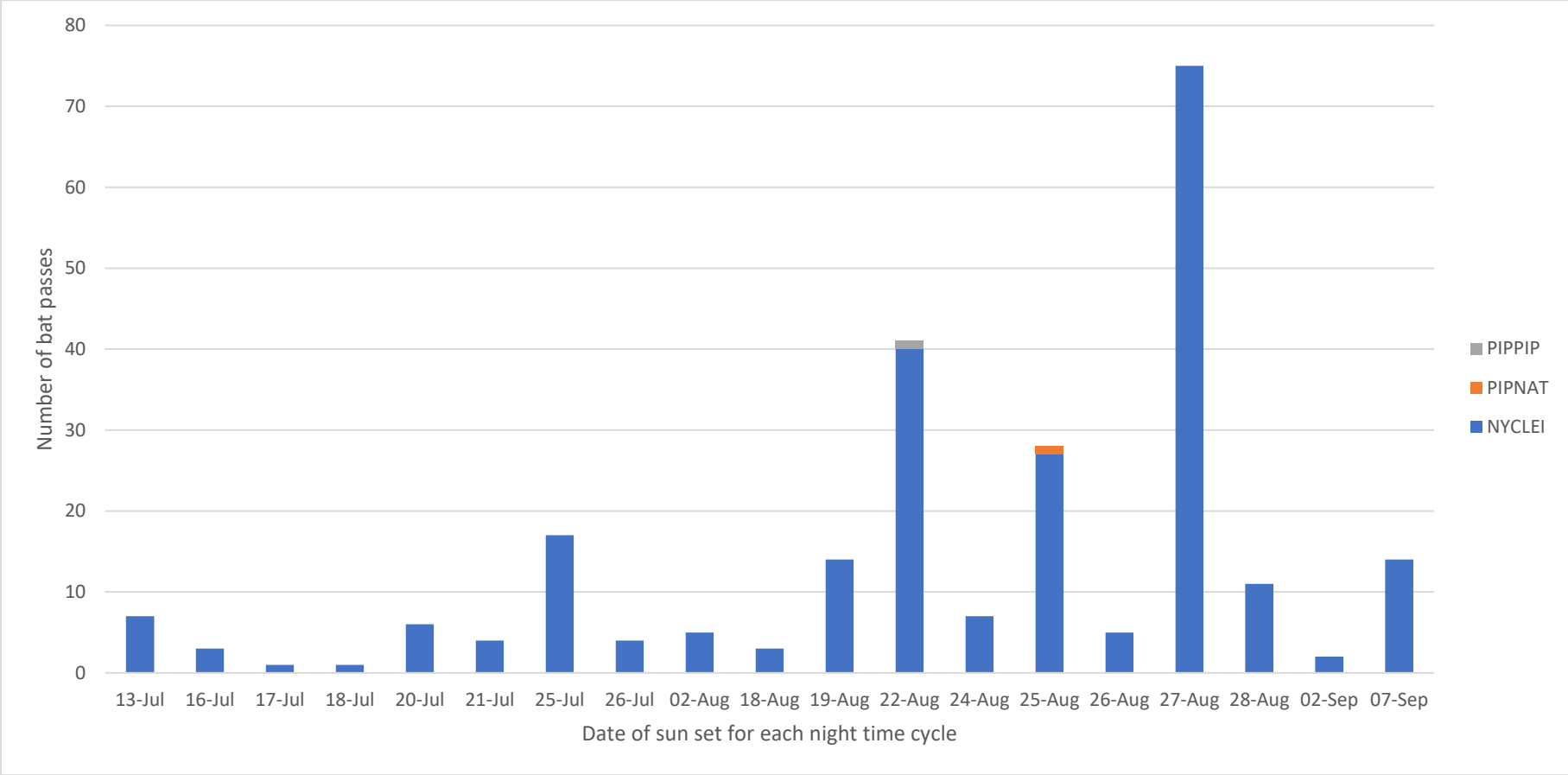


Figure 4 Number of bat passes per night at Kish Bank Lighthouse, on dates that they were recorded

3.2.12 Based on the activity at Kish Bank Lighthouse, which shows many days with no activity, it is interesting to compare the monthly activity (bat pass per month) at each location to determine if this changes over time. Figure 5 has been generated for Nathusius' pipistrelle. The highest activity was recorded at Dalkey Island in July, with the second highest at Sorrento Point in June. There was no peak in activity in September or October. (Note that the Sorrento Point detector provided data to 20th September only).

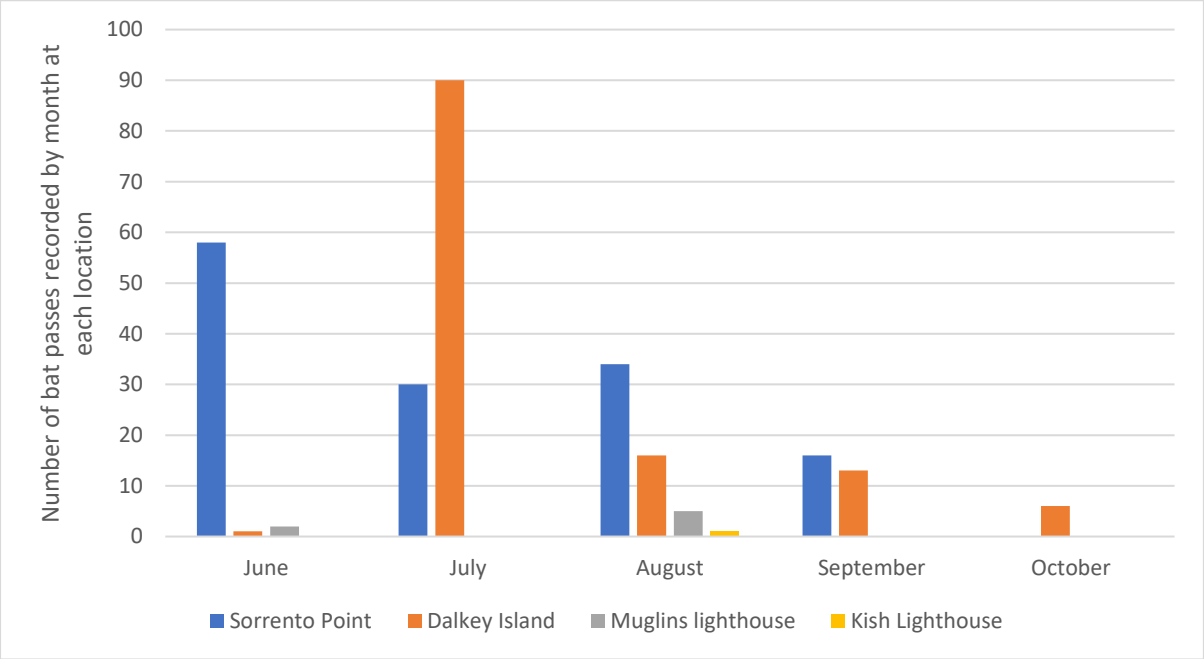


Figure 5 Bat pass counts, by location and month for Nathusius' pipistrelle

3.2.13 The same data analysis was conducted for Leisler's bat. Figure 6 shows that Leislser's bat activity was highest in June at Sorrento Point and Dalkey Island, dropping off towards the autumn when migration activity would be expected. The highest levels of bat activity at Muglins Lighthouse and Kish Bank Lighthouse were recorded in August.

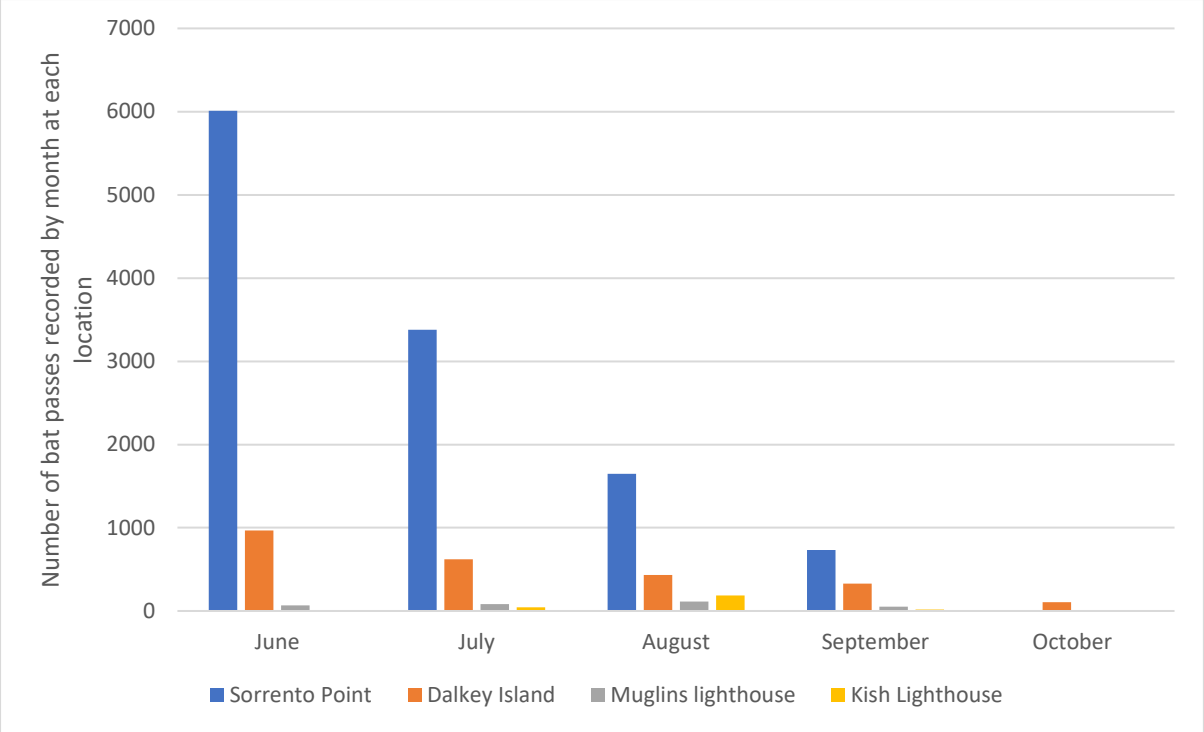


Figure 6 Bat pass counts, by location and month for Leisler's bat

Bat activity and wind speed

3.2.14 The windspeed data provided by RWE was measured at Kish Bank Lighthouse and used to compare the dates when bat passes occurred with the windspeed. The WindCube device measures windspeed using lidar at various heights up to 300 m. The lowest height, closest to the level of the static detector at Kish Bank Lighthouse, is 40 m above sea level. Therefore, windspeed measurements at 40 m were used for comparison with the bat data.

3.2.15 Figure 7 provides a visual representation of the data, showing the average windspeed as a line and the bat pass count each night shown as bars. Missing portions of the line (in September) are due to data recording errors. The data shows that most bat activity at Kish Bank Lighthouse was recorded when the average evening windspeed was below 5 m/s. On one occasion, 02nd September 2021, two bat passes were recorded when the average wind speed was 5.36 m/s. Both passes were recorded at 21:39 hrs within five seconds of each other, possibly representing one bat foraging or two bats flying together, though this cannot be determined with certainty.

3.2.16 Temperature data was also available, but when analysed using the same date averages as the wind data, the temperature at Kish Bank Lighthouse was found to be relatively constant. The lowest recorded temperature was 12.6°C and the highest was 20.7°C. There were no discernible trends between temperature and bat activity at this location.

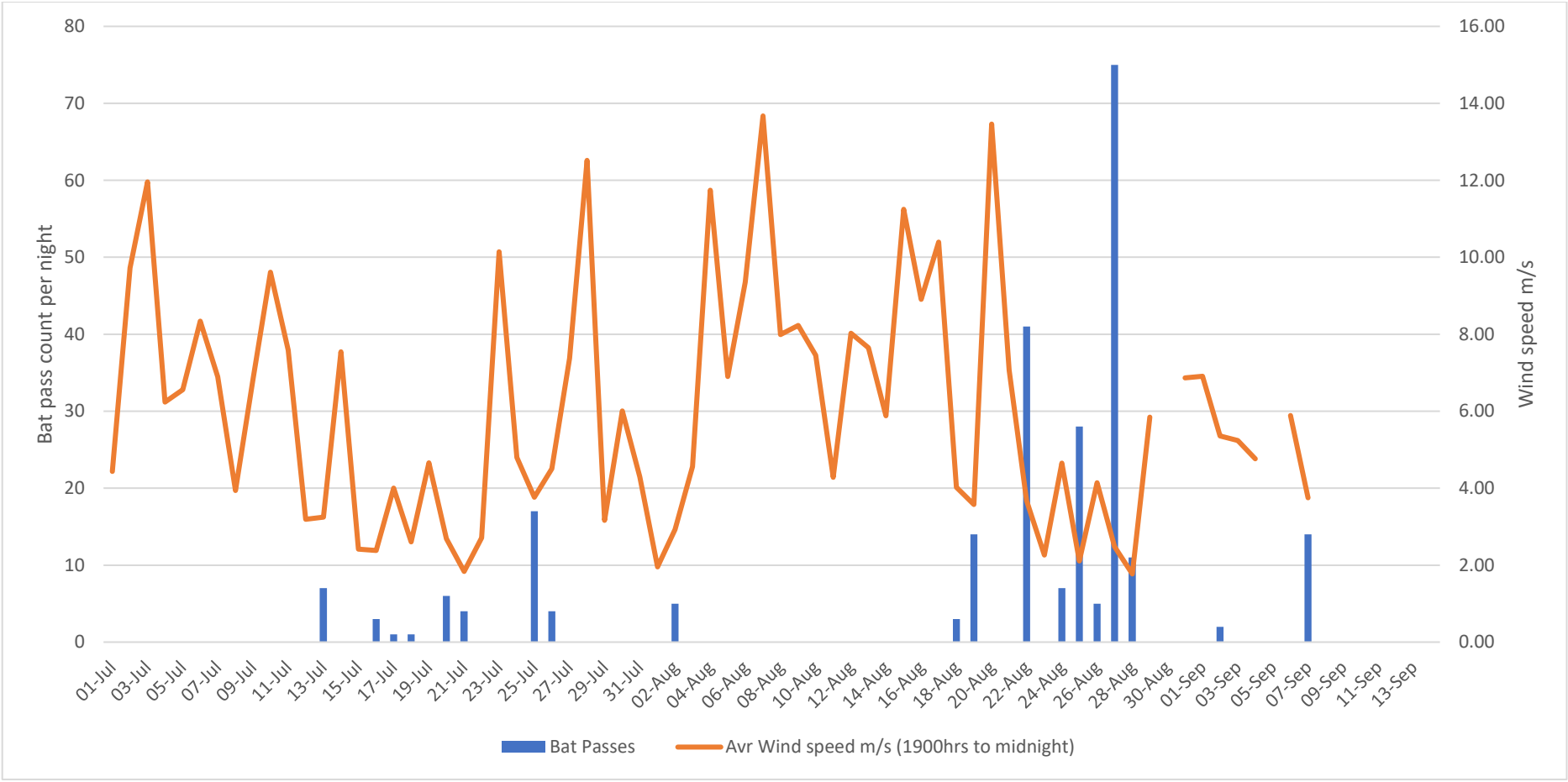


Figure 7 Graph showing wind speed and bat activity (all species combined) at Kish Bank Lighthouse

4 Discussion

4.1.1 The baseline studies aimed to gather information to address the questions listed in paragraph 2.1.3. This discussion section focuses on analysing the results presented in section 3 to answer these questions.

4.2 Do bats forage offshore?

4.2.1 The desk study provided evidence that bats do forage offshore. One relevant study, Bats and offshore wind turbines studied in southern Scandinavia (Ahlen et al., 2009), found that bats can be attracted to offshore turbines when insects are gathered there. The study highlighted that *'it became quite obvious that the great amounts of prey organisms, flying, drifting and in the water surface, are an important food source for migrating bats and also for non-migratory species'*. The authors observed that both migrating and resident species search for and hunt insects near the turbines. This study, conducted in the Baltic Sea, noted that many of the insects consumed by the bats are produced in the sea itself.

4.2.2 *Clunio marinus,* a marine chironomid, is discussed in a short paper by O'Reilly (n.d.). This non-biting midge has larvae that inhabit the mid-littoral zone and hatch over a brief period in August. Although it is unlikely for the midge to hatch as far out as the Dublin Array area, one hypothesis suggests that westerly winds could blow the midges out to sea towards Kish Bank and the proposed array area, attracting bats for foraging. Additionally, land-based invertebrates might be blown out to sea, providing further foraging opportunities for bats flying offshore.

4.2.3 Among the reviewed papers, the Nathusius' pipistrelle is the most likely species to be found foraging offshore. Studies in the North Sea and English Channel have also identified the noctule as a frequent offshore forager. More recent research (Lagerveld, 2021) has confirmed that Leisler's bat has been recorded over the North Sea. Given its size and strength, similar to the noctule, it is reasonable to consider that Leisler's bat could also forage over the Irish Sea and other coastal waters.

4.3 Will bats forage up to 10 km offshore?

4.3.1 The results from the study at Kish Bank Lighthouse (c12 km offshore) indicate that Leisler's bats were exhibiting foraging behaviours. This conclusion is supported by the recording of long series of calls during each bat pass. These sequences are typical when a bat's echolocation detects an insect; as the bat approaches its prey, the call rate increases, resulting in what surveyors call a 'feeding buzz'. This rapid series of calls enables the bat to accurately locate and capture its prey mid-air (Figure 8).

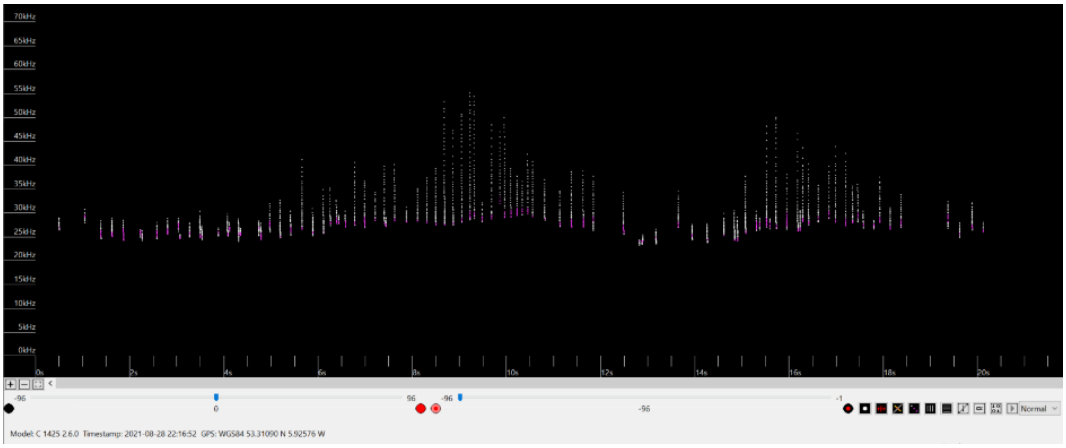


Figure 8 Sonogram of Leisler's bat activity recorded at Kish Bank Lighthouse, showing feeding activity

4.3.2 The survey results indicated that only one Nathusius' pipistrelle and one common pipistrelle were recorded at Kish Bank Lighthouse. The calls produced did not allow for a determination of whether they were foraging or commuting. The fact that they were recorded only once, unlike the multiple recordings of Leisler's bats within the same hour, can only be hypothesised. It is possible that these two pipistrelle bats simply flew past Kish Bank Lighthouse and did not remain in the immediate area to forage.

4.4 Do some species fly further offshore than others?

4.4.1 Although no published data exists for offshore occurrence of bats in the Irish Sea, studies from the North Sea indicate that some species are more likely to be recorded offshore than others. As discussed in section 3.1, large bats such as Nyctalus bat (Leisler's and noctule) are often recorded offshore, as are pipistrelle bats, with Nathusius' pipistrelle being the most frequently recorded. In contrast, some bats, such as those from the Rhinolophidae genus (horseshoe bats) and the Myotis genus, are rarely, if ever, recorded offshore.

4.4.2 The survey results from this project also found that some species do fly further offshore than others. At Sorrento point, five species and one species group (likely Dubenton's bat) were recorded. The same species were recorded at Dalkey Island, 390 m from Sorrento Point. However, at Muglins Lighthouse, 1.13 km from Sorrento Point, only four bat species were recorded. This number further reduced to three species at Kish Bank Lighthouse, 11.89 km from Sorrento Point, with Nathusius' and common pipistrelle recorded only once, and 246 bat pass records for Leisler's bat.

4.4.3 Based on the results of this study, it can be concluded that bat activity decreases with distance from shore, as shown on Figure 1, and the number of species occurring further offshore also diminishes (Table 5). Leisler's bat was the only species that regularly flew as far as Kish Bank Lighthouse, being recorded on 19 nights between July and September.

4.5 Is bat activity offshore seasonal?

4.5.1 The desk study found no published data for the Irish Sea, but there is relevant data from the North Sea. A recent study by Lagerveld (2021) highlighted the importance of seasonality in detecting *Nathusius pipistrelle* offshore. Generally, bat activity increases during spring and autumn due to migration needs. Other studies, such as Ahlen (2009), have shown that bat foraging over the sea occurs during suitable weather conditions, which are also linked to seasonality. Calm, warm nights are more common in summer and are less frequent in spring and autumn.

4.5.2 The results from this study showed that bat activity varied by month, species and location. As illustrated in Figure 5 and Figure 6, the highest bat activity was recorded at all locations in June, July or August. August was a defined peak in activity for Kish Lighthouse particularly. When comparing wind speed and bat activity at Kish bank Lighthouse, all but one of the bat pass records was recorded when the average wind speed was less than 5m/s. Therefore, it is likely that offshore bat activity is seasonal, depending on suitable weather conditions – calm nights with wind speeds generally less than 5 m/s), temperatures above 10°C, and no precipitation.

4.6 Are there any signs that bats are migrating from Britain to Ireland across the Irish Sea?

4.6.1 The desk study found information on migratory bat species related to the North Sea, but no firm evidence of bat migration across the Irish Sea was located.

4.6.2 Published data indicates that the most frequently encountered bats species over the North Sea is the Nathusius' pipistrelle (Lagerveld, 2021). Other species encountered include the common pipistrelle, noctule, Leisler's bat and the particoloured bat *Vespertilio murinus.*

4.6.3 If Nathusius' bat migration was happening on a large scale between Ireland and Great Britain, a peak in activity would be expected in coastal areas during spring and autumn, corresponding with migration between winter and summer roost locations. This study did not begin early enough to cover the potential spring migration period, but did include the autumn months. If significant migration were taking place, a peak in Nathusius' bat activity would be expected in late August into September. However, Figure 5 shows that the largest number of passes for Nathusius' pipistrelle at all locations occurred before autumn.

4.6.4 The same data analysis was undertaken for Leisler's bat. Figure 6 shows that Leislser's bat activity was highest in June at Sorrento Point and Dalkey Island, decreasing towards autumn. However, the recorder at Sorrento Point did not provide data beyond September 2021 due to theft, resulting in an incomplete data set for September and October.

4.6.1 The data showed site usage of the Kish lighthouse area by bats on 21 nights from the 13th of July to the 7th of September. Of this data over 70% of the records were after midnight – which would be beyond the peak foraging period. Similarly, over 60% if the records were between the 22nd of August and the 28th of August. With a peak of activity on the 27th of August with over 70 records spanning the night.

Migration – consideration of other factors

4.6.5 The distance between Sorrento Point and the nearest landfall in Britain is 94 km to Holyhead in Wales. While bats have been recorded flying over 50 km from mainland Europe to the UK (Bach, 2017), there is no firm evidence that they fly further. Anecdotal evidence includes drowned bats found on the Northumberland coast, presumed to have flown from Holland or Germany over 400 km away. Sightings of bats on North Sea oil rigs (Petersen, 2014) suggest that these artificial refuges may help bats travel long distances by providing stopping points or navigational aids over inhospitable habitats. Therefore, it is not possible to refute the idea that bats could migrate across the Irish Sea on distance alone.

4.6.6 A paper by Boston *et al*. (2016) aimed to determine the status of Nathusius' pipistrelle in Ireland and found that this species has becoming more commonly recorded across Ireland in recent years. Additionally, Lundy et al. (2010) showed that the mitochondrial DNA of this species in Ireland supports the theory of recent colonisation. Habitat suitability modelling (Boston et al. 2016) indicates that there is suitable habitat for this species beyond its current distribution in Ireland. The fact that this species is primarily recorded in summer and that maternity colonies are known in Northern Ireland suggests that it is breeding in Ireland. This raises the question: are Nathusius' pipistrelle bats migrating to hibernate elsewhere in winter, or are they resident all year-round?

4.6.7 Stable isotope study data (Boston *et al*, 2016) suggests that surveyed individuals are stable resident populations or at least faithful migrants to the same colonies.

4.6.8 Long distance bat migrations occur across Europe seasonally driven by the need to find suitable winter hibernation sites or summer foraging areas, which differ in environmental variables. However, there are no apparent differences between the habitats of Britain and Ireland that would prompt migration between the two. Additionally, if bats were migrating between Ireland and Britain, the bat species occurrence in each location would be more similar. For example, Leislers bats are much less common in the UK than in Ireland, and there are no noctules in Ireland at all.

Conclusion – migration

4.6.2 The baseline data aimed to assess the presence of bat migration; however, no peaks in bat activity were recorded at survey locations during autumn, indicating no clear evidence of significant migration. Despite this, the data suggest the potential for migration. Findings show that bats engage in foraging activity at sea under low wind and warm nighttime conditions, reaching distances of up to 11.89 km. Therefore, any migration is likely limited to late August and would occur only during favourable weather conditions.

4.7 Does windspeed affect offshore bat activity?

4.7.1 The data collated from Kish Bank Lighthouse showed that most bat passes were recorded when the windspeed was below 5 m/s between 8pm and midnight. Similar findings have also been reported elsewhere, such as in Ahlen (2007), which found that most bat activity occurred at wind speeds below 5 m/s. On land, bat activity also correlates with wind speed, with most activity occurring below 5 m/s. Behr (2017) found that wind speed strongly influences bat activity for all species and species groups, showing an approximately logarithmic trend. Only 15% of all bat activity was recorded at wind speeds of ≥ 5m/s. However, for Nathusius' pipistrelle, the wind tolerance was slightly higher, with 18% of activity occurring at wind speeds of ≥ 5m/s.

4.7.2 The inverse correlation between wind speed and bat activity is likely due to several factors, such as the ease of flying in lower wind speeds, reduced energy expenditure, and prey availability. Insect prey is also less likely to be flying in high winds.

4.7.3 It is concluded that wind speeds greater than 5m/s negatively affect bat activity when flying offshore, similar to the effect onshore.

5 Data gaps or uncertainties

5.1.1 The survey methodology ideally would have involved more than four detector locations between the coastline and the proposed array area, as well as within the array itself. This would have facilitated data comparisons across open water 10 km from the coastline, the fixed landmark of Kish Bank Lighthouse, and intermediate points. However, due to concerns about equipment loss and damage, buoys with recorders were not deployed in open water. As a result, data comparisons were limited to fixed locations, such as lighthouses, islands, and the mainland. While not deemed a significant risk, using static objects like lighthouses for monitoring may inadvertently attract bats, potentially leading to a higher species count at Kish Bank Lighthouse compared to the surrounding open sea.

5.1.2 The static detector at Sorrento Point was stolen following the last memory card and battery change on 20th September 2021. The remaining detectors at Muglins Lighthouse, Kish Bank Lighthouse, and Dalkey Point remained in place until early November. The theft resulted in the loss of approximately six weeks of data. While this loss made direct comparison after 20th September 2021 challenging, it is not considered a significant limitation for data analysis, as no bat activity was recorded at Kish Bank Lighthouse after 7th September 2021. This location remains critical for understanding offshore bat activity.

6 Summary

6.1.1 Currently there is no published guidance for undertaking bat surveys for offshore wind farms. Therefore, the study for Dublin Array Wind Farm was designed to gather both desk study data and field data. The desk study involved contacting organisations that might hold records of bat migrations across the Irish Sea. The field study deployed static bat detectors from 28th May to 4th November 2021, at four locations: Sorrento Point (onshore), Dalkey Island (0.39 km offshore), Muglins Lighthouse (1.13 km offshore) and Kish Bank Lighthouse (11.89 km offshore). Kish Bank Lighthouse was chosen as it matches the distance offshore of the proposed Dublin Array array area. Wind speed data was also collected from Kish Bank Lighthouse.

6.1.2 The desk study results found no conclusive evidence of bat migrations from Britain to Ireland. However, there is published evidence of bat migrations around the North Sea from Europe to England, particularly involving Nathusius' pipistrelle and larger *Nyctalus* genus bats, such as the Leisler's, both of which are present in Ireland.

6.1.3 The field studies recorded five bat species at Sorrento Point, with additional Myotis genus calls that were not determined to species level. Bat activity at Sorrento Point was consistently higher than at the offshore locations. The same species were recorded at Dalkey Island, but the activity level of Sorrento Point. At Muglins Lighthouse, four species were recorded (Leisler's bat and three pipistrelle species), with activity at 6% of Sorrento Point levels. At Kish Bank Lighthouse, three species were recorded, with Nathusius' and common pipistrelle recorded only once each, and the remaining activity attributed to Leisler's bat. Activity at Kish Bank Lighthouse was 1.5% of Sorrento Point levels, occurring between 14th June and 7th September 2021.

6.1.4 Data from Kish Bank Lighthouse indicated primarily Leisler's bats were recorded, with only one common and one Nathusius' pipistrelle recorded. Bats were recorded on 21 out of 160 nights, mostly when wind speeds were below 5 m/s.

6.1.5 The data showed site usage of the Kish lighthouse area by bats on 21 nights from the 13th of July to the 7th of September. Of this data over 70% of the records were after midnight – which would be beyond the peak foraging period. Similarly, over 60% if the records were between the 22nd of August and the 28th of August. With a peak of activity on the 27th of August with over 70 records spanning the night.

6.1.6 The baseline data aimed to determine if bat migrations occur. Although there was no firm evidence to support migration, there is data to support its potential. The data suggest that under low wind and warm nighttime conditions, there is bat activity at sea, reaching distances up to 11.89 km. It is therefore determined that any migration is likely to be limited to late August and occur during favourable weather conditions.

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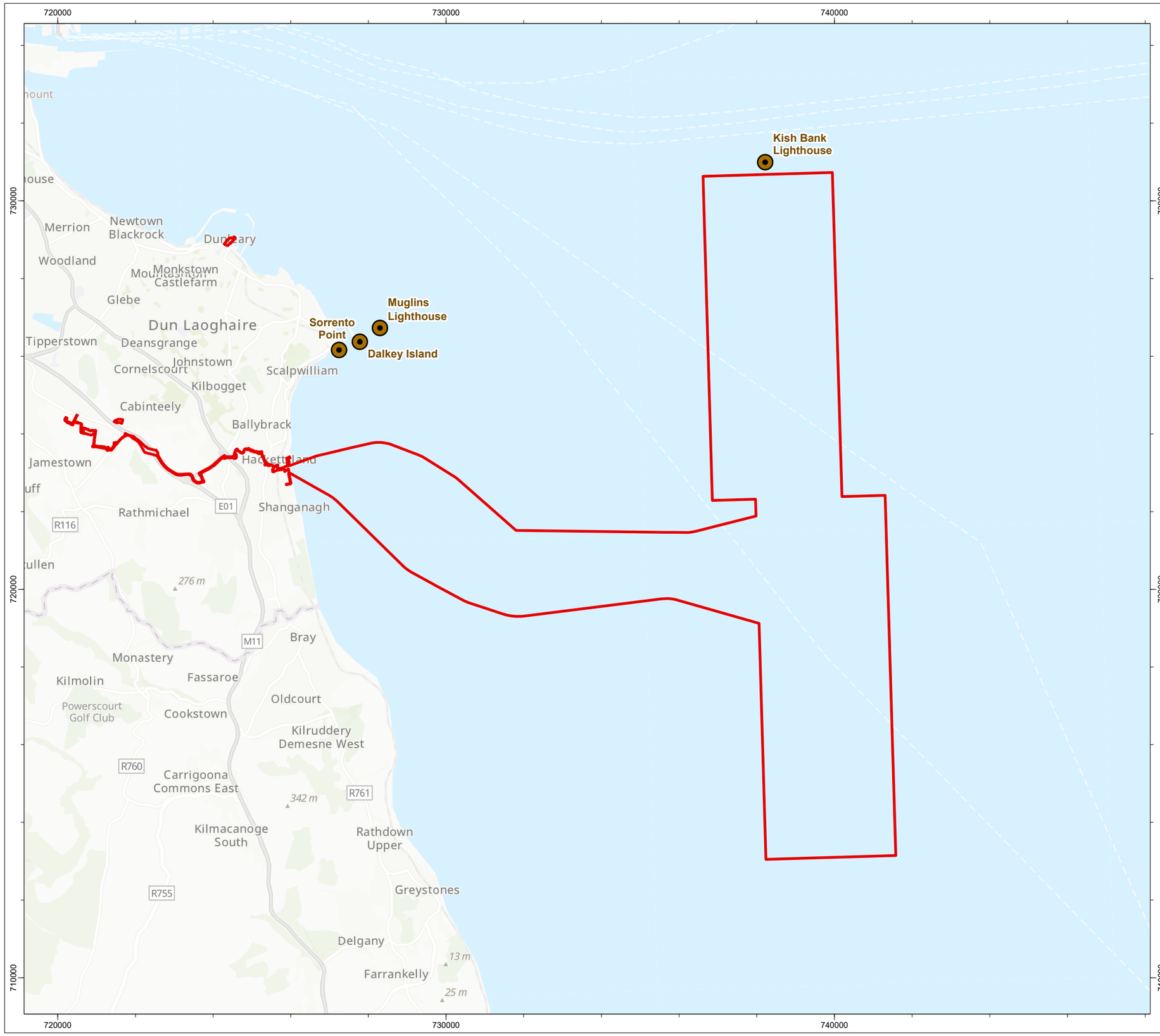
Annex A



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PROJECT TITLE

Dublin Array

DRAWING TITLE

Offshore Bats: Static Detector Locations

DRAWING NUMBER: **Figure 1**

PAGE NUMBER: **1 of 1**

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02	2025-01-30	Public	JK	CB	AM

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