Environmental Impact Assessment Report

NISA

North Irish Sea Array

Volume 5: Wider Scheme Aspects

Chapter 35
Offshore Bats

Statkraft

CIP
Copenhagen Infrastructure Partners

GoBe
APEM Group

ARUP

Contents

Tables

35. Offshore Bats

35.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) presents an assessment of likely significant effects from the North Irish Sea Array (NISA) Offshore Wind Farm (hereafter referred to as the 'proposed development') in relation to offshore bats during the construction, operation and decommissioning phases.

This chapter sets out the methodology followed (Section 35.2), describes the baseline environment (Section 35.3) and summarises the main characteristics of the proposed development which are of relevance to offshore bats (Section 35.4), including any embedded mitigation. Potential impacts and relevant receptors are identified, and an assessment of likely significant effects on offshore bats is undertaken, details of which are provided (Section 35.5).

Additional mitigation measures are proposed to mitigate and monitor these effects if required (Section 35.6) and any residual likely significant effects are then described (Section 35.7). Transboundary effects are considered (Section 35.8), and cumulative effects are considered in Section 35.9 and are summarised in Volume 6, Chapter 38 Cumulative and Inter-Related Effects (hereafter referred to as the 'Cumulative and Inter-Related Effects Chapter'). The chapter then provides a reference section (Section 35.10).

The EIAR also includes the following:

- Detail on the competent experts that have prepared this chapter is provided in Appendix 1.1 in Volume 8
- Detail on the extensive consultation that has been undertaken with a range of stakeholders during the development of the EIAR is set out in Appendix 1.2; and
- A glossary of terminology, abbreviations and acronyms is provided at the beginning of Volume 2 of the EIAR.

A detailed description of the proposed development including construction, operation and decommissioning is provided in Volume 2, Chapter 6: Description of the Proposed Development – Offshore (hereafter referred to as the 'Offshore Description Chapter'), Volume 2, Chapter 7: Description of the Proposed Development – Onshore (hereafter referred to as the 'Onshore Description Chapter'), Volume 2, Chapter 8: Construction Strategy – Offshore (hereafter referred to as the 'Offshore Construction Chapter'), and the Construction methodology is described in Volume 2, Chapter 9: Construction Strategy – Onshore (hereafter referred to as the 'Onshore Construction Chapter').

The assessment should be read in conjunction with following linked EIAR chapters:

- Volume 4: Chapter 23 Biodiversity (hereafter the Biodiversity Chapter); and
- Volume 5: Chapter 29 Seascape, Landscape and Visual (hereafter the SLVIA Chapter).

This chapter should also be read alongside the following appendices:

- Appendix 35.1 Rockabill Island and Headland Offshore Bat Monitoring 2022 (hereafter referred to as Appendix 35.1); and
- Appendix 35.2 Rockabill Island and Headland Offshore Bat Monitoring 2023 (hereafter referred to as Appendix 35.2).

All figures within this Chapter are provided in Volume 7A.

35.2 Methodology

35.2.1 Introduction

The assessments of offshore bats are consistent with the overall EIA methodology presented in Volume 2, Chapter 2: EIA and Methodology for the preparation of an EIAR (hereafter referred to as the EIAR Methodology Chapter).

This section provides the methodology for undertaking the offshore bat assessment, including the study area from within which receptors are identified, relevant guidance and policy, data collection, consultation and EIA methodology.

35.2.2 Study Area and Zone of Influence

The offshore elements of the proposed development seaward of the High Water Mark (HWM) consist of the array area and the offshore Export Cable Corridor (ECC), referred to collectively as the 'offshore development area' hereafter.

Based on the findings of the literature review (refer to Section 35.3.2) and the lack of data regarding bat species in the offshore environment between Ireland and the UK, a zone of influence (ZoI) has not been defined in strict distance terms but rather a species-specific basis (Figure 35.1), taking into account potential movements between land masses, the area occupied by the offshore development area and its proximity to the coast, and the potential for the proposed development to be visible from coast and island locations. Therefore, the study area is greater than that defined within CIEEM and NatureScot (10km) and extends from Clogherhead, County Louth in the north to Rush, County Dublin in the south comprising approximately 40km of coastline that could be used as departing/landing locations for migrating bat species traveling between Ireland and the UK that would cross the offshore development area; and by local individuals choosing to forage or commute offshore.

Baseline data was collected by the developer from a vessel traveling within the offshore development area, and from terrestrial locations including the entry pit location at Balbriggan, Skerries Harbour and the islands of Rockabill (approximately 6km offshore of Skerries to the south west of the array area), as shown in Figure 35.1.

The study area for the literature review extends to Europe and America due to the lack of data regarding bat species in the offshore environment between Ireland and the UK.

35.2.3 Relevant Legislation, Guidance and Policy

This section outlines guidance and policy specific to offshore bats, including best practice guidelines. Overarching guidance and legislation on EIA is presented in the EIAR Methodology Chapter. Furthermore, policy applicable to the proposed development is detailed in Volume 2, Chapter 3: Legal and Policy Framework.

Although there is no Irish guidance specific to the assessment of offshore bats, several pieces of national and international legislation, guidance and policy are applicable to developments in Ireland that have the potential to impact on ecological receptors. Where no relevant Irish guidance exists, the equivalent from other jurisdictions has been provided in order to support the assessment in this chapter.

The assessment of likely significant effects upon offshore bats has been made with specific reference to the following identified relevant legislation, policies and guidance:

- EU Habitats Directive 92/43/EEC, European Communities (Natural Habitats) Regulations 1997, European Communities (Birds and Natural Habitats) Regulations 2011
- Bern and Bonn Convention
- United Nations (UN) Convention on Biological Diversity (CBD)
- The Wildlife Act 1976 as amended
- Planning and Development Act 2000, as amended

- Policies and plans
- Survey guidance; and
- Other guidance and sources of information.

EU Habitats Directive 92/43/EEC, European Communities (Natural Habitats) Regulations 1997, European Communities (Birds and Natural Habitats) Regulations 2011

The Habitats Directive provides the basis of protection for European sites, namely Special Protection Areas (SPAs) and Special Areas of Conservation (SACs). Article 6 of the EU Habitats Directive requires that any proposal that may have a significant effect on a European Site must be subject to an Appropriate Assessment (AA). An AA is also listed under Annex II of the Directive which ensures that core areas of their habitat – designated as Sites of Community Importance - must be protected under the Natura 2000 Network and the sites managed in accordance with the ecological requirements of the species.

The Habitats Directive also contains obligations in relation to the strict protection of Annex IV species wherever they occur, which are set out in Article 12 and Article 13 of the Directive. These obligations require each Member State to establish a system of Strict Protection for the species listed in Annex IV of the Directive. All bat species are Annex IV species within the Directive. Only one species Lesser Horseshoe bat (*Rhinolophus hipposideros*), is designated under Annex II, in which an SAC could be designated for it. There are 41 SACs designated for Lesser Horseshoe bat (NPWS 2018) within Ireland, none of which are identified as within the ZoI of the proposed development and have been screened out for potential direct and in-direct likely significant effects within the proposed developments Supporting Information for Screening for Appropriate Assessment Report (SISAA).

Given that all SACs are s screened out, designated sites are scoped out of this EIAR and are not considered further in this assessment. Additionally, the conclusion of the proposed development's Natura Impact Statement (NIS) (North Irish Sea Array Windfarm Ltd, 2024) was that the proposed development will not adversely affect the integrity of any European site, either alone or in combination with other plans or projects.

Bern and Bonn Convention

The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982) exists to conserve all species and their habitats. It is an international legal instrument for nature conservation of which Ireland is a member country.

The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migratory species across all European boundaries. It is an intergovernmental treaty of which Ireland is a member country. The main pieces of legislation to ensure that the provisions of the Bonn convention are applied include the Birds Directive and the Habitats Directive.

United Nations (UN) Convention on Biological Diversity (CBD)

The CBD entered into force on 29 December 1993. It has three main objectives:

- The conservation of biological diversity
- The sustainable use of the components of biological diversity; and
- The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

Parties to the CBD are required to submit a National Biodiversity Action Plan and report annually on the status of biodiversity and measures to address and reverse loss of biodiversity. Ireland's 4th National Biodiversity Action Plan (NBAP) (2023-2030) is the latest version of the NBAP.

EUROBATS

Many bats, like birds, migrate long distances between summer and winter grounds. The Convention on the Conservation of Migratory Species (CMS) was established in recognition of the fact that endangered migratory species can be properly protected only if activities are conducted over the entire migratory range of the species. The Agreement on the Conservation of Populations of European Bats (EUROBATS) was set up under CMS and came into force in 1994.

EUROBATS aims to protect all 53 European bat species through legislation, education, conservation measures and international co-operation. The Agreement provides a framework of co-operation for the conservation of bats throughout Europe, Northern Africa and the Middle East. Ireland is actively involved in promoting and developing the EUROBATS Agreement and in 2015 Ireland was elected Chair of the EUROBATS Advisory Committee.

The Wildlife Act 1976, as amended

The Wildlife Act 1976 is the principal national legislation in Ireland providing for the protection of wildlife and the control of some activities. It gives protection to a wide variety of birds, animals and plants and also provides a mechanism to give statutory protection to Natural Heritage Areas (NHAs).

Planning and Development Act 2000, as amended

For the purposes of an application for planning permission certain protections for, and assessments of biodiversity are additionally provided for in the 2000 Act, as amended, and the Planning and Development Regulations 2001, as amended, which incorporate provisions of the Habitats and Birds Directives as well as the Wildlife Acts, the Water Framework Directive, and the biodiversity provisions of the County Development Plan.

Policies and plans

Due to the overlap between potential impacts occurring to offshore bats from both the onshore and offshore infrastructure aspects of the proposed development, the assessment has taken into account the policies and plans that occur within the terrestrial sections of the study area. The following plans and policies were reviewed as part of the assessment:

- Fingal County Development Plan 2023-2029[1]
- Fingal Biodiversity Action Plan 2022-2030[2]
- Dublin City Development Plan 2022-2028[3]
- National Biodiversity Action Plan (NBAP) 2017-2021[4]
- Ireland's 4th NBAP 2023-2027[5]
- River Basin Management Plan for Ireland 2018-2021
- Third Cycle Draft River Basin Management Plan 2022-2027; and
- All-Ireland Species Action Plan – Bats[6].

The key National Marine Planning Framework (NMPF), 2021, policy that is applicable to the assessment of offshore bats is summarised in Table 35.1. NMPF policies are addressed in their entirety in Appendix 3.1: NMPF Compliance Report.

---

[1] Fingal County Council (2022) *Draft Fingal Development Plan 2023-2029*. February 2022 [Accessed September 2023]

[2] Fingal County Council (2022) *Fingal Biodiversity Action Plan 2022-2030*. Draft for Consultation. Dublin, Fingal County Council. [Accessed September 2023]

[3] Dublin City Council (2022) *Dublin City Development Plan 2022-2028*. December 2022 [Accessed September 2023]

[4] Available at: https://www.npws.ie/sites/default/files/publications/pdf/National%20Biodiversity%20Action%20Plan%20English.pdf [Accessed September 2023]

[5] Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/281711/d424b166-763b-4916-8eba-8afff955c5e5.pdf#page=null [Accessed September 2023]

[6] Available at: https://www.npws.ie/sites/default/files/publications/pdf/2008_Bat_SAP.pdf [Accessed September 2023]

Table 35.1 Key NMPF policies relevant to the assessment

Policy Name	Policy Description	Where addressed
National Marine Planning Framework (2021)	Biodiversity Policy 1 Proposals incorporating features that enhance or facilitate species adaptation or migration, or natural native habitat connectivity will be supported, subject to the outcome of statutory environmental assessment processes and subsequent decision by the competent authority, and where they contribute to the policies and objectives of this NMPF. Proposals that may have significant adverse impacts on species adaptation or migration, or on natural native habitat connectivity must demonstrate that they will, in order of preference and in accordance with legal requirements: a. avoid, b. minimise, or c. mitigate significant adverse impacts on species adaptation or migration, or on natural native habitat connectivity.	This chapter recognises that the potential for bats to be present within the ECC and/or array area cannot be ruled out however, the likelihood is very low and the number of individuals is expected to be very low (refer to Section 35.3.2 and 35.3.3). Turbine height and spacing has ensured that impacts are avoided and minimised as far as practicable (Section 35.4.2).
	Biodiversity Policy 4 Proposals must demonstrate that they will, in order of preference and in accordance with legal requirements: a. avoid, b. minimise, or c. mitigate significant disturbance to, or displacement of, highly mobile species.	

Survey guidance

There are currently no best practice guidelines for establishing a baseline for offshore bats to assess potential impacts from offshore wind development in Ireland. Some countries in Europe without national guidelines base their approach on the EUROBATS publication 'Guidelines for consideration of bats in windfarm projects' (revised 2014).

Surveys were undertaken to inform the baseline of this assessment using an adaptation of onshore bat surveying best practice guidelines produced by Sustainability Energy Authority of Ireland (SEAI) 2017, Scottish Natural Heritage 2021 (now referred to as NatureScot) and Northern Ireland Environment Agency (NIEA) 2021 along with adaptation methodologies from EUROBATS 2014 and recent literature. Details of the surveys undertaken are provided in Section 35.2.4.1.

Other guidance and sources of information

The assessment had regard to the following guidance documents and sources of information:

- CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management (CIEEM)
- EPA (2022). Guidelines on the Information to be Contained in Environmental Impact Assessment Report (May 2022). Environmental Protection Agency, Dublin
- Environmental Protection Agency (EPA) Maps[7]
- National Parks and Wildlife Services (NPWS) Online Mapviewer[8]
- National Biodiversity Data Centre (NBDC) Biodiversity Maps[9]

[7] EPA Maps. Available at: https://gis.epa.ie/EPAMaps/ [Accessed January 2023]. [Accessed September 2023]

[8] NPWS Designations Viewer. Available at: https://dahg.maps.arcgis.com/apps/webappviewer/ Accessed September 2023]

[9] National Biodiversity Data Centre. Biodiversity Maps. Available at: https://maps.biodiversityireland.ie/ [Accessed September 2023]

- EPA Catchments Database[10]
- EirGrid Ecology Guidelines[11]
- National Parks and Wildlife Service – Irish Wildlife Manuals[12] and Red Lists[13]
- White and grey literature as part of the literature review; and
- Offshore Description Chapter, Onshore Construction Chapter, Volume 4, Chapter 21: Land, Soils, Geology and Hydrogeology (hereafter referred to as the Land & Soils Chapter), Volume 4, Chapter 22: Water (hereafter referred to as the Water Chapter), Volume 5, Chapter 27: Air Quality (hereafter referred to as the Air Chapter), and Volume 5, Chapter 30: Noise and Vibration (hereafter referred to as the Noise Chapter).

35.2.4 Data Collection and Collation

35.2.4.1 Site-specific Surveys

Rockabill Lighthouse

Following consultation with Commissioners of Irish Lights (CIL), BirdWatch Ireland and NPWS, in February 2022, permission was received to access Rockabill for the purpose of monitoring bat activity. Rockabill is approximately 5km southwest of the array area, and the closest accessible island to the proposed development.

Static detector surveys were undertaken using Wildlife Acoustics full spectrum Song Meter 4s (SM4s) with SMM-U2 ultrasonic microphones. Detectors were deployed on Rockabill, approximately 6km offshore of Skerries, County Dublin. The detectors were powered by external Lithium-ion batteries. The detectors were housed in simple plastic boxes modified to allow for power and microphone cables, to prevent excessive fouling from terns directly onto detectors. Two static detectors were deployed from 19-Apr 2022 to 25-Oct 2022 and 04-Apr 2023 to 11-Oct 2023. One detector was positioned on the eastern side of the island at [53.597212, -6.00454] while the other was placed on the western side [53.597285, -6.004187]. The devices were set to start recording 30 minutes pre-sunset to 30 minutes post sunrise in order to capture the period that is likely to have the greatest bat activity, as per Bat surveys for professional ecologists: Good practice guidelines (Collins 2016) for static detector surveys. The surveys are also in line with updated guidance Collins (2023).

The detectors were fitted with two 512GB memory cards each, in anticipation of high levels of noise being recorded because of the island's large breeding tern colony. The detectors were set with 16kHz as the minimum frequency trigger for recording, differing from standard Irish bat survey methodology for which a minimum trigger of 12kHz is used to cover all species present in Ireland. This was done in order the reduce the amount of interfering noise files produced by the large tern colony on the island, while still recording within the normal echolocation frequencies of relevant species. For detector locations refer to Figure 1 of Appendix 35.1.

Marine Vessel Survey

Offshore site investigations were carried out at the array area by a marine survey vessel (Fugro Mercator vessel) during May-July 2022. Two detectors Song Meter Minis (SM-mini) were also deployed on the Fugro Mercator vessel surveying the array area on dates between 31-May 2022 and 11-Jul 2022.

10 EPA Catchments Database. Available at: https://www.catchments.ie/data/ Accessed September 2023]

11 EirGrid Ecology Guidelines. Available at: https://www.eirgridgroup.com/site-files/library/EirGrid/Ecology-Guidelines-for-Electricity Transmission-Projects.pdf [Accessed September 2023]

12 NPWS Irish Wildlife Manuals. Available at: https://www.npws.ie/publications/irish-wildlife-manuals [Accessed September 2023]

13 NPWS Red Lists. Available at: https://www.npws.ie/publications/red-lists [Accessed September 2023]

One detector was placed on a walkway railing on the centre-front of the boat while the second was placed on a railing at the top of the boat. These detectors were set to record 30 minutes pre-sunset to 30 minutes post sunrise with a minimum trigger frequency of 12kHz. For detector locations refer to Figure 2 of Appendix 35.1.

Headland Monitoring

Two SM-mini detectors were also strategically deployed along the north Dublin coast to complement the offshore surveys (at Rockabill and the marine survey vessel) to identify any activity peaks that may be associated with bat migration/movement. They recorded from 30 minutes pre-sunset to 30 minutes post-sunrise. Unlike the island-based detectors the minimum triggering frequency was left at 12kHz as large amounts of noise interreference such as that recorded on the island was not present on the headlands. These detectors were deployed between 07-Sep 2022 and 24-Oct 2022 and between 28-Apr 2023 and 08-Nov 2023. One detector was placed on a treeline north of Balbriggan [53.624458, -6.189347] while a second was deployed on the RNLI lifeboat station in Skerries [53.585937, -6.105593].

Data Analysis

Sound files were analysed using Kaleidoscope Pro (5.4.0) with automatic European classifiers filtered to Irish species. All files were manually verified by a suitably experienced member of the Woodrow bat ecology team, with the aid of Russ 2012 Barataud 2015, and Middleton et al. 2022. Bat activity was measured by the number of bat passes recorded. Bat passes are commonly used as a metric for bat activity and determine species presence (Kerbiriou et al., 2019). Therefore, a bat pass was defined as the detection of one or more bat calls from a single species within a 15 second sound file. Recordings in which multiple species were recorded were split into separate bat passes per species. Due to the large quantity of noise generated during the 2022 boat-based survey every second batch of 100 noise files were manually verified while the remainder were left as automatically classified as noise.

As a result of the length of deployment of detectors during the 2022 and 2023 survey seasons and the presence of resident bats surrounding the headland detectors a large quantity of data was generated. The headland data was processed through Kaleidoscope's automatic identification feature and identifications with match ratios >0.75 were accepted as bat calls. However, for migratory species considered to be at high risk from wind turbine generators (WTG), Leisler's bat (*Nyctalus leisleri*) and Nathusius' pipistrelle (*Pipistrellus nathusii*), manual verification was applied. A precautionary approach was taken to manually verifying echolocation calls for Nathusius' pipistrelle and Leisler's bat. Calls with a FM-qCF structure resembling pipistrelle echolocation calls with a peak frequency below 41.5kHz and a minimum frequency below 40.5kHz were labelled as Nathusius' pipistrelle calls and calls with a peak frequency of 22kHz to 28kHz were labelled Leisler's bat (Bat Conversation Ireland (BCIreland) BATLAS 2010).

Weather data was gathered from the M2 weather buoy in the Irish Sea accessed via the Marine Institute website (Irish Weather Buoy Data[14]). An important caveat is that the weather recorded comes from the middle of the Irish Sea as opposed to from Rockabill itself. This buoy is located 40km south-east of Rockabill which means that there may be localised differences to Rockabill unaccounted for, i.e., there may be higher wind and lower temperature effects from the mainland. However, it provides an insight into the weather conditions in a marine context for the Irish Sea rather than using a land-based weather station.

The weather data for the headland sites was obtained from Dublin Airport weather station (accessed 2023[15]) which is the closest weather station providing land-based weather data. Dublin Airport is located approximately 20km south-west of the headland sites.

[14] Marine Institute Website: Irish Weather Buoy Network Observations. Available at: http://www.marine.ie/site-area/data-services/real-time-observations/irish-weather-buoy-network-imos (Accessed December 2022)

[15] Dublin Airport Hourly Data. Published by: Met Éireann. Available at https://data.gov.ie/dataset/dublin-airport-hourly-data (Accessed February 2023)

35.2.4.2 Desk-based Review

Existing ecological records

A search was completed for species records occurring within the study area, using the NBDC website in September 2023[16]. Species records from the last 10 years were obtained for the study area, and included national grid squares O16, O17, O18, O25, O26, O27, O28, O35, O36, O37 and O38 (refer to Figure 35.1). These records were used to determine which bat species may occur within the study area to inform survey design and identify potential constraints. While the grid squares include offshore areas, the database does not include any offshore bat records other than those for Lambay Island (approximately 15km south of the array area). There is no other data for bats within the offshore environment of the Irish Sea.

A search was completed for species records occurring within 10km of a central location within the onshore development area (53.624458, -6.189347) by BCIreland.

Given the nature of the works and the types of habitats within the study area, the above records were deemed sufficient to inform this assessment, when supplemented by field surveys, allowing direct observations and records to be made.

Habitats along the coastline adjacent to the proposed development

Habitats along the coastline within the study area (within grid squares O16, O17, O18, O25 and O26) were assessed using digital imagery to ascertain/ identify areas that may be suitable along the coastline for bat migration corridors and/or holding areas.

Literature Review

A search was undertaken to identify any evidence/ studies or literature that would help determine if any of the nine resident bat species of Ireland could or do migrate or forage in the marine environment e.g. the Irish Sea. Vagrant species have been considered with regards to their potential migration to Ireland from neighbouring countries. As there are very few studies having been undertaken within Ireland on the subject of offshore bats, the review was expanded to include all relevant evidence/ studies and literature from Europe, and North America where relevant.

European studies have the potential to include bat species relevant to Ireland, and observations and results on the behaviour of these species have the potential to be applied to the marine environment in Ireland.

Furthermore, the literature review included the consideration of studies and papers published on the presence or absence of bats in the marine environment in North America. There is more limited overlap of bat species with those found in North America however, there are similarities that can be drawn in the consideration of the potential impacts of offshore wind developments impacting bats within the marine environment. As this is an emerging field of study and in order to provide as robust an approach as possible to the assessment, the review was further expanded to include other countries.

35.2.5 Consultation

As part of the data collection and assessment process, consultation with statutory consultees and relevant stakeholders was undertaken. This included two meetings with NPWS in 2022 and 2023 to discuss survey scope to support the better understanding of offshore bat activity.

The feedback from those meetings was incorporated into the development of the survey monitoring undertaken at Rockabill, headland locations and on the vessel (refer to Appendix 35.1 and 35.2).

Refer to Volume 8, Appendix 1.2 for further details.

35.2.6 Data Limitations

The following data limitations are acknowledged in relation to the desk-based review and the site-specific surveys.

[16] NBDC maps: https://maps.biodiversityireland.ie/Map

Overall, the limitations detailed below are not considered to affect the validity or robustness of the impact assessment within this chapter. In all cases, a precautionary approach has been taken at an appropriate scale, and where appropriate mitigation measures have been included to reduce the risk of impacts on bat species to an acceptable level.

35.2.6.1 Literature review

Despite evidence of migratory routes in continental Europe, little is known about the seasonal movements of Nathusius' pipistrelle and Leisler's bats in Ireland and if Irish Nathusius' pipistrelles and/or Leisler's are migratory or travel over the marine environment for commuting, feeding or other behavioural activities.

While there are records of Nathusius' pipistrelle in an Irish/Northern Europe marine environment, there are currently no available public records of Leisler's bat in an Irish/Northern Europe marine environment.

35.2.6.2 Marine Vessel Survey

Due to the engine noise, high winds, metal movement, rigging etc, high quantities of noise data were recorded during the deployment surveys on marine vessels in 2022. Therefore, during the data analysis process every second batch of 100 noise files were manually verified while the remainder were left as automatically classified as noise. While only two bat registrations were recorded during the marine vessel survey, the survey is classed as valid, having provided any registrations for a marine environment.

The bat registrations recorded during the marine vessel survey each consisted of a single pulse and were therefore labelled noise by automatic classifiers (which are generally configured only to classify registration of two or more 'pulses'). Given the nature of this survey it is exceedingly difficult to confirm these as bat passes, however, as registrations within the marine environment would most likely consist as low quality, single pulse calls due to a noisy moving target attempting to record a small, fast-moving target, the files have been included within the assessment.

35.2.6.3 Rockabill Lighthouse Monitoring

While no microphones experienced complete failure, the build-up of bird droppings on microphones on Rockabill during both the 2022 and 2023 surveys, resulted in the partial loss of microphone sensitivity towards the end of the recording period for some deployments. Despite this partial loss of sensitivity, data was still collected for the full duration of the deployment. Therefore, it was considered that data captured effectively on both detectors for the duration of the surveys provided an accurate representation of bat activity on Rockabill.

35.2.6.4 Headland Monitoring

Both detectors for the headland surveys of the 2022 survey season suffered technical issues because of torrential rain in October 2022, compromising the waterproof seals and corroding the extended battery housing. This resulted in the detector at Balbriggan failing on 05-Oct 2022 and the detector at Skerries failing on the 09-Oct 2022. Despite the failures it is considered that the data recorded up to the failure dates provides an accurate representation of the bat activity for the headland locations during the recording period. Furthermore, only two Leisler's bats were recorded at Rockabill after the failures occurred, therefore, the data is still comparable with that collected at Rockabill for the 2022 surveys prior to the failures.

During the 2023 survey season, the Balbriggan detector was deployed on 28-Apr-2023, however, due to a unit failure, recording did not begin until 10-June-2023. Maintenance on the RNLI radio tower also delayed deployment of the second detector until 16-June-2023. Both detectors were collected on 08-Nov-2023. Despite missing the spring migration window to provide comparison between the headlands and Rockabill, the data recorded provides an accurate representation of the bat activity for the headland locations for comparison during the reminder of the survey season. Furthermore, no bats were recorded at the Rockabill locations during the spring period for comparison.

As the decision to include the headlands within the survey scope was not agreed with NPWS until late in the 2022 season, no land access agreement was in place until 7th September 2022 and headland detectors were not in place for the night of 02-Sep 2022, which was the peak date of both Leisler's and Nathusius' pipistrelle activity on Rockabill.

Although the deployment does not coincide with Rockabill, the recording does coincide with anticipated autumn migration period and therefore does provide coastal context with regards to potential migration past Rockabill.

35.2.6.5 Undertaking baseline survey

The locations for surveys undertaken would have preferably been the array area and the corridor between the array and the exit pit location, however, due to significant limitations of obtaining data, including, no existing platforms or structures present, no buoys available to place equipment on, no existing equipment available with appropriate weather/sea protection to study bats in the marine environment, baseline data was mainly collected from terrestrial locations relevant to the study area including the entry pit location at Balbriggan, Skerries harbour and Rockabill (approximately 6km offshore of Skerries to the southwest of the array area).

To provide a picture of the potential for migrating bats occurring in the offshore environment of the proposed development an extensive literature review of potential migrating species has been undertaken. The literature review provided insight into known aspects of migration and potential attraction and fills the potential gaps in data.

35.2.7 Methodology for the Assessment of Effects

The general approach for the EIAR methodology is set out in the EIAR Methodology Chapter. As the subject is new to Environmental Impact Assessments in Ireland and there are many unknowns with regards to sensitivity and magnitude of impacts of bat species in the offshore environment, it is determined that the CIEEM (CIEEM 2018, updated 2022) approach to impact assessment be used to establish significance of effects on offshore bats. This is also the approach adopted to assessing impacts to onshore bats (refer to Biodiversity Chapter). The following list provides a summary of the process for undertaking an ecological impact assessment (EcIA), as detailed in the CIEEM guidance document:

- *Scoping: Determining the matters to be addressed in the EcIA, including consultation to ensure the most effective input to defining the scope.*
  - It should be noted that offshore bats were not included within the initial scope of the EIAR for the proposed development. Offshore bats were included within the EIAR following consultation with NPWS. Refer to Consultation Section 35.2.5;
- *Establishing the baseline: Collecting information and describing the ecological conditions in the absence of the proposed project, to inform the assessment of impacts*
- *Important Ecological Features: Identifying Important Ecological Features (habitats and species) that may be affected, with reference to a geographical context in which they are considered important*
- *Impact assessment: An assessment of whether Important Ecological Features may be subject to potential impacts and characterisation of these impacts and their effects. Assessment of potential residual ecological impacts of the proposed development remaining after mitigation and the significance of their effects, including cumulative effects*
- *Avoidance, mitigation, compensation and enhancement: Incorporating measures to avoid, reduce and/or compensate potential ecological impacts, and the provision of ecological enhancements; and*
- *Monitoring: Monitoring impacts of the development and evaluation of the success of proposed mitigation, compensation, and enhancement measures.*

35.2.7.1 Identifying Ecological Features within the ZoI

Information obtained during the field surveys identified ecological features which have the potential to be affected by the proposed development and as such, occur within the ZoI of the proposed development.

The ZoI depends on the type of development taking place, its likely impacts and the presence of ecological connections which enable such impacts to affect sensitive ecological features. The ZoI may extend a great distance (several kilometres) beyond the boundaries of the proposed development site, due to the presence of ecological connections with an ecological feature of interest.

Similarly, ecological features that have no ecological connection with the proposed development are not within its ZoI, regardless of their proximity to the proposed development, as no pathway for impacts exists. Furthermore, as identified within Collins 2023, Factors to consider when defining the ZoI of a project on bats are:

- The nature of the project and project activities, and the potential for effects at all development stages
- The nature of the land use and habitats in the vicinity, their connectivity, and how they may be used by bats
- The assemblage of bat species which may be in the area based on the site location and desk study data; and
- The different habits, behaviours and preferences of different bat species that could be affected, and how these vary both spatially and seasonally.

Due to the potential ecological connectivity of the ecological features (in this case the bat species) and the offshore development area, the ZoI has been determined to extend from Clogherhead, County Louth in the north to Rush, County Dublin in the south comprising approximately 40km of coastline that could be used as departing/ landing locations for migrating bat species traveling between Ireland and the UK and crossing the offshore development area or array area; and by local individuals choosing to forage or commute offshore; extending out to incorporate the offshore development area.

35.2.7.2 Evaluating Ecological Features within the ZoI

Those ecological features which occur within the ZoI such as nature conservation sites, habitats, or species, are then evaluated in geographic hierarchy of importance. The categories and criteria used for this evaluation are listed in Table 35.2 below.

Table 35.2 Geographic frame of reference used to determine ecological value Source: Adapted from CIEEM (2018, updated 2022)

Importance	Criteria
International importance	'European Sites' including SACs, Site of Community Importance (SCIs), candidate Special Area of Conservation (cSAC). Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended). Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of animal and plants listed in Annex II and/or IV of the Habitats Directive. World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972). Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979). Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1982).
National importance	Sites, habitats, and species populations of importance in a national context. Undesignated site fulfilling the criteria for designation as an NHA, Statutory Nature Reserve, Refuge for Fauna and Flora protected under the Wildlife Act, and/or a National Park. Refuge for Fauna and Flora protected under the Wildlife Acts. Resident or regularly occurring populations (assessed to be important at the national level in Ireland) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list.
County/regional importance	Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of animal and plants listed in Annex II and/or IV of the Habitats Directive Species protected under the Wildlife Acts Ireland); and/or Species listed on the relevant Red Data list. County important populations of species, or viable areas of semi-natural habitats, or natural heritage features identified in the National or Local BAP, if this has been prepared.

Importance	Criteria
	Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county. Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.
Local importance (higher value)	Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared. Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive Species of animal and plants listed in Annex II and/or IV of the Habitats Directive Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality. Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.

The status of a species as requiring protection at an international or national level (as is the case for bat species) does not necessarily impose an international or national conservation value on any single example of that species found at the site Approaches to attributing nature conservation value to species at a site level have been previously developed for some species groups such as bats. The approach to attributing nature conservation value to bat populations and foraging habitats for this assessment is adapted from Wray et al., (2010).

35.2.7.3 Identification and characterisation of impacts

When describing ecological impacts, reference is made to the following characteristics:

- Beneficial or adverse
- Extent
- Magnitude
- Duration
- Timing
- Frequency; and
- Reversibility.

However, the assessment only needs to describe those characteristics relevant to understanding the ecological effect and determining the significance; and as such does not need to incorporate all stated characteristics (CIEEM 2018, updated 2022).

35.2.7.4 Significant effects on Important Ecological Features

For the purpose of EcIA, a significant effect is an effect that either supports or undermines biodiversity conservation objectives for those ecological features which have been identified as being an important feature of the site i.e., Important Ecological Features. Conservation objectives may be specific (e.g., for a designated site) or broader at a plan level (e.g., national/local nature conservation policy). As such effects can be considered significant in a wide range of geographic scales from international to local. Consequently, 'significant' effects are qualified with reference to the appropriate geographic scale (CIEEM 2018, updated 2022).

35.2.7.5 Assessment of residual effects

After characterising the potential impacts of the development and assessing the likely significant effects of these impacts on the Important Ecological Features, measures are proposed to avoid and/or mitigate the identified ecological effects. Once measures to avoid and mitigate ecological effects have been finalised, assessment of the residual effects is undertaken on the Important Ecological Features.

35.2.7.6 Assessment of cumulative impacts and effects

Cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location (CIEEM 2018, updated 2022). Different types of actions can cause cumulative impacts and effects. As such, these types of impacts may be characterised as:

- Additive/incremental – in which multiple activities/projects (each with potentially insignificant effects) add together to contribute to a significant effect due to their proximity in time and space (CIEEM 2018, updated 2022); and
- Associated/connected – a development activity 'enables' another development activity, e.g., phased development, as part of separate planning applications. Associated developments may include different aspects of the project which may be authorised under different consent processes. It is important to assess impacts of the 'project' as a whole and not ignore impacts that fall under a separate consent process (CIEEM 2018, updated 2022).

The cumulative effects assessment is presented in Section 35.9.

35.3 Baseline Environment

35.3.1 Introduction

The baseline provides a representation of the existing environment within the study area in the absence of the proposed development. As described in Section 35.2, this baseline has been developed through:

- A literature review, to understand the potential for bats offshore
- A desk study, to ascertain the likely bat species within the ZoI; and
- Analysis of the bat monitoring surveys undertaken within the ZoI.

35.3.2 Literature review

The purpose of the literature review is to provide a focus on bats in relation to the offshore environment and the offshore infrastructure proposed for the proposed development. The literature review has considered the following animal behaviours that would lead to bats potentially occurring offshore:

- Migration
- Foraging; and
- Vagrancy.

Since all European bats are protected by international and national legislation (refer to Section 35.3), any intentional killing of any European Protected Species is prohibited by law. Therefore, avoidance of bat mortality from activities such as being struck by a WTG blade is not only a priority for bat conservation, but also a legal obligation in Europe.

There are nine resident species of bat in Ireland and two vagrant species that have been identified as present at least once within Ireland. These are:

- Resident
  - Common pipistrelle *(Pipistrellus pipistrellus)*
  - Soprano pipistrelle *(Pipistrellus pygmaeus)*

  - Nathusius' pipistrelle *(Pipistrellus nathusii)*
  - Leisler's bat *(Nyctalus leisleri)*
  - Brown long-eared bat *(Plecotus auratus)*
  - Daubenton's bat *(Myotis daubentonii)*
  - Whiskered bat *(Myotis mystacinus)*
  - Natterer's bat *(Myotis nattereri)*
  - Lesser horseshoe bat *(Rhinolophus hipposideros)*
- Vagrant
  - Brandt's bat (*Myotis Brandtii*)
  - Greater Horseshoe bat *(Rhinolophus ferrumequinum)*

After undertaking the review, it was identified that although several of the species found in Ireland migrate within the country, only two species have been identified as having potential for migrating offshore to neighbouring countries. Furthermore, it has also been identified that several species may not migrate but can forage offshore. Therefore, for the purposes of this report the literature review focussed on the two Irish species; Nathusius' pipistrelle and Leisler's bat with regards to potential migration, and the remaining seven resident species with regards to potential foraging offshore. The vagrant species have been considered with regards to their potential migration to Ireland.

It should be noted that the greatest migration for each species has been identified. This is to help determine if the array area is within a commutable distance for each of the species beyond their identified core sustenance zone (CSZ)[17]. While this is used as precautionary approach the distances travelled to feeding sites vary considerably, both within and between bat species. Some species feed close to their roost site, like brown long-eared bats, which normally forage within 1km of their roost, others fly long distances – noctules have been recorded flying more than 26km to feeding areas (Entwistle *et al*., 2001).

It should be noted that it is not known (at the time of writing this report) what proportion of the Irish and UK Nathusius' pipistrelle and Leisler's bat populations migrate across the Irish Sea, as the majority of European-based literature available on the offshore migration of bats is centred around the North Sea, however as the species do migrate across large water bodies and seas it is inferred to occur from Ireland. Therefore, using the precautionary principal, for the purposes of this report, it is assumed migratory species do cross the Irish Sea.

Species recorded in this literature include Nathusius' pipistrelle, noctule (*Nyctalus noctula*), northern bat (*Eptesicus nilssonii*), serotine (*Eptesicus serotinus*) and parti-coloured bat (*Vespertilio murinus*) (Boshamer & Bekker 2008, Jonge Poerink et al. 2013, Lagerveld et al. 2014a, 2014b, 2015, Leopold et al. 2014, Bat conservation trust 2014, Lagerveld et al. 2019). Some European studies do show Nathusius' pipistrelle to be the more common migratory species with common pipistrelles (*Pipistrellus pipistrellus*) and members of the Nyctalus genus being much scarcer (Lagerveld et al. 2018 and 2019, UK Offshore Energy Strategic Environmental Assessment 4 (OESEA4) 2022 Appendix A1a.7).

35.3.2.1 Migratory and Vagrant Species

As stated in Section 35.3.3, the outcome of the literature review on migratory species indicates that there only two relevant species within the ZoI; Nathusius' pipistrelle and Leisler's bat.

[17] A core sustenance zone (CSZ), as applied to bats, refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost. (BCT, 2020)

Nathusius' pipistrelle

The Nathusius' pipistrelle is a small migratory bat (weighing 6-10g) with a widespread distribution across Europe into western Asia (ARUP 2024). This species currently holds the world record for the longest migration distance of any bat, covering over 2,200km across Europe (Assembly, 2023) as well as movement over open waters (Alcade et al., 2020). The study undertaken by Suba (2014) identified that Nathusius' pipistrelle (assuming bats are active for 7.3 hours per night) has a migration range of 30 to 120km per night, which is in line with other studies including Pētersons (2004) and Hedenström (2009 and 2019) which also concluded that the species migrate on average 47km and 46km per night (range 32 to 77km per night) respectively. A recent study showed that Nathusius' exhibited high metabolic rates during migratory transit flights, even when flying at an energetically optimal speed (Troxell et al., 2019). To cover the elevated energy demands of transit flights, they use a 'mixed-fuel strategy' based on oxidizing ingested insect proteins from insects caught en route ("aerial refuelling") and fatty acids from their body reserves (Voigt et al., 2012). Although they depend on insects as an oxidative fuel for migration, they rarely engage in foraging while flying in an actual migration corridor (Voigt et al., 2018). Instead, they seem to forage first at nightfall and then launch into the sky to proceed to their migration route.

In Ireland, where the winters are relatively mild, Nathusius' pipistrelle may relinquish its migratory behaviour in favour of a more sedentary lifestyle. While the CSZ for Nathusius' pipistrelle in Ireland has not been determined, the Bat Conservation Trust (BCT) in the UK recommend a distance of 3km (BCT, 2020). It is possible that Ireland (which lies in a transitional region) has resident bats being supplemented during winter by the migratory individuals returning from the north-east of the species range (Petersons, 2004 and Lagerveld et al., 2023).

The first confirmed Irish breeding colony of this bat was identified in May 1997 near Lough Neagh, with smaller roosts located throughout the country (non-breeding). A recent assessment undertaken by Bat Conservation Ireland through the Car-Transect Monitoring Scheme (2003-2021) has found that Nathusius' pipistrelles are widely distributed with individuals recorded in all counties across the country albeit in low numbers. The study also showed that Northern Ireland (Lough Neagh) had a mean encounter rate of ten times the mean of all other survey squares combined (refer to Diagram 35.1). According to the Article 17 (2013 - 2018) Assessment the estimated population of Nathusius' pipistrelle bat in the Republic of Ireland is estimated to be between 3,000 and 5,000 individuals.

Distribution and migration mapping for Nathusius' pipistrelle from EUORBATS in 2015 identifies a possible migration route between the UK and Norway, with no known migration routes mapped between Ireland and the UK, nor the UK and France, Netherlands or Belgium. However, the National Nathusius' Pipistrelle Project (NNPP)[18] undertaken in the UK and the Motus tracking project undertaken by Wageningen University and Research [19] have identified the long-distance movement of individual Nathusius' bats (through ringing) between the south of England and mainland Europe, including the coast of the Netherlands, Latvia and Lithuania (Bat Conservation Trust 2019, Motus tracking data accessed September 2023). Diagram 35.2 shows the migration routes undertaken by Nathusius' pipistrelle bats during the spring migration period of 2023 between the UK and mainland Europe.

Despite evidence of these migratory routes in continental Europe, little is known about the seasonal movements of Nathusius' pipistrelle in Ireland and if Irish Nathusius' pipistrelles are migratory.

Nathusius' pipistrelle were recorded at both the Rockabill Lighthouse island and headland monitoring sites during the project specific surveys, further information on this is found in Sections 35.3.4 and 35.3.5.

[18] https://www.bats.org.uk/our-work/national-bat-monitoring-programme/surveys/national-nathusius-pipistrelle-survey

[19] https://www.wur.nl/en/product/telemetry-network-for-birds-and-bats-motus.htm

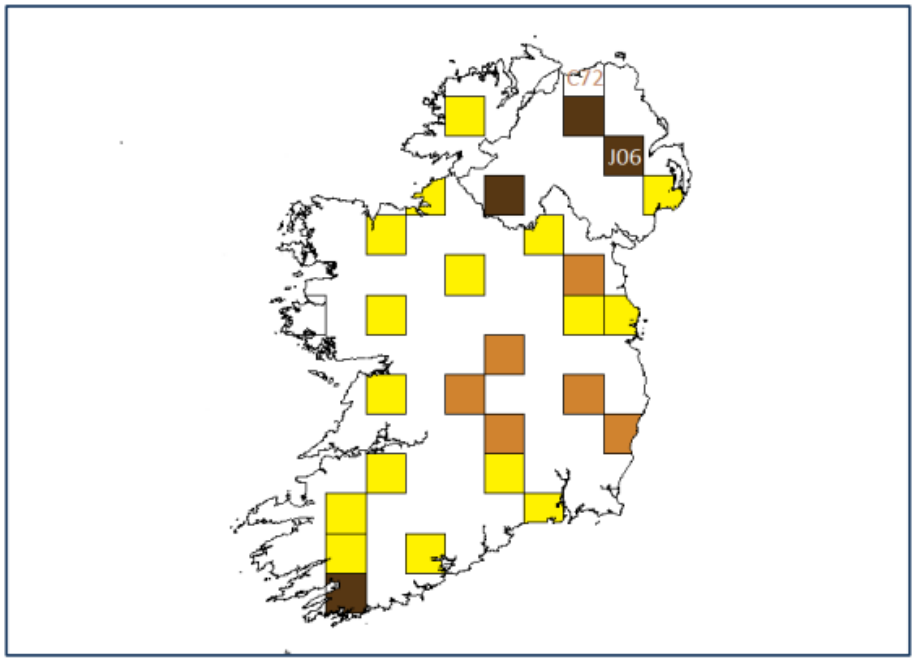


Figure 2.10 Survey squares colour coded according to mean Nathusius' pipistrelle encounter rates from Batlogger detectors (per hour) from 2019-2021. The overall average rate of Nathusius' bat encounters for all squares from 2019-2021 was 2.2hr^{-1}.

Encounter rate >0≤1.5hr^{-1}
Encounter rate >1.5≤3hr^{-1}
Encounter rate >3hr^{-1}

Diagram 35.1 Nathusius' pipistrelle encounter rate.

Source: Irish Bat Monitoring Programme 2018-2021. Irish Wildlife Manuals, No. 137

Diagram 35.2 Nathusius' pipistrelle track map showing migration movements between the UK and Northern Europe on between 30/03/2023 and 06/05/2023

Source: Motus Tracking Wildlife System https://motus.org/data/tracksSearch. Note the actual migratory route taken is unknown, lines are indicative base on software parameters identified in Motus.

Leisler's Bat

Leisler's bat is the biggest of the nine resident species of bats found in Ireland (12-20g) with a widespread but rare distribution in Europe, including the British Isles and Isle of Man. Ireland is considered a European stronghold for Leisler's bat, where the species is the third most common bat (BCIreland). A recent assessment undertaken by Bat Conservation Ireland through the Car-Transect Monitoring Scheme (2003-2021) has found Leisler's bats to be the third most frequently encountered species during the monitoring scheme in most survey years to-date and that there is a southern bias in species distribution (refer to Diagram 35.4). According to the Article 17 (2013 - 2018) Assessment the estimated population of Leisler's bat in the Republic of Ireland is estimated to be between 63,000 and 113,000 individuals. The CSZ for Leisler's bat in Ireland has not been determined but the BCT in the UK recommend a distance of 3km (BCT, 2020).

There are much less data and literature available about the offshore migratory habits of Leisler's bat (Ahlen et al., 2009, Motus tracking data accessed September 2023). While in continental Europe Leisler's bat is one of the long-distance seasonally migratory species (Giavi 2014), with six records of flights over 1,000km (EUROBATS, Dondinni 2012) including three over 1500km (Wohlgemuth 2004 and Dondini 2012). There are currently no available public records of this species in an Irish marine environment. However, they have been recorded offshore in Europe.

It is not known whether the Irish population migrates within or from Ireland to another country, however, it should be noted that some authors submit that '*Leisler's bat does not migrate from Ireland'* (Vincet Wildlife trust). This is an argument further strengthened by Shiel (1999) which states '*in Ireland, it seems N. leisleri remain within their summer range to hibernate'* and Boston et al., (2015) which compares phylogeographic relationships of Irish populations in relation to those across Europe. In contrast, Pinder (2020) highlights that Leisler's bats have colonised/re-colonised the Isle of Man since the 1990s with population levels increasing since, demonstrating that there is a level of migratory activity of this species in the Irish sea. Pinder (2020) does not however, state whether the assumption is that the species migrate from the UK or Ireland.

Leisler's bat were recorded at both the Rockabill Lighthouse island and headland monitoring sites during the project specific survey, further information on this is found in Sections 35.3.4 and 35.3.5.

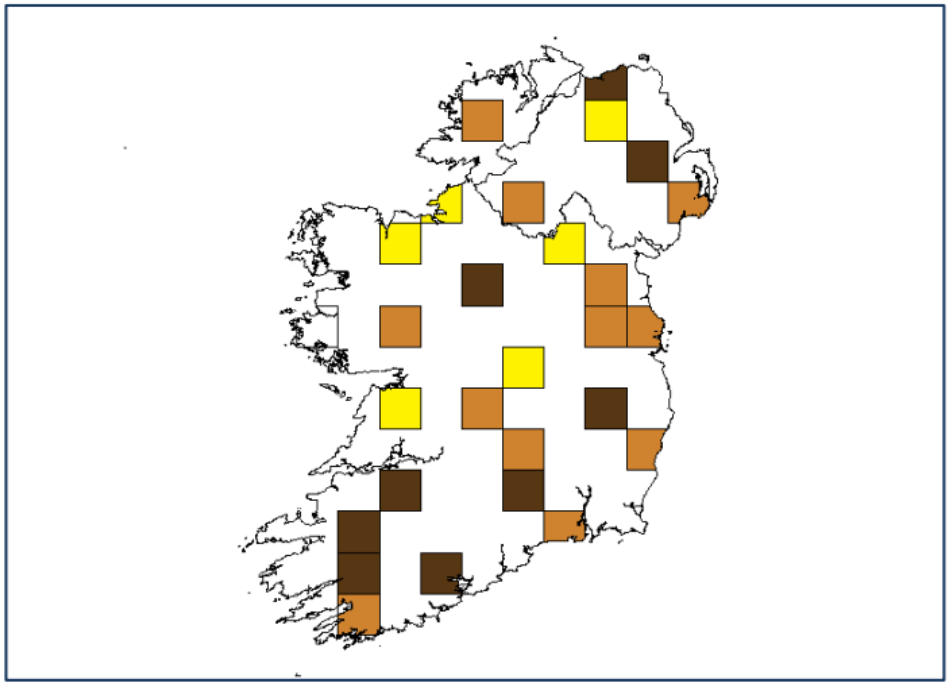


Figure 2.8 Survey squares colour coded according to mean Leisler's bat encounter rates from Batlogger detectors (per hour) from 2019-2021. The overall average rate of Leisler's bat encounters for all squares from 2019-2021 was 22.3hr^{-1}.

Encounter rate >0≤12hr^{-1}

Encounter rate >12≤24hr^{-1}

Encounter rate >24hr^{-1}

Diagram 35.3 Leisler's Bat encounter rate

Source: Irish Bat Monitoring Programme 2018-2021. Irish Wildlife Manuals, No. 137

Vagrant Species

Brandt's Bat

A specimen of Brandt's Bat was first recorded in Ireland in 2003 when one was discovered in County Wicklow. The bat subsequently died, and its identification was determined by Deoxyribonucleic acid (DNA) analysis. This bat is known from only five specimens found to date in Co. Cavan, Clare, Kerry, Tipperary and Wicklow. However, these animals were identified by physical characteristics while being held and not genetically. As no resident population has yet been identified on the island of Ireland, the species' status remains unknown. This species is known as a regional migrant (seasonal migration of a few hundred km but also disperse or facultatively migrate over distances up to 800km^2) Jones et al. (2009). The longest recorded migrations of this species have been up to 300km.

Greater Horseshoe Bat

The greater horseshoe bat is the largest species that has been found in Ireland. In winter 2013 a single male was found hibernating in an underground site in Co. Wexford. The same individual was ringed and found in the same location the following summer. It is assumed that this individual is a vagrant from the Welsh population. The species are known as sedentary (travel short ranges between roosts (tens of km), barely disperse or migrate less than 100km). However, the longest recorded migrations of this species have been up to 180km.

Migration activity and conditions

Activity at offshore locations from studies within Europe is most frequently documented for Nathusius' pipistrelle and Leisler's bat during the spring (April–May) and autumn (August–October) migration periods (Boshamer & Bekker 2008, Motus tracking data accessed September 2023).

During the autumn period there are favourable weather conditions identified for offshore migration towards the UK (Nathusius' pipistrelle only) to occur including temperature >13ºC, wind speed <5 m/s, and wind direction originating from the east, northeast and southeast. As shown in Diagram 35.2, there are movements along the coast before moving out to sea. It is assumed that along with gathering food stores for the trip, the bats are awaiting the favourable weather conditions to travel.

It is also highlighted within the studies that the presence of tailwinds as an important determinant of offshore migration events (Hüppop & Hill 2016; Brabant et al., 2019; Brabant et al., 2021, Lagerveld et al., 2021). There is very little data available to identify favourable weather conditions for the spring migratory period, however, Hüppop & Hill (2016) identify presumed direction of migration as (west-southwest in autumn and east-northeast in spring). It should be noted that the platform used for the study is to the west of Heligoland, within the eastern section of the southern North Sea. There is currently no published information on the favourable weather conditions of offshore Leisler's bat migrations. Most recorded recoveries of long-distance flights lie in south-west to north-east directions (Rydell et al., 2014).

The studies also indicate that more active flying insects were caught in low wind-speeds, with increasing winds, passively transported aeroplankton (such as drifting ballooning small spiders) were observed. This also coincides with weather conditions known to trigger insect migration in August-September (Chapman et al., 2004, Drake & Reynolds 2012), along with insect migration over sea being associated with lunar phasing and late summer/ early autumn migrations (Lagerveld 2023).

The literature is currently inconclusive on the flight height at which bats migrate in the offshore environment. Some literature suggests that bats migrate at higher altitudes in favourable tailwinds (Hüppop & Hill 2016), while others suggest much lower migration heights of <10m, assuming the use of echolocation against the surface of the water (Ahlén et al., 2009, Troxell et al., 2019, Brabant et al., 2020). Another North Sea based study in the Thornton bank, 27km from the Belgian coast, examined the height of Nathusius' pipistrelle offshore activity. This study recorded an approximate 90% to 10% split in data between a detector mounted at 16m on a WTG and another at 93m. This suggests that migratory behaviour is primarily low altitude (Brabant et al., 2019) however, it does highlight the need for further study with surveys to be undertaken at heights between the two used (i.e. within the rotor swept area).

Although there is currently no published information on the potential heights of offshore Leisler's bat migrations, onshore its commuting height is up to 100m and its foraging height is higher than other species at around 30m (BCIreland, 2010 and VWT 2024[20]).There are studies offshore involving common noctule (a close relative to Leisler's bat) identifying flight heights of 50m (+/- 45m above ground level (AGL)) to 295 (+/- 84m AGL) with 1 no. individual ascending to 800m AGL (O'Mara, M. T., 2019). It should be noted that this study identified that bats of the same species showed individual migratory behaviour (both within and among individuals) therefore a precautionary approach is taken as to whether the two species, Leisler and noctule will show similarities in migration altitudes.

35.3.2.2 Foraging Species

The foraging behaviours of Nathusius' pipistrelle and Leisler's bat are described with their migratory behaviour in Section 35.3.3.1.

Common pipistrelle and Soprano pipistrelle

Common and soprano pipistrelle are Ireland's two smallest resident bat species and also the commonest, weighing no more than 5-6g, the weight of a 1-euro piece (BCIreland accessed 2023). While the two species are not known to migrate offshore, both species are known as regional migrant Jones et al. (2009) and have been recorded at wind farms and coastal islands up to 10km from the coast (Ahlén et al., 2007; Boshamer and Bekker, 2008). The longest recorded migrations for common pipistrelle have been up to approximately 1,100km, whilst for soprano pipistrelle are unknown. The CSZ for common pipistrelle is 2km while for soprano pipistrelle is 3km (BCT 2020). According to the Article 17 (2013 - 2018) Assessment the estimated population of common pipistrelles in the Republic of Ireland is estimated to be between 1,070,000 and 2,400,000 individuals. The estimated population of soprano pipistrelles is between 500,000 and 1,200,000.

[20] Vincent Wildlife Trust. Species Profiles. Leisler's Bats. https://www.vincentwildlife.ie/species/leislers-bat Accessed February 2024.

Brown Long-eared Bat

The brown long-eared bat is one of the most common of Ireland's nine resident bat species and is found all over the country (BCIreland accessed 2023). The species are known as sedentary with the longest recorded migrations of this species being up to 90km. There has only been one reported sighting of the species from North Sea platforms, while anecdotal sightings have been reported at lighthouses and light-ships in the North Sea (Boshamer and Bekker, 2008; Racey et al., 2004). The species has also been recorded at Lambay Island, approximately 4km off the coast of Portraine (NBDC accessed September 2023). The CSZ for this species is 3km (BCT 2020). According to the Article 17 (2013 - 2018) Assessment the estimated population of Daubenton's bats in the Republic of Ireland is estimated to be 1,580.

Daubenton's Bat

Daubenton's Bat has a widespread distribution throughout Western Europe, including Ireland and the UK (NBDC accessed 2024, EUROBATS). This species primarily occurs close to freshwater rivers and lakes and can forage up to 10km from roosts. While not a species known to migrate offshore, the species are known as a regional migrant (Jones et al., 2009) covering a distance of up to 150km between roosts and have been recorded at wind farms and coastal islands hunting over the sea surface up to 10km from the coast (Ahlén et al., 2007; Boshamer and Bekker, 2008). The species has also been recorded along coastlines (Lagerveld et al., 2017). The longest recorded migrations of this species have been up to 300km. The CSZ for this species is 2km (BCT 2020). According to the Article 17 (2013 - 2018) Assessment the estimated population of Daubenton's bats in the Republic of Ireland is estimated to be 1,580.

Whiskered Bat /Natterer's Bat

While these species are thought to be present throughout Ireland, they are two of the rarer bat species for the country. Due to the difficulty to definitively identify them to species level without capture techniques, little is known about the flight or foraging behaviour of the two species. Whiskered are known as a regional migrant and natterer's sedentary (Jones et al., 2009), with the longest recorded migrations for whiskered bats up to 600km and Natterer's bat up to 300km. While these species have not been recorded offshore in Europe, relatives in the Myotis family found in mid-latitude areas of the American coastline have been recorded as far out as 7km in the mid-Atlantic (Biodiversity Research Institute. 2022). The CSZ for whiskered is 1km and for natterer's is 4km (BCT 2020). According to the Article 17 (2013 - 2018) Assessment the estimated population of whiskered bats in the Republic of Ireland is estimated to be 270. The estimated population of Natterer's bats is 464.

Lesser Horseshoe Bat

The range of the lesser horseshoe bat in Ireland is, for the most part, limited to six western counties – Mayo, Galway, Clare, Limerick, Kerry and Cork, with strongholds in Kerry/West Cork and in Clare (Augney et al. 2022). This species is considered to be largely sedentary and one that does not undertake extensive migrations (Jones et al., 2009). The longest recorded migrations of this species have been up to 153km. (Schober and Grimmberger, 1997). The CSZ for this species is 2km (BCT 2020). According to the Article 17 (2013 - 2018) Assessment the estimated population of lesser horseshoe bats in the Republic of Ireland is estimated to be between 5,000 and 7,000.

35.3.2.3 Vagrant Species

Brandt's Bat (Myotis Brandtii)

Brandt's Bat was first recorded in Ireland in 2003 when one was discovered in County Wicklow. The bat subsequently died and its identification was determined by DNA analysis. This bat is known from only five specimens found to date in Counties Cavan, Clare, Kerry, Tipperary and Wicklow. However, these animals were identified by physical characteristics in the hand and not genetically. As no resident population has yet been identified on the island of Ireland, the species' status remains unknown. This species is known as a regional migrant (seasonal migration a few hundred km but also disperse or facultatively migrate over distances up to 800m) Jones et al. (2009). The longest recorded migrations of this species have been up to 300km. The CSZ for this species is 1km (BCT 2020).

Greater Horseshoe Bat (Rhinolophus ferrumequinum)

The greater horseshoe bat is the largest species that has been found in Ireland. In winter 2013 a single male was found hibernating in an underground site in County Wexford. The same individual was ringed and found in the same location the following summer. It is assumed that this individual is a vagrant from the Welsh population (BCIreland). The species are known as sedentary (travel short ranges between roosts (tens of km) barely disperse or migrate less than 100km). The longest recorded migrations of this species have been up to 180km. The CSZ for this species is 3km (BCT 2020).

35.3.3 Field survey results 2022

Rockabill

Three species were recorded at Rockabill during the survey period; Leisler's bat, Nathusius' pipistrelle, and soprano pipistrelle. Only one recording period during the deployment recorded no bats on both detectors. This was between the 19 May 2022 to the 14 Jun 2022.

Leisler's bat activity was low but consistent throughout much of the deployment duration. There were either none, or individual passes during the initial deployment on 19 Apr to 07 Aug 2022. The 16 Jun 2022 is a slight outlier in this period, with six recorded passes. Across August, 79 passes were recorded in total, with noted increases on 07 Aug and 27 Aug 2022 comprising 26 passes and 33 passes, respectively. There was frequent Leisler's bat activity across the entire month of September with a total of 430 passes recorded. The two largest peaks in activity occurred on single nights on the 02 Sep and 11 Sep 2022, with 310 passes and 75 passes respectively. The Leisler's bat activity on the 02 Sep 2022 occurred between 02:00 and 05:00. This is relative to a sunrise at 06:36. It is also important contextually that there were no Leisler's bat passes on the night of the 01 Sep 2022. The activity during this early morning period also featured 29 recorded feeding calls ('buzzes') and a social call in a sound file containing two Leisler's bats. There were also two feeding buzzes recorded on 28-Aug.

Leisler's bat activity primarily coincided with easterly winds; a trend heavily driven by the activity peak on the 02 Sep 2022 which had an average easterly wind speed of 3.5m/s. The three most frequently observed wind directions while Leisler's bat activity was recorded were easterly, south-easterly and northerly winds. These conditions were present for 59.46%, 15.25%, and 11% of recorded passes respectively. Of the 11% of records made during northerly winds, a notable 4.44% of records were recorded during 5-7m/s wind speeds. There was a single pass which occurred during a westerly wind. This occurred on the 16 Oct 2022, while the average hourly wind speed was 10.42m/s.

Nathusius' pipistrelle activity was recorded on two occasions, 01 May and 02 Sep 2022. The activity recorded in May consisted of a single pass on the eastern detector at 22:18:29, followed by a single pass on the western detector at 22:18:38. This is relative to a sunset on the 01 May 2022 was at 20:54 making these passes approximately 90 minutes after sunset. Recordings on the 02 Sept 2022, during which time the only other Nathusius' pipistrelle calls were captured, two passes were recorded in the morning at 06:33 and 06:34. Sunrise on the 02 Sep 2022 was at 06:36. That evening, eight passes were recorded between 20:45 and 20:47 relative to a sunset at 20:12. It is likely that a single bat used the island as a temporary roost for the one day.

Although Nathusius' pipistrelle passes are low in number, there is a similar trend in wind direction as to what is observed with the Leisler's bat, with easterly and south-easterly winds being the most frequently occurring conditions, 83% and 17% respectively. It is important to note that 67% of the easterly wind recorded was between 5-7m/s in wind speed. This observation is heavily influenced by the conditions which were present on 02-Sep which was a combination of south easterly winds between 5-7m/s and easterly winds between 1-3m/s.

On 22 Sep 2022 at 20:25 and 20:36, two soprano pipistrelle passes were recorded. The calls were not identified as foraging or social behaviour. Both passes were only recorded on the detector on the western side of the island.

Marine Vessel Survey

The detectors deployed on the marine survey vessel recorded high levels of noise. Only two potential bat calls were recorded at times during which the boat was at sea. Both recordings comprised a single pulse, because of this, confirmation to species level can be more difficult.

One is a potential single pulse of a Leisler's bat continuous frequency call with a peak frequency at 24kHz. The second is a prospective *Nyctalus* species continuous frequency bat call with a peak frequency of 13.5kHz. Refer to Table 3 in Appendix 35.1 for the locations and times of the calls.

Headland Monitoring

The headland detector data was examined specifically for trends in Nathusius' pipistrelle and Leisler's bat data, in light of the results recorded at Rockabill. There were no Nathusius' pipistrelle calls recorded on either headland detectors. Leisler's bats were recorded at both locations with higher pass numbers recorded at Balbriggan on the 10th (308 passes) and 11th September (91 passes) and higher pass numbers recorded at Skerries on 12th September (317 passes). Examining temporal pass density plot, on the 11 Sep 2022 indicates that activity increased and decreased simultaneously at Skerries in tandem with activity on the island (Refer to Figure 11 in Appendix 35.1).

Further static detector surveys were undertaken as part of baseline data collection in relation to onshore infrastructure of the proposed development, landward of the HWM, described further in the Biodiversity Chapter. Within this survey effort one static detector was located at the grid facility location (D.07) and two at the entry pit location (D.08 and D.09). D.09 is the same location as the headland monitoring location at Balbriggan (Section 35.2.4.2). All three location are classed as having high species aggregate activity. Furthermore, despite multiple locations having high activity, D.08 which was placed along a hedgerow in arable fields at the entry pit location recorded activity orders of magnitude higher than other high locations (76.59 bat passes/hour). This was, however, due to the level of activity for common and soprano pipistrelles recorded at the site rather than any other species. Leisler's bat was recorded at all three locations, whilst there are no recordings for Nathusius' pipistrelle at any of the three locations.

35.3.4 Field survey results 2023

Rockabill

Four species were recorded during the survey period; Leisler's bat, Nathusius' pipistrelle, soprano pipistrelle and common pipistrelle. Total passes for each species are displayed in Figure 2 of Appendix 35.2. With the exception of Nathusius' pipistrelle, all species were more active at the eastern detector. This contrasts with the previous 2022 year's data in which the western detector recorded more passes for each species. No bats were recorded on either detector during the spring survey season (April–May). The prevailing nightly winds were southerly winds between 4-10m/s consisting of 14% of the conditions during the survey. Overall, 21% of the recorded nightly wind conditions were southerly winds.

Leisler's bat were recorded between 11 June 2023 and 11 Oct 2023. The peak in their activity occurred in September with 3 nights of the highest activity on 04 Sep 2023 (37 passes), 08-Sep-2023 (38 passes), and 09 Sep 2023 (35 passes). While there is a similar total level of activity to the 2022 survey, the passes during the 2022 survey are distributed more evenly throughout the survey with significant spikes in activity in August and September (activity levels of approximately ten passes increasing to over 300 passes). The 2023 distribution is more even with no significant spikes in activity levels (activity levels between 10 and 35 passes). Only two feeding buzzes were produced by Leisler's bats on the 05 Sep 2023 and 06 Sep 2023. This is a large decrease in comparison to 2022 which had an aggregate of 31 feeding buzzes recorded on two separate nights. The peak in activity within night varies across the entire deployment in 2023 as opposed to 2022 where most activity occurred between 02:00 and 05:00.

Wind conditions during which Leisler's were active show a similar trend to the weather data gathered in 2022, Leisler's bat activity coincided with predominantly easterly and southerly winds, with the wind directions being present for 21% of the recorded passes. 14% of passes were recorded during easterly winds with speeds of 4-7m/s. 17% of passes occurred while there were north-easterly winds and the remaining 48% is distributed across the remaining wind directions.

Given that Leisler's bat were highly active on Rockabill in easterly wind speeds relative to the prevailing nightly winds which were predominantly southerly, long with the peak in activity (September) during the known migration period for the species and with similar activity during the 2022 surveys, it is assumed migratory behaviour may be present and that the use of tailwinds may also be a factor, however this is based on two years of survey only.

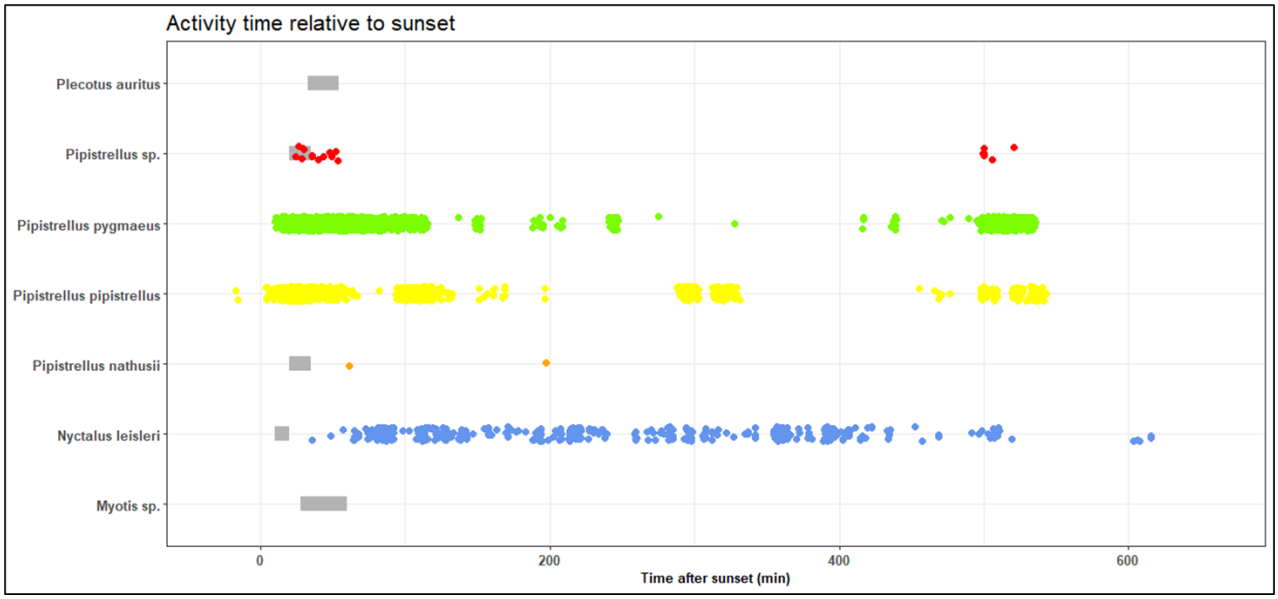
Leisler's bat are known to be a species capable of long-distance migrations particularly on continental Europe (Shiel et al., 1999; Dondini et al., 2012; Ongoing data collection project, Charlotte Roemer/CESCO Lab 2021 – Presentation Weblink 1, Janssen,. R. Dechmann Lab 2023). Literature has detailed the use of tailwinds by migrating bats (Dechmann et al., 2017; Lagerveld et al., 2021), however, this has not been substantiated for Leisler's to date but is a behaviour noted in both Nathusius' pipistrelle and common noctule.

Only two Nathusius' pipistrelle passes were recorded throughout the survey, on 05 Jun 2023 at 23:02 and 08 Aug 2023 at 00:40. Both occurred in wind speeds of approximately 2.5m/s winds (north-easterly and north-westerly, respectively) and between 12°C and 14°C. The recordings are outside the known migration window for the species.

During the 2022 survey only two Soprano pipistrelle passes were recorded. This is significantly less than the 2713 bat passes recorded for both common and soprano pipistrelle species in 2023. Of the 2713 passes recorded for the survey duration 2699 occurred in August. The calls recorded included high levels of feeding buzzes (310) and social calls (384).

Wind conditions during which common and soprano pipistrelle species were active include strong southerly winds, which are the more common conditions within the Irish Sea. 43% of passes occurred during southerly winds between 10-13m/s.

Analysis of the activity of species relative to sunset demonstrates there is a high likelihood of a nearby (on Rockabill Island) pipistrelle species roost (emergence windows in which bats are known to emerge from there roosts are estimated using Identification Guide to Irish Bats, Bat Conservation Ireland (Roache & Torsney 2022)). Graph 1 shows species activity relative to sunset for the full survey period. Given the level of activity for common and soprano pipistrelle within their respective emergence windows (Graph 1), the levels of activity within August, along with the level of social activity recorded, there is a high likelihood that features on the island are used as both a roost and for swarming behaviour for common and soprano pipistrelles. While the potential roost has been identified in 2023, there are no corresponding records for 2022, therefore, it is assumed that it may not be used every year.



Graph 35.1 Species activity relative to sunset, emergence windows denoted by the grey box

Headland Monitoring

The headland detector data was examined specifically for trends in Nathusius' pipistrelle and Leisler's bat data based on the results recorded at Rockabill. The detector at Skerries recorded the most passes for these two species with 71% of the total aggregate bat passes, while the Balbriggan detector recorded 21% of the total aggregate bat passes. Passes were recorded into November 2023 for Leisler's bat.

Leisler's bat activity was recorded across both headland detectors with a peak of activity occurring on 14 July 2023 (688 passes) at the Skerries location. It has not been determined whether this is due to the result of a single feeding event of one or several bats in proximity to the detector or as the result of a larger population commuting/ foraging at this location. There was a period of no activity between 05 Sep 2023 and 02 Oct 2023, followed by an increase in activity which peaked on 09 Oct 2023 with 338 passes recorded in one night for both locations. This peak coincides with the known migration period for the species. Overall, this species was active mostly in light to moderate south westerly winds.

The detector located at Skerries recorded only seven passes for Nathusius' pipistrelle, while the detector at Balbriggan recorded considerably higher activity with 255 passes. Most of the passes at Balbriggan were recorded in a peak of activity between 9 Oct 2023 and 16 Oct 2023, which coincides with the known migration period for the species. This species was most active during light to moderate westerly winds (42% of all passes) and light northerly winds (29% of all passes).

It is noted that none of the periods of activity for Nathusius' pipistrelle recorded on the headlands correspond to the activity recorded on the Rockabill detectors.

35.3.5 Desk Study Results

35.3.5.1 Existing ecological records

Records of bat species within the study area were obtained from the NBDC database.

Table 35.3 identifies the bat species records from NBDC for the 10km grid squares O16, O17, O18, O25, O26, O27, O28, O35, O36, O37 and O38 (refer to study area in Figure 35.1). It shows that species have only been recorded on land and nothing recorded offshore to date. All onshore locations (O16, O17, O18, O25, O26) have historical records of Leisler's bat but only two (O16 and O25) have historical records of Nathusius' pipistrelle.

Table 35.3 Bat species records from NBDC for the 10km grid squares O16, O17, O18, O25, O26, O27, O28, O35, O36, O37 and O38

	Common Pipistrelle	Soprano pipistrelle	Nathusius' pipistrelle	Leisler's bat	Brown long-eared bat	Daubenton's bat	Whiskered bat
O16	✓	✓	✓	✓	✓	✓	✓
O17	✓	✓		✓	✓	✓	
O18	✓	✓		✓			
O25	✓	✓	✓	✓	✓	✓	
O26	✓	✓		✓	✓		
O27							
O28							
O35					✓		
O36							
O37							
O38							

35.3.5.2 Coastal Habitats

Habitats within O16, O17, O25 and O26 (refer to Figure 35.1) have previously been mapped to Fossitt level 2 and/or 3 as part of previous mapping exercises and results posted to NBDC. Along the coastline in these areas are sedimentary sea cliffs (CS3), sand shores (LS2), embryonic dunes (CD1), fixed dunes, shingle and gravel banks (CB1), shingle and gravel shores (LS1), lower saltmarsh (CM1), upper saltmarsh (CM2), shelter rocky shores (LR3), exposed rocky shores (LR1), muddy sand shores (LS3), fixed dunes (CD3) and tidal rivers (CW2).

Behind the coastal habitats are extensive areas of cultivated land (BC and GA1), amenity grassland (GA2), recolonising bare ground (ED3), dry calcareous and neutral grassland (GS1), built land (BL), scrub (WS1), ornamental/non-native shrub (WS3), (mixed broadleaf woodland (WD1), scattered trees and parkland (WD5), hedgerows (WL1), treelines (WL2) and watercourses (FW).

To the north within O18 (refer to Figure 35.1), the coastal habitats are similar with sand dune systems (CD) and littoral sediment (LS). Behind the coastal habitats are also similar to the above.

35.3.5.3 Records of Roosts

A BCIreland data search was undertaken that provided locations of roosts, transect records and ad-hoc observations of bat species within 10km of a central search coordinate. The indicative locations of the roosts are provided on Figure 35.2. These roost sites are not exclusive and a buffer has been indicated to protect the exact location of the sites. Six roosts have been recorded within the 10km search area including the coastline at Balbriggan.

The species observed at the roosts include Brown Long-eared Bat, Leisler's Bat (*Nyctalus leisleri*; and Common Pipistrelle.

35.3.5.4 Offshore Habitats

The offshore habitats of relevance to offshore bats within the array area and ECC comprise open water of varying depths up to 55m below lowest astronomical tide. Benthic habitats are discussed in Chapter 12 Benthic Subtidal and Intertidal Ecology. There are no existing platforms present within the array area to provide offshore resting places for species. Rockabill is located approximately 6km from the mainland and approximately 5km from the offshore development area, at the closest point. Aerial imagery[21] shows habitats on Rockabill to include exposed rocky shores (LR1), recolonising bare ground (ED3) Semi-natural grassland (GS), stone walls and other stonework (BL1), buildings and artificial surfaces (BL3), scrub (WS1), ornamental/non-native shrub (WS3) and hedgerows (WL1).

35.3.6 Summary of Important Ecological Features

The following table summarises Important Ecological Features that have been identified as at risk of likely significant impacts via a source-pathway-receptor link. For the purposes of this chapter the Important Ecological Features are all nine resident and the two vagrant bat species.

Table 35.4 Valuation of Important Ecological Features in relation to the proposed development

Feature	Highest Evaluation / Importance	Important Ecological Feature?
Common pipistrelle	National	Yes
Soprano pipistrelle	National	Yes
Nathusius' pipistrelle	National	Yes
Leisler's bat	National	Yes
Brown long-eared bat	National	Yes
Daubenton's bat	National	Yes
Whiskered bat	National	Yes
Natterer's bat	National	Yes
Lesser horseshoe bat	National	Yes
Brandt's bat	International	Yes
Greater Horseshoe bat	International	Yes

[21] Google maps available at https://www.google.com/maps?authuser=0 Accessed April 2024

Based on bat behaviour, their reported occurrence offshore and also taking into account species sensitivity to onshore wind farms (NatureScot, 2021), species identified as being at possible risk of impact from the proposed development are identified in Table 35.5.

Table 35.5 Bat species identified as being at possible risk of impact from the proposed development, based on species ecology and distribution (adapted from Wray et al., 2010 using data from the Irish Bat Monitoring Programme 2018-2021)

Feature	Migration	Collision Risk from onshore wind farm	Recorded offshore in the North Sea/ Irish Sea	Risk from offshore wind farm
Common pipistrelle	Regional	High	Yes	Yes
Soprano pipistrelle	Potential Regional (Lindecke 2019)	High	No	Yes
Nathusius' pipistrelle	Long distance	High	Yes	Yes
Leisler's bat	Long distance	High	Yes	Yes
Brown long-eared bat	Sedentary	Low	Yes	Yes
Daubenton's bat	Regional	Low	No	No
Whiskered bat	Regional	Low	No	No
Natterer's bat	Sedentary	Low	No	No
Lesser horseshoe bat	Sedentary	Low	No	No
Brandt's bat	Regional	Low	No	No
Greater Horseshoe bat	Sedentary	Low	No	No

35.3.7 Potential interactions of offshore bats with wind developments

Due to the proximity of the offshore development area (within a commutable range) to coastal and island locations that are likely to have bat populations (as indicated in the desk study, literature review, and surveys), and that migration between the UK and Ireland cannot be ruled out (the distance between Skerries and Holyhead (UK) is c. 100km) it is assumed that there is the potential for a number of interactions for bat species that are known to either forage and/or migrate offshore (refer to Table 35.5 for those at risk).

Studies demonstrate that bats (whether migrating or foraging) do not avoid offshore WTGs. They can stay for periods hunting close to the WTGs because of the accumulation of flying insects (Ahlen et al., 2007, Lagerveld et al., 2017, Boshamer & Bekker /Lutra 2008, Guest et al., 2022).

Additionally, there is the potential for bat species to be attracted to offshore wind developments. Potential theories of 'Attraction Hypotheses' (Cryan and Barclay, 2009) include:

- Bats perceiving the WTGs as potential roosts (Cryan and Barclay, 2009);
- Potentially increased prey base (Ahlén et al., 2007, Lagerveld et al., 2017, Boshamer & Bekker / Lutra 2008, Guest et al., 2022);
- Visual attraction (Guest et al., 2022);
- Disorientation due to EMFs or decompression (Nicholls and Racey, 2009); or
- Attraction due to mating strategies (Arnett et al., 2008; Cryan 2007; Kunz et al. 2007, Cryan & Barclay 2009; Foo et al., 2017; Richardson et al., 2021; Guest et al., 2022, SEER 2022).

Studies examining these hypotheses suggest that out of these theories bats are most likely attracted to insect populations surrounding WTG, which are themselves attracted to WTG (Kunz et al., 2007; Rydell et al., 2010).

The presence of WTG in a terrestrial (onshore) environment is a well-established source of bat mortality with estimates of mainland European fatalities ranging between 0.6–11 bat mortalities per megawatt (MW) of energy generated, depending on the habitat present near the WTG (Rydell et al., 2010; Korner-Nievergelt et al., 2013; Arnett et al., 2016). This is also shown worldwide (e.g. Barclay et al., 2007, Arnett et al., 2008), with mortality most commonly associated with species migrating long distances (Kunz et al., 2007). Fatalities have been recorded within mainland Europe to increase at onshore wind farms during autumn, when there is a general peak in activity and migratory behaviour (Arnett et al., 2008; Lagerveld et al., 2020).

While there is evidence of bat mortality at turbines for onshore bats, information on interactions between bats and offshore WTG is almost completely lacking. Although studies have been carried out at offshore WTG locations including Ahlén et al., (2007) which involved monitoring of bat behaviour around offshore wind farms in the Baltic and Kattegat, where bats were observed foraging near the turbines, no mention is made of observed collisions between bats and offshore WTGs.

Nathusius' pipistrelle are considered to be at high risk of collisions from onshore wind farms due to their occurrence in open habitats and migratory behaviour (NatureScot 2021, NIEA 2021, Brabant et al., 2021, Lagerveld et al., 2021, Lagerveld et al., 2023), and the species has been reported among the most commonly observed fatalities under turbines at onshore wind farms in mainland Europe (Rodrigues et al., 2015). Whilst the previous studies relate to onshore wind farms, due to the migratory behaviour of Nathusius' pipistrelle and their known presence in the offshore environment, potential for collision must be considered during this assessment.

Leisler's bats are also considered to be at high risk of collisions from onshore wind farms due to their occurrence in open habitats and migratory behaviour (BCIreland accessed 2023, NatureScot 2021, NIEA 2021) along with their known foraging height of approximately 40m above ground level. Whilst the previous studies relate to onshore wind farms, due to the migratory behaviour of Leisler's bats, and the short flight distance between the UK and Ireland, potential for collision must be considered during this assessment.

Studies from onshore windfarms have shown that Common pipistrelle and Soprano pipistrelle are at high risk of collision from onshore WTGs (Mathews et al., 2016), despite having a low foraging flight height of 2-6m (BCIreland, 2010). Foraging flight heights for Nathusius pipistrelle range from 4 – 15m (Lundy, et al., 2011).

In consideration of construction activities for the proposed development, there is also the potential for offshore bats to change their behaviour when within a noisy environment (Allen et al., 2021).

The following potential interactions/impacts have been identified for offshore bats to take forward into the assessment:

- Displacement and disturbance due to noise during construction;
- Displacement and disturbance due to increased vessel activity and infrastructure during construction, operation and decommissioning;
- Displacement and disturbance due to artificial lighting at night (ALAN) during construction, operation and decommissioning;
- Indirect displacement and disturbance due resulting from changes to prey during construction, operation and decommissioning; and
- Collision and barotrauma during operation.

35.4 Characteristics of the Proposed Development

This section outlines the characteristics of the proposed development that are relevant to the identification and assessment of effects on offshore bats during each phase of the proposed development. In this chapter this is limited to activities and infrastructure occurring in the offshore development area and it considers both Project Options 1 and 2, the key characteristics for assessment are provided in Table 35.6 and are detailed in full in the Offshore Description Chapter.

The characteristics of the proposed development that are relevant to the identification and assessment of effects on onshore bats (landward of the HWM) during each phase of the proposed development are assessed in the Biodiversity Chapter. Where there is a potential impact pathway for onshore activities and development to impact on bats in the offshore environment it is assessed in this chapter. Where there is a potential impact pathway for offshore activities and development to impact on bats in the onshore environment, this is assessed within the Biodiversity Chapter. The potential for both onshore and offshore activities and development to impact on a single bat individual has been considered within the Biodiversity Chapter.

Table 35.6 Key characteristics of Project Option 1 and Project Option 2

Key Offshore Characteristics	Project Option 1	Project Option 2
Array area	88.5km^2	88.5km^2
ECC	36.45km^2	36.45km^2
Landfall	One landfall site, immediately south of Bremore Point, which includes two subtidal exit pits within the ECC	One landfall site, immediately south of Bremore Point, which includes two subtidal exit pits within the ECC
Wind Turbine Generator (WTG)	49 WTGs with 250m rotor diameter	35 WTGs with 276m rotor diameter
WTG Foundations	49 monopiles of 12.5m diameter	35 monopiles of 12.5m diameter or jacket foundations (three or four leg configurations, with 6m diameter pin piles)
WTG dimensions	Hub height of 165m (LAT) blade tip height of 290m (LAT) Blade tip clearance (height of rotor tip above LAT) of 40m	Hub height of 178m (LAT) blade tip height of 316m* or 311m** (LAT) Blade tip clearance (height of rotor tip above LAT) of 40m* or 35m**
Offshore Substation Platform (OSP) foundations (array area)	One OSP, with either a four-legged jacket foundation with pin piles, or one monopile; or two monopiles	One OSP, with either a four-legged jacket foundation with pin piles, or one monopile; or two monopiles
Cables	Installation of 111km of array cables within the array area and installation of two 18km export cables within the ECC	Installation of 91km of array cables within the array area and installation of two 18km export cables within the ECC

*When located outside the aviation restricted zone

**When located inside the aviation restricted zone

35.4.1 Parameters for assessment

The below activities, infrastructure and key design parameters have been considered within this chapter when determining the potential impacts. Further detail on the offshore infrastructure of the proposed development is provided in the Offshore Description Chapter and Offshore Construction Chapter. These parameters apply to both project options and any differences in values that may require consideration have been identified in Table 35.7.

35.4.1.1 Construction

During construction the following activities and infrastructure have the potential to impact on offshore bats:

- WTG installation
- OSP installation
- Use of construction vessels; and
- Lighting of structures and vessels.

35.4.1.2 Operational Phase

During operation, the following activities and infrastructure have the potential to impact on offshore bats:

- Presence of offshore infrastructure
- Use of operational vessels; and
- Operational lighting.

35.4.1.3 Decommissioning

The infrastructure that will be decommissioned and methodology for doing so is not currently known but will be agreed prior to the commencement of decommissioning works and will be based upon current best regulations/practices and available technology, as described in the Offshore Description Chapter. For the purposes of this assessment, the following activities and infrastructure have the potential to impact on offshore bats:

- WTG removal
- OSP removal
- Use of decommissioning vessels; and
- Decommissioning lighting.

35.4.2 Embedded Mitigation Measures

There are no embedded mitigation measures that have been included within the proposed development design that are specific to the reduction of impacts and effects on offshore bats as their presence is uncertain. However, those measures that have been implemented through the design development process to reduce impacts on birds (refer to the Ornithology Chapter) may potentially benefit offshore bats, should they be present within the array area. This includes the reduction in the size of the array area, from the extent of the MAC boundary, and the increase in lowest blade tip height above LAT (also known as the air draft). These elements have been considered within the parameters for assessment.

35.4.3 Potential Impacts

The identification of potential impacts has been undertaken by considering the relevant characteristics from both project options (refer to Section 35.4) and the potential for a pathway for direct and indirect effects on known receptors (as identified in Section 35.3). Each identified impact relevant to offshore bats is presented in Table 35.7.

For each impact, the relevant characteristics of Project Option 1 and Project Option 2 are presented to determine the magnitude (size or extent) of the potential impact, defined by the proposed development parameters in the Offshore Description Chapter and in consideration of the WTG Limits of Deviation (LoD[22]), in line with the approach detailed in the EIAR Methodology Chapter. A comparison of the project options has then been undertaken to determine which project option has the greatest likely significant effect.

Table 35.7 Potential impacts and magnitude of impact per project option. The project option that has the greatest likely significant effect is identified in blue

Potential impact	Project Option 1 (49 WTG)	Project Option 2 (35 WTG)	Rationale for the project option with the greatest likely significant effect
Construction			
Impact 1 – Displacement and disturbance from noise during construction	**WTG infrastructure presence:** Installation of 49 WTGs and foundations.	**WTG infrastructure presence:** Installation of 35 WTGs and foundations.	Project 1 represents the greatest magnitude of impact in relation to this impact.

[22] Both Project Option 1 and Project Option 2 layouts have a 500m Limit of Deviation (LoD)

Potential impact	Project Option 1 (49 WTG)	Project Option 2 (35 WTG)	Rationale for the project option with the greatest likely significant effect
	OSP infrastructure presence: Installation of 1 OSP and foundation. **Total number of construction vessels:** 67. **Total number of construction vessel return trips:** 3,008. **Maximum vessels simultaneously onsite during construction:** 49. **Total number of helicopter return trips during WTG installation:** 10	**OSP infrastructure presence:** Installation of 1 OSP and foundation. **Total number of construction vessels:** 69. **Total number of construction vessel return trips:** 2,530. **Maximum vessels simultaneously onsite during construction:** 47. **Total number of helicopter return trips during WTG installation:** 7	The greatest likely significant effect for noise results from the greatest pile-driving activities and vessel movements during construction. Project Option 1 has a greater number of structures, and vessels trips than Project Option 2.
Impact 2 – Displacement and disturbance due to increased vessel activity and infrastructure presence	**WTG infrastructure presence:** Installation of 49 WTGs. **OSP infrastructure presence:** Installation of 1 OSP. **Total number of construction vessels:** 67. **Total number of construction vessel return trips:** 3,008. **Maximum vessels simultaneously onsite during construction:** 49.	**WTG infrastructure presence:** Installation of 35 WTGs. **OSP infrastructure presence:** Installation of 1 OSP. **Total number of construction vessels:** 69. **Total number of construction vessel return trips:** 2,5308. **Maximum vessels simultaneously onsite during construction:** 47.	Project 1 represents the greatest magnitude of impact in relation to this impact. The greatest likely significant effect for increased vessel activity and infrastructure presence results from the project option with the most vessels and infrastructure during construction. Project Option 1 has a greater number of WTGs, and therefore has more overall infrastructure than Project Option 2.
Impact 3 – Displacement and disturbance due to artificial lighting at night (ALAN)	**WTG infrastructure presence:** Installation of 49 WTGs. **OSP infrastructure presence:** Installation of 1 OSP. **Maximum vessels simultaneously onsite during construction:** 49. **Total number of construction vessels:** 67. **Total number of construction vessel return trips:** 3,008. **Maximum vessels simultaneously onsite during construction:** 49.	**WTG infrastructure presence:** Installation of 35 WTGs. **OSP infrastructure presence:** Installation of 1 OSP. **Maximum vessels simultaneously onsite during construction:** 47. **Total number of construction vessels:** 69. **Total number of construction vessel return trips:** 2,530. **Maximum vessels simultaneously onsite during construction:** 47.	Project 1 represents the greatest magnitude of impact in relation to this impact. The greatest likely significant effect for disturbance and displacement due to ALAN results from the project option with the most vessels present and infrastructure during construction and therefore greater illuminated areas. Project Option 1 has a greater number of WTGs and therefore has more overall infrastructure than Project Option 2.

Potential impact	Project Option 1 (49 WTG)	Project Option 2 (35 WTG)	Rationale for the project option with the greatest likely significant effect
	Lighting All structures will be illuminated with temporary lighting with a range of at least 2 nautical miles (nm) up until the commissioning of the operational lighting. Construction buoys will also be deployed within the development area with a range of at least 5nm.	**Lighting** All structures will be illuminated with temporary lighting with a range of at least 2 nautical miles (nm) up until the commissioning of the operational lighting. Construction buoys will also be deployed within the development area with a range of at least 5nm.	
Impact 4 – Indirect displacement and disturbance resulting from changes to prey	**WTG infrastructure presence:** Installation of 49 WTGs. **OSP infrastructure presence:** Installation of 1 OSP. **Total number of construction vessels:** 67. **Total number of construction vessel return trips:** 3,008. **Maximum vessels simultaneously onsite during construction:** 49.	WTG infrastructure presence: Installation of 35 WTGs. OSP infrastructure presence: Installation of 1 OSP. Total number of construction vessels: 69. Total number of construction vessel return trips: 2,530. Maximum vessels simultaneously onsite during construction: 47.	Project 1 represents the greatest magnitude of impact in relation to this impact. The greatest likely significant effect for indirect impacts via prey distribution results from the project option with the most infrastructure and lighting during construction. Project Option 1 has a greater number of WTGs and therefore has more overall infrastructure than Project Option 2.
Operation			
Impact 5 – Displacement and disturbance due to increased vessel activity and infrastructure presence	**Number of operational WTGs:** 49 WTGs. **OSP infrastructure presence:** 1 OSP. **Rotor rotational speed:** 3 – 8.3 rotations per minute (rpm). **Total number of operation vessels:** 12. **Total number of operation vessel return trips annually:** 1,261; and **Maximum vessels simultaneously onsite during operation:** 12.	**Number of operational WTGs:** 35 WTGs. **OSP infrastructure presence:** Presence of 1 OSP. **Rotor rotational speed:** 3 – 7.5rpm. **Total number of operation vessels:** 12. **Total number of operation vessel return trips annually:** 1,055; and **Maximum vessels simultaneously onsite during operation:** 12.	Project 1 represents the greatest magnitude of impact in relation to this impact. The greatest likely significant effect for impact on movement results from Project Option 1 due to the higher increase in presence of infrastructure. Project Option 1 has a greater number of WTGs and therefore has more overall infrastructure than Project Option 2.
Impact 6 - Displacement and disturbance due to ALAN	**WTG infrastructure presence:** 49 WTGs. **OSP infrastructure presence:** 1 OSP. **Total number of operation vessels:** 12. **Total number of operation vessel return trips annually:** 1,261	**WTG infrastructure presence:** 35 WTGs. **OSP infrastructure presence:** 1 OSP. **Total number of operation vessels:** 12. **Total number of operation vessel return trips annually:** 1,055.	Project 1 represents the greatest magnitude of impact in relation to this impact. The greatest likely significant effect for artificial lighting at night results from the project option with the greatest infrastructure, and therefore illuminated areas.

Potential impact	Project Option 1 (49 WTG)	Project Option 2 (35 WTG)	Rationale for the project option with the greatest likely significant effect
	Maximum vessels simultaneously onsite during operation: 12. Lighting Selected peripheral structures (SPS) visible from at least 5nm. Non-SPS visible from at least 2nm.	**Maximum vessels simultaneously onsite during operation:** 12. Lighting Selected peripheral structures (SPS) visible from at least 5nm. Non-SPS visible from at least 2nm.	Project Option 1 has a greater number of WTGs and therefore has more overall infrastructure than Project Option 2.
Impact 7 – Indirect displacement and disturbance resulting from changes to prey	**WTG infrastructure presence:** 49 WTGs. **OSP infrastructure presence:** 1 OSP. **Total number of operation vessels:** 12. **Total number of operation vessel return trips annually:** 1,261. **Maximum vessels simultaneously onsite during operation:** 12. **Lighting** Selected peripheral structures (SPS) visible from at least 5nm. Non-SPS visible from at least 2nm.	**WTG infrastructure presence:** 35 WTGs. **OSP infrastructure presence:** 1 OSP. **Total number of operation vessels:** 12. **Total number of operation vessel return trips annually:** 1,055. **Maximum vessels simultaneously onsite during operation:** 12. Lighting Selected peripheral structures (SPS) visible from at least 5nm. Non-SPS visible from at least 2nm.	Project 1 represents the greatest magnitude of impact in relation to this impact. The greatest likely significant effect for artificial lighting at night results from the project option with the greatest infrastructure, and therefore illuminated areas. Project Option 1 has a greater number of WTGs and therefore has more overall infrastructure than Project Option 2.
Impact 8 - Collision and barotrauma	**Number of operational WTGs:** 49 WTGs. **OSP infrastructure presence:** 1 OSP. **Lower blade tip height:** 40m above LAT. **Upper blade tip height:** **290m above LAT.** **Minimum rotation speed:** 3 rotations per minute (rpm). **Maximum rotation speed:** 8.3rpm.	**Number of operational WTGs:** 35 WTGs. **OSP infrastructure presence:** 1 OSP. **Lower blade tip height:** 40m* or 35m** above LAT. **Upper blade tip height:** 316* or 311** above LAT. **Minimum rotation speed:** 3rpm. **Maximum rotation speed:** 7.5rpm.	Project 1 represents the greatest magnitude of impact in relation to this impact. Whilst the greatest blade tip length has the potential to cause likely significant effects, both options have a lower blade tip of 40m above LAT (35m when located inside the aviation restricted zone for Option 2) and the upper blade tip height is not significant between the two options, therefore, the greatest likely significant effect for collision and barotrauma results from Project Option 1 due to the highest increase in presence of infrastructure. Project Option 1 has a greater number of WTGs and therefore has more overall infrastructure than Project Option 2.
Decommissioning			

Potential impact	Project Option 1 (49 WTG)	Project Option 2 (35 WTG)	Rationale for the project option with the greatest likely significant effect
Impact 9 – Displacement and disturbance due to noise	**WTG infrastructure presence:** Removal of 49 WTGs. **OSP infrastructure presence:** Removal of 1 OSP.	**WTG infrastructure presence:** Removal of 35 WTGs. **OSP infrastructure presence:** Removal of 1 OSP.	Project 1 represents the greatest magnitude of impact in relation to this impact. The greatest likely significant effect for noise results from the removal of the largest number of WTG and OSP structures and vessel movements during decommissioning. Project Option 1 has a greater number of structures, and therefore greater overall construction duration than Project Option 2.
Impact 10 - Displacement and disturbance due to increased vessel activity and infrastructure presence	**WTG infrastructure presence:** Removal of 49 WTGs. **OSP infrastructure presence:** Removal of 1 OSP.	**WTG infrastructure presence:** Removal of 35 WTGs. **OSP infrastructure presence:** Removal of 1 OSP.	Project 1 represents the greatest magnitude of impact in relation to this impact. The greatest likely significant effect for increased vessel activity and infrastructure presence results from the project option with the most vessels and infrastructure during decommissioning. Project Option 1 has a greater number of WTGs, and therefore has more overall infrastructure than Project Option 2.
Impact 11 - Displacement and disturbance due ALAN	**Lighting** All structures will be illuminated to a range of at least 2 or 5nm up until their removal. Construction buoys will also be deployed within the decommissioning area with a range of at least 5nm.	**Lighting** All structures will be illuminated to a range of at least 2 or 5nm up until their removal. Construction buoys will also be deployed within the decommissioning area with a range of at least 5nm.	Project 1 represents the greatest magnitude of impact in relation to this impact. The greatest likely significant effect for disturbance and displacement due to ALAN results from the project option with the most vessels present and infrastructure during decommissioning and therefore greater illuminated areas. Project Option 1 has a greater number of WTGs and therefore has more overall infrastructure than Project Option 2.
Impact 12 – Indirect displacement and disturbance resulting from changes to prey	**WTG infrastructure presence:** Removal of 49 WTGs. **OSP infrastructure presence:** Removal of 1 OSP. **Lighting**	**WTG infrastructure presence:** Removal of 35 WTGs. **OSP infrastructure presence:** Removal of 1 OSP. **Lighting**	Project 1 represents the greatest magnitude of impact in relation to this impact. The greatest likely significant effect for indirect impacts via prey distribution results from the

Potential impact	Project Option 1 (49 WTG)	Project Option 2 (35 WTG)	Rationale for the project option with the greatest likely significant effect
	All structures will be illuminated to a range of at least 2 or 5nm up until their removal. Construction buoys will also be deployed within the decommissioning area with a range of at least 5nm.	All structures will be illuminated to a range of at least 2 or 5nm up until their removal. Construction buoys will also be deployed within the decommissioning area with a range of at least 5nm.	project option with the most infrastructure and lighting during decommissioning. Project Option 1 has a greater number of WTGs and therefore has more overall infrastructure than Project Option 2.

*When located outside the aviation restricted zone

**When located inside the aviation restricted zone

An aviation restricted zone has been identified by the Developer due to the partial overlap of the array area with a Dublin Airport Instrument Flight Procedure. This is further detailed in Volume 3, Chapter 19: Aviation and Radar.

35.5 Potential Effects

The assessment of likely significant effects, both beneficial and adverse, on offshore bats for each stage of the proposed development, are presented here. Specifically, the likely significant effects of the proposed development during its construction, operational, and decommissioning phases associated with the offshore infrastructure within the offshore development area. The environment in the vicinity of the offshore development area is naturally dynamic, and as such will exhibit some level of natural variation and change over time whether the proposed development proceeds or not. Consequently, the identification and assessment of likely significant effects must be considered in the context of natural change, both spatial and temporal.

As per the relevant guidelines, and due to the conservation status of all bat species in Ireland, likely significant effects have been assessed for all bat species identified as being at risk from offshore wind farms as listed in Table 35.5. An impact is considered to be ecologically significant if it is predicted to affect the integrity or conservation status of a bat species at a specified geographical scale. All impacts are described in the absence of additional mitigation.

35.5.1 Do-Nothing Scenario

Should the proposed development not be constructed, the baseline environment is unlikely to change significantly beyond that which already exists. Species will continue to migrate, vessels will continue to move between land masses and habitats will continue in natural succession.

35.5.2 Construction Phase

This section presents the assessment of impacts arising from the construction phase of the proposed development.

Construction phase impacts that could result in likely significant effects to offshore bats include:

- Disturbance and displacement from noise during construction
- Disturbance and displacement due to increased vessel activity and infrastructure presence
- Disturbance and displacement due to ALAN; and
- Indirect disturbance and displacement resulting from changes to prey.

35.5.2.1 Impact 1 - Displacement and disturbance due to noise during construction

Anthropogenic noise associated with offshore wind construction, including noise from pile-driving and other construction activities such as vessel and helicopter use, has the potential to disturb or displace offshore bats present within the array area due to:

- Auditory impacts; and/or

- Habitat-related impacts.

Within the offshore development area auditory impacts to offshore bats are most likely to be caused by pile-driving activities and vessel/helicopter movements during construction. Noise from pile driving (if required) for Project Option 1 would occur during the installation of 50 foundations (for WTGs and the OSP) and for Project Option 2 during the installation of 36 foundations (for WTGs and the OSP) at a duration of 6 hours 5 minutes of piling time per monopile and 6 hours 40 mins for two jacket piles within a 24 hour period, over a 9 month period. The activity will be temporary and highly localised.

Noise from helicopter movements will be (if required) for 1 no. trip per week during daylight hours for the duration of the WTG installation for a period of 7.5 months.

Auditory impacts to offshore bats from piling and vessel/helicopter movements are not expected to occur, as recent research has shown that bats may be less sensitive to temporary threshold shifts than other terrestrial mammals (Simmons et al., 2016). Furthermore, onshore, bats are found in structures (bridges, factories etc) that produce large amounts of noise and vibration and appear accustomed/ habituated to the noise levels.

Habitat-related impacts (i.e., displacement from potential migration routes or natural communities or habitats onshore) could occur in response to noise from construction activities which could cause avoidance behaviour in individual migrating or foraging bats (Schaub et al., 2008, Luo 2015). Behavioural avoidance is more likely to occur during times of pile-driving, construction activities and helicopter movements (should they be required during hours of darkness which is likely to be limited to emergencies) between the array area and land. These impacts are unlikely to occur or be significant to migratory bats as they would only happen during migration periods, spring (April–May) and autumn (August–October), refer to Section 35.3.3.

For foraging bats, while the noise from construction activities would occur for the activity season (April to October), the impacts are unlikely to occur or be significant due to the auditory responses of bats (see above) and the duration of the activities will be temporary (piling restricted to a maximum of 6hrs 5 minutes within a 24hr period and helicopter movements only being required during darkness in emergencies). Furthermore, impacts from noise may also reduce the potential for attraction to the offshore development area (refer to Impact 3 and Impact 4).

The potential for disturbance and displacement impact on offshore bats due to noise during construction has been assessed as temporary, restricted in duration and localised in extent. It is also expected that for the very low number of bats that may be present within the ECC and array area there will be biologically insignificant responses to those impacts by the bats. Therefore, no significant effects will be expected to occur as a result of noise during the construction activities of the offshore development area associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

35.5.2.2 Impact 2 – Displacement and disturbance due to increased vessel activity and infrastructure presence during *construction*

The construction activities will require a variety of different vessel and helicopter options dependent on the final WTG, foundation, construction port, and construction strategy adopted. This will also include numerous trips by each of the vessels/ helicopters during the foundation, WTG/ OSP, and cable installation phases, along with movement of personnel. There are a maximum of 47 vessels onsite simultaneously during construction (including within the array area, the ECC and exit pit location). Refer to the Offshore Construction Strategy for full list of vessel requirements.

Increased vessel activity and infrastructure presence during construction have the potential to disturb or displace offshore bats present within the offshore development area due to obstruction or change in flightpaths impacts.

For foraging bats, it is likely that they are only present within the offshore development area during the construction phase due to attraction to the presence of vessels and infrastructure, which is assessed in full in Impact 3 and 4.

The presence of large infrastructure in areas where none had previously been, could cause migrating bats to potentially change course and expend more energy in doing so. This could lead to expenditure of food reserves and incomplete migration of individual bats.

While some potential exists for migrating bats to encounter large infrastructure (including non-operating WTGs) during migration, unlike with terrestrial migration routes, there are no landscape features that would concentrate bats in a particular direction (Baerwald and Barclay 2009; Cryan and Barclay 2009; Smith and McWilliams 2016, Kirkpatrick et al., 2017, Fitch et al., 2020) and thereby increase exposure to the large infrastructure. Furthermore, with the proposed spacing between structures being a minimum of 500m between blade tips, individual bats migrating over the array area would likely pass between large infrastructure with only slight course alterations, if any, to avoid the infrastructure or vessels (stationary or moving). Also, as stated above, helicopter movements will be during daylight hours unless needed in emergencies during night hours. Furthermore, bats' echolocation abilities and agility make it unlikely that these stationary objects or moving vessels would pose a collision risk to individuals in flight (SEER 2022).

The potential for disturbance and displacement impact on migratory bats during construction due to increased vessel activity and infrastructure presence has been assessed as temporary, restricted in duration, and localised in extent. It is also expected that for the very low number of bats that may be present within the ECC and array area there will be biologically insignificant responses to those impacts by the bats. Therefore, no significant effects will be expected to occur as a result increased vessel activity and infrastructure presence associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

35.5.2.3 Impact 3 – Displacement and disturbance due to ALAN during construction

During the construction phase lights on WTGs or associated infrastructure (e.g. cranes) and vessels may directly or indirectly contribute to increased bat activity.

For WTGs (during construction, operation and decommissioning) the selected peripheral structures (SPS) and non SPS will exhibit synchronised flashing yellow lights of at least 5 nm and 2 nm respectively. All lights will be visible from all directions and exhibited at the same height (i.e. between 6 and 30m above highest astronomical tide (HAT). Aviation lighting requirements are described within the Lighting and Marking Plan (refer to Appendix 17.2).

Although a 2014 study by Bennett and Hale states that bats are not attracted to aviation lighting, further studies have shown bat attraction to red light for migratory species including Nathusius' pipistrelle (Voigt 2018, ILP-GN 08/23). Conversely, several studies, most of which were conducted at wind energy facilities, reported no relationship between bat activity or mortality with the presence or absence of red light for some bat species (Guest et al., 2022).

While vessel lighting is not as bright as WGT and OSP lighting (apart from the spotlights needed for WTG installation if required during night-time hours), there will be a maximum of 47 installation vessels in the offshore development area at any one time, with a maximum construction schedule of 24 hours a day, seven days a week. Furthermore, all structures will be illuminated with temporary lighting with a range of at least 2 nautical miles (nm) up until the commissioning of the operational lighting. Construction buoys will also be deployed within the development area with a range of at least 5nm.

Lights on WTG or associated infrastructure (e.g. cranes) and vessels during construction may directly or indirectly contribute to increased bat activity. For example, bats may orient towards light of certain wavelengths during migration or be attracted by insect concentrations near illuminated areas. The overall effect of ALAN on bats has demonstrated variable responses across numerous species, regarding research conducted at wind farms, artificial lights do not appear to be the primary cause of bat attraction to WTG (Voigt 2018, ILP-GN 08/23). Indirect disturbance and displacement resulting from changes to prey is covered in Impact 4 and not repeated here.

Displacement of bats from natural communities or habitats onshore due to attraction to the offshore development area from ALAN could therefore lead to physical deterioration and potential death of relevant bat species due to energy expenditure in undertaking the displacement activity and insufficient food resources at the source of light/attraction.

For bats, artificial lighting is also thought to increase the chances of predation by avian predators, therefore, in lit areas bats modify their behaviour, potentially in response to this threat. Predators of Nathusius' pipistrelle and other insectivorous bats include several species of owls, diurnal raptors, gulls and crows (Speakman, 1991; Sieradzki & Mikkola, 2020). Predation risk is likely to increase with more lit areas at sea

including the WTGs and OSP (most likely limited to gull species), and lit areas on or near the coast including the entry and exits pit location since bats become more visible (all avian predators). For potential ALAN impacts of the HDD entry pit location refer to the Biodiversity Chapter.

For several years studies have recorded that faster-flying species can congregate around white light sources (GN08/23), species such as:

- Noctule
- Leisler's; and
- Pipistrelle.

This is particularly true for lights sources with ultra-violet spectrum light. This is a problem especially if it is a single light source in a dark area, as will be the case within the array area, as it creates a 'vacuum effect', denuding the surrounding area of invertebrate prey and pulling the bats from their natural foraging locations.

Migrating bats

Using a precautionary approach, it has been assumed that migrating species will be present within (flying through or over) the offshore development area during the construction phase. It should, however, be noted, that it is likely that migrating Nathusius' pipistrelles, will avoid the distraction of ALAN as a result of optimisation strategies when performing long-distance migratory flights. The strategy will be to fly the shortest distance from origin to destination without distractions (Marggraf *et al*., 2023), therefore, the presence of ALAN would not create a barrier to movement and individuals will still pass through the offshore development area and not be disturbed while flying within or be forced to fly around the lit area. Leisler's bat can fly faster than Nathusius' pipistrelle, often exceeding 40km per hour (Shiel, 2006), meaning they are more likely to reach landfall quicker, and forage in familiar habitats including pasture, drainage canals, lake and conifer forest, estuary, stream, beach and dunes, which are located within the study area, than be distracted by the presence of ALAN while passing through the offshore development area or be forced to fly around the lit area.

Therefore, no significant effects will be expected to occur from displacement of migrating bat species because of ALAN within the offshore development area during the construction phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

Foraging bats – from the mainland coast

Species present along the coastline of the mainland may be displaced from natural communities or habitats onshore due to ALAN during construction, as some activities and vessels will be visible from the coast, particularly works within the offshore ECC as this is closer to shore. There is little evidence to suggest that bats are attracted to artificial lighting alone (refer to Impact 4 for attraction due to prey) on vessels and infrastructure in the offshore environment.

As the array area is 11.3km from the closest shore point on the mainland of Ireland and lights within this area are unlikely to be very visible from the mainland coast. Volume 5: Chapter 29 Seascape, Landscape and Visual contains an assessment of the night time visual impacts from the lighting of the WTG including photomontages to illustrate the effects of WTG lighting from coastal viewpoints (Appendix 29.1). This assessment indicates that WTG lighting for both Project Option 1 and Project Option 2 will read as small pinpricks of light in the far distance, that may not be noticeable at all (especially in unclear weather conditions). The assessment is carried out for human receptors not other species of mammal. Although bats use echolocation to navigate, they have good low-light / dark vision eyesight and will see ALAN differently to humans. Bats tend to use their eyesight to detect objects outside the effective range of echolocation, which is about ten to twenty meters (Baird, C., S. accessed February 2024[23]). Therefore, for this assessment, it is assumed that the WGT lighting will also be pinpricks of light for bat species.

[23] https://www.wtamu.edu/~cbaird/sq/2013/04/09/why-are-bats-blind/#:~:text=Most%20microbats%20use%20echolocation%20to,(ten%20to%20twenty%20meters).

It is also recognised that alternative attraction locations exist within the ZoI on the coast or out to sea, including works at the entry pit location and other existing infrastructure with lighting (such as the Rockabill lighthouse and the Drogheda East Lighthouse), will further reduce the likelihood and the number of bats travelling to the offshore development area.

While Daubenton's bat and brown long-eared bat have been recorded within the study area (BCIreland records and Biodiversity Chapter), lesser horseshoe have been scoped out due to their current distribution range (refer to Section 35.2.3). It is known Myotis (Daubenton's bat, whiskered bat, and Brandt's bat) and brown long-eared bat species are light-sensitive (light-averse) species that have shown significant reduction in activity levels and avoidance of areas that are illuminated with white and amber lighting (GN08/23). As the offshore working areas, vessels and non-operational structures (WTGs and OSP) are to be lit with white lighting it is unlikely these species will be present within the offshore development area during the construction phase.

Therefore, no significant effects will be expected to occur from displacement of Myotis species and brown long-eared bats because of ALAN within the offshore development area during the construction phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the Proposed Development. Refer to the Biodiversity Chapter for impacts from ALAN regarding the entry pit location.

For all other species that may undertake offshore foraging (common, soprano, and Nathusius pipistrelle, and Leisler's bat. Refer to Section 35.3.6), should the bats encounter offshore vessels and infrastructure, it is assumed that bat echolocation abilities and agility will ensure they avoid the infrastructure or vessels (stationary or moving). Due to the distance of the array area from the shore, the potential for foraging bats from the mainland coast due to ALAN attraction is limited to the ECC, which is within their foraging ranges.

In the unlikely scenario that bats from the mainland coast attempt foraging within the array area during construction (which is outside of their foraging ranges), unless they are moving from WTG to WTG to investigate the lighting with no return to a roosting location, the distance is commutable (including without stopover locations) and they will be able to return to their roosts without the energy expenditure from the displacement activity significantly compromising individuals.

Therefore, no significant effects will be expected to occur from displacement of foraging bat species from the mainland because of ALAN within the offshore development area during the construction phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

Foraging bats – from Rockabill

During the 2022 and 2023 Rockabill surveys, Leisler's bat, Nathusius', common and soprano pipistrelle were recorded on the island. Due to the presence of a lighthouse on the island and the distance between the island and the mainland of 6km (4km is the longest CSZ for the resident bat species, refer to Section 35.2.4.2), it would indicate that these species do commute/ forage offshore.

As the offshore development area is only 5km from Rockabill and it is assumed a pipistrelle roost is present there, taking a precautionary approach, it is also possible that common and soprano pipistrelle may be displaced to forage within the offshore development area due to ALAN. While the potential roost has been identified in 2023, there are no corresponding records for 2022, therefore, it is assumed that it may not be used every year.

Furthermore, it is assumed that the Leisler's and Nathusius' pipistrelle bats recorded present at the island, if not migrating, could be displaced to forage within the offshore development area. It should be noted that the Rockabill lighthouse is a historic feature (Rockabill lighthouse was built in the 19th century) therefore, any bats that are using or attracted to the island will be habituated to the presence of the lighthouse which already provides attraction due to ALAN.

It is anticipated that if bats that do decide to attempt foraging within the offshore development area during construction, the distance is commutable, and they will be able to return to their roosts on Rockabill without the energy expenditure from the displacement activity significantly compromising individuals.

Therefore, no significant effects will be expected to occur from displacement of foraging bat species from Rockabill because of ALAN within the offshore development area during the construction phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

Myotis species and brown long-eared bats were not detected at the Rockabill location indicting it is either unlikely these species currently forage offshore in the study area or the aversion to light for each of the species is stronger than the potential draw of the island.

Therefore, no significant effects will be expected to occur to Myotis species and brown long-eared bats from displacement from Rockabill because of ALAN within the offshore development area during the construction phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

35.5.2.4 Impact 4 - Indirect displacement and disturbance resulting from changes to prey distribution during construction.

During studies undertaken at offshore locations (wind farms and platforms) (Kunz et al., 2007; Rydell et al., 2010, Ahlén et al., 2007, Lagerveld et al., 2017, Boshamer & Bekker / Lutra 2008, Guest et al., 2022), it was noticed that not only were migratory bats present, but also resident species were traveling to the sites to feed on the insects there. This is likely due to the ALAN causing a 'vacuum effect', denuding the surrounding area of invertebrate prey. Displacement of bats from natural communities or habitats due to attraction to the offshore development area during construction due to changes to prey distribution could lead to physical deterioration and potential death of bat species due to energy expenditure in undertaking the displacement activity.

Therefore, the presence of vessels and infrastructure within the offshore development area during construction has the potential to cause attraction of bats via a change in prey distribution (an indirect impact from the presence of lighting from the vessels and infrastructure).

Studies also demonstrated that bats did not avoid the WTGs, on the contrary they were documented as staying for (unspecified) periods hunting close to the WTGs because of the accumulation of flying insects (Ahlen et al., 2007, Lagerveld et al., 2017, Boshamer & Bekker /Lutra 2008, Guest et al., 2022). Furthermore, WTGs are typically white or light grey in colour, which has been demonstrated to be significantly more attractive to insects during the day and one hour after sunset compared to other colours, furthering the potential for bats to be attracted to wind turbines because of increased prey availability (Guest et al., 2022). The WTG towers and OSP for the proposed development will be coloured grey (refer to the Offshore Construction Chapter).

Migrating bats

As per Impact 3, using a precautionary approach, it has been assumed that migrating species are within the offshore development area and that it is likely that migrating Nathusius' pipistrelles will avoid distractions (including change in prey distribution) as a result of optimisation strategies when performing long-distance migratory flights (Marggraf *et al*., 2023). Leisler's are also more likely to avoid distractions as they are more likely to reach landfall quicker due to flight speed, to forage in familiar habitats found within the study area (Shiel 2006).

Therefore, no significant effects will be expected to occur from displacement of migrating species because of indirect disturbance and displacement resulting from changes to prey within the offshore development area during the construction phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

Foraging bats – from the mainland coast

As identified within Impact 3, Myotis and brown long-eared bat species are light-averse species that have shown significant reduction in activity levels and avoidance of areas that are illuminated with white and amber lighting (GN08/23). While Myotis and brown long-eared bat species have been recorded within the study area (BCIreland data and Biodiversity Chapter) they have not been recorded at the Rockabill location, indicating it is unlikely they currently forage offshore within the study area. Furthermore, the aversion to light for each of the species is stronger than the potential draw of the prey. Therefore, it is unlikely these species will be present within the offshore development area.

Therefore, no significant effects will be expected to occur from displacement of Myotis and brown long-eared bat species because of indirect disturbance and displacement resulting from changes to prey distribution within the offshore development area during the construction phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

As stated in Impact 3, the other potential species (common, soprano, and Nathusius pipistrelle; and Leisler's bat) present along the coast of the mainland may be attracted to the ECC due to ALAN attraction during construction and therefore indirectly due to changes in prey distribution. Displacement to the array area has been scoped out as lighting is unlikely to be visible from the coast.

Unless the foraging bats are moving between several vessels and infrastructure to investigate the prey with no return to a roosting location, no further physical deterioration and potential death of bat species due to energy expenditure is expected in undertaking the displacement activity, therefore there will be no significant effect on the individuals.

No significant effects will be expected to occur from displacement of common, soprano, and Nathusius pipistrelle; and Leisler's bat species because of indirect disturbance and displacement resulting from changes to prey distribution within the offshore development area during the construction phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

Foraging bats – from Rockabill

During the 2022 and 2023 Rockabill surveys, Leisler's bat, Nathusius', common and soprano pipistrelles were recorded on the island. Their presence on the island and the level of activity in August and September would indicate a sufficient food source at the island and within the surrounding waters. Furthermore, common pipistrelles have been shown to be attracted to onshore wind turbines with activity up to 37% higher than control sites (Richardson et al., 2021).

Given the presence of the potential roost on Rockabill; the assumption of prey on the island and within the surrounding water off the island; the potential for light spill from the array area to be seen from the island; and the proximity of the island to the mainland and the closest area of works in the array area (approximately 6km and 5km respectively); attraction to the offshore development area (array area and ECC) from Rockabill cannot be ruled out due to prey presence. However, the lighthouse on Rockabill is a historic feature (Rockabill lighthouse was built in the 19th century) therefore, any bats that are using or attracted to the island may be habituated to the presence of the lighthouse and bird population which already provide appropriate attraction due to the prey population (due to significant amounts of bird faeces).

It is also recognised that alternative attraction locations (indirect disturbance due to ALAN) exist within the ZoI, further reducing the likelihood of bats travelling to the offshore development area.

Should the bats from Rockabill encounter offshore vessels and infrastructure, it is assumed that bat echolocation abilities and agility will ensure they avoid the infrastructure or vessels (stationary or moving).

Therefore, while attraction cannot be ruled out, no significant effects will be expected to occur to foraging species from Rockabill because of indirect disturbance and displacement resulting from changes to prey distribution associated with Project Option 1. The same has been assessed for Project Option 2 of the proposed development.

35.5.3 Operational Phase

Operational phase impacts that could result in potentially significant impacts to offshore bats include:

- Disturbance and displacement due to increased vessel activity and infrastructure presence.
- Disturbance and displacement due to ALAN.
- Indirect disturbance and displacement resulting from changes to prey; and
- Collision and barotrauma.

35.5.3.1 Impact 5 – Displacement and disturbance due to increased vessel activity and infrastructure presence during operation

The operational phase will have less vessel activity but a greater number of permanent structures with lighting, compared to the construction phase.

Migrating bats

While some potential exists for migrating bats to encounter operating WTGs during migration, unlike terrestrial migration routes, there are no landscape features that would concentrate bats in a particular direction and thereby increase exposure to the operational WTGs. Furthermore, with the proposed spacing of WTGs within the array area (for Project Option 1 and Project Option 2), individual bats migrating within the array area would likely pass between WTGs with only slight course alterations, if any, to avoid WTGs.

It should be noted, however, due to the survey results obtained in 2022 and 2023, Rockabill is assumed to be a potential stopover / navigational landmark. As the island is located to the south of the array area, and migrating bats are likely to head east or even south-east from the island to the nearest landfall (Wales), it is also likely that any bats migrating to / from the island will ultimately avoid the array area. The individuals migrating to the Isle of Man (northeast of the array area) will likely use optimisation strategies and travel north along the coastline before departing at a closer point to reduce the distance between origin and destination.

Given the localised position of the WTGs, the slower WTG rotation speeds during optimal migration conditions associated with lower wind speeds (as blades naturally go slower at slower wind speeds), the distance between WTGs, the low numbers of bats anticipated to be migrating within the array area, and the bats' echolocation abilities and agility, it is unlikely that the WTGs would displace migrating individuals.

Therefore, no significant effects will be expected to occur on migrating bats because of displacement and disturbance due to increased vessel activity and infrastructure presence during the operational phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

Foraging bats

For foraging bats, it is likely that they are only present within the offshore development area during the operational phase due to attraction to the presence of vessels and infrastructure (including WTGs), which is assessed in full in Impact 6 and 7.

35.5.3.2 Impact 6 – Displacement and disturbance due to ALAN during operation

As detailed in Impact 3, certain wavelengths from lights on infrastructure (including WTGs) and vessels during operation may directly or indirectly contribute to increased bat activity within the offshore development area. That disturbance could lead to physical deterioration and potential death of bat species due to energy expenditure in undertaking the displacement activity.

It is expected that there will be limited or nil lighting within the ECC during operation, the use of maintenance vessels is more likely to occur during daylight hours. This assessment is therefore limited to lighting within the array area.

Migrating bats

As per the justification detailed within Impact 3, a precautionary approach has been taken for this assessment that assumes migrating species (limited to Nathusius' pipistrelle and Leisler's bat) are within or will pass by the offshore development area during the operational phase. However as explained in Impact 3, migratory species are more likely to avoid the distraction of ALAN because of optimisation strategies when performing long-distance migratory flights (Marggraf et al., 2023, Shiel 2006).

Therefore, no significant effects will be expected to occur from displacement of migrating species because of ALAN within the offshore development area during the operational phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

Foraging bats – from the mainland coast

Impact 3 identifies that lighting within the array area is unlikely to be visible from the mainland coast during operation, especially on unclear weather conditions. Therefore, there is no direct pathway for foraging bats from the mainland coast to be attracted to the array area because of ALAN and effects are not considered further.

Foraging bats – from Rockabill

Common and soprano pipistrelle, and Leisler's bats were identified at Rockabill and on the headlands during the 2022 and 2023 surveys. The presence of these species outside the migration periods would indicate that the species do commute / forage to at least 6km offshore. As the offshore development area is only 5km from Rockabill and it is assumed a pipistrelle roost is present on Rockabill, taking a precautionary approach, it is also assumed common and soprano pipistrelle may be displaced to forage within the array area due to ALAN. Furthermore, it is assumed that the Leisler's and Nathusius' pipistrelle bats recorded present at the island, if not migrating, could be displaced to forage within the array area.

It is anticipated that for those bats that attempt foraging within the offshore development area during the operational phase, the distance is commutable and they will be able to return to their roosts on Rockabill without the energy expenditure from the displacement activity significantly compromising individuals.

Therefore, no significant effects will be expected to occur from displacement of foraging bat species from Rockabill because of ALAN within the offshore development area during the operational phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

Impact 3 identifies that Myotis species and brown long-eared bats were not detected at the Rockabill location indicting it is either unlikely these species currently forage offshore in the study area or the aversion to light for each of the species is stronger than the potential draw of the island. Therefore, there is no pathway for these bat species via Rockabill to be directly attracted to the array area because of ALAN and effects are not considered further.

35.5.3.3 Impact 7 - Indirect displacement and disturbance resulting from changes to prey distribution during operation

As identified in the literature review and detailed within Impact 4, the presence of ALAN on vessels and infrastructure within the offshore development area during construction has the potential to cause attraction of bats via a change in prey distribution (an indirect impact from the presence of lighting from the vessels and infrastructure).

Migrating bats

As per Impact 3, using a precautionary approach, it has been assumed that migrating species are within the offshore development area and that it is likely that migrating Nathusius' pipistrelles will avoid distraction due to prey as a result of optimisation strategies when performing long-distance migratory flights (Marggraf *et al*., 2023). Leisler's are also more likely to avoid the distraction area as they are more likely to reach landfall quicker due to flight speeds of 40km per hour and forage in familiar habitats within the study area (Shiel 2006).

Therefore, no significant effects will be expected to occur to migrating bats because of disturbance and displacement resulting from changes to prey within the array area during the operational phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

Foraging bats – from the mainland coast

Impact 3 identifies that lighting within the array area is unlikely to be visible from the mainland coast during operation, especially on unclear weather conditions. Therefore, there is no direct pathway for foraging bats from the mainland coast to be attracted to the array area and effects are not considered further.

Foraging bats – from Rockabill

The data obtained at Rockabill indicates that there is consistent use of the island by common and soprano pipistrelle in August 2023 and Leisler's bat in September 2022 and 2023 with feeding buzzes identified for all species recorded within the island environment.

Furthermore, potential for a common and soprano pipistrelle roost on the island has also been identified. While the potential roost has been identified in 2023, there are no corresponding records for 2022, therefore, it is assumed that it may not be used every year. It should also be noted that the lighthouse on Rockabill is a historic feature (Rockabill lighthouse was built in the 19th century) therefore, any bats that are using or attracted to the island may be habituated to the presence of the lighthouse and bird population which already provide appropriate attraction due to ALAN and prey population (due to significant amounts of bird faeces).

It is also recognised that there are alternative attraction locations within the study area further reducing the likelihood of bats travelling to the array area. Also should the bats encounter offshore vessels and stationary infrastructure with lighting, it is assumed that bat echolocation abilities and agility will ensure they avoid stationary objects and moving vessels. However, as the array area will be visible from Rockabill, attraction cannot be ruled out.

While attraction cannot be ruled out and therefore the displacement of individuals to the array area, unless they are moving from WTG to WTG to forage with no return to a roosting location, leading to further physical deterioration and potential death of bat species due to energy expenditure in undertaking the displacement activity, there will be no significant effect on the individuals. Furthermore, the distance to the array area is commutable, as discussed in the Literature review, for the species assumed to be drawn to forage from Rockabill to within the array area.

Therefore, no significant effects will be expected to occur to foraging bats because of disturbance and displacement resulting from changes to prey within the array area during the operational and maintenance phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

35.5.3.4 Impact 8 – Collision and barotrauma

Bat mortality due to collision has been reported around terrestrial WTGs worldwide for years. This had led to the potential for collision to be assumed as an impact with regards to the offshore wind industry also (SEER, 2022, Thaxter et al., 2017, Huos et al., 2016, Lagerveld 2020 etc).

Although mortality of bats at wind farms include barotrauma (results from exposure to the pressure variations caused by rotating turbine blades) as first presented by Baerwald et al., (2008) several studies since, including NREL (2012) and Lawson et al., (2020), disputes the hypothesis that barotrauma is responsible for a significant number of WTG related bat fatalities. However, it should be noted, the more recent studies have been undertaken on several mammal species (representative of bat species) as there is no data available on pressure change levels that cause barotrauma in bats. Therefore, this section assesses the potential for impacts from collision to include barotrauma as they are closely related with regards to the proximity to the blades in which a bat must be for an impact to occur.

Migrating bats

As per the justification detailed within Impact 3 and Impact 4 (along with Impacts 5, 6 and 7), a precautionary approach has been taken for this assessment that assumes migrating species (limited to Nathusius' pipistrelle and Leisler's bat) are within or will pass by the offshore development area during the operational phase. However as explained, migratory species are more likely to avoid distraction while within the array area because of optimisation strategies when performing long-distance migratory flights (Marggraf et al., 2023, Shiel 2006). The migrating species from Rockabill are more likely to avoid the array area and travel east rather than north due to optimisation strategies.

Furthermore, given the localised position of the WTGs, no landscape features channelling bats towards the individual WTG', the slower rotation speeds from slower wind speeds during optimal migration conditions, the low numbers of bats anticipated to be migrating within the array area, and the bats' echolocation abilities and agility, it is unlikely that the WTGs would pose a collision risk to migrating individuals. Therefore, no significant effects will be expected to occur to migrating bats because of collision and barotrauma during the operational and maintenance phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

Foraging bats – from the mainland coast

Impact 3 identifies that lighting within the array area is unlikely to be visible from the mainland coast during operation, especially on unclear weather conditions. Therefore, there is no direct pathway for foraging bats from the mainland coast to be attracted to the array area and effects are not considered further.

Foraging bats – from Rockabill

It has been identified that Impact 6 and Impact 7 could attract foraging bats to the array area (WTGs and OSPs) from Rockabill during the operational phase. Common, soprano and Nathusius' pipistrelle and Leisler's bats have been recorded at Rockabill during the 2022 and 2023 surveys (refer to Appendix 35.1 and 35.2), with the activity during the 2023 survey indicating that a roost may be present for either common and/ or soprano pipistrelle, although it may not be used every year.

The increased presence of bat species within the array area (due to Impact 6 and Impact 7) would in turn increase the likelihood of interactions between bats and the WTG blades and therefore the risk of collision and barotrauma. Onshore studies show that collision risk is a factor when determining impacts to bat species at wind farm locations (refer to Section 35.3.2). It should be noted, however, that results of studies monitoring behaviour around offshore wind farms (Ahlén et al., 2007, ESGS surveillance footage 2014) where bats were observed foraging near the WTGs, feeding on accumulations of flying insects, there is no mention of observed collisions between bats and WTGs.

While the current literature suggests foraging bats cannot be ruled out from occurring within the array area, the baseline data shows it is likely to be at a low level and limited to a small number of individuals from Rockabill. Furthermore, Rockabill lighthouse is a historic feature (Rockabill lighthouse was built in the 19th century) therefore, any bats that are using or attracted to the island may be habituated to the presence of the lighthouse and bird population which already provide appropriate attraction due to ALAN and prey population (due to significant amounts of bird faeces).

The baseline numbers of foraging bats that occur within the offshore development area as it is at present is not currently known but assumed to be low/non-existent due to the lack of features that may attract bats. As highlighted in Lintott et al, 2016, the array area will change significantly to what is being assessed as the baseline and bat activity recorded during the baseline surveys may not accurately reflect activity levels post-construction, notably with respect to disturbance and displacement due to ALAN and indirect disturbance and displacement resulting from changes to prey.

There are a number of factors that would suggest that despite the proximity of Rockabill to the array area, the number of bats from Rockabill that will forage within the offshore development area will remain low. This includes:

- Visibility of the lights on the turbines may only be possible during clear weather conditions;
- There are other more prominent ALAN features within proximity to Rockabill, including the lighthouse on the island and onshore lighting;
- The average wind speed conditions at sea are high 9.7m/s [24], making the journey only viable for certain days of the year; and
- Low prey availability at the WTGs will discourage any bat individuals from returning to the array area after the initial investigation.

Furthermore, the likelihood of those bats that do forage within the array area being impacted by the WTG via collision or barotrauma is also very low, due to the lowest blade height above LAT, spacing between WTGs, and the bats echolocation abilities and agility (noting that this is not as efficient for moving infrastructure in comparison to stationary infrastructure and vessels).

[24] Marine Institute Website: Irish Weather Buoy Network (IMOS). Available at https://www.marine.ie/site-area/data-services/real-time-observations/irish-weather-buoy-network-imos Accessed December 2023.

Despite the number and likelihood of foraging bat individuals from Rockabill being impacted by collision or barotrauma being very low, it is not known what effect this could have on the potential residential bat population/roost on Rockabill. Without being able to definitively determine (without further monitoring to determine if a roost is confirmed) how individual bats will react once WTGs are operational and the significance of that on the potential residential bat population on Rockabill, according to the precautionary principle, potential for adverse effects cannot be excluded at this stage.

Therefore, likely significant effects to the Rockabill bat population cannot be ruled out, and must, in line with the precautionary principle, be assumed to occur due to collision and barotrauma during the operational and maintenance phase associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development based on the current baseline data.

35.5.4 Decommissioning Phase

It is anticipated that any offshore decommissioning process will involve similar activities to the construction process but that these will be undertaken in reverse, with removal of above surface structures initially (blades, nacelle, turbine, towers, and transition piece) followed by removal of foundations and associated subsurface infrastructure. It may be decided that the removal of foundations, pilings, scour protection and inter-array/offshore export cabling may cause greater environmental impacts than leaving in-situ and that if safe to do so, then certain infrastructure may be cut at 1m to 2m below the seabed with cabling left buried.

Decommissioning phase impacts that could result in likely significant effects to offshore bats include:

- Disturbance and displacement from noise;
- Disturbance and displacement due to increased vessel activity and infrastructure presence;
- Disturbance and displacement due to ALAN; and
- Indirect disturbance and displacement resulting from changes to prey.

35.5.4.1 Impact 9 – Displacement and disturbance due to noise

The decommissioning phase will be subject to the same impacts regarding anthropogenic noise as that of the construction phase (Impact 1). However, the impacts from infrastructure presence will be a complete reverse to that of the construction phase as WTGs and OSPs will be removed as part of the decommissioning phase. As these potential impacts have been ruled out for significant effects during the construction phase and with the implementation of the Rehabilitation Schedule, no significant effects will be expected to occur as a result of direct disturbance and displacement due to anthropogenic noise during decommissioning associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

35.5.4.2 Impact 10 - Displacement and disturbance due to increased vessel activity and infrastructure presence

The decommissioning phase will be subject to the same impacts regarding vessel presence as that of the construction phase (Impact 2). However, the impacts from infrastructure presence will be a complete reverse to that of the construction phase as WTGs and OSPs will be removed as part of the decommissioning phase. As these potential impacts have been ruled out for significant effects during the construction phase and with the implementation of the Rehabilitation Schedule (Volume III, Appendix 4.1), no significant effects will be expected to occur as a result of direct disturbance and displacement due to increased vessel activity and infrastructure presence during decommissioning associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

35.5.4.3 Impact 11 – Displacement and disturbance due to ALAN

The decommissioning phase will be subject to the same impacts regarding ALAN as that of the construction phase. However, the impacts from infrastructure presence will be a complete reverse to that of the construction phase as WTGs and OSPs will be removed as part of the decommissioning phase.

As these potential impacts have been ruled out for significant effects during the construction phase and with the implementation of the Rehabilitation Schedule (Volume III, Appendix 4.1), no significant effects will be expected to occur as a result of direct disturbance and displacement due ALAN during decommissioning associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

35.5.4.4 Impact 12 – Indirect disturbance and displacement resulting from changes to prey

As the decommissioning phase will be subject to the same impacts regarding ALAN as that of the construction phase but in reverse, so too will the indirect impact disturbance and displacement resulting from changes to prey.

The impacts from infrastructure presence will be a complete reverse to that of the construction phase as WTGs and OSPs will be removed as part of the decommissioning phase. As these potential impacts have been ruled out for significant effects during the construction phase and with the implementation of the Rehabilitation Schedule (Volume III, Appendix 4.1), no significant effects will be expected to occur as a result of direct disturbance and displacement due changes to prey during decommissioning associated with Project Option 1, and the same has been assessed for Project Option 2 of the proposed development.

35.6 Mitigation and Monitoring Measures

35.6.1 Mitigation

Significant effects cannot be ruled out, due to the precautionary principle, in relation to impacts due to collision and barotrauma on the inferred bat population at Rockabill based on the current baseline. Further monitoring is required as set out in Section 35.6.5. No further mitigation is proposed at this time.

35.6.2 Monitoring

Surveys – 2024

Island surveys

Preliminary Roost Assessment (PRA)

Buildings on Rockabill will be subject to an internal / external inspection for evidence or potential for bat roosting. Surveys will be carried out in accordance with Marnell et al., (2022), Collins (2023) and NIEA (2022 and 2024) guidance. Buildings / structures will to be assigned negligible, low, medium or high potential for bat roosting in accordance with BCT (2023).

Roost Characterisation Survey

Upon completion of the PRA, 3 no. roost characterisation surveys will be conducted on the buildings identified as having roost potential (safety permitting). The surveys will be conducted 1 no. per spring (April to end May), summer (June to end August) and autumn (September to end October) season. The surveys will be accompanied using Infra-Red/ Thermal cameras.

Acoustic Detector Survey

Deployment of static acoustic bat detectors with high-capacity batteries and memory cards on Rockabill off Co. Dublin (as during the pre-application surveys), to characterise the use of the island by bat species. The data will further assist determination of the potential population levels for attraction within the array area. All surveys will require monthly maintenance visits to ensure microphones, batteries, detectors etc are functioning appropriately.

Headland surveys

Deployment of static acoustic bat detectors with high-capacity batteries and memory cards at the entry pit location and Skerries harbour (as during the pre-application surveys) will be undertaken in 2024. Coverage will be undertaken for a minimum of one survey season and will require monthly maintenance visits to ensure microphones, batteries, detectors etc are functioning appropriately.

Vessel surveys

Three static acoustic bat detectors with high-capacity batteries and memory cards will be deployed on a vessel (used for other surveys) traveling within the array area (as during the 2022 surveys). The siting of the detectors will be undertaken prior to vessel departure and will require maintenance visits to ensure microphones, batteries, detectors etc are functioning appropriately.

35.6.2.1 Further Monitoring

As the topic of offshore bats is a fluid topic at present with several countries within Europe updating their approach to policy and guidance, the monitoring scope and schedule will be produced in discussion with NPWS and collaboration with other appropriate bodies.

The proposed development is committed to participating in the 'East Coast Monitoring Group' (ECMG), to discuss and agree potential strategic monitoring initiatives in relation to offshore bats. The need for strategic monitoring, and the level of participation by individual projects, will be determined by the conclusions of the EIAR process, in consultation with statutory and technical stakeholders, and with a focus on validation and evidence gathering.

35.7 Residual Effects

This section presents the residual effects of the proposed development once the mitigation and monitoring provided in Section 35.6 has been applied to the potential effects.

The assessment of Impact 8 identified that on a precautionary basis a significant effect to the inferred bat population at Rockabill cannot be ruled out. For all other impacts there are no likely significant effects identified. The presence of infrastructure in the offshore development area has the potential to change the baseline environment, and the effect of this has been considered at a precautionary level. Section 35.6 provides details of the approach that will be undertaken by the proposed development to undertake further monitoring.

No mitigation has been proposed at this stage, therefore there is no difference between the pre-mitigation effects outlined in Section 35.5 and the residual effects. Table 35.8 provides a summary of the impact assessment outcomes.

Table 35.8 Residual effects relating to offshore bats

Potential impact	Likely significant effect Project Option 1	Likely significant effect Project Option 2	Residual effect – Project Option 1	Residual effect – Project Option 2
Construction				
Impact 1 - Disturbance and displacement due to noise	Not significant	Not significant	Not significant	Not significant
Impact 2 - Disturbance and displacement due to increased vessel activity and infrastructure presence	Not significant	Not significant	Not significant	Not significant
Impact 3 - Disturbance and displacement due to artificial lighting at night	Not significant	Not significant	Not significant	Not significant
Impact 4 – Indirect disturbance and displacement due to changes to prey	Not significant	Not significant	Not significant	Not significant
Operation				
Impact 5 - Disturbance and displacement due to increased vessel activity and infrastructure presence	Not significant	Not significant	Not significant	Not significant
Impact 6 - Disturbance and displacement due to artificial lighting at night	Not significant	Not significant	Not significant	Not significant

Potential impact	Likely significant effect Project Option 1	Likely significant effect Project Option 2	Residual effect – Project Option 1	Residual effect – Project Option 2
Impact 7 - Indirect disturbance and displacement due to changes to prey	Not significant	Not significant	Not significant	Not significant
Impact 8 - Collision and barotrauma	Not significant for coastal foraging bats and migrating bats. Significant effects cannot be ruled out for the bat population at Rockabill only.	Not significant for coastal foraging bats and migrating bats. Significant effects cannot be ruled out for the bat population at Rockabill only.	Not significant for coastal foraging bats and migrating bats. Significant effects cannot be ruled out for the bat population at Rockabill only.	Not significant for coastal foraging bats and migrating bats. Significant effects cannot be ruled out for the bat population at Rockabill only.
Decommissioning				
Impact 9 - Disturbance and displacement due to noise	Not significant	Not significant	Not significant	Not significant
Impact 10 - Disturbance and displacement due to increased vessel activity and infrastructure presence	Not significant	Not significant	Not significant	Not significant
Impact 11 - Disturbance and displacement due to artificial lighting at night	Not significant	Not significant	Not significant	Not significant
Impact 12 - Indirect disturbance and displacement due to changes to prey	Not significant	Not significant	Not significant	Not significant

35.8 Transboundary Effects

Transboundary effects are defined as those effects upon the receiving environment of other states, whether occurring from the proposed development alone, or cumulatively with other projects in the wider area.

A screening of transboundary impacts has been carried out and has identified that there was no potential for significant transboundary effects with regard to offshore bats from the proposed development upon the interests of other states. The potential transboundary impacts assessed are summarised below:

- Direct disturbance and displacement due to anthropogenic noise during the construction, operational and maintenance and decommissioning phases. Overall bat species are less sensitive to temporary threshold shifts than other terrestrial mammals. Therefore, no significant transboundary effects will be expected to occur because of offshore noise associated with the proposed development.
- Direct disturbance and displacement due to increased vessel activity and infrastructure presence noise during the construction, operational and maintenance and decommissioning phases. Overall bats' echolocation abilities and agility make it unlikely that the stationary objects or moving vessels would pose a collision risk to individuals in flight. Therefore, no significant transboundary effects will be expected to occur because of disturbance and displacement due to increased vessel activity and infrastructure presence associated with the proposed development.
- Disturbance and displacement due to Artificial Lighting at Night (ALAN) during the construction, operational and maintenance and decommissioning phases. Overall, the two resident migratory species are likely to avoid the proposed development due to optimisation strategies. The two vagrant species are likely to avoid the proposed development due to ALAN. Therefore, no significant transboundary effects will be expected to occur because of disturbance and displacement due to ALAN.

- Indirect disturbance and displacement resulting from changes to prey during the construction, operational and maintenance and decommissioning phases. Overall, the two resident migratory species are likely to avoid the proposed development due to optimisation strategies. The two vagrant species are likely to avoid the proposed development due to ALAN. Therefore, no significant transboundary effects will be expected to occur because of disturbance and displacement resulting from changes to prey.
- Collision and Barotrauma during the operational and maintenance phase. While impacts to foraging species from the Rockabill population have been determined as significant based on the current baseline data, the two resident migratory species are likely to avoid the distraction of the proposed development due to optimisation strategies and the two vagrant species are likely to avoid the proposed development due to ALAN. Therefore, no significant transboundary effects will be expected to occur because of collision and barotrauma on migrating species.

35.9 Cumulative Effects

Likely significant cumulative effects of the proposed development in-combination with existing and/or approved projects for offshore bats have been identified, considered and assessed. The methodology for this cumulative assessment is a three-stage approach which is presented in the Cumulative and Inter-Related Effects Chapter.

The Cumulative and Inter-Related Effects Chapter contains the outcome of Stage 1 Establishing the list of 'Other Existing and/or Approved Projects'; and Stage 2 'Screening of 'Other Existing and/or Approved Projects'. This section presents Stage 3, an assessment of whether the proposed development in combination with other projects, grouped in tiers, will be likely to have significant cumulative effects.

The assessment specifically considers whether any of the approved developments in the local or wider area have the potential to alter the significance of effects associated with the proposed development. Developments which are already built and operating, and which are not identified in this chapter, are included in the baseline environment or have been screened out as there is no potential to alter the significance of effects.

The assessment of cumulative effects has considered likely significant effects that may arise during construction, operation and decommissioning of the proposed development. Cumulative effects were assessed to a level of detail commensurate with the information that has either been directly shared with the proposed development or was publicly available at the time of assessment.

Given the location and nature of the proposed development, a tiered approach to establishing the list of other existing and/or approved projects has been undertaken in Stage 1 of the cumulative effects assessment. The tiering of projects is based on project relevance to the proposed development and it is not a hierarchical approach nor based on weighting. Further information on the tiers is provided in Section 35.9.2 and in the Cumulative and Inter-Related Effects Chapter.

35.9.1 Offshore bat cumulative screening exercise

The existing and/or approved projects selected as relevant to the cumulative effects assessment of impacts to offshore bats are based on an initial screening exercise undertaken on a long list (see Cumulative and Inter-Related Effects Chapter). Consideration of effect-receptor pathways, data confidence and temporal and spatial scales has allowed the selection of the relevant projects for the offshore bat cumulative short-list.

When assessing likely significant effects for offshore bats, projects were screened into the assessment based on their ability to impact receptors within a 40km screening range surrounding the array area. This is approximately twice the ZoI of the proposed development and therefore should encompass the combined extent of impacts from the proposed development and also any regional projects likely to contribute to cumulative effects under a precautionary assumption that other projects may have a similar ZoI to the proposed development. Additional to this, Codling Wind Park and Arklow Bank Phase 2 and have been screened into the assessment regardless of distance so that all east coast Phase One Offshore Wind Farm projects are considered in the cumulative assessment. Despite being outside of the screening range, they have been considered within the Stage 3 assessment as a precautionary approach because it is likely they will have impacts of a similar size and scale, occurring within a similar timescale and involving the same species.

The project alone assessment takes into account the fact that bats may already be habituated to existing long-term projects and therefore these may be considered to be part of the baseline conditions, however there is the recognition of the potential for on-going impacts and as a precaution these impacts are considered in the cumulative effects screening exercise.

For the full list of projects considered, including those screened out, please see the Cumulative and Inter-Related Effects Chapter and Appendix 38.2.

35.9.2 Projects considered within the cumulative effects assessment

The planned, existing and/or approved projects selected through the screening exercise as potentially relevant to the assessment of impacts to offshore bats are presented in Table 35.9.

- Tier 1 is limited to the Operation and Maintenance Facility (OMF) for the proposed development. The OMF option being considered involves the adaption and leasing part of an existing port facility at Greenore. Further detail is provided in the Offshore Description Chapter.
- Tier 2 is the east coast Phase One Offshore Wind Farms.
- Tier 3 is all other projects that have been screened in for this topic.

The tiering structure is intended to provide an understanding of the potential for likely significant effects of the proposed development with the construction of its OMF (tier one); followed by a cumulative assessment of the likely significant effect of that scenario combined with the east coast Phase One Offshore Wind Farms (tier two); and lastly the combination of tier one and tier two with all other existing and/or approved projects that have been screened in (tier three).

Although marine projects require the use of vessels, and therefore present the potential for impacts from increased presence, noise and ALAN, as identified in Impacts 1, 2, 3 and 4, the impacts from vessels are localised, short term and unlikely to affect bat species that are migrating or foraging. Therefore, there are no cumulative pathways with the proposed development and other projects including cable laying, dredging operations and coastal developments have been screened out.

There are also several offshore wind projects within the UK and the Isle of Man that are either operational or in the planning stages, however, due to their positioning north and south of Wales and not to the west (between Wales and the proposed development), there is no predicted impacts from the projects to bats traveling east of the proposed development to Wales (shortest direct route) or vice versa. The distance to the UK offshore wind farm projects is also beyond the foraging distance for the resident bat species.

Following the above approach has resulted in no Tier 3 projects being screened into the assessment. Refer to the long list for those projects screened out of cumulative effects with the proposed development.

Table 35.9 Projects and plans considered within the cumulative impact assessment

Development Type	Project	Status	Data Confidence	Distance to the proposed development		Justification for screening into the assessment
				Array area	ECC	
Tier 1	Operations Maintenance Facility (OMF)	The OMF has not been screened into offshore bat cumulative effects assessment				
Tier 2 Phase One Offshore Wind Farms	Oriel Wind Park		Medium – as construction programmes and methodology has been shared between the Phase One Projects. scoping report available at time of writing. A foreshore licence has been granted for site investigations (2022-2027). Reference FS007383	16.9km	21.6km	Overlap in construction period, Oriel Wind Park due to construct during 2026-2028
	Dublin Array Offshore Wind Farm		Medium - as construction programmes and methodology has been shared between the Phase One Projects. scoping report available at time of writing. A foreshore licence has been granted for site investigations (2022-2027). Reference FS007188. Site investigations have been undertaken and EIA in prep.	32.9km	37.6km	Overlap in construction period, Dublin Array due to construct during 2028-2032.
	Codling Wind Park	Phase One Concept/Early Planning (MAC awarded) Initial foreshore licence granted in 2005, more recently in 2021.	Medium- as construction programmes and methodology has been shared between the Phase One Projects. Scoping report available at the time of writing. A foreshore licence has been granted for site investigations. Reference FS007045	50.9km	56.9km	Overlap in construction period, with Colding Wind Park due to construct during 2027-2028.
	Arklow Bank Phase 2	Phase One Concept/Early Planning (MAC awarded) Initial foreshore licence granted in 2020 - quashed but next FLA determined in 2022.	Medium- as construction programmes and methodology has been shared between the Phase One Projects. Scoping report available at time of writing. A foreshore licence has been granted for site investigations (2022-2027). Reference FS007339. Site investigations have been undertaken and EIA in prep.	76.4km	80.0km	Overlap in construction period with Arklow Bank Phase 2 due to construct during 2026-2030.
Tier 3	No projects have been screened into Tier 3					

35.9.3 Project impacts and options included in the assessment

The identification of potential impacts has been undertaken by considering the relevant characteristics from both project options (refer to Section 35.4.1) and the potential for a pathway for them to have direct and indirect effects on known receptors (as identified in Section 35.5) when combined with other projects.

For each impact, the project option with the greatest potential for a likely significant effect has been determined based on the comparison and justification provided in Table 35.6. The impacts and the project option considered in the cumulative assessment are presented in Table 35.10. As the residual effects for Project Option 1 and Project Option 2 are the same (as identified in Section 35.7), the cumulative effects assessment presented in this section applies to both options.

The cumulative effects assessment for the proposed development has considered the following impacts:

- Disturbance and displacement from noise during construction and decommissioning;
- Disturbance and displacement due to increased vessel activity and infrastructure presence during the lifetime of the proposed development;
- Disturbance and displacement due to ALAN during the lifetime of the proposed development;
- Indirect disturbance and displacement resulting from changes to prey during the lifetime of the proposed development; and
- Collision and barotrauma during operation.

Table 35.10 Potential cumulative impacts and tiers for assessment

Potential cumulative impact	Phase	Tiers and Projects	Justification for inclusion in cumulative effects assessment
1. Increase in noise during construction and decommissioning from pile-driving and construction activities	Construction/ Decommissioning	Tier 2 – Phase One Offshore Wind Farm Projects	Potential for noise increase due to the greater number of WTGs and longer construction/ decommissioning phases.
2. Increased vessel activity and infrastructure presence	Construction/ Operation/ Decommissioning	Tier 2 – Phase One Offshore Wind Farm Projects	Potential for increases activity and infrastructure due to the greater number of WTGs and longer construction/ decommissioning phases.
3. Increased artificial light at night	Construction/ Operation/ Decommissioning	Tier 2 – Phase One Offshore Wind Farm Projects	Potential for increased lighting due to the greater number of WTGs.
4. Indirect disturbance and displacement resulting from changes to prey distribution	Construction/ Operation/ Decommissioning	Tier 2 – Phase One Offshore Wind Farm Projects	Potential for indirect changes to prey due to the greater number of WTGs and therefore increased ALAN and attraction of prey.
5. Collision and barotrauma	Operation	Tier 2 – Phase One Offshore Wind Farm Projects	Potential for collision and barotrauma due the greater number of WTGs.

35.9.4 Cumulative Impact 1 - Increase in noise during construction and decommissioning

35.9.4.1 Tier 1

No Tier 1 projects have been scoped into the offshore bat cumulative effects assessment.

35.9.4.2 Tier 1 and 2

No Tier 1 projects have been carried forward into this assessment.

All east coast Phase One offshore wind farms have been considered within the Tier 2 assessment of impacts from noise during construction and decommissioning. Noise associated with construction of the proposed development, together with noise associated with the construction of other offshore wind farms in the Irish Sea, may contribute to cumulative disturbance and displacement of offshore bats if the periods of construction of different projects overlap.

From the information available on construction timeframes there is the potential for a construction phase overlap with the Phase One projects (although this does not consider that the availability and procurement of vessels may be limiting to this occurring). While the impact is highly dependent on the extent of temporal overlap across projects, levels of disturbance will be localised to the ECC and array areas for each project and their associated ZoI.

The proposed development alone was not predicted to have a significant effect (based on both Project Option 1 and Project Option 2) for construction phase disturbance and displacement impacts due to noise. This assessment has assumed a similar ZoI and outcome for the other wind farms. In acknowledgment that auditory impacts to offshore bats from piling and vessel/helicopter movements are not expected to occur (refer to Impact 1), and the distance between projects is significant (closest offshore wind farm to the proposed development is Oriel at 17km) (which rules out cumulative impacts on foraging bat individuals) it is unlikely that a significant effect will occur.

Any effects generated from the cumulative impact of disturbance and displacement due to anthropogenic noise during the decommissioning phase are expected to be similar, or reduced, to those generated during the construction phase, as certain activities such as piling would not be required. This is because it would generally involve a reverse of the construction phase through the removal of structures and materials installed.

Therefore, no significant cumulative effects will be expected to occur because of disturbance and displacement due to noise associated with both the proposed development and other projects during the construction and decommissioning phases.

35.9.4.3 Tier 1, 2 and 3 (All tiers)

No Tier 3 projects have been scoped into the offshore bat cumulative effects assessment. Therefore the cumulative assessment for all tiers remains the same as the prior Tier 1 and Tier 2 assessment; no significant cumulative effects will be expected to occur as a result of increased noise during construction and decommissioning associated with both the proposed development and other projects.

35.9.5 Cumulative Impact 2 – Increased vessel activity and infrastructure presence

35.9.5.1 Tier 1

No Tier 1 projects have been scoped into the offshore bat cumulative effects assessment.

35.9.5.2 Tier 1 and 2

No Tier 1 projects have been carried forward into this assessment.

All east coast Phase One offshore wind farms have been considered within the Tier 2 assessment of impacts from increased vessel activity and infrastructure presence during all project phases.

Vessel movements and infrastructure installation associated with construction of the proposed development, together with vessel movements and infrastructure installation associated with the construction of other Phase One Offshore Wind Farms in the Irish Sea, may contribute to cumulative disturbance and displacement if the periods of construction of different projects overlap. While the impact is highly dependent on the extent of temporal overlap across projects, the distance between projects (closest offshore wind farm is Oriel at 17km) would mean the levels of disturbance will be localised to the ECC and array areas for each project. Therefore, even if there is a complete overlap in construction for all projects for the duration of construction (which is unlikely due to vessel availability) and the distance between projects, it is unlikely that a significant effect will occur. Furthermore, the proposed development alone was not predicted to have a significant effect based on both Project Option 1 and Project Option 2 due to increased vessel activity and infrastructure presence.

Any effects generated from the cumulative impact of disturbance and displacement due to increased vessel activity and infrastructure presence during the decommissioning phase are expected to be similar, or reduced, to those generated during the construction phase, as certain activities such as piling would not be required. This is because it would generally involve a reverse of the construction phase through the removal of structures and materials installed.

Therefore, no significant cumulative effects will be expected to occur as a result of disturbance and displacement due to increased vessel activity and infrastructure associated with both the proposed development and other projects during the construction and decommissioning phases.

Vessel movements and infrastructure presence associated with operation and maintenance of the proposed development, together with vessel movements and infrastructure presence associated with the construction and or operation and maintenance of other offshore wind farms in the Irish Sea, may contribute to cumulative disturbance and displacement if the periods of construction and/or operation and maintenance of different projects overlap. Since this impact is highly dependent on the extent of temporal overlap across projects, the distance between projects (closest offshore wind farm is Oriel at 17km) would mean the levels of disturbance will be localised to the array area for each project. Therefore, even if there is a complete overlap for all projects for the duration of operation and maintenance phase or vessels are traveling between projects (unlikely due to all projects having their own dedicated operation and maintenance facilities), it is unlikely that a significant effect will occur.

Therefore, no significant cumulative effects will be expected to occur because of disturbance and displacement due to increased vessel activity and infrastructure associated with both the proposed development and other projects during the operational and maintenance phase.

35.9.5.3 Tier 1, 2 and 3 (All tiers)

No Tier 3 projects have been scoped into the offshore bat cumulative effects assessment. Therefore the cumulative assessment for all tiers remains the same as the prior Tier 1 and Tier 2 assessment; no significant cumulative effects will be expected to occur as a result of increased vessel activity and infrastructure presence associated with both the proposed development and other projects.

35.9.6 Cumulative Impact 3 – Increased artificial light at night

35.9.6.1 Tier 1

No Tier 1 projects have been scoped into the offshore bat cumulative effects assessment.

35.9.6.2 Tier 1 and 2

No Tier 1 projects have been carried forward into this assessment.

All east coast Phase One Offshore Wind Farms have been considered within the Tier 2 assessment of impacts from increased artificial light at night during all project phases.

Lights on WTGs, the OSP and vessels during construction may directly or indirectly contribute to increased bat activity. ALAN associated with construction of the proposed development, together with ALAN associated with the construction of other offshore wind farms in the Irish Sea may contribute to cumulative disturbance and displacement if the periods of construction of different projects overlap.

While the impact is highly dependent on the extent of temporal overlap across projects, the distance between projects (closest offshore wind farm is Oriel at 17km) would mean the levels of disturbance will be localised to the ECC and array areas for each project. Therefore, even if there is a complete overlap in construction for all projects for the duration of construction (which is unlikely due to vessel availability), due to the distance between projects being beyond the foraging distance of bat species and the distance between projects meaning that the ALAN of each project would not likely be visible from other projects, it is unlikely that a significant cumulative effect will occur.

Migrating species are also more likely to pass through the array area of the individual projects and not be distracted using optimisation strategies. Locations such as Rockabill may offer alternative ALAN locations, further reducing the likelihood of bats within the array area.

Any effects generated from the cumulative impact of disturbance and displacement due to ALAN during the decommissioning phase are expected to be similar, or reduced, to those generated during the construction phase. This is because it would generally involve a reverse of the construction phase through the removal of structures and materials installed.

Therefore, no significant cumulative effects will be expected to occur because of disturbance and displacement due ALAN associated with both the proposed development and other projects during the construction and decommissioning phases.

During the operational and maintenance phase of the proposed development the SPS and IPS will exhibit synchronised flashing yellow lights of at least 5 nm and 2 nm nominal range respectively. As this is a requirement with regards to H&S and navigation at sea, it is assumed that other wind farm projects will adhere to similar lighting regimes.

ALAN associated with operational and maintenance of the proposed development, together with ALAN associated with the operational and maintenance of other offshore wind farms in the Irish Sea, may contribute to cumulative disturbance and displacement if the periods of operation and maintenance of different projects overlap. While it is recognised the presence of vessels, WTGs and OSPs have the potential to cause attraction by bats via an increase in ALAN. Even if large numbers of bats are commuting offshore to investigate the lighting and indirectly the prey (refer to Impact 7), unless bats are commuting from wind farm to wind farm and not roosting, (unlikely as the distance between projects would mean the ALAN of each project would not likely be visible from other projects), leading to further physical deterioration and potential death of bat species due to energy expenditure in undertaking the displacement activity, there will be no cumulative effect on the bat species. Furthermore, migrating species are more likely to pass through the area and not be distracted by the presence of ALAN using optimization strategies.

Therefore, no significant cumulative effects will be expected to occur because of disturbance and displacement of bat species via a change in prey associated with both the proposed development and other projects during the operational and maintenance phase.

35.9.6.3 Tier 1, 2 and 3 (All tiers)

No Tier 3 projects have been scoped into the offshore bat cumulative effects assessment. Therefore the cumulative assessment for all tiers remains the same as the prior Tier 1 and Tier 2 assessment; no significant cumulative effects will be expected to occur as a result of increased artificial light at night associated with both the proposed development and other projects.

35.9.7 Cumulative Impact 4 – Indirect disturbance and displacement resulting from changes to prey distribution

35.9.7.1 Tier 1

No Tier 1 projects have been scoped into the offshore bat cumulative effects assessment. Therefore the cumulative assessment for all tiers remains the same as the prior Tier 1 and Tier 2 assessment; no significant cumulative effects will be expected to occur as a result of collision and barotrauma associated with both the proposed development and other projects.

35.9.7.2 Tier 1 and 2

No Tier 1 projects have been carried forward into this assessment.

All east coast Phase One Offshore Wind Farms have been considered within the Tier 2 assessment of impacts from indirect disturbance and displacement resulting from changes to prey distribution during all project phases.

WTG or associated infrastructure and vessels during construction may directly or indirectly contribute to increased bat activity as they travel to the site to partake in the potential of insects. This is likely due to the ALAN causing a 'vacuum effect', denuding the surrounding area of invertebrate prey. Displacement of bats from natural communities or habitats due to attraction to the array area due to changes to prey distribution could lead to physical deterioration and potential death of bat species due to energy expenditure in undertaking the displacement activity.

Changes to prey associated with construction of the proposed development, together with indirect disturbance and displacement resulting from changes to prey associated with the construction of other offshore wind farms in the Irish Sea, may contribute to cumulative disturbance and displacement if the periods of construction of different projects overlap. While the impact is highly dependent on the extent of temporal overlap across projects, the distance between projects (closest offshore wind farm is Oriel at 17km) would mean the levels of disturbance will be localised to the ECC and array areas for each project. Therefore, even if there is a complete overlap in construction for all projects for the duration of construction (which is unlikely due to vessel availability) or vessels are traveling between projects, due to the distance between projects being beyond the foraging distance of bat species and the distance between projects meaning that the ALAN of each project would not likely be visible from other projects, reducing the likelihood of bats investigating potential prey, it is unlikely that a significant cumulative effect will occur.

Furthermore, unless bats are commuting from project area to project area and not roosting, leading to further physical deterioration and potential death of bat species due to energy expenditure in undertaking the displacement activity, there will be no cumulative effect on the bat species. Migrating species are also more likely to pass through the area and not be distracted by the presence of prey using optimisation strategies.

Any effects generated from the cumulative impact of disturbance and displacement due to change in prey during the decommissioning phase are expected to be similar, or reduced, to those generated during the construction phase. This is because it would generally involve a reverse of the construction phase through the removal of structures and materials installed.

Therefore, no significant cumulative effects will be expected to occur because of disturbance and displacement of bat species via a change in prey associated with both the proposed development and other projects during the construction and decommissioning phases.

WTG or associated infrastructure and vessels during operational and maintenance may directly or indirectly contribute to increased bat activity as they travel to the site to partake in the potential prey population. This is likely due to the ALAN causing a 'vacuum effect', denuding the surrounding area of invertebrate prey. Displacement of bats from natural communities or habitats due to attraction to the array area due to changes to prey distribution could lead to physical deterioration and potential death of bat species due to energy expenditure in undertaking the displacement activity. While the presence of WTGs and OSPs has the potential to cause attraction by bats via a change in prey distribution (an indirect impact from the presence of lighting from the infrastructure). Even if large numbers of bats are commuting offshore to investigate the changes in prey distribution (as an indirect effect from increased ALAN, refer to Impact 6), unless bats are commuting from wind farm to wind farm and not roosting, (unlikely as the distance between projects would mean the ALAN of each project would not likely be visible from other projects), leading to further physical deterioration and potential death of bat species due to energy expenditure in undertaking the displacement activity, there will be no cumulative effect on the bat species. Furthermore, migrating species are more likely to pass through the area and not be distracted by the presence of prey using optimization strategies.

Therefore, no significant cumulative effects will be expected to occur as a result of disturbance and displacement of bat species via a change in prey associated with both the proposed development and other projects during the operational and maintenance phase.

35.9.7.3 Tier 1, 2 and 3 (All tiers)

No Tier 3 projects have been scoped into the offshore bat cumulative effects assessment. Therefore the cumulative assessment for all tiers remains the same as the prior Tier 1 and Tier 2 assessment; no significant cumulative effects will be expected to occur as a result of Indirect disturbance and displacement resulting from changes to prey distribution associated with both the proposed development and other projects.

35.9.8 Cumulative Impact 5 – Collision and barotrauma

35.9.8.1 Tier 1

No Tier 1 projects have been scoped into the offshore bat cumulative effects assessment.

35.9.8.2 Tier 1 and 2

No Tier 1 projects have been carried forward into this assessment.

All east coast Phase One Offshore Wind Farms have been considered within the Tier 2 assessment of impacts from collision and barotrauma during the operation phase.

The proposed development, together with other offshore wind farms in the Irish Sea, may contribute to cumulative collision and barotrauma, in the event the operational and maintenance phases of different projects overlap. Bats are highly mobile, therefore they can encounter offshore wind farms, and be at risk of collisions, across large areas. While a precautionary approach is taken, assuming migrating species are within the proposed development array area, it should be noted that given the localised position of the WTGs, the slower rotation speeds during optimal migration conditions, the low numbers of bats anticipated to be migrating within the array area, the bats' echolocation abilities and agility, the distance between rotating WTG (minimum 500m between blade tips) and the distance between wind farm projects (closest wind farm project is Oriel approximately 17km north of the proposed development) it is unlikely that the projects would pose a cumulative collision risk to migrating individuals.

While significant effects from collision and barotrauma cannot be ruled out for the population of bats located on Rockabill for the project alone, the distance between the projects and Rockabill (closest wind farm to the north is Oriel at approximately 34km and closest wind farm to the south is the Dubin Array at approximately 32km), would indicate they are beyond the foraging range of the species on Rockabill and they would not be visible from the island. It is therefore unlikely that the other projects would pose a cumulative collision risk to the Rockabill population.

Therefore, no significant cumulative effects will be expected to occur as a result of collision and barotrauma associated with both the proposed development and other projects.

35.9.8.3 Tier 1, 2 and 3 (All tiers)

No Tier 3 projects have been scoped into the offshore bat cumulative effects assessment. Therefore the cumulative assessment for all tiers remains the same as the prior Tier 1 and Tier 2 assessment; no significant cumulative effects will be expected to occur as a result of collision and barotrauma associated with both the proposed development and other projects.

35.10 References

Ahlén, I., Bach, L., Baagøe, H.J. and Pettersson, J. 2007. *Bats and offshore wind turbines studied in southern Scandinavia*. Naturvårdsverket.

Ahlén I., Baagøe HJ., & Bach L., 2009. Behavior of Scandinavian bats during migration and foraging at sea. Journal of Mammalogy 90: 1318-1323.

Alcade J. T., Jimenez M., Brila M., Vintulis V., Voigt C.C., and Petersons G. 2021. Transcontinental 2200 km migration of a Nathusius' pipistrelle (*Pipistrellus nathusii*) across Europe, Mammalia, vol. 85(2), pp. 161-163. https://www.researchgate.net/publication/346388035_Transcontinental_2200_km_migration_of_a_Nathusius'_pipistrelle_Pipistrellus_nathusii_across_Europe

Allen LC, Hristov NI, Rubin JJ, Lightsey JT, Barber JR. 2021. Noise distracts foraging bats. Proc. R. Soc. B

Arnett, E., Brown, W., Erickson, W., Fiedler, J., Hamiltons, B., Henry, T., Jain, A., Johnson, G., Kerns, J., Koford, R., Nicholson, C., O'Connell, T., Piorkowski, M., Tankersley, R. Jr. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. The Journal of Wildlife Management, 72(1), 61-78.

ARUP, 2024. North Irish Sea Array Offshore Windfarm. Offshore Bats - Literature Review Reference: Technical Note

Baerwald, E.F., D'Amours, G.H., Klug, J.B. and Barclay, R.M.R. 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology 18, 695–696.

Baerwald, E.F. and Barclay, R.M. 2009. Geographic variation in activity and fatality of migratory bats at wind energy facilities. Journal of mammalogy, 90(6), pp.1341-1349.

Bat Conservation Ireland, 2010. Bat Conservation Ireland's National Bat Distribution Atlas Programme. Irish Bats in Flight Identification Card. Environment, Heritage and Local Government

Bat Conservation Trust. 2014. Tiny Bat Crosses the North Sea! Tiny Bat Crosses the North Sea! - News - Bat Conservation Trust (bats.org.uk)

BCT (2020) Core Sustenance Zones and habitats of importance for designing Biodiversity Net Gain for bats. Bat Conservation Trust, London. https://www.bats.org.uk/resources/guidance-for-professionals/bat-species-core-sustenance-zones-and-habitats-for-biodiversity-net-gain

Bennett, V.J. and Hale, A.M. 2014. Red aviation lights on wind turbines do not increase bat-turbine collisions. Animal Conservation 17: Issue 4, 354-358

Boshamer J.P.C. and Bekker J.P. 2008. Nathusius' pipistrelles *(Pipistrellus nathusii)* and other species of bats on offshore platforms in the Dutch sector of the North Sea. Lutra 51: 17-36.

Boston Emma S. M., Ian Montgomery W., Hynes Rosaleen and Prodöhl Paulo A. 2015. New insights on postglacial colonization in western Europe: the phylogeography of the Leisler's bat (Nyctalus leisleri) Proc. R. Soc. B.2822014260520142605.

Brabant R., Laurent Y., Muteti J., Jonge Poerink B., and Degraer S. 2019. The influence of meteorological conditions on the presence of Nathusius' pipistrelle (*Pipistrellus nathusii*) at sea. In: S. Degraer, R. Brabant, R. Rumes & L. Vigin (eds), Environmental Impacts of Offshore Wind Farms in the Belgian North Sea: Marking a decade of monitoring, research and innovation. Brussels: Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management. pp.117-124.

Brabant R., Laurent Y., Jonge Poerink B., Degraer S. 2021. The Relation between Migratory Activity of Pipistrellus Bats at Sea and Weather Conditions Offers Possibilities to Reduce Offshore Wind Farm Effects. Animals. 11(12):3457. https://doi.org/10.3390/ani11123457.

Buckley D., Puechmaille S., Roche N., & Teeling E. 2011 A critical assessment of the presence of *Barbastella barbastellus* and *Nyctalus noctula* in Ireland with a description of *N. leisleri* echolocation calls from Ireland. Hystrix, Italian J. Mammal. 22.

Chapman, J. W., Reynolds, D. R., Smith, A. D., Smith, E. T., & Woiwod, I. P. 2004. An aerial netting study of insects migrating at high altitude over England. Bulletin of Entomological Research, 94(2), 123–136.

Choi DY., Wittig TW. and Kluever BM. 2020. An evaluation of bird and bat mortality at wind turbines in the Northeastern United States. PLoS One. Aug 28;15(8):e0238034. doi: 10.1371/journal.pone.0238034. PMID: 32857780; PMCID: PMC7454995.

CIEEM. 2018, updated 2022. Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.2.Chartered Institute of Ecology and Environmental Management, Winchester

Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London. ISBN-13 978-1-872745-96-1Collins, J. (ed.) (2023) Bat Surveys for Professional Ecologists: Good Practice Guidelines (4th edition). The Bat Conservation Trust, London. ISBN-978-1-7395126-0-6

Cryan, P.; Brown, A. 2007. Migration of Bats Past a Remote Island Offers Clues toward the Problem of Bat Fatalities at Wind Turbines. Biological Conservation, 139(1-2), 1-11.

Cryan, P., Barclay, R. 2009. Causes of Bat Fatalities at Wind Turbines: Hypotheses and Predictions. Journal of Mammalogy, 90(6), 1330-1340. https://doi.org/10.1644/09-MAMM-S-076R1.1

Department of Communications, Climate Action and Environment, 2017. Guidance on EIS and NIS Preparation for Offshore Renewable Energy Projects. Prepared for the Environmental Working Group of the Offshore Renewable Energy Steering Group and the Department of Communications, Climate Action and Environment by MacCabe Durney Barnes. https://www.gov.ie/en/publication/3d6efb-guidance-documents-for-offshore-renewable-energy-developers/

Dondini, G., Rutkowski, T., Vergari, S., and Wojtaszyn, G. 2012. Long distance migration of female Leisler's bat (*Nyctalus leisleri*) from Italy to Poland. *Hystrix, the Italian Journal of Mammalogy*, 23(2), pp.95-96. https://doi.org/10.4404/hystrix-23.2-8602

Drake, V., & Reynolds, D. 2012. Radar Entomology: observing insect flight and migration. Cabi, Wallingford, UK.

Entwistle, A. C., Harris, S., Hutson, A. M., Racey, P. A., Walsh, A., Gibson, S. D., Hepburn, I. and Johnston, J. (2001). Habitat management for bats A guide for land managers, land owners and their advisors. Joint Nature Conservation Committee. ISBN 1 86107 528 6

ESGS surveillance footage 2014. https://www.youtube.com/watch?v=mttpX53OCwU

EUROBATS, *Nyctalus leisleri.*
https://www.eurobats.org/about_eurobats/protected_bat_species/nyctalus_leisleri

Finch D., Schofield H. and Mathews F. 2020. Habitat Associations of Bats in an Agricultural Landscape: Linear Features Versus Open Habitats. Animals. 10(10):1856. https://doi.org/10.3390/ani10101856

Foo, C.F., Bennett, V.J., Hale, A.M., Korstian, J.M., Schildt, A.J. and Williams, D.A. 2017. Increasing evidence that bats actively forage at wind turbines. PeerJ, 5, p.e3985.

Giavi S., Moretti M., Bontadina F., Zambelli N., Schaub M. 2014 Seasonal Survival Probabilities Suggest Low Migration Mortality in Migrating Bats. PLOS ONE 9(1): e85628. https://doi.org/10.1371/journal.pone.0085628.

GN08/23, Guidance Note 8 Bats and Artificial Lighting. https://theilp.org.uk/publication/guidance-note-8-bats-and-artificial-lighting/

Guest, E., Stamps, B., Durish, N., Hale, A., Hein, C., Morton, B., Weaver, S., Fritts, S. 2022. An Updated Review of Hypotheses Regarding Bat Attraction to Wind Turbines. Animals, 12(3), 343.

Jones, G., Cooper-Bohannon, R., Barlow, K. and Parsons, K., (2009) Determining the potential ecological impact of wind turbines on bat populations in Britain. Scoping and Method Development Report, Defra

Kirkpatrick L., Maher SJ., Lopez Z., Lintott PR., Bailey S., Dent D. and Park K. 2017. Bat use of commercial coniferous plantations at multiple spatial scales: Management and conservation implications, Biological Conservation, 206, pp. 1-10.

Kunz, T., Arnett, E., Erickson, W., Hoar, A., Johnson, G., Larkin, R., Stickland, M., Thresher, R., Tuttle, M. 2007. Ecological Impacts of Wind Energy Development on Bats: Questions, Research Needs, and Hypotheses. Frontiers in Ecology and the Environment, 5(6), 315-324.

Lagerveld, S., 2018. Bat migration at sea and along the North Sea coast. Presentation to Wageningen University and Research. Noordzeeloket.

Lagerveld S., B .Jonge Poerink, & H. Verdaat 2014a. Monitoring bat activity in offshore wind farms OWEZ and PAWP in 2013. IMARES Report C165/14.

Lagerveld S., B. Jonge Poerink, R. Haselager & H. Verdaat 2014b. Bats in Dutch offshore wind farms in autumn 2012. Lutra 57 (2): 61-69.

Lagerveld S., B. Jonge Poerink & P. de Vries 2015. Monitoring Bat activity at the Dutch EEZ in 2014. IMARES Report C094/15.

Lagerveld. S., Gerla. D., van der Wal. J.T., de Vries. P., Brabant. R., Stienen. E., Deneudt. K., Manshanden. J., Scholl. M. (2017) Spatial and temporal occurrence of bats in the southern North Sea area. Wageningen Marine Research (University and Research centre), Wageningen Marine Research report C090/17; 52 p

Lagerveld, S., van der Wal, J.T., Vries, V., Verdaat, H., Sonneveld, C., van der Meer, J., Brabant, R. and Noort, B., 2019. *Bats at the southern North Sea in 2017 & 2018*. Wageningen Marine Research.

Lagerveld, S., Noort, C.A., Meesters, L., Bach, L., Bach, P. and Geelhoed, S., 2020. Assessing fatality risk of bats at offshore wind turbines (No. C025/20). Wageningen Marine Research.

Lagerveld, S., Jonge Poerink, B. and Geelhoed, S.C., 2021. Offshore occurrence of a migratory bat, Pipistrellus nathusii, depends on seasonality and weather conditions. Animals, 11(12), p.3442.

Lagerveld, S., Wilkes, T., van Puijenbroek, M.E.B. et al. Acoustic monitoring reveals spatiotemporal occurrence of Nathusius' pipistrelle at the southern North Sea during autumn migration. Environ Monit Assess 195, 1016 (2023). https://doi.org/10.1007/s10661-023-11590-2

Lawson, M., 2013. Reducing Bat Fatalities From Interactions with Operating Wind Turbines (Fact Sheet) (No. NREL/FS-5000-60427). National Renewable Energy Lab.(NREL), Golden, CO (United States).

Lawson, M., Jenne, D., Thresher, R., Houck, D., Wimsatt, J. and Straw, B., 2020. An investigation into the potential for wind turbines to cause barotrauma in bats. *Plos one*, *15*(12), p.e0242485.

Leopold M.F., M. Boonman, M.P. Collier, N. Davaasuren, R.C. Fijn, A. Gyimesi, J. de Jong R.H. Jongbloed, B. Jonge Poerink, J.C. Kleyheeg-Hartman, K.L. Krijgsveld, S. Lagerveld, R. Lensink, M.J.M. Poot, J.T. van der Wal & M. Scholl 2014. A first approach to deal with cumulative effects on birds and bats of offshore wind farms and other human activities in the Southern North Sea. IMARES Report C166/14.

Lindecke, O., Elksne, A., Holland, R.A., Pētersons, G. and Voigt, C.C., 2019. Orientation and flight behaviour identify the Soprano pipistrelle as a migratory bat species at the Baltic Sea coast. Journal of Zoology, 308(1), pp.56-65.

Lintott, P. R., Richardson, S. M., Hosken, D. J., Fensome, S.A., Mathews, F. 2016. Ecological impact assessments fail to reduce risk of bat casualties at wind farms. Current Biology. Volume 26, Issue 21. Pages R1135-R1136, ISSN 0960-9822, https://doi.org/10.1016/j.cub.2016.10.003.

Lundy MG, Aughney T, Montgomery WI, Roche N. 2011. Landscape conservation for Irish bats & species specific roosting characteristics. Bat Conservation Ireland.

Luo, J., Siemers, B.M. and Koselj, K., 2015. How anthropogenic noise affects foraging. Global Change Biology, 21(9), pp.3278-3289.

Marggraf LC, Lindecke O, Voigt CC, Pētersons G and Voigt-Heucke SL (2023) Nathusius' bats, Pipistrellus nathusii, bypass mating opportunities of their own species, but respond to foraging heterospecifics on migratory transit flights. Front. Ecol. Evol. 10:908560. doi: 10.3389/fevo.2022.908560

Marnell, F., Kelleher, C. & Mullen, E. (2022) Bat mitigation guidelines for Ireland v2. Irish Wildlife Manuals, No. 134. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland

Mathews, F., Richardson, S., Lintott, P. & Hosken, D. 2016. Understanding the Risk to European Protected Species (bats) at Onshore Wind Turbine Sites to inform Risk Management. University of Exeter/DEFRA.

Nicholls, B., and Racey, P.A., 2009. The Aversive Effect of Electromagnetic Radiation on Foraging Bats—A Possible Means of Discouraging Bats from Approaching Wind Turbines. PLoS ONE 4(7): e6246. doi:10.1371/journal.pone.0006246

North Irish Sea Array Windfarm Ltd, (2024). Natura Impact Statement.

Northern Ireland Environment Agency (2022). Guidance on Bat Surveys, Assessment & Mitigation for Onshore Wind Turbine Developments – Version 1.1 NIEA, Natural Environment Division.

Northern Ireland Environment Agency (2024). Bat Surveys - NIEA Specific Requirements. Available at https://www.daera-ni.gov.uk/sites/default/files/publications/daera/NED%20Bat%20Survey%20Specifications%20review%20Dec%202023%20v2.0.pdf

NPWS, 2018. Conservation objectives supporting document – lesser horseshoe bat (Rhinolophus hipposideros) Version 1. Conservation Objectives Supporting Document Series. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Dublin, Ireland

O'Mara MT., Wikelski M., Kranstauber B., Dechmann DKN. 2019. Common noctules exploit low levels of the aerosphere. R Soc Open Sci. Feb 27;6(2):181942. doi: 10.1098/rsos.181942. PMID: 30891300; PMCID: PMC6408413.

O'Mara, M. T., M. Wikelski, B. Kranstauber, and D. K. N. Dechmann. 2019. First three-dimensional tracks of bat migration reveal large amounts of individual behavioral flexibility. Ecology 100(9):e02762. 10.1002/ecy.2762

Petersons, G., 2004. Seasonal migrations of north-eastern populations of Nathusius' bat *Pipistrellus nathusii* (Chiroptera), Myotis, vol. 41(42), pp. 29-56. https://www.researchgate.net/publication/313473217_Seasonal_migrations_of_north-eastern_populations_of_Nathusius'_bat_Pipistrellus_nathusii_Chiroptera

Pinder N., 2020. When did the Leisler's bat colonise the Isle of Man? BCT British Islands Bats Volume 1, pp.150-156

Poerink, B.J., Lagerveld, S. and Verdaat, J.P., 2013. *Pilot study Bat activity in the dutch offshore wind farm OWEZ and PAWP* (No. C026/13). IMARES.

Richardson, S.M., Lintott, P.R., Hosken, D.J., Economou, T. and Mathews, F., 2021. Peaks in bat activity at turbines and the implications for mitigating the impact of wind energy developments on bats. Scientific Reports, 11(1), pp.1-6.

Rodrigues, L., Bach, L., Dubourg-Savage, M.-J., Karapandža, B., Kovač, D., Kervyn, T., Collins, J. 2015. Guidelines for consideration of bats in wind farm projects: Revision 2014. UNEP/EUROBATS.

Roche, N. and Torsney, A. (2021). Identification Guide to Ireland's Bats, National Biodiversity Data Centre, Wexford.

Rydell, J., Bach, L., Dubourg-Savage, M.J., Green, M., Rodrigues, L. and Hedenström, A., 2010. Bat mortality at wind turbines in northwestern Europe. Acta Chiropterologica, 12(2), pp.261-274.

Rydell J., Bach L., Bach P., Diaz L., Furmankiewicz J., Hagner-Wahlsten N., Kyheröinen E.-M., Lilley T., Masing M., Meyer M. M., Pētersons G., Šuba J., Vasko V., Vintulis V., and Hedenström A., 2014.

Phenology of migratory bat activity across the Baltic Sea and the south-eastern North Sea, Acta Chiropterologica, vol. 16, no. 1, pp. 139-147(9).

Schaub A., Ostwald J., Siemers BM., 2008. Foraging bats avoid noise. Journal of Experimental Biology, 211, 3174–3180.

Shiel CB., Shiel RE., & Fairley JS. 1999 Seasonal changes in the foraging behaviour of Leisler's bats (*Nyctalus leisleri*) in Ireland as revealed by radiotelemetry. J. Zool. Lond. 249, 195–214. doi:10.1111/j.1469-7998.1999.tb00770.x

Shiel, Conor & Shiel, R. & Fairley, J.. (2006). Seasonal changes in the foraging behaviour of Leisler's bats (Nyctalus leisleri) in Ireland as revealed by radio-telemetry. Journal of Zoology. 249. 347 - 358. 10.1111/j.1469-7998.1999.tb00770.x.

Sieradzki, A., & Mikkola, H., 2020. A review of European owls as predators of bats. https://doi.org/10.5772/intechopen.90330

Simmons, A.M., Hom, K.N., Warnecke, M. and Simmons, J.A., 2016. Broadband noise exposure does not affect hearing sensitivity in big brown bats (*Eptesicus fuscus*). Journal of Experimental Biology, 219(7), pp.1031-1040.

Smith AD., McWilliams SR., 2016. Bat activity during autumn relates to atmospheric conditions: implications for coastal wind energy development. Journal of Mammalogy 97:1565–1577.

Speakman, J. R., 1991. The impact of predation by birds on bat populations in the British Isles. Mammal Review, 21, 123–142.

Šuba, J., Pētersons, G., and Rydell, J., 2012. Fly-and-Forage Strategy in the Bat *Pipistrellus nathusii* During Autumn Migration., *Acta Chiropterologica,* vol. 14, pp. 379-385.

T. C. Assembly, "Report of the Citizens' Assembly on Biodiversity Loss," March 2023. [Online]. Available: https://citizensassembly.ie/wp-content/uploads/Report-on-Biodiversity-Loss_mid-res.pdf

Thaxter Chris B., Buchanan Graeme M., Carr Jamie, Butchart Stuart H. M., Newbold Tim, Green Rhys E., Tobias Joseph A., Foden Wendy B., O'Brien Sue and Pearce-Higgins James W. 2017. Bird and bat species' global vulnerability to collision mortality at wind farms revealed through a trait-based assessment Proc. R. Soc. B.2842017082920170829

Troxell SA., Holderied MW., Pētersons G., and Voigt CC. 2019. Nathusius' bats optimize long-distance migration by flying at maximum range speed. Journal of Experimental Biology 222: jeb176396.

UK Offshore Energy Strategic Environmental Assessment 4 (OESEA4) 2022. Appendix A1a.7 UK Offshore Energy Strategic Environmental Assessment 4 (OESEA4) - GOV.UK (www.gov.uk)

U.S. Offshore Wind Synthesis of Environmental Effects Research (SEER), 2022. Research Brief. https://tethys.pnnl.gov/sites/default/files/summaries/SEER-Educational-Research-Brief-Bat-Bird-Interactions.pdf

Vincent Wildlife Trust, Leislers bat. https://www.vincentwildlife.ie/species/leislers-bat

Wohlgemuth R., Devrient I., García A& Hutterer R., 2004. Long distance flight of a Lesser noctule (*Nyctalus leisleri*) after rehabilitation. Myotis 42–42, 69–73.