Environmental Impact Assessment Report - Volume 2C

Chapter 31:
Bats in the Marine Environment

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

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ORIEL WIND FARM PROJECT

Environmental Impact Assessment Report
Chapter 31: Bats in the Marine Environment

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31 BATS IN THE MARINE ENVIRONMENT

31.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) provides an assessment of the potential impacts of the Oriel Wind Farm Project (hereafter referred to as 'the Project') on bats in the marine environment. Specifically, this chapter considers the potential impact of the offshore infrastructure (offshore wind farm and offshore cable) on offshore bat activity (March to October) and offshore bat migration (mid-March to May; and mid-August to October) during the construction, operational and maintenance and decommissioning phases of the Project. Consideration of bats in a terrestrial environment is provided in chapter 19: Onshore Biodiversity.

The assessment presented is informed by the following technical report:

- Appendix 31-1: Offshore Bat Survey Technical Report.

This assessment is informed by the Clogherhead offshore wind farm survey data collected between May and August 2022. Additionally, this chapter presents the findings of a literature-based review undertaken to examine potential offshore bat migration associated with the offshore infrastructure of the Project.

The details and competencies of the specialist who prepared this chapter can be found in volume 2A, chapter 1: Introduction.

31.2 Purpose of this chapter

The primary purpose of the EIAR chapter is to provide an assessment of the likely direct and indirect significant effects of the Project on bats in the marine environment. In particular, this EIAR chapter:

- Presents the existing environmental baseline established from desk studies, survey data and consultation (section 31.7);
- Identifies any assumptions and limitations encountered in compiling the environmental information (section 31.7.5);
- Presents an assessment of the potential likely significant effects on bats in the marine environment arising from the Project (section 31.10), based on the information gathered and the analysis and assessments undertaken. An assessment of potential cumulative impacts is provided in section 31.11 and an assessment of transboundary effects is outlined in section 31.12; and
- Highlights any necessary monitoring (section 31.10.4) and/or measures (section 31.10.3) which could prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process (section 31.10).

31.3 Study area

In the absence of published guidance or studies to determine the study area for bats in the marine environment, it is considered appropriate to define the Bats in the Marine Environment Study Area as the Irish Sea. Based on the location of the Project, the Bats in the Marine Environment Study Area is considered to be bounded by the potential migration corridors of the east/northeast of Ireland, south of Scotland, north of England and north of Wales.

The Bats in the Marine Environment Study Area is determined by the Zone of Influence (ZoI) of the Project, which is discussed below.

The Bats in the Marine Environment Study Area was also used to inform the Cumulative Impact Assessment (CIA) (see section 31.11).

31.3.1 Zone of Influence

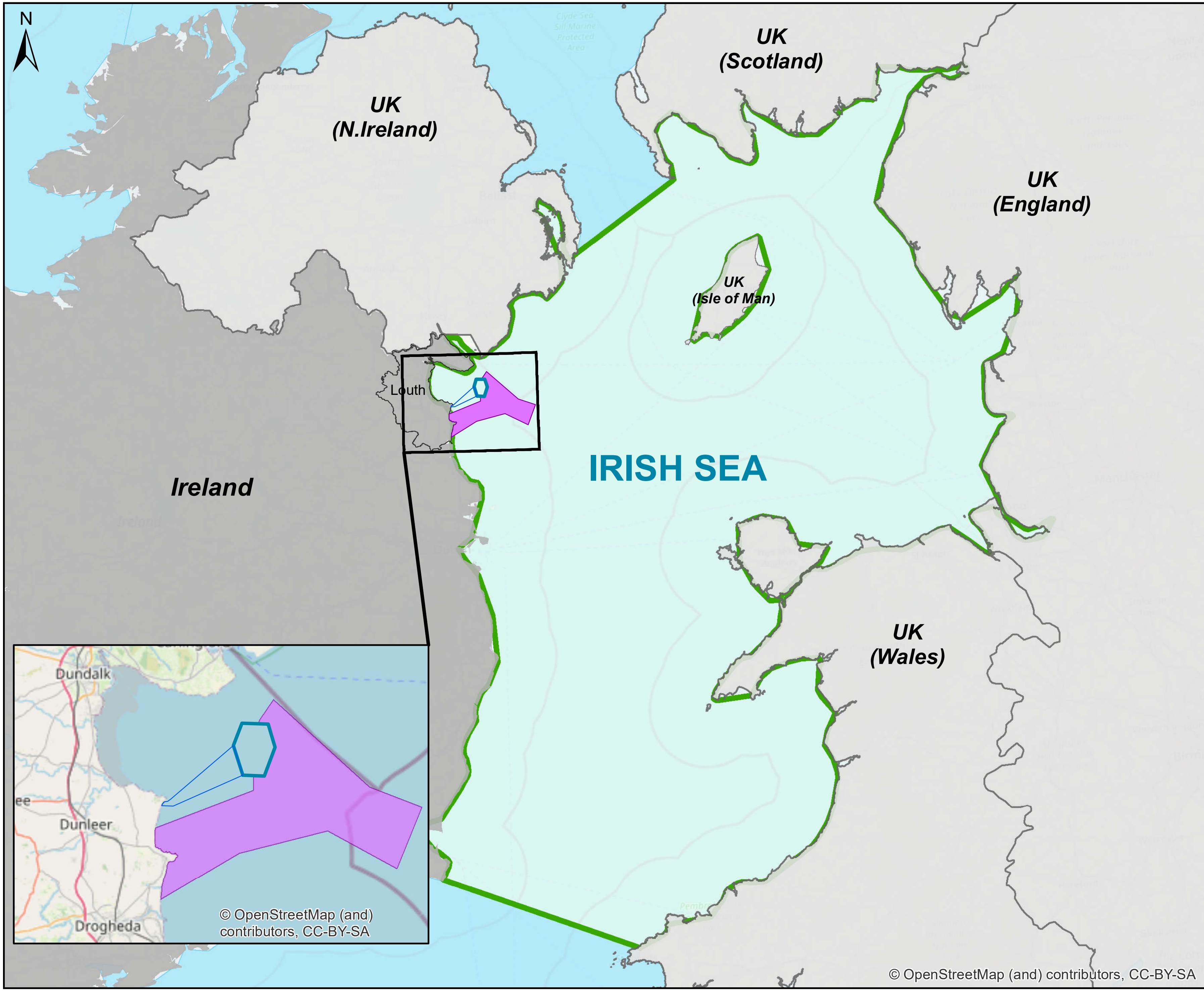
The Zone of Influence (ZoI) for a project (or 'spatial extent of the impact' as described in Annex III(3) of the EIA Directive) is the area over which ecological features may be subject to significant impacts as a result of the Project and associated activities.

The ZoI is likely to extend beyond the boundary of a development, for example where there are pathways or linkages extending beyond the site boundaries. Activities associated with the construction, operational and maintenance and decommissioning phases should be separately identified (where relevant).

The ZoI will vary for different ecological features depending on their sensitivity to an environmental change. It is therefore appropriate to identify different ZoIs for different features. The features affected could include various species, and the processes on which they depend.

It is also important to acknowledge, as per EPA guidance (EPA, 2022) '*that the absence of a designation or documented feature does not mean that no such feature exists within the site*'. As such, a ZoI should be identified for all features potentially occurring within the Project site, in addition to any known to occur. As recommended by CIEEM (2018), professionally accredited or published studies were used to determine ZoI for this Project.

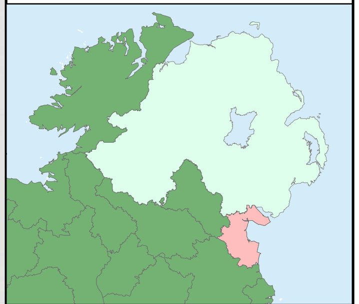
Due to a high degree of uncertainty regarding the presence of bat species within the marine environment, the ZoI is difficult to define. However, it is considered to encompass the offshore wind farm area and offshore cable corridor for commuting and foraging bats, and is predicted to extend to the onshore populations of bats in County Louth for migrating bat species (see Figure 31-1).



Legend

- Offshore Wind Farm Area
- Offshore Cable Corridor
- Study Area
- Clogherhead Survey Area

Data Sources: OWL, OSi, Gov.ie,
The United Kingdom Hydrographic Office,
The Scottish Government,
the Marine Management Organisation
Marine Atlas
Note ZoI = Zone of Influence



Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title

**Figure 31-1:
Study Area for Bats in
the Marine Environment**

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Scale: 1:2,000,000 @ A4	**Projection:** ITM (IRENET95) Geographic Co-ordinates: ETRS89
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31.4 Policy context and legislation

Planning policy on renewable energy infrastructure is presented in volume 2A, chapter 2: Policy and Legislation. This section presents planning policy that specifically relates to bats in the marine environment, which is contained in the Offshore Renewable Energy Development Plan I and II (OREDP) (Department of Energy and Climate Change (DECC), 2022) and the National Marine Planning Framework (NMPF) (Department of Housing, Local Government and Heritage (DHLGH), 2021). The OREDP and NMPF include guidance on what matters are to be considered in the assessment. These are summarised in Table 31-1 below.

In February 2023, the 'OREDP II - National Spatial Strategy for the transition to the Enduring Regime' was published in draft and subject to consultation. The key objectives of OREDP II are:

- *"Assess the resource potential for ORE in Ireland's maritime area.*
- *Provide an evidence base to facilitate the future identification of Broad Areas of Interest most suitable for the sustainable deployment of ORE in Ireland's maritime area.*
- *Identify critical gaps in marine data or knowledge and recommend prioritised actions to close these gaps."*

The OREDP II will provide an evidence base to facilitate the future identification of Broad Areas of Interest most suitable for the sustainable deployment of ORE in Ireland's maritime area, to be assessed in greater detail at regional scale. This assessment will subsequently inform the identification of more refined areas as part of the designation process for Designated Maritime Area Plans (DMAP).

When published, the OREDP II will update the original OREDP published in 2014.

The National Biodiversity Action Plan 2017-2021 (Department of Culture, Heritage and the Gaeltacht (DCHG), 2017) through its objectives recognises the shared responsibility for the conservation of biodiversity and the sustainable use of its components, by all sectors. The relevant actions, and how these have been considered in this EIAR, are summarised in Table 31-1.

Table 31-1: Summary of relevant policy framework and where it is considered in the EIAR.

Summary of relevant policy framework	How and where considered in the EIAR
Offshore Renewable Energy Development Plan (Department of Communications, Energy and Natural Resources (DCENR), 2014)	
Protected sites and species - suggested project level mitigation measures	
Impacts on protected species: several measures are suggested including careful site selection, avoiding environmental risks through design, characterising sensitive sites and species through surveys and avoiding sensitive seasons.	Volume 2A, chapter 4: Consideration of Alternatives provides details on site selection and project design. The assessment of protected species (i.e. bats) is provided in section 31.10. Appropriate mitigation measures for relevant ecological features are provided in section 31.10.3.
National Marine Planning Framework	
Biodiversity	
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	The potential effects of the construction, operational and maintenance and decommissioning phases of the Project have been assessed in section 31.10. Disturbance is assessed in section 31.10.1. Measures to avoid or minimise potential effects on bats are discussed in section 31.10.3. Potential effects on the integrity of protected sites are considered in the Natura Impact Statement (NIS).

Summary of relevant policy framework	How and where considered in the EIAR
significant adverse impacts on species adaptation or migration, or on natural native habitat connectivity.	
Biodiversity policy 2: Proposals that protect, maintain, restore and enhance the distribution and net extent of important habitats and distribution of important species 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 must avoid significant reduction in the distribution and net extent of important habitats and other habitats that important species depend on, including avoidance of activity that may result in disturbance or displacement of habitats.	
Biodiversity policy 3: Where marine or coastal natural capital assets are recognised by Government: • Proposals must seek to enhance marine or coastal natural capital assets where possible. • Proposals 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 marine or coastal natural capital assets, or d) if it is not possible to mitigate significant adverse impacts on marine or coastal natural capital assets proposals must set out the reasons for proceeding.	
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.	

31.4.1 Legislation and guidance

The assessment on offshore bats in the marine environment has considered the following legislation and conservation agreements:

- EUROBATS (1991) Agreement on the Conservation of Populations of European Bats (EUROBATS) under the Convention on the Conservation of Migratory Species (CMS);
- The European Communities (Birds and Natural Habitats) Regulations 2011, as amended (“the Habitats Regulations”); and
- The Wildlife Acts 1976 to 2021, as amended.

The assessment on bats in the marine environment has considered the following guidance:

- Bat Conservation Ireland (BCI) (2012) Wind Turbine/Wind Farm Development Bat Survey Guidelines, Version 2.8, December 2012. Bat Conservation Ireland;
- CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine, Version 1.2 - Updated April 2022;
- Reason, P.F. and Wray, S. (2023) UK Bat Mitigation Guidelines. A guide to impact assessment, mitigation and compensation for developments affecting bats. Version 1.1. Chartered Institute of Ecology and Environmental Management, Ampfield;
- Department of Housing, Planning and Local Government (DHPLG) (2019) Draft Revised Wind Energy Development Guidelines, Department of Housing, Planning and Local Government;
- European Commission (EC) (2020) Commission notice. Guidance document on wind energy developments and EU nature legislation, European Commission;

- Marnell, F., Kelleher, C. and 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;
- Natural England (2009) Bats and onshore wind turbines. Interim Guidance. Natural England Technical Information Note TIN051;
- NatureScot (2021) Bats and Onshore Wind Turbines: Survey Assessment and Mitigation. Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, the University of Exeter and Bat Conservation Trust (BCT); and
- Rodrigues, L., Bach, L., Dubourg-Savage, M.J., Karapandža, B., Kovac, D., Kervyn, T., Dekker, J., Kepel, A., Bach, P., Collins, J. and Harbusch, C., (2015) Guidelines for consideration of bats in wind farm projects: Revision 2014. UNEP/EUROBATS.

31.5 Consultation

Consultation was undertaken with BCI as part of EIA scoping in 2019, and no response was received. It is noted however that the knowledge and understanding of how bats use and exist in the marine environment is an emerging topic of interest in Ireland, and therefore it was not included as a topic when consultation on EIA scoping for the Project was undertaken in 2019.

Consultation was also undertaken with the National Parks and Wildlife Service (NPWS) as part of EIA scoping and also discussions on the Project were held in 2020 and 2021. No specific issues related to bats in the marine environment were raised as part of discussions with the NPWS. Further consultation was requested with the NPWS in 2022, however no response has been received to date.

31.6 Methodology to inform the baseline

31.6.1 Desktop study

Information on bats in the marine environment was collected through a detailed desktop review of existing guidance (see section 31.4) and literature relevant to the Project. Key literature sources are listed below:

- Ahlén, I., Bach, L. Baagøe, H.J., and Pettersson, J. (2007) Bats and offshore wind turbines studied in southern Scandinavia – Report 5571. Swedish Environmental Protection Agency;
- Ahlén, N.I., Baagoe, H.J. and Bach, L., (2009) Behaviour of Scandinavian bats during migration and foraging at sea. J. Mammal. 90(6), pp. 1318-1323;
- BCI (2006) Irish Bat Monitoring Programme, Proposals and Recommendations for a Pilot Daubenton's Bat Waterway Survey, Final Report;
- BCT (2009) Determining the Potential Ecological Impact of Wind Turbines on Bat Populations in Britain, University of Bristol and Bat Conservation Trust;
- BSG Ecology (2014a) Pembroke Islands Bat Report;
- BSG Ecology (2014b) North Sea Ferries Bat Migration Research Report;
- Carden, R., Aughney, T., Kelleher, C. and Roche, N. (2010) Irish Bat Monitoring Schemes; BATLAS Republic of Ireland Report for 2008-2009. Bat Conservation Ireland;
- Hutterer, R., Ivanova, T., Meyer-Cords, C. and Rodrigues, L. (2005) Bat Migrations in Europe. A Review of Banding Data and Literature. Naturschutz und BiologischeViefalt 28. Federal Agency for Nature Conservation, Bonn;
- 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;
- Lagerveld, S., Poerink, B.J., Haselager, R. and Verdaat, H. (2014). Bats in Dutch offshore wind farms in autumn 2012. Lutra. 57. 61-69;

- 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 & Research centre), Wageningen Marine Research report C090/17; 52 p;
- NPWS (2016) Updating the distribution and status of the Nathusius pipistrelle (*Pipistrellus nathusii*) in Ireland: Final Report;
- Roche, N., Langton, S. and Aughney, T. (2012) Car-based bat monitoring in Ireland 2003-2011. Irish Wildlife Manuals, No. 60. National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Ireland;
- Rodrigues, L., Bach, L., Dubourg-Savage, M.J., Karapandža, B., Kovac, D., Kervyn, T., Dekker, J., Kepel, A., Bach, P., Collins, J. and Harbusch, C., (2015) Guidelines for consideration of bats in wind farm projects: Revision 2014. UNEP/EUROBATS; and
- Rydell, J., Bach, L. Dubourg-Savage, M.-J., Green, M., Rodrigues, L. and Hedenström, A. (2010) Bat mortality at wind turbines in north-western Europe. Acta Chiropterologica 12 (2): 261 – 274.

31.6.2 Site specific surveys

As detailed under section 31.1, data collected between May and August 2022 adjacent to the Project (see appendix: 31-1: Offshore Bat Survey Technical Report) has been used to inform the assessment on bat commuting and foraging (i.e. bat activity) in the context of the Project. The Clogherhead offshore bat survey area 2022 shares a boundary with the Oriel offshore wind farm area, overlapping for an area of approximately 28.9 ha. The offshore cable corridor is located approximately 2 km north of the Clogherhead offshore bat survey area. The deployment method and data results are provided in appendix 31-1: Offshore Bat Survey Technical Report.

31.7 Baseline environment

31.7.1 Resident bat species

All native bat species receive strict legal protection under the EU Habitats Directive (92/43/EEC); which is transposed into domestic legislation in Ireland via the European Communities (Birds and Natural Habitats Regulations 2011 (as amended). In addition, all native bat species and their roosts are also protected under domestic legislation via the Wildlife Act 1976 and subsequent amendments (see section 31.4).

This section provides an overview of the known ecology of the species resident in Ireland and, based on the desk-based evidence available, considers the likelihood of these species foraging or migrating offshore.

There are a total of nine bat species in two families confirmed as resident in Ireland with two vagrant/migratory species. Several of these species such as the common and soprano pipistrelles are widespread and common in Ireland; while others such as the lesser horseshoe bat are rare and restricted in distribution (Pickett *et al.,* 2019). Outside of Ireland, many of these species are known to be migratory, particularly in continental Europe where more northerly breeding species migrate southwards during the autumn and return north in the spring (BCI, 2022).

While it is understood that some bat species undertake seasonal migrations within Ireland, due to a lack of scientific studies, the bat migration patterns within and to/from Ireland are not understood or significantly researched. BCI have records of Brandt's bat (*Myotis brandti*) and the greater horseshoe bat (*Rhinolophus ferrumequinum*) in Ireland, and neither are considered resident species. The Brandt's bat was recorded in Co. Wicklow in 2003 and the greater horseshoe bat in Co. Wexford in 2013. Both species are likely to be vagrants since there is no evidence of additional specimens or resident populations of either species in Ireland, or no evidence of regular migrations to Ireland by these species.

There is currently no published empirical evidence of offshore bat activity (e.g. migration, commuting, foraging) within Irish marine waters. This is due to an absence of survey data being gathered rather than empirical evidence that such activity does not occur. Within the wider European context, there is increasing evidence of offshore bat activity (Lagerveld *et al*., 2014, 2021). Certain species, such as Nathusius' pipistrelle (*Pipistrellus nathusii*) (NPWS, 2016) and Leisler's bat (*Nyctalus leisleri*) (McAney, 2006) are known to be migratory outside of Ireland; with migrations of 800 to 1,950 km between summer and hibernation sites being recorded, including long-distance migration by certain species (e.g. between continental Europe and the UK) (Russ *et al*., 2001; Russ, 2014; Ahlén *et al.*, 2007).

In a study completed in the southern North Sea, most offshore bat activity occurred during nights with low wind speeds, high atmospheric pressure and no rain (Limpens *et al.*, 2017). Other studies have also shown that bats wait for favourable weather conditions before migrating over sea (Ahlén *et al.*, 2007, 2009). With respect to foraging, studies have shown that bats do forage offshore, particularly in areas with an abundance of insects in the air and crustaceans in the surface waters (Ahlén *et al.*, 2009). The study by Ahlén *et al.* (2009) observed bats regularly foraging at a group of wind turbines 5.8 km offshore.

Common pipistrelle (*Pipistrellus pipistrellus*)

Common pipistrelle is the most abundant and widespread bat species in Ireland (BCI, no date)[1], and is of favourable conservation status (NPWS, 2019). Roosts occur in both natural (e.g. trees) and built (e.g. buildings) structures and the species is generally low flying. The species is not thought to be a long-distance migrant, although they will undertake regular seasonal movements between summer and winter roosts of several hundred km (BSG Ecology, 2014b).

In an Irish context, currently there is no evidence of the species being found offshore. In a European context, no common pipistrelles have been reported at offshore platforms in the Dutch sector of the North Sea indicating that they may not be regular migrants far offshore, but they have been recorded at offshore wind farms in Sweden up to 10 km from the coast (Ahlén *et al*., 2007; Boshamer and Bekker, 2008).

Additionally, in the UK it has been noted that the common pipistrelle is the second most frequently recorded species to be impacted by onshore wind farms (Jones *et al*., 2009). Details of bat sensitivity and risk from wind turbines (see section 31.7.2) based on guidance developed by NatureScot (2021) for onshore wind farms, and collision risk based on Jones *et al*. (2009) have reported this species as being a regional migrant and is considered to be at high risk of collision from onshore turbines.

In the North Sea the common pipistrelle has been frequently encountered in recent studies. Most of the recordings have been noted as occurring during the migratory seasons – late March to June and late August to October (Largerveld *et al.,* 2021). The longest recorded migrations of this species have been up to approximately 1,100 km.

Soprano pipistrelle (*Pipistrellus pygmaeus*)

The soprano pipistrelle is also an abundant and widespread species of bat in Ireland[1], and is of favourable conservation status (NPWS, 2019). Roosts occur in both natural (e.g. trees) and built (e.g. buildings) structures and the species is also generally low flying. Little is known about soprano pipistrelle as this species was split from common pipistrelle after the publication of Hutterer *et al*. (2005) and there is very little data for this species in Europe.

There is no evidence of the species being found offshore in Ireland. The soprano pipistrelle is not known to be a migratory species in the UK and there have been no records from offshore platforms. However, studies undertaken in Sweden found it to occur regularly at the offshore turbines (up to 10 km from the coast) where it was thought to be a migrant (Ahlén *et al*., 2007).

Details of bat sensitivity and risk from wind turbines (see section 31.7.2) based on guidance developed by NatureScot (2021) for onshore wind farms and collision risk based on Jones *et al*. (2009) have reported this species to be at high risk of collision from onshore turbines. The migratory status of soprano pipistrelle is currently unknown (i.e. long distance migrant, regional migrant or sedentary species), however studies suggest soprano pipistrelle is migratory at the Baltic Sea coast (Lindecke *et al.,* 2019).

The longest recorded migrations of this species are unknown.

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[1] Bat Conservation Ireland Website , Irish Bat Species. Available at: https://www.batconservationireland.org/irish-bats/species. Accessed September 2023.

Nathusius' pipistrelle (*Pipistrellus nathusii*)

Nathusius' pipistrelle has been recorded in a number of counties in the Republic of Ireland and small roosts have been found here but it has not yet been confirmed breeding. This bat is of favourable conservation status (NPWS, 2019) and has similar features to the two other pipistrelles so it is possible that it has been under-recorded in roosts, or the Irish population may be recent in origin[1]. A recent origin would indicate movement from the UK and/or continental Europe. The Nathusius' pipistrelle often forages over water[1].

The species is migratory in Europe with migrations of more than 2,486 km being recorded between summer and winter sites (Vasenkov *et al*., 2022). It is not known whether the Irish population migrates within or from Ireland to the UK and/or continental Europe; although there is evidence that Nathusius' pipistrelle bats migrate from Britain to continental Europe[1]. Also, given that there is the potential that the Irish population may be of recent origin would also indicate tendency for species migration to and from Ireland.

Nathusius' pipistrelle is a highly migratory species and is one of the most frequently recorded bats from North Sea platforms and offshore islands (e.g. Shetland). Out of 34 bats reported from North Sea platforms located in the Dutch sector between 1988 and 2007, 26 (76%) were of this species (Boshamer and Bekker, 2008; Russ *et al*., 2001). In addition, it was one of the most common species recorded offshore in the southern North Sea (Limpens *et al.*, 2017; BSG Ecology, 2014b)

According to guidance developed by Natural England (2009) for onshore wind farms, this species is reported as the third most frequently recorded species killed by onshore wind farms in Europe and is considered one of three UK resident species to be at particular risk from onshore turbines. Details of bat sensitivity and risk from wind turbines (see section 31.7.2) based on guidance developed by NatureScot (2021) for onshore wind farms and collision risk based on Jones *et al.* (2009) have reported this species as being a long distance migrant and is considered to be at high risk of collision from onshore turbines.

In 2016, Gemini Offshore Wind Park off the coast of the Netherlands conducted a bat monitoring campaign and Wageningen Marine Research executed a bat monitoring programme at Wintershall platform P6-A and offshore research station FINO3 (Lagerveld *et al*., 2017). This joint monitoring effort studied 12 different offshore locations and five locations at the coast, and bat activity was monitored with ultrasonic recorders. The results illustrated Nathusius' pipistrelle as a very common species along the coast during spring and autumn migrations, with regular occurrences throughout the summer. This species was also most frequently observed offshore, however in noticeably lower frequencies than at the coast. Offshore, Nathusius' pipistrelle was recorded from late August until late October and to a lesser extent from early April until the end of June, matching observation patterns of previous studies in the German and Dutch North Sea and the Belgian North Sea (Degraer *et al*., 2018; Lagerveld *et al*., 2017).

Monitoring for bats in the Belgian North Sea (C Power, approximately 27 km offshore) was conducted by Brabant *et al*. (2019), where four detectors were placed in the nacelle of the turbine (at 93 m above sea-level) and seven attached to the transition piece (16 m above sea level). Bats were recorded during the study period from late August to late November with activity noted to have peaked in the latter half of September (63% of all calls recorded) and was considerably less in October and November. All detections were of Nathusius' pipistrelle. While most longer recordings were categorised as transiting behaviour, approximately a quarter of longer recordings included search calls (possibly indicating simultaneous transit and looking for prey), with a lesser number described as intensive exploratory behaviour and/or feeding buzzes.

The migration distance for this species is understood to be around 29 to 48 km per night on mainland Europe, although some can fly up to 80 km per night (Boshamer and Bekker, 2008).

Leisler's bat (*Nyctalus leisleri*)

Leisler's bat is relatively common in Ireland but is considered 'rare' throughout most of Britain and the rest of Europe. For this reason, the Irish population of Leisler's bat is considered of International Importance[1]. Leisler's are of favourable conservation status in Ireland (NPWS, 2019), and are relatively large bats capable of flying long distances at speeds of up to 40 km/h when commuting or foraging (BSG Ecology, 2014a).

In Ireland, there is no evidence of offshore activity by this species. However, in continental Europe, where Leisler's bats occur, they are known to be long distance migrants and the species has been recorded from offshore installations and islands in the North Sea and is therefore likely to occur, at least occasionally, as a migrant across the North Sea (Boshamer and Bekker, 2008; Racey *et al*., 2004).

The Environmental Statement carried out for Neart na Gaoithe Offshore Wind Farm (Mainstream Renewable Power, 2018), also discusses Leisler's bat sensitivity based on guidance developed by Natural England for onshore wind farms. Several potential effect pathways are discussed, including ultrasound emissions and collision with rotors (including barotrauma). The report states that Jones *et al*. (2009) identified the Leisler's at risk of disturbance from ultrasounds emitted by the wind turbines.

Leisler's bats have been occasionally recorded in small numbers in the southern North Sea. The seasonal pattern of records is consistent with the species' seasonal migration patterns (Lagerveld *et al., 2013,* 2021).

Details of bat sensitivity and risk from wind turbines (see section 31.7.2) based on guidance developed by NatureScot (2021) for onshore wind farms and collision risk based on Jones *et al.* (2009) have reported this species as being a long distance migrant and is considered to be at high risk of collision from onshore turbines.

The longest recorded migrations of this species have been up to approximately 1,500 km.

Brown long-eared bat (*Plecotus auritus*)

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. This species is of favourable conservation status (NPWS, 2019) and typically roosts in built structures and is strongly associated with woodlands. This species tends not to forage over open areas[1].

There has been one reported sighting of a brown long-eared bat from North Sea platforms and the species has been reported from lighthouses and lightships in the North Sea. Therefore, there may be some migration of brown long-eared bats across the North Sea (Boshamer and Bekker, 2008; Racey *et al*., 2004). There have been three reported fatalities of brown long-eared bats from onshore turbines in Europe.

Details of bat sensitivity and risk from wind turbines (see section 31.7.2) based on guidance developed by NatureScot (2021) for onshore wind farms and collision risk based on Jones *et al.* (2009) have reported this species as being a sedentary species and is considered to be at low risk of collision from onshore turbines.

The longest recorded migrations of this species have been up to 90 km.

Daubenton's bat (*Myotis daubentonii*)

Daubenton's Bat has a widespread distribution throughout Western Europe, including Ireland and the UK (although absent from northern Scotland) and southern Scandinavia to Spain (Harris and Yalden, 2008). This species is of favourable conservation status in Ireland (NPWS, 2019) and primarily occurs close to freshwater rivers and lakes and can forage up to 10 km from roosts. They typically forage very close to the water flying within 30 cm of the water surface (BCI, 2006). This species is considered to be at lower risk of impacts from onshore wind farms (Natural England, 2009).

There is no evidence of this species being active offshore in Ireland. However, migrant Daubenton's bats were one of the most frequently recorded bats offshore during the studies undertaken in the Kalmar Sound in Sweden although, they have not been reported at offshore platforms in the North Sea (Ahlén *et al*., 2007). Daubenton's bats are not considered to be long-distance migrants (Jones *et al*., 2009); however, they may be regional migrants and therefore occur offshore.

In 2016, Gemini Offshore Wind Park, off the coast of the Netherlands, conducted a bat monitoring campaign and Wageningen Marine Research executed a bat monitoring programme at Wintershall platform P6-A and offshore research station FINO3 (Lagerveld *et al*., 2017). This joint monitoring effort studied 12 different offshore locations and five locations at the coast, and bat activity was monitored with ultrasonic recorders. The results indicated some occasional records of Daubenton's bats at the coast (Lagerveld *et al*., 2017). In Scotland, a fixed-point study in the coastal waters of Argyll, western Scotland noted that during the survey period between April and October 2019 the detection of Daubenton's bat was noted as very rare in these coastal regions (Benjamins, 2020).

Details of bat sensitivity and risk from wind turbines (see section 31.7.2) based on guidance developed by NatureScot (2021) for onshore wind farms and collision risk based on Jones *et al.* (2009) have reported this species as being a regional migrant and is considered to be at low risk of collision from onshore turbines.

The longest recorded migrations of this species have been up to approximately 300 km.

Whiskered bat (*Myotis mystacinus*)

Although the whiskered bat is widely distributed throughout Ireland, there are relatively few records and are considered one of Irelands' rarer bats. It is of favourable conservation status in Ireland (NPWS, 2019) and occurs throughout Europe but is absent from northern Scotland and most of Denmark (McAney, 2006). Due to the difficulty in distinguishing *Myotis* species in the field, little is known about the flight or foraging behaviour of whiskered bat (McAney, 2006).

There is no evidence of this species being active offshore in Ireland and whiskered bats are not thought to be strongly migratory and there have been no records of this species from offshore North Sea platforms (Ahlén *et al*., 2007; Boshammer and Bekker, 2008; Racey *et al*., 2004). There is only one recorded fatality of this species caused by turbines from onshore wind farms across Europe (Jones *et al*., 2009).

Details of bat sensitivity and risk from wind turbines (see section 31.7.2) based on guidance developed by NatureScot (2021) for onshore wind farms and collision risk based on Jones *et al.* (2009) have reported this species as being a regional migrant and is considered to be at low risk of collision from onshore turbines.

The longest recorded migrations of this species have been up to approximately 625 km.

Natterer's bat (*Myotis nattereri*)

One of the rarer Irish bat species, the Natterer's bat likes woodland, mature hedgerow and pasture habitats[1]. Although this species is widely distributed throughout Ireland, it is one of the least recorded bat species. The species is of favourable conservation status in Ireland (NPWS, 2019) and occurs throughout Europe (McAney, 2006).

There is no evidence of this species being active offshore in Ireland and the species has not been recorded from North Sea platforms or from offshore islands in Europe. Details of bat sensitivity and risk from wind turbines (see section 31.7.2) based on guidance developed by NatureScot (2021) for onshore wind farms and collision risk based on Jones *et al*. (2009) have reported this species as being a sedentary species and is considered to be at low risk of collision from onshore turbines. It is thought that this species does not undertake extensive migrations and is therefore unlikely to be encountered offshore (Jones *et al*., 2009).

The longest recorded migrations of this species have been up to approximately 327 km.

Lesser horseshoe bat (*Rhinolophus hipposideros*)

The range of the lesser horseshoe bat in Ireland is, for the most part, limited to six western counties – Clare, Cork, Galway, Kerry, Limerick and Mayo[1]. This species is of inadequate conservation status (NPWS, 2019). The Irish population of this species is considered of International Importance because it has declined dramatically and become extinct in many other parts of Europe. In the UK, this species is also rare but is widespread across the southwest of England and much of Wales (BCT, 2010).

Details of bat sensitivity and risk from wind turbines (see section 31.7.2) based on guidance developed by NatureScot (2021) for onshore wind farms and collision risk based on Jones *et al*. (2009) have reported this species as being a sedentary species, of low population vulnerability and is considered to be at low risk of collision from onshore turbines.

There is no evidence of this species being active offshore in Ireland and there are no reports of this species from any North Sea installations or islands. It is a species considered to be largely sedentary and one that does not undertake extensive migrations (Jones *et al*., 2009). It is therefore unlikely that lesser horseshoe bats will occur offshore on the east coast.

31.7.2 Bat species sensitivity

Table 31-2 identifies resident Irish bat species 'at risk' from offshore wind turbines based on species sensitivity assessment related to onshore turbines, and a review of the evidence for their likely occurrence in the offshore wind farm area which was evaluated based on desktop literature reviews.

Table 31-2: Bat species sensitivity criteria (onshore) and potential collision risk (offshore) based on species autecology and distribution (adapted from Hutterer *et al*., 2005; Jones *et al*., 2009; NatureScot, 2021).

Species	Migration (Jones *et al*., 2009)	Risk from Onshore Turbines (NatureScot, 2021)	Recorded offshore in the North Sea
Common pipistrelle	Regional migrant	High	No
Soprano pipistrelle	Unknown	High	No
Nathusius' pipistrelle	Long distance	High	Yes
Leisler's bat	Long distance	High	Yes
Brown long-eared bat	Sedentary	High	Yes
Daubenton's bat	Regional migrant	Low	Yes
Whiskered bat	Regional migrant	Low	No
Natterer's bat	Sedentary	Low	No
Lesser horseshoe bat	Sedentary	Low	No

31.7.3 Data capture

Based on the results provided in appendix 31-1: Offshore Bat Survey Technical Report, no bats were recorded commuting or foraging for the duration of bat detector deployment between May and August 2022. Bat activity was recorded only when the vessel was alongside or anchored outside Dun Laoghaire harbour.

Being mindful of the limitations of the survey (summer period only- which is outside the migratory period (April and September to October for bats)), this does not indicate that there is no such bat activity offshore, but rather that such activity in the vicinity of the vessel at the time of survey, which coincides with the period when bats are most active (breeding season- late May to early August – Marnell *et al.,* 2022), appears to be low.

31.7.4 Important Ecological Features (IEF)

Having defined the relevant baseline conditions within the ZoI of the Project, ecological features therein are valued, in advance of commencing the assessment of potential impacts.

The methodology used to value ecological features takes cognisance of the relevant principles underpinning impact assessment under the EPA (2022) guidelines and CIEEM (2018); however, it also has regard for the geographic frames of reference outlined by the National Roads Authority (NRA) (2009). The geographic frames of reference outlined by the NRA (2009) are employed in this chapter.

It is possible that features which are in and of themselves of negligible ecological value (e.g. improved grassland of negligible floristic value) may be of high value in the resource they provide to other features (e.g. a significant resource of invertebrates breeding in the grasslands, which are an important food for local badgers). In some cases, therefore, habitats and species of negligible value may nevertheless be considered of greater importance due to their value to protected species.

'Important Ecological Features' (IEF), as termed in CIEEM (2018), are defined here as those ecological features which are valued at Local Importance (Higher Value) or above (NRA, 2009; see appendix 19-1: Onshore Biodiversity - Supporting Information). Ecological features below this value are not carried forward to impact assessment.

Based on the literature review undertaken in section 31.7.1 and the data capture provided in section 31.7.3 (see appendix 31-1: Offshore Bat Survey Technical Report), Table 31-3 summarises the resident bat species in Ireland identified as IEFs which have been scoped into the assessment of significance. The identification of IEFs is based on their ecological evaluation (i.e. whether they are considered important ecological features to be scoped into impact assessment) combined with whether or not they are at risk of significant negative impact from the Project.

Table 31-3: Summary valuation of bat species and identification of species scoped for impact assessment.

Bat Species	Highest Ecological Valuation within ZoI of the Project	At Risk of Potential Significant Negative Impact	IEFs (Scoped into Impact Assessment)
Common pipistrelle (*Pipistrellus pipistrellus*)	International (Annex IV of the EU Habitats Directive)	**Bat commuting and foraging** • No. Bat activity was not recorded offshore (see section 31.7.3). **Bat migration** • Yes. This regional migrant has been recorded offshore in the North Sea, and it is considered to be at high risk of impacts from wind turbines (see section 31.7.2).	**Yes** (migration only)
Soprano pipistrelle (*Pipistrellus pygmaeus*)	International (Annex IV of the EU Habitats Directive)	**Bat commuting and foraging** • No. Bat activity was not recorded offshore (see section 31.7.3). **Bat migration** • Yes. This species has been recorded offshore in the North Sea, and is considered to be at high risk of impacts from wind turbines (see section 31.7.2).	**Yes** (migration only)
Nathusius' pipistrelle (*Pipistrellus nathusii*)	International (Annex IV of the EU Habitats Directive)	**Bat commuting and foraging** • No. Bat activity was not recorded offshore (see section 31.7.3). **Bat migration** • Yes. This long distance migrant has been frequently recorded offshore in continental Europe and the UK, and is considered to be at high risk of impacts from wind turbines (see section 31.7.2).	**Yes** (migration only)
Leisler's bat (*Nyctalus leisleri*)	International (Annex IV of the EU Habitats Directive)	**Bat commuting and foraging** • No. Bat activity was not recorded offshore (see section 31.7.3). **Bat migration** • Yes. This long distance migrant has been recorded offshore in continental Europe and the North Sea, and is considered to be at high risk of impacts from wind turbines (see section 31.7.2).	**Yes** (migration only)
Brown long-eared bat (*Plecotus auritus*)	International (Annex IV of the EU Habitats Directive)	**Bat commuting and foraging** • No. Bat activity was not recorded offshore (see section 31.7.3). **Bat migration** • Yes. This sedentary species has been recorded offshore in the North Sea, and is considered to be at low risk from wind turbines (see section 31.7.2).	**Yes** (migration only)
Daubenton's bat (*Myotis daubentonii*)	International (Annex IV of the EU Habitats Directive)	**Bat commuting and foraging** • No. Bat activity was not recorded offshore (see section 31.7.3). **Bat migration** • Yes. This regional migrant has been recorded offshore in the North Sea, however, it is considered to be at low	**Yes** (migration only)

Bat Species	Highest Ecological Valuation within ZoI of the Project	At Risk of Potential Significant Negative Impact	IEFs (Scoped into Impact Assessment)
		risk of impacts from wind turbines (see section 31.7.2).	
Whiskered bat (*Myotis mystacinus*)	International (Annex IV of the EU Habitats Directive)	**Bat commuting and foraging** • No. Bat activity was not recorded offshore (see section 31.7.3). **Bat migration** • No. This regional migrant has not been recorded offshore, and is considered to be at low risk from wind turbines (see section 31.7.2).	No
Natterer's bat (*Myotis nattereri*)	International (Annex IV of the EU Habitats Directive)	**Bat commuting and foraging** • No. Bat activity was not recorded offshore (see section 31.7.3). **Bat migration** • No. This sedentary species has not been recorded offshore, and is considered to be at low risk from wind turbines (see section 31.7.2).	No
Lesser horseshoe bat (*Rhinolophus hipposideros*)	International (Annex II of the EU Habitats Directive)	**Bat commuting and foraging** • No. Bat activity was not recorded offshore (see section 31.7.3). **Bat migration** • No. This sedentary species has not been recorded offshore, and is considered to be at low risk from wind turbines (see section 31.7.2).	No

Based on known bat migratory behaviour, their reported occurrence offshore and also taking into account species sensitivity to onshore wind farms, the following species of Irish bats have been identified as being at possible risk of impact from wind turbine operation within the Project:

- Common pipistrelle;
- Soprano pipistrelle;
- Nathusius' pipistrelle;
- Leisler's bat;
- Brown long-eared bat; and
- Daubenton's bat.

The remaining bat species - whiskered bat, Natterer's bat and lesser horseshoe bat have been excluded from further assessment based on the desk study findings (section 31.7) that these species have not been recorded offshore in the North Sea and are at low risk of impacts from onshore turbines (NatureScot, 2021).

31.7.5 Data validity and limitations

Desk study

Due to the limited amount of information regarding offshore bat activity in Ireland or between Ireland and the UK/Europe, the desk-based literature review has drawn significantly on evidence from the UK/Europe; particularly relating to offshore activities in the North Sea and Scandinavia. The limited amount of information available specific to Ireland is not an indication that offshore bat activity does not occur but rather that limited survey and research has been completed to date to determine and characterise such activity.

This is not unique to Ireland as recent EC guidance (EC, 2020) notes that there are considerable challenges and uncertainties with respect to the offshore environment and bats. These challenges include a lack of empirical data on offshore migratory flight activity and limited empirical data regarding at-sea collisions and barotrauma.

Sources of desk study information are neither exhaustive nor necessarily easily available, and an extensive effort was made to obtain ecological data in the public domain to inform the description of the baseline environment and its assessment. Additional information, not in the public domain, is likely to exist, but could not be obtained or assessed here.

These desk study limitations are acknowledged and the precautional principle has been applied to the subsequent assessments. This limitation is not deemed to affect the certainty or predictability of the assessment.

Field study

Data collection for offshore bat migration within the offshore wind farm area has not been undertaken. However, the Applicant has obtained survey data close to the Project. Although the data obtained does not overlap with the Project it was collected in an area directly adjacent to and in close proximity to the Project, and is considered to provide a representative baseline for the Project.

Currently, there are no standard survey methods in Ireland or internationally for characterising offshore bat activity which can be implemented; however, existing United Nations Environment Programme (UNEP) guidelines recommend surveying offshore wind turbines in the same manner as land-based turbines (Rodrigues *et. al.,* 2015). The data was collected in 2022 and is considered recent and up to date to inform this assessment and in line with the CIEEM (2019) advice note for data validity (see appendix 31-1: Offshore Bat Survey Technical Report).

The survey data obtained is provided in appendix 31-1: Offshore Bat Survey Technical Report. The data collection (appendix 31-1: Offshore Bat Survey Technical Report) was completed between 26 May 2022 and 10 August 2022. In the event that seasonal migration does occur between Ireland and UK/Europe, the survey was completed outside of the typical window (Spring or Autumn) where such migration may be evident. It should be noted, however, that bats are generally active in Ireland between April to October (Marnell *et al*., 2022) and therefore the survey was undertaken during the season when bats are most active. Some limitations were also noted in relation to survey methodology and these are detailed in appendix 31-1: Offshore Bat Survey Technical Report.

31.8 Key parameters for assessment

31.8.1 Project design parameters

The project description is provided in volume 2A, chapter 5: Project Description. Table 31-4 outlines the project design parameters that have been used to inform the assessment of potential impacts on migrating bats (see Table 31-3) during the construction, operational and maintenance and decommissioning phases of the Project.

In respect of collision with rotors, due to the limited data available on bat flight behaviour (i.e. flight heights), should the final lower blade tip height be greater than 27 m (e.g. 28 m), the assessment and significance of effects outlined in section 31.10 would not change.

Table 31-4: Project design parameters considered for the assessment of potential impacts on migrating bats in the marine environment.

Potential impact	Phase[1]			Project design parameters
	C	O	D	
Disturbance/ ultrasonic emission interference (i.e. interference with echolocation signal)	✗	✓	✗	Presence of 25 x Wind Turbine Generators (WTG) within the offshore wind farm area
Injury and/or death (i.e. barotrauma (rapid atmospheric pressure	✗	✓	✗	Presence of 25 x WTGs within the offshore wind farm area:

Potential impact	Phase[1] C	O	D	Project design parameters
fluctuations) and collision with rotors)				• Hub height 145 to 152 m above Lowest Astronomical Tide (LAT); • Lower blade tip height of 27 m above LAT; • Upper blade tip height of 270 m above LAT; • Rotor diameter of 236 m; • Cut-in wind speed of 2.6 m/s; • Electricity generation at 13 to 16 m/s which will reach nominal power output with approximately 8 rotor rotations per minute; • At 25 m/s the wind turbine output starts to decrease gradually towards zero; and • The cut-out wind speed depends on WTG type and is between 28 and 35 m/s.

1 C= Construction, O = Operation, D = Decommissioning

31.8.2 Measures included in the Project

No measures included in the Project in relation to bats in the marine environment have been proposed.

31.8.3 Impacts scoped out of the assessment

On the basis of the baseline environment and the project description outlined in volume 2A, chapter 5: Project Description, a number of impacts are proposed to be scoped out of the assessment for migrating bats in the marine environment. These impacts are outlined, together with a justification for the scoping out decision, in Table 31-5.

Table 31-5: Impacts scoped out of the assessment for migrating bats in the marine environment.

Potential impact	Justification
Disturbance from lighting	**Construction/decommissioning phase** During the construction and decommissioning phases, lighting is largely related to temporary buoys used to demarcate the construction area and vessels/machinery used to undertake the construction activities. During migration periods, lighting associated with vessels and machinery during construction activities may give rise to potential impacts, however owing to the temporary nature of the construction activities (i.e. 15 months) disturbance impacts on migrating bats is not considered to have any foreseeable significant effects and has been scoped out from further assessment. **Operational and maintenance phase** During the operational and maintenance phase, lighting is largely related to navigational marine aids, safe air traffic and the operation of the offshore substation. There is limited information on the risk to bats from lighting associated with offshore wind turbines, and the sensitivity/tolerance of various species to such effects. Lighting during the operational and maintenance phase includes both continuous lighting (offshore substation) and synchronised momentary flashes (i.e. strobe-like lights) (wind turbines). It is known in general that bats avoid artificial lighting (Boshammer and Bekker, 2008), and the impact of effects may be more or less damaging depending on the landscape (Mathews *et al.,* 2015). For example, light in open areas such as the offshore environment may be less damaging than the lighting of woodland due to 'edge effects'[2] (Matthews *et al.,* 2015). Preliminary evidence also suggests that there is no significant statistical difference between fatalities at lit and unlit offshore turbines (Bennet and Hale, 2014).

[2] Edge effects relate to the potential impact of, in this case – lighting, being controlled by its position within the landscape. For example, as woodland habitats often have boundaries, effects of lighting can often be more damaging, limiting the movement and foraging behaviour of light-sensitive species. However, as the offshore environment is very open and boundaries are not a limitation, effects of lighting may be less damaging as light-sensitive species have greater opportunity (and space available) to avoid such impacts.

Potential impact	Justification
	Lighting is not considered to have any foreseeable significant effects causing disturbance to migrating bats in the marine environment and has been scoped out from further assessment.
Provision of roosting	There is potential for offshore migrating bats to use the wind turbine hub and nacelle to seek shelter. The offshore substation could also potentially be suitable for roosting for migrating bats, however in relation to wind turbines the likelihood that migrating bats use them for roosting purposes can be directly correlated with the casualty risk (Ahlén *et al*., 2007). The provision of roosting, albeit positive if it were to occur, is not considered likely nor is it considered likely to occur in significant numbers based on the rotor blade acting as a barrier for access to the turbine hub and nacelle, and the known potential effects of barotrauma causing injury and/or death (note: other risks are also possible such as exposure to high voltage). For this reason, the provision of roosting provided by the Project has been scoped out from further assessment.
Provision of foraging resource and prey distribution	Invertebrates are believed to be attracted to the heat of the nacelle of wind turbines, lighting sources, and perhaps the prominence of these features in the landscape (Horn *et al.,* 2008; Trieb, 2018; Reimer *et al.,* 2018). Invertebrates may fly offshore, already occur offshore such as crustaceans on the water surface or drift offshore due to changes in winds (Ahlén *et al.,* 2009). The presence of invertebrates are generally known to be higher during the spring and summer months, whilst other invertebrates such as offshore crustaceans can occur all year round. Little evidence is available on the feeding-attraction hypothesis of migrating bats and invertebrates. One study by Ahlén *et al.* (2009) in Scandinavia recorded offshore bat echolocation calls between June and October, whereby migrating echolocation calls could be defined as migrating (or commuting) flight without foraging behaviour (i.e. feeding buzz). Other studies (Lagerveld *et al.,* 2021) suggest that the presence of invertebrates offshore are used as a direct foraging resource to fuel migratory flights, and enable the "fly-and-forage" strategy (Suba *et al.,* 2012). Contrary to this, studies further afield in Canada showed that bat attraction to invertebrates at nacelle height did not differ to the proportion of bat recorded at ground level, further suggesting that foraging activity by migrating bats is not a direct result of attraction to invertebrates (Reimer *et al.,* 2018). Overall, it is possible that migrating bats are attracted to offshore invertebrates that may congregate around offshore wind turbines, but the evidence of this within published literature is variable. The provision of offshore wind turbines as a foraging resource, potentially altering prey distribution is considered unlikely and is not considered to have any foreseeable significant effects. Therefore it has been scoped out from further assessment.

31.9 Impact assessment methodology

31.9.1 Overview

For the purposes of this impact assessment process on bats in the marine environment, the CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine, Version 1.2- Updated April 2022 (CIEEM, 2018) have been used for the basis of the assessment. The process takes cognisance of the EPA (2022) guidelines and incorporates NRA (2009) guidelines for the ecological valuation and geographic context.

31.9.2 Ecological impact assessment process

The impact assessment process, as described by CIEEM (2018), involved:

- Identifying and characterising impacts and their effects;
- Incorporating measures to avoid and mitigate negative impacts and effects;
- Assessing the significance of any residual effects after mitigation;
- Identifying appropriate compensation measures to offset significant residual effects; and
- Identifying opportunities for ecological enhancement.

The assessment comprises the review of the baseline data gathered and the identification of IEFs with features valued on the basis of available information/guidance and using professional ecological judgement.

31.9.3 Impact assessment criteria

Impact on IEFs are characterised with the following qualitative terms, as relevant (CIEEM, 2018):

- **Positive or Negative (adverse)**. Positive and negative (adverse) impacts and effects were determined according to whether the change is in accordance with nature conservation objectives and policy:
  - Positive – a change that improves the quality of the environment (e.g. by increasing species diversity, extending habitat or improving water quality). This may also include halting or slowing an existing decline in the quality of the environment.
  - Negative (adverse) – a change which reduces the quality of the environment (e.g. destruction of habitat, removal of foraging habitat, habitat fragmentation, pollution).
- **Extent**. The extent is the spatial or geographical area over which the impact/effect may occur under a suitably representative range of conditions (e.g. noise transmission under water);
- **Magnitude**. Magnitude refers to size, amount, intensity and volume. It was quantified if possible and expressed in absolute or relative terms (e.g. the amount of habitat lost, percentage change to habitat area, percentage decline in a species population);
- **Duration**. Duration was defined in relation to ecological characteristics (such as the lifecycle of a species) as well as human timeframes. For example, five years, which might seem short-term in the human context or that of other long-lived species, would span at least five generations of some invertebrate species;
- **Frequency and Timing**. The number of times an activity occurs will influence the resulting effect. For example, a single person walking a dog will have very limited impact on nearby waders using wetland habitat, but numerous walkers will subject the waders to frequent disturbance and could affect feeding success, leading to displacement of the birds and knock-on effects on their ability to survive. The timing of an activity or change may result in an impact if it coincides with critical life-stages or seasons (e.g. bird nesting season); and
- **Reversibility**. An irreversible effect is one from which recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it. A reversible effect is one from which spontaneous recovery is possible or which may be counteracted by mitigation.

There may be any number of possible impacts on IEFs arising from a project. However, it is only necessary to describe in detail the impacts that are likely to be significant. Impacts that are either unlikely to occur, or if they did occur are unlikely to be significant, are scoped out. If in doubt, the precautionary principle is applied, and the potential impact will be assessed.

When assessing the significance of an effect and for the purposes of this assessment, the significance of an effect is simply any effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project. For the purposes of ecological impact assessment, a “significant effect” is defined as an effect that either supports or undermines the biodiversity conservation for the IEF. These significant effects are qualified with reference to an appropriate geographical scale.

The approach to determining significance does not utilise a matrix of degrees of impact significance (such as EPA (2022)), but instead follows the industry standard for ecological impact significance (CIEEM, 2018) where impacts/effects are determined to be ‘significant’ or ‘not significant.’

31.10 Assessment of significance

The potential impacts arising from the operational and maintenance phase of the Project are listed in Table 31-4, along with the project design parameters against which each impact has been assessed.

A description of the potential effect (following a desk-based and precautionary approach) on offshore migrating bat receptors caused by each identified impact is given below. Offshore migrating bats considered in this assessment, and of which have been identified to be ‘at risk’ of impact from the Project include:

common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, brown long-eared bat and Daubenton's bat.

31.10.1 Disturbance/ ultrasonic emission interference

Operational and maintenance phase

Disturbance and ultrasonic emission interference may occur due to the ultrasonic acoustic emissions generated by moving wind turbine blades. This emissions interference has the potential to cause disorientation, preventing bats from foraging effectively; and exposing bats to navigational difficulties. Species-specific effects during migration are not currently well-known.

To date, there have been very few investigations into the ultrasonic emissions of turbines, how they affect echolocation and at what distance from turbines acoustic cues of bats are disturbed. The results of studies vary, and there appears to be 'no standard' type of ultrasound between different makes of turbines, with some structures emitting no ultrasound (due to the nature of ultrasound being increasingly attenuated with distance) while others may emit significant levels of ultrasonic noise (Long *et al.,* 2011).

For example, in the UK a study by Long *et al.* (2011), a microphone assessed the frequency range of 45 to 55 kHz in an anechoic chamber[3] of a microturbine (0.91 m rotor diameter), at 0.6 m from the hub of the operational rotor, and found that the microturbine did not produce appreciable ultrasonic noise above the undistorted noise floor of the microphone.

In the U.S, Szewczak and Arnett (2006) undertook a preliminary investigation to measure the ultrasound emissions of operating turbines (Neg Micon 1.5 MW). Recordings made at ground level (34 m below turbine rotors), showed that only minor levels of ultrasound were recorded above ambient levels (i.e. 5, 3 and 2 decibels above ambient at 20, 30 and 40 kHz, respectively; and above 50 kHz, there were no significant differences).

In Germany, Schröder's study (1997) (cited in Long *et al*., 2011 and BCT, 2009) found that turbines produced ultrasound typically between 20 and 50 kHz, which correlates well with frequencies used by European bat species for echolocation (although the sound intensity, and the relationship with bat mortality, were not investigated), and may disturb bats.

As research indicates that turbines generate ultrasound (albeit it is potentially indiscernible from ambient sound), and emissions of turbines could be perceptible by some bat species, the precautionary principle has been applied.

Emission interference – foraging success during migration

Common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, brown long-eared bat and Daubenton's bat

The operational and maintenance phase impact of disturbance/ ultrasonic emission interference as a result of moving wind turbines blades, has the potential to affect the echolocation signal of migrating bats, therefore effecting foraging success (e.g. forager may miss its target). The extent of the effect is unknown within the offshore wind farm area (the distance from turbines that bats experience emission interference is not currently known). The magnitude of the effect is a reduction in feeding success. The duration of the effect is considered to be the operational lifetime of the Project (40 years) and is considered long-term. This effect is considered to be reversible during the operational lifetime of the Project (i.e. alternative foraging opportunities available outside the wind farm area). Due to the magnitude, the long-term nature of the Project, and reversibility of the impact, the effect of disturbance/ ultrasonic emission interference causing disorientation of migrating bats (i.e. effective foraging) in the marine environment during the operational and maintenance phase of the Project, is predicted to be not significant.

[3] An anechoic chamber is a room designed to stop reflections or echoes of sound and electromagnetic waves.

Emission interference – navigation

<u>*Common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, brown long-eared bat and Daubenton's bat*</u>

The operational and maintenance phase impact of disturbance/ ultrasonic emission interference as a result of moving wind turbines blades, has the potential to expose bats to navigational difficulties during migration. As detailed above, ultrasound emissions of turbines could be perceptible by some bats and therefore the precautionary principle has been applied. The extent of the effect is unknown within the offshore wind farm area (the distance from turbines that bats experience emission interference is not currently well known). The magnitude of the effect is the risk of navigational difficulties to an unknown number of migrating bats. The duration of the effect is considered to be the operational lifetime of the Project (40 years) and is considered long-term. This effect is considered to be reversible during the operational lifetime of the Project (i.e. recovery is possible). Due to the magnitude, the long-term nature of the Project, and reversibility of the impact, the effect of disturbance/ ultrasonic emission interference causing navigational difficulties to migrating bats in the marine environment during the operational and maintenance phase of the Project, is predicted to be not significant.

Navigation difficulty also has the potential to cause barotrauma and collision with rotors resulting in injury and/or death. Barotrauma and collision with rotors are detailed below in section 31.10.2.

31.10.2 Injury and/or fatality

Operational and maintenance phase

Barotrauma

Barotrauma due to the sudden and extreme changes in atmospheric pressure may cause tissue damage and rupture of air-containing structures (such as the lungs) in bats resulting in haemorrhaging, internal bleeding, injury and/or death (Baerwald *et al*., 2009). Bats have large lungs and hearts, high blood oxygen-carrying capacity, and blood-gas barriers thinner than those of terrestrial mammals. These flight adaptations suggest that bats are particularly susceptible to barotrauma (Baerwald *et al.,* 2008). Species-specific effects during migration are not currently well-known.

To date, research has been limited on the calculations of pressure changes that bats may be exposed to when flying near wind turbines and therefore the likelihood that turbines cause barotrauma in bats.

A study conducted by Lawson *et al.* (2020) aimed to address this shortcoming by performing fluid dynamics simulations of a wind turbine and undertaking analytical calculations of blade-tip vortices to estimate the characteristics of the sudden pressure changes bats may experience when flying near a utility-scale wind turbine. The results showed, based on a specific 5 MW operational wind turbine characteristics (i.e. hub height 90 m; rotor 126 m; cut in speed 3 m/s) that the low- and high-pressure regions generated by the blade are localized to a small region near the leading edge of the blade of which decay rapidly with increasing distance from the blade. Lawson *et al.* (2020) concluded that bats must therefore take a very specific and unlikely flight path to enter the regions of low- and high pressure caused by the turbine blade without being struck (i.e. the probability of collision is higher than the probability of barotrauma).

However, studies suggest that barotrauma contribute to cause of death in bats, just as much as direct collision with rotor blades (Baerwald, *et al.,* 2008). Baerwald *et al.* (2008) identified that barotrauma was a significant cause of bat fatalities at wind turbines after collecting two types of bat species killed at a wind energy facility. Of 188 bats killed, 57% of individuals had internal haemorrhaging but no external injuries, many of which had lesions on the lungs consistent with barotrauma.

Other studies (Grodsky *et al.,* 2011) despite the intensive application of various veterinary diagnostic procedures, the exact cause of death (i.e. barotrauma) could not be determined in most bats due to the variability of injuries and a lack of exclusively attributable lesions. Findings suggest that cause of death for bats killed by wind turbines was not exclusively or predominantly barotrauma or direct collision but rather an indiscernible combination of both.

As research reveals bats are potentially perceptible to barotrauma as a result of wind turbines, the precautionary principle has been applied.

Nathusius' pipistrelle

Of the bat species in Ireland identified 'at risk' of significant impact from the Project (i.e. the IEFs), the effects of injury and/or death on Nathusius' pipistrelle populations may be of greater magnitude compared to other species. This is owing to the status and distribution of this species in Ireland being comparatively unknown (NPWS, 2016); the strong evidence and records that this bat migrates in Europe (i.e. it is a relatively recent addition to Irish fauna) (Russ *et al*., 2001; Vasenkov *et al.,* 2022; Limpens *et al.,* 2017; BSG Ecology, 2014b); and the high risk of this bat to turbines (NatureScot, 2021). Furthermore, based on available migration research, Nathusius' pipistrelle could potentially be migrating in large numbers. For these reasons, Nathusius' pipistrelle has been assessed separately to other Irish bat species.

The operational and maintenance phase impact of barotrauma as a result of moving wind turbines blades, has the potential to result in injury and/or fatality to Nathusius' pipistrelle during migration. The extent of the effect is unknown within the offshore wind farm area (i.e. the distance from turbines that bats experience barotrauma is not currently well known), however it is predicted to be within several meters of the turbine blades. The magnitude of the effect is the potential injury and/or fatality of an unknown numbers of Nathusius' pipistrelles during migration. The duration of the effects is considered to be the operational lifetime of the Project (40 years) and is therefore considered long-term. This effect is considered to be irreversible (based on the limited Nathusius' pipistrelle population data available in Ireland) during the operational lifetime of the Project. Due to the magnitude and long-term nature of the Project, the effect of barotrauma during the operational and maintenance phase of the Project, is predicted to be potentially likely **significant**.

Common pipistrelle, soprano pipistrelle, and Leisler's bat

In relation to soprano pipistrelle and common pipistrelle, these two species are the most frequently encountered in Ireland, whilst the Leisler's bat is usually the third most frequently encountered (Roche *et al.,* 2012). These bat populations are widespread in Ireland and can be found in most 10 km grid squares across the island[1].

Based on available migration research, these three species could potentially be migrating within the marine environment. Although they are widespread in Ireland, and the status of their populations are favourable, *Pipistrellus spp*. and *Nytalus spp*. have been noted as some of the main groups of bats noted in fatalities as a result of wind turbines (Salguero *et al.,* 2023). The effects of injury and/or death on these bat populations could potentially be of significance.

The operational and maintenance phase impact of barotrauma as a result of moving wind turbines blades, has the potential to result in injury and/or fatality to common pipistrelle, soprano pipistrelle and Leisler's bat during migration. The extent of the effect is unknown within the offshore wind farm area (i.e. the distance from turbines that bats experience barotrauma is not currently well known), however it is predicted to be within several meters of the turbine blades. The magnitude of the effect is the potential injury and/or fatality of an unknown numbers of bats during migration. The duration of the effects is considered to be the operational lifetime of the Project (40 years) and is therefore considered long-term. This effect is considered to be irreversible (based on high frequency of these species being returned as a result of fatalities from wind turbines) during the operational lifetime of the Project. Due to the magnitude and long-term nature of the Project, the effect of barotrauma during the operational and maintenance phase of the Project, is predicted to be potentially likely **significant**.

Brown long-eared bat and Daubenton's bat

In relation to brown long-eared bat and Daubenton's, these two species are widely distributed throughout Ireland (NPWS, 2019). Based on available migration research, these species could potentially be migrating. However, a study on bat mortality in Southern Europe (Salguero *et al.,* 2023), found that *Plecotus* species (i.e. brown long-eared bat) and *Myotis* species (i.e. Daubenton's bat) normally tend to fly below rotor height due to their broad-wings and are less susceptible injury/death from wind turbines. These species are also considered to be at lower risk of impacts from onshore wind farms (Natural England, 2009). The effects of injury and/or death (if they were to occur) on these bat populations are likely to be of lesser magnitude.

The operational and maintenance phase impact of barotrauma as a result of moving wind turbines blades, has the potential to result in injury and/or fatality to brown long-eared bat and Daubenton's bat during migration. The extent of the effect is unknown within the offshore wind farm area (i.e. the distance from turbines that bats experience barotrauma is not currently well known), however it is predicted to be within several meters of the turbine blades. The magnitude of the effect is the potential injury and/or fatality of an unknown numbers of bats during migration. The duration of the effects is considered to be the operational lifetime of the Project (40 years) and is therefore considered long-term. This effect is considered to be reversible during the operational lifetime of the Project. Due to the magnitude and long-term nature of the Project, reversibility of the impact, the effect of barotrauma during the operational and maintenance phase of the Project, is predicted to be not significant.

Collision with rotors

Collision with rotors is the most common impact resulting in bat fatality (Rodrigues *et al.,* 2015; Rollins *et al.,* 2012). How collision with rotors will affect bats in the marine environment depends on species ecology such as flight behaviour, however offshore flight behaviour (e.g. flight height) is not well known.

In relation to common and soprano pipistrelle bats, and based on available desk-study information, neither species have been recorded in the North Sea but have been recorded offshore at wind farms in Sweden (Ahlén *et al*., 2007). Studies undertaken in Sweden on wind farms situated between 4 km and 12 km offshore, showed the majority of bats were detected foraging and migrating less than 10 m above sea level (Ahlén *et al*., 2009). The majority of sightings at rotor height were noted as noctule bats (Ahlén *et al.,* 2009).

Monitoring for bats in the Belgian North Sea (C Power, approximately 27 km offshore) was conducted by Brabant *et al*. (2019), where four detectors were placed in the nacelle of the turbine (at 93 m above sea-level) and seven attached to the transition piece (16 m above sea level). Bats were recorded within the study period from late August to late November with activity noted to have peaked in the latter half of September (63% of all calls recorded) and was considerably less in October and November. All detections were of Nathusius' pipistrelle.

Leisler's are high flying species with known onshore flight heights between 1 m and 30 m. Applying this as a proxy for similar flight heights offshore (if it was to occur), this suggests Leisler's bat may be at risk of collision with the operational wind turbines. Although there is lack of data on this species.

The exact flight heights of brown-long-eared bat are unclear, however within onshore terrestrial environments they are generally known to fly close to the ground and fly slowly[1]. A study based on a bat monitoring database of bat mortality in Southern Europe (Salguero *et al.,* 2023), found that *Plecotus* species (i.e. brown long-eared bat), in addition to other genera such as *Myotis* normally tend to fly below rotor height due to their broad-wings and are less susceptible injury/death from wind turbines. These results were also consistent with studies conducted in Northern Europe (Rydell *et al.,* 2010). Therefore, if the species did occur offshore then it would be less likely to be significantly impacted.

Daubenton's bat fly at either slow or medium speeds (range 2 to 6 m/s; Jones and Raynor, 1988) and are known to fly close to the water surface. *Myotis* species have a slow and low flight[1], suggesting that they are unlikely to fly at the same height as a rotating blade of a wind turbine (minimum blade tip height for the Project turbines is 27 m above Lowest Astronomical Tide (LAT)). A study based on a bat monitoring database of bat mortality in Southern Europe (Salguero et al., 2023), found that *Myotis* species normally tend to fly below rotor height due to their broad-wings and are less susceptible injury/death from wind turbines (Salguero *et al.,* 2023). Therefore, if the species did occur offshore then it would be less likely to be impacted.

Nathusius' pipistrelle

The operational and maintenance phase impact of collision as a result of moving wind turbines blades, has the potential to result in injury and/or death to Nathusius' pipistrelle during migration. The extent of the effect is the 25 wind turbines with a lower blade tip height of 27 m above LAT and their rotating blades which have a rotor diameter of 236 m. The magnitude of the effect is the potential injury and/or fatality of an unknown numbers of Nathusius' pipistrelles during migration. The duration of the effects is considered to be the operational lifetime of the Project (40 years) and is therefore considered long-term. This effect is considered to be irreversible (based on the limited Nathusius' pipistrelle population data available in Ireland) during the operational lifetime of the Project. Due to the magnitude and long-term nature of the Project, the effect of barotrauma during the operational and maintenance phase of the Project, is predicted to be potentially likely **significant**.

Common pipistrelle, soprano pipistrelle, and Leisler's bat

The operational and maintenance phase impact of collision as a result of moving wind turbines blades, has the potential to result in injury and/or fatality to common pipistrelle, soprano pipistrelle and Leisler's bat during migration. The extent of the effect is the 25 wind turbines with a lower blade tip height of 27 m above LAT and their rotating blades which have a rotor diameter of 236 m. The magnitude of the effect is the potential injury and/or fatality of an unknown numbers of bats during migration. The duration of the effects is considered to be the operational lifetime of the Project (40 years) and is therefore considered long-term. This effect is considered to be irreversible (based on high frequency of these species being returned as a result of fatalities from wind turbines) during the operational lifetime of the Project. Due to the magnitude and long-term nature of the Project, the effect of barotrauma during the operational and maintenance phase of the Project, is predicted to be potentially likely **significant**.

Brown long-eared bat and Daubenton's bat

The operational and maintenance phase impact of collision as a result of moving wind turbines blades, has the potential to result in injury and/or fatality to brown long-eared bat and Daubenton's bat during migration. The extent of the effect is the 25 wind turbines with a lower blade tip height of 27 m above LAT and their rotating blades which have a rotor diameter of 236 m. The magnitude of the effect is the potential injury and/or fatality of an unknown numbers of bats during migration. The duration of the effects is considered to be the operational lifetime of the Project (40 years) and is therefore considered long-term. This effect is considered to be reversible during the operational lifetime of the Project. Due to the magnitude and long-term nature of the Project, reversibility of the impact, the effect of barotrauma during the operational and maintenance phase of the Project, is predicted to be not significant.

31.10.3 Mitigation and residual effects

The assessment of impacts has concluded that there is potential for significant effects on the following bats in the marine environment should it be recorded that they use the area for migration; Nathusius' pipistrelle, common pipistrelle, soprano pipistrelle, and Leisler's bat as a result of barotrauma and collision with wind turbines causing injury and/or fatality. Therefore, the following measures will be required during bat migration.

Injury and/or fatality - curtailment

The NatureScot (2021) Guidelines '*Bats and onshore wind turbines - survey, assessment and mitigation*' outline a number of measures including curtailment for onshore wind farms to mitigate impacts on bats. The Rodrigues *et al.* (2015) guidance notes that blade feathering and increase of cut-in wind speeds are currently the only proven ways to reduce bat fatalities at operating wind farms. Furthermore, Collins (2023) *Bat Surveys for Professional Ecologists: Good Practice Guidance Guidelines* (4th edn), discusses environmental conditions in which bat activity is reduced and which have been used to define the curtailment measures below.

Curtailment measures have considered these guidance documents (Rodrigues *et al.,* 2015; NatureScot, 2021; Collins, 2023) in addition to the curtailment measures proposed by Arcadis Ost – another offshore wind farm developed by Parkwind (the joint venture partner of the Applicant) in Germany.

Curtailment measures for the Project include the following:

During the first year of operation:

- A set of curtailment criteria will be established based on a combination of conditions (i.e. ideal conditions for bats) to stop or slow down the turbines during peak bat migration periods. These measures will minimise bat barotrauma and collisions. The curtailment will apply when all of the following parameters are met:
  - Peak bat migration periods; mid-March (e.g. 15 March) to end of May (i.e. 31 May); and mid-August (e.g. 15 August) to October (i.e. 31 October);
  - Between sunset and sunrise;
  - Sunset temperatures above 10 °C (Collins, 2023);
  - Wind speeds of < 5.4 m/s (20 km/hr) (Collins, 2023);
  - Where rainfall is < 4 mm/hr (i.e. low to moderate rainfall levels) occurring for a duration of longer than 30 minutes; and

  - When one bat call is acoustically detected within the previous thirty minutes. Bat detectors will be evenly placed across fifteen wind turbines[4] within the offshore wind farm area (one at the lowest blade tip height; and one at the nacelle).

- It is also considered important, whilst still ensuring bat protection during migration periods, that the curtailment criteria do not cause any unnecessary energy losses. To ensure this, bat echolocation detection measures will be put in place which will limit the curtailment criteria to only those times when bats are detected. Such detection measures may include the application of a Detection and Active Response Curtailment (DARC) system, which aims to reduce wind energy's impact on bats while increasing energy production. The bat echolocation detection system will be agreed with the NPWS;
- Static detector surveys will be undertaken at the lowest blade tip height above LAT of 27 m and at the nacelle/hub height of 145 to 152 m. Thirty bat detectors will be deployed evenly across fifteen turbines within the offshore wind farm area; and
- The results of the mitigation during the first year of operation will be compiled into a report and submitted to the NPWS for review.

During the second year of operation:

- Upon agreement with the NPWS, an adjustment to the curtailment criteria may be made based on the results of bat migration records during the first year of operation, and static detectors will be re-deployed; and
- The results of the mitigation during the second year of operation will be compiled into a report and submitted to the NPWS for review.

During the third year of operation:

- Upon agreement with the NPWS, static detector survey results from year one and year two will be used as an average to update the curtailment criteria. Acoustic surveys will continue for the third year of operation.

Operational years thereafter:

- Acoustic surveys will continue for the remaining duration of the operational lifetime of the Project. The curtailment criteria shall be reviewed and updated, as required.

With the implementation of the mitigation measures outlined above, the Project is considered not to have any significant residual effects on migrating bats.

31.10.4 Future monitoring

Prior to Project commencement, a competent and experienced Ecologist will be appointed by the Applicant to ensure that the mitigation measures and monitoring scheme outlined in this document in relation to migrating bats are implemented in full.

A monitoring scheme will include the following:

- At pre-construction stage, bat data will be collected using appropriate vessels to provide information on the usage of the offshore wind farm area by migrating bats during at least one spring migration period and at least one autumn migration period. Two bat detectors will be required per vessel and data will be collected weekly during the peak bat migration periods;
- During the operational and maintenance phase, thirty static bat detectors will be deployed evenly across fifteen wind turbines within the offshore wind farm area (one at the lowest blade tip height; and one at the nacelle). These static bat detectors will be required to monitor bats during peak migration periods and monitor the success of mitigation measures;
- Bat monitoring will be carried out annually, until Project decommissioning unless otherwise agreed with the NPWS; and

[4] The number of offshore wind turbines to be fixed with a bat detector is based upon onshore wind turbine survey methodologies: *Bats and Onshore Wind Turbines – Survey, Assessment and Mitigation* (NatureScot, 2021).

- The monitoring scheme and success of mitigation measures will be documented annually into a detailed report and submitted to the NPWS for discussion.

31.11 Cumulative Impact Assessment (CIA)

31.11.1 Methodology

The Cumulative Impact Assessment (CIA) takes into account the impact associated with the Project together with other projects within the Bats in the Marine Environment Study Area. The projects selected as relevant to the CIA presented within this chapter are based upon the results of a screening exercise (see volume 2A, appendix 3-1: Cumulative Impact Assessment Screening Annex). Each project has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

The approach to CIA examines the effects of the Project alongside the following projects if they fall within the Zone of Influence (ZoI) for bats in the marine environment:

- Other projects with consent but not yet constructed/construction not completed;
- Other projects in a consent application process but not yet determined (including planning applications, foreshore lease/licence applications, Dumping at Sea Permit applications);
- Other projects currently operational that were not operational when baseline data were collected, and/or those that are operational but have an ongoing impact; and
- Projects, which satisfy the definition of 'relevant maritime usage' under the Maritime Area Planning Act (2021) (i.e. wind farm projects designated as 'Relevant Projects' or 'Phase 1 Projects') including Arklow Bank II, Bray Bank and Kish Bank; North Irish Sea Array, Codling Wind Park (I and II).

The specific projects screened into this CIA are outlined in Table 31-6. The location of screened in projects in relation to the Project is illustrated in Figure 31-2.

Table 31-6: List of other projects considered within the CIA.

Project	Status	Distance from offshore wind farm area (km)	Distance from offshore cable corridor (km)	Description of Project	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with Project
North Irish Sea Array (NISA)	Maritime Area Consent	16.2	18.1	EIA Scoping Report (2021) refers to the construction of an offshore wind farm of up to 500 MW, consisting of 36 turbines with a maximum height of 320 m and rotor diameter of up to 290 m. Offshore substation platforms may be required.[5]	Unknown	Unknown (Design life minimum 35 years)	Potential for operational and maintenance phases to overlap with the Project.
Dublin Array	Maritime Area Consent	61.2	57	EIA Scoping report (2020) refers to the construction of Bray and Kish offshore wind farm of up to 900 MW, consisting of up to 61 turbines with a max. height of 308 m and rotor diameter of up to 285 m and up to three offshore substation platforms.[6]	Unknown	Unknown (Design life minimum 35 years)	Potential for operational and maintenance phases to overlap with the Project.
Codling Wind Park	Maritime Area Consent	61.4	57.2	EIA Scoping report (2020) refers to the construction of an offshore wind farm of up to 1,500 MW, consisting of up to 140 turbines with a maximum height of 320 m and rotor diameter of up to 288 m. The project will also contain up to five offshore substation platforms.[7]	Unknown	Unknown (Design life minimum 35 years)	Potential for operational and maintenance phases to overlap with the Project.
Arklow Bank Wind Park	Maritime Area Consent	107.1	104.7	EIA Scoping Report (2023): The project will include between 37 and 56 turbines ad up to two Offshore Substation Platforms (OSP) and foundation substructures. The area in which the proposed wind turbines, inter-array cables and OSP(s) will be located on Arklow Bank covers an area of seabed approximately 64 km^2.[8]	Unknown	Unknown (Design life minimum 35 years)	Potential for operational and maintenance phase to overlap with the Project.

[5] Project website https://northirishseaarray.ie/: states that wind farm will consist of 35 to 46 turbines.

[6] Project website: https://dublinarray.com/project-information/key-facts/: states between 39 and 50 turbines (total project capacity 824 MW) individual tip heights between approximately 270 m and 310 m.

[7] Project website: https://codlingwindpark.ie/the-project/: states max energy output 1,300 MW, 100 turbines, turbine tip height max 320 m.

[8] Project website https://www.sserenewables.com/: states between 36 and 60 turbines (up to 800MW) along with one to two OSS and foundation substructures, a network of inter-array cabling and two offshore export cables.

Project	Status	Distance from offshore wind farm area (km)	Distance from offshore cable corridor (km)	Description of Project	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with Project
Mona Offshore Wind Farm	Planning	127	131	Offshore Wind Farm (1.5 GW capacity) in Welsh and English waters. Scoping report indicates up to 107 turbines and up to eight offshore substations. Application not yet submitted.	Unknown	Unknown	Potential for operational and maintenance phase to overlap with the Project.
Morgan Offshore Wind Farm – Generation Assets	Planning	119	119	Offshore Wind Farm (1.5 GW capacity) in English waters. Scoping report indicates up to 107 turbines and up to eight offshore substations. Application not yet submitted	Unknown	Unknown	Potential for operational and maintenance phase to overlap with the Project.
Morecambe Offshore Wind Farm - Generation Assets	Planning	155	155	Offshore Wind Farm (Maximum 960 MW capacity) in English waters. Scoping report indicates up to 40 turbines and up to two offshore substations. Application not yet submitted.	Unknown	Unknown	Potential for operational and maintenance phase to overlap with the Project.
Awel y Môr Offshore Wind Farm	Planning	142	145	Offshore Wind Farm (500 MW capacity) in Welsh waters. Application submitted but not awarded.	2026 to 2029 (subject to consent)	2030 to 2055 (subject to consent)	Potential for operational and maintenance phase to overlap with the Project.
Arklow Bank Wind Farm Phase 1	Operational	120.2	117.5	Seven 3.6 MW turbines. Hub height 73.5 m. Rotor diameter 124 m.	2002 to 2003	2004 to 2028	Potential for operational and maintenance phases to overlap with the Project.
Walney Extension 3 Offshore Wind Farm	Operational	139.9	144.6	40 8.25 MW turbines. Hub height 113 m. Rotor diameter 164 m	2017	2018 to 2039	Potential for operational and maintenance phase to overlap with the Project.
Walney Extension 4 Offshore Wind Farm	Operational	146	150.6	47 7 MW turbines. Hub height 111 m. Rotor diameter 154 m	2017	2018 to 2039	Potential for operational and maintenance phase to overlap with the Project.

Project	Status	Distance from offshore wind farm area (km)	Distance from offshore cable corridor (km)	Description of Project	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with Project
Walney 2 Offshore Wind Farm	Operational	155.8	160.5	51 3.6 MW turbines. Hub height 84 m. Rotor diameter 107 m.	2011	2012 to 2032	Potential for operational and maintenance phase to overlap with the Project.
Walney 1 Offshore Wind Farm	Operational	162.5	166.7	51 3.6 MW turbines. Hub height 84 m. Rotor diameter 107 m.	2010	2010 to 2032	Potential for operational and maintenance phase to overlap with the Project.
West of Duddon Sands Offshore Wind Farm	Operational	162.3	166.7	108 3.6 MW turbines. Hub height 90 m Rotor diameter 120 m.	2013 to 2014	2014 to 2033	Potential for operational and maintenance phase to overlap with the Project.
Gwynt y Mor Offshore Wind Farm	Operational	163.4	166.3	160 3.6 MW turbines. Hub height 98 m. Rotor diameter 107 m.	2012	2015 to 2032	Potential for operational and maintenance phase to overlap with the Project.
Rhyl Flats Offshore Wind Farm	Operational	165.6	168.3	25 3.6 MW turbines. Hub height 80 m. Rotor diameter 107 m.	2007	2009 to 2027	Potential for operational and maintenance phase to overlap with the Project.
Ormonde Offshore Wind Farm	Operational	168.6	173.2	30 5 MW turbines. Hub Height 100 m. Rotor diameter 126 m.	2010	2012 to 2036	Potential for operational and maintenance phase to overlap with the Project.
Robin Rigg Offshore Wind Farm	Operational	173.3	178.5	58 3 MW turbines. Hub height 80 m Rotor diameter 90 m.	2009	2010 to 2030	Potential for operational and maintenance phase to overlap with the Project.

Project	Status	Distance from offshore wind farm area (km)	Distance from offshore cable corridor (km)	Description of Project	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with Project
North Hoyle Offshore Wind Farm	Operational	177.1	180.0	30 2 MW turbines. Hub height 70 m. Rotor diameter 80 m.	2003	2004 to 2028	Potential for operational and maintenance phase to overlap with the Project.
Barrow Offshore Wind Farm	Operational	177.2	181.6	30 3 MW turbines. Hub height 75 m. Rotor diameter 90 m.	2005	2006 to 2028	Potential for operational and maintenance phase to overlap with the Project.
Burbo Bank Offshore Wind Farm Extension	Operational	181.1	184.3	32 8.0 MW turbines. Hub height 105 m. Rotor diameter 160 m	2016	2017 to 2045	Potential for operational and maintenance phase to overlap with the Project.
Burbo Bank Offshore Wind Farm	Operational	191.1	194.4	23 3.6 MW turbines. Hub height 78 m. Rotor diameters 107 m.	2006	2007 to 2039	Potential for operational and maintenance phase to overlap with the Project.

Table 31-7 presents the relevant project design parameters from Table 31-4, which are used to assess the potential cumulative impact of the Project with the other projects identified in Table 31-6 (where information is available).

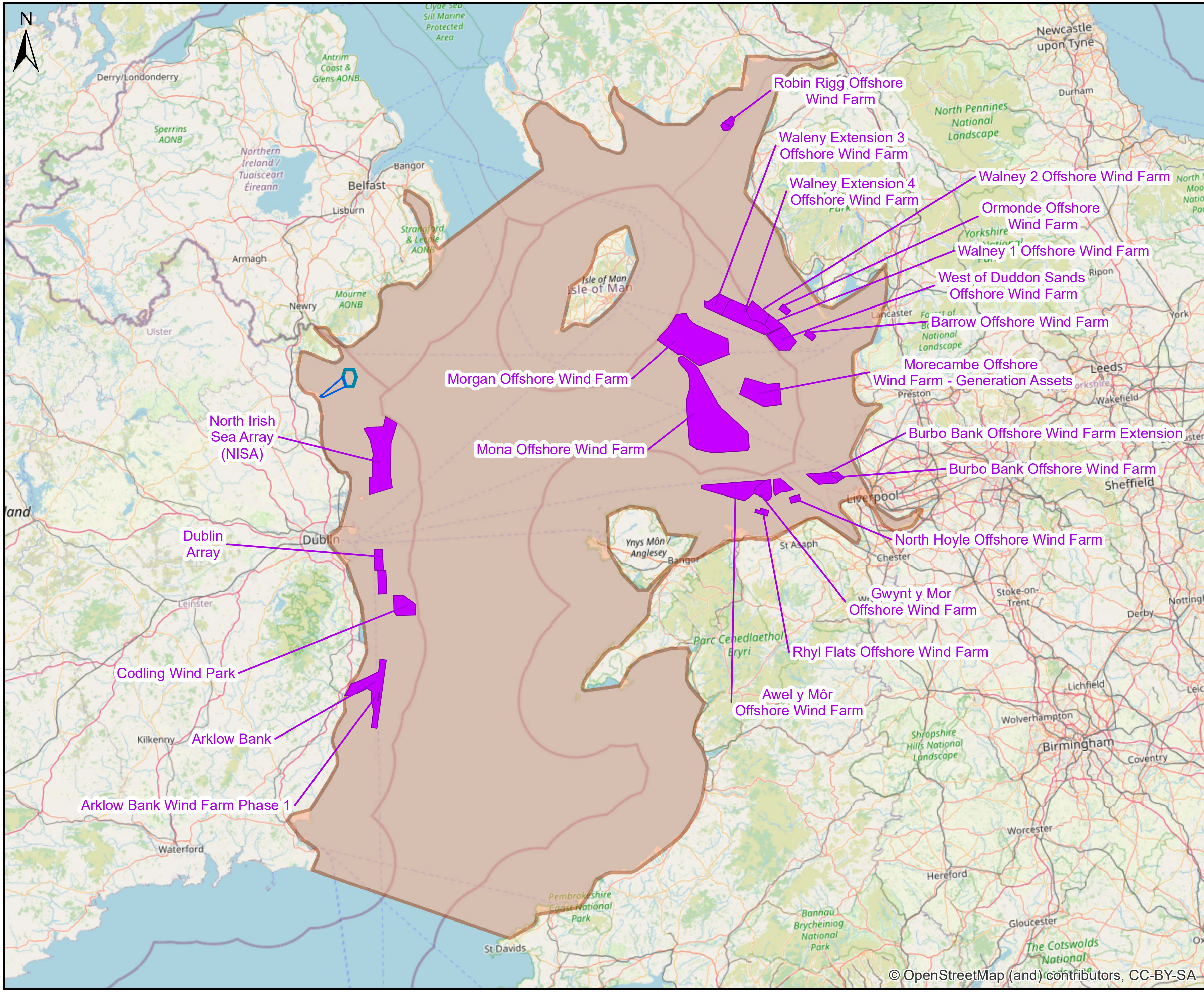
Impacts have been carried forward for assessment where there is potential for an effect to occur from the Project alone over a scale that could impact cumulatively with other projects within the Bats in the Marine Environment Study Area. Other aspects, such as provision of roosting, provision of foraging resource and prey distribution, and disturbance from lighting are very difficult to quantify, and although it is acknowledged that cumulative effects are possible, the magnitude of these impacts are not considered to be significant at a population level and is therefore not considered further within the CIA. The impacts excluded from the cumulative assessment are:

- Disturbance from lighting during all phases as the effect is considered to be of a limited magnitude that will not cause any foreseeable significant effects. The effect is not considered significant at a population level;
- Provision of roosting during the operational and maintenance phase as it considered unlikely for migrating bats to be roosting in significant numbers, owing to the rotor blade acting as a barrier for access to the turbine hub and nacelle. It is not considered significant at a population level; and
- Provision of foraging resource and prey distribution during the operational and maintenance phase as the effect is considered to be of a limited magnitude that will not cause any foreseeable significant effects. It is not considered significant at a population level.

Table 31-7: Project design parameters considered for the assessment of potential cumulative impacts on bats in the marine environment.

Potential impact	Phase[1]			Project design parameters	Justification
	C	O	D		
Disturbance/ ultrasonic emission interference (i.e. interference with echolocation signal)	✗	✓	✗	Project design parameters as described for the Project (Table 31-4) assessed cumulatively with the projects listed in Table 31-6.	Outcome of the CIA will be greatest when the greatest number of other wind farms are considered.
Injury and/or death (i.e. Barotrauma (rapid atmospheric pressure fluctuations) and collision with rotors)	✗	✓	✗		
Alteration of migration routes (i.e. locations of wind farms effecting migration routes taken by bats)	✗	✓	✗		

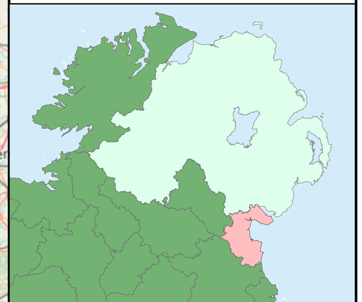
1 C= Construction, O = Operation, D = Decommissioning



Legend

- Offshore Wind Farm Area
- Offshore Cable Corridor
- Cumulative Bats in the Marine Environment Study Area
- Offshore Wind Farm

Data Sources: OWL, Marine Atlas



Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title

Figure 31-2: Other Projects screened into the cumulative impact assessment

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Issue Details

Drawn By: NR	**Project No.** MDR1520b
Checked By: HF	**File Ref:**
Approved By: CC	MDR1520bArc3039F02
Scale: 1:2,000,000 @ A4	**Projection:** ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date: 22/03/2024	

NOTE:
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31.11.2 Assessment of significance

The CIA is limited by the data available upon which to base the assessment. Due to the age of developments in the Irish Sea and surrounding areas which have the potential to have a cumulative impact upon receptors, none have datasets upon which to base an assessment. Additionally, older developments did not carry out certain impact assessments for bats in the marine environment likely due to limited research data available or due to the topic of bats in the marine environment being a relatively new topic. As such it has not been possible to undertake a comprehensive CIA.

Disturbance/ ultrasonic emission interference - operational and maintenance phase

Emission interference – foraging success during migration

Common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, brown long-eared bat and Daubenton's bat

The cumulative operational and maintenance phase impact of disturbance/ ultrasonic emission interference as a result of moving wind turbines blades, has the potential to affect the echolocation signal of migrating bats, therefore effecting foraging success (e.g. forager may miss its target). The extent of the effect is the Irish Sea. The magnitude of the effect is a reduction in feeding success. The duration of the effect is considered to be the operational lifetime of the cumulative Projects and is considered long-term. This effect is considered to be reversible. Due to the magnitude, the long-term nature of the Project, and reversibility of the impact, the effect of disturbance/ ultrasonic emission interference cumulatively causing disorientation of migrating bats (i.e. effective foraging) in the marine environment during the operational and maintenance phase of the Project, is predicted to be not significant.

Emission interference – navigation

Common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, brown long-eared bat and Daubenton's bat

The cumulative operational and maintenance phase impact of disturbance/ ultrasonic emission interference as a result of moving wind turbines blades, has the potential to expose bats to navigational difficulties during migration. As detailed above. The extent of the effect is the Irish Sea. The magnitude of the effect is the risk of navigational difficulties to an unknown number of migrating bats. The duration of the effect is considered to be the operational lifetime of the cumulative Projects and is considered long-term. This effect is considered to be reversible (i.e. recovery is possible). Due to the magnitude, the long-term nature of the Project, and reversibility of the impact, the effect of disturbance/ ultrasonic emission interference cumulatively causing navigational difficulties to migrating bats in the marine environment during the operational and maintenance phase of the Project, is predicted to be not significant.

Injury and/or fatality - operational and maintenance phase

Barotrauma

Nathusius' pipistrelle

The cumulative operational and maintenance phase impact of barotrauma as a result of moving wind turbines blades, has the potential to result in injury and/or fatality to Nathusius' pipistrelle. The extent of the effect is the Irish Sea. The magnitude of the effect is the potential injury and/or fatality of an unknown numbers of Nathusius' pipistrelles during migration. The duration of the effect is considered to be the operational lifetime of the cumulative Projects and is considered long-term. This effect is considered to be irreversible (based on the limited Nathusius' pipistrelle population data available in Ireland) during the operational lifetime of the Project. Due to the magnitude and long-term nature of the Project, the cumulative effect of barotrauma during the operational and maintenance phase of the Project, is predicted to be potentially likely **significant**.

Common pipistrelle, soprano pipistrelle, and Leisler's bat

The following bats have been assessed; common pipistrelle, soprano pipistrelle and Leisler's bat.

The cumulative operational and maintenance phase impact of barotrauma as a result of moving wind turbines blades, has the potential to result in injury and/or fatality to common pipistrelle, soprano pipistrelle and Leisler's bat during migration. The extent of the effect is the Irish Sea. The magnitude of the effect is the potential injury and/or fatality of an unknown numbers of bats during migration. The duration of the effect is considered to be the operational lifetime of the cumulative Projects and is considered long-term. This effect is considered to be irreversible (based on high frequency of these species being returned as a result of fatalities from wind turbines) during the operational lifetime of the Project. Due to the magnitude and long-term nature of the Project, the cumulative effect of barotrauma during the operational and maintenance phase of the Project, is predicted to be potentially likely **significant**.

<u>*Brown long-eared bat and Daubenton's bat*</u>

The cumulative operational and maintenance phase impact of barotrauma as a result of moving wind turbines blades, has the potential to result in injury and/or fatality to brown long-eared bat and Daubenton's bat during migration. The extent of the effect is the Irish Sea. The magnitude of the effect is the potential injury and/or fatality of an unknown numbers of bats during migration. The duration of the effect is considered to be the operational lifetime of the cumulative Projects and is considered long-term. This effect is considered to be reversible (i.e. unlikely migrating in large numbers) during the operational lifetime of the Project. Due to the magnitude and long-term nature of the Project, reversibility of the impact, the cumulative effect of barotrauma during the operational and maintenance phase of the Project, is predicted to be not significant.

Collision with rotors

<u>*Nathusius' pipistrelle*</u>

The cumulative operational and maintenance phase impact of collision as a result of moving wind turbines blades, has the potential to result in injury and/or death to Nathusius' pipistrelle during migration. The extent of the effect is the Irish Sea. The magnitude of the effect is the potential injury and/or fatality of an unknown numbers of Nathusius' pipistrelles during migration. The duration of the effect is considered to be the operational lifetime of the cumulative Projects and is considered long-term. This effect is considered to be irreversible (based on the limited Nathusius' pipistrelle population data available in Ireland) during the operational lifetime of the Project. Due to the magnitude and long-term nature of the Project, the cumulative effect of collision during the operational and maintenance phase of the Project, is predicted to be potentially likely **significant**.

<u>*Common pipistrelle, soprano pipistrelle, and Leisler's bat*</u>

The cumulative operational and maintenance phase impact of collision as a result of moving wind turbines blades, has the potential to result in injury and/or fatality to common pipistrelle, soprano pipistrelle and Leisler's bat during migration. The extent of the effect is the Irish Sea. The magnitude of the effect is the potential injury and/or fatality of an unknown numbers of bats during migration. The duration of the effect is considered to be the operational lifetime of the cumulative Projects and is considered long-term. This effect is considered to be irreversible (based on high frequency of these species being returned as a result of fatalities from wind turbines) during the operational lifetime of the Project. Due to the magnitude and long-term nature of the Project, the cumulative effect of barotrauma during the operational and maintenance phase of the Project, is predicted to be **significant**.

<u>*Brown long-eared bat and Daubenton's bat*</u>

The cumulative operational and maintenance phase impact of collision as a result of moving wind turbines blades, has the potential to result in injury and/or fatality to brown long-eared bat and Daubenton's bat during migration. The extent of the effect is the Irish Sea. The magnitude of the effect is the potential injury and/or fatality of an unknown numbers of bats during migration. The duration of the effect is considered to be the operational lifetime of the cumulative Projects and is considered long-term. This effect is considered to be reversible during the operational lifetime of the Project. Due to the magnitude and long-term nature of the Project, reversibility of the impact, the cumulative effect of barotrauma during the operational and maintenance phase of the Project, is predicted to be not significant.

Alteration of migration routes - operational and maintenance phase

Cumulatively, wind farms in the Irish Sea may contribute at a larger scale, to the alteration of possible bat migration routes and therefore the displacement of migrating bat populations. Bat migration routes in the Irish Sea are not well understood, however in mainland Europe some migration routes are well known and studies have shown that some species, such as pipistrelles can travel great distances over land (Hutterer *et al.,* 2005). Applying the precautionary principle, a cumulative assessment has been undertaken.

Nathusius' pipistrelle

The cumulative operational and maintenance phase impact of wind farms in the Irish Sea has the potential to result in the alteration of Nathusius' pipistrelle migration routes. The extent of the effect is the Irish Sea. The magnitude of the effect is the displacement of an unknown numbers of Nathusius' pipistrelles during migration. The duration of the effect is considered to be the operational lifetime of the cumulative Projects and is considered long-term. This effect is considered to be irreversible (based on the limited Nathusius' pipistrelle population data available in Ireland) during the operational lifetime of the Project. Due to the magnitude and long-term nature of the Project, the cumulative effect of the alteration of migration routes during the operational and maintenance phase of the Project, is predicted to be potentially likely **significant**.

Common pipistrelle, soprano pipistrelle, and Leisler's bat

The cumulative operational and maintenance phase impact of wind farms in the Irish Sea has the potential to result in the alteration of common pipistrelle, soprano pipistrelle, and Leisler's bat migration routes. The extent of the effect is the Irish Sea. The magnitude of the effect is the displacement of an unknown number of bats during migration. The duration of the effect is considered to be the operational lifetime of the cumulative Projects and is considered long-term. This effect is considered to be irreversible (based on high frequency of these species being returned as a result of fatalities from wind turbines) during the operational lifetime of the Project. Due to the magnitude and long-term nature of the Project, the cumulative effect of the alteration of migration routes during the operational and maintenance phase of the Project, is predicted to be potentially likely **significant**.

Brown long-eared bat and Daubenton's bat

The cumulative operational and maintenance phase impact of wind farms in the Irish Sea has the potential to result in the alteration of brown long-eared bat and Daubenton's bat migration routes. The extent of the effect is the Irish Sea. The magnitude of the effect is the displacement of an unknown number of bats during migration. The duration of the effect is considered to be the operational lifetime of the cumulative Projects and is considered long-term. This effect is considered to be reversible during the operational lifetime of the Project. Due to the magnitude, long-term nature of the Project, and the reversibility of the impact, the cumulative effect of the alteration of migration routes during the operational and maintenance phase of the Project, is predicted to be not significant.

31.11.3 Mitigation and residual effects

See section 31.10.3 for the mitigation measures outlined for the protection of bats in the marine environment. With the implementation of these measures, the Project is considered not to have any cumulative significant residual effects on migrating bats.

31.12 Transboundary effects

As outlined in section 31.3, the Bats in the Marine Environment Study Area extends into the jurisdictions of UK and Northern Ireland. Therefore, the effects outlined in section 31.10 have potential to result in transboundary effects. With the implementation of the mitigation measures outlined in section 31.10.3, the Project will not result in any significant transboundary effects.

31.13 Interactions

A description of the likely inter-related effects arising from the Project on bats in the marine environment is provided in chapter 32: Interactions.

31.14 Summary of impacts, mitigation measures and residual effects

Table 31-8 presents a summary of the potential impacts, mitigation measures and residual effects in respect to bats in the marine environment. The impacts assessed include:

- Disturbance/ ultrasonic emission interference; and
- Injury and/or fatality.

Potential effects as a result of disturbance/ ultrasonic emission interference and injury and/or fatality were assessed for bats in the marine environment. The effect of disturbance/ ultrasonic emission interference was assessed to be long-term, reversible, and not significant for common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, brown long-eared bat and Daubenton's bat. The effect of injury and/or fatality was assessed to be long-term, irreversible, and significant for common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle and Leisler's bat. The effect of injury and/or fatality was assessed to be long-term, reversible, and not significant for brown long-eared bat and Daubenton's bat.

Curtailment mitigation and monitoring measures are proposed, and no residual effects have been identified. Table 31-8 presents a summary of the potential impacts, mitigation measures and residual effects in respect to bats in the marine environment. Table 31-9 presents a summary of the potential cumulative impacts, mitigation measures and residual effects.

The cumulative impacts assessed include:

- Disturbance/ ultrasonic emission interference;
- Injury and/or fatality; and
- Alteration of migration routes.

No potential transboundary impacts have been identified in regard to effects of the Project.

Table 31-8: Summary of potential environment effects, mitigation and monitoring.

Potential impact	Phase C	Phase O	Phase D	Measures included in the Project	Extent	Magnitude	Duration	Timing/Frequency	Reversibility	Significance of effect	Mitigation measures	Residual effect	Proposed monitoring
Disturbance/ ultrasonic emission interference	×	✓	×	N/A	Unknown	A reduction in feeding success	Operational lifetime of the Project (40 years).	Operational turbine parameters defined in volume 2A, chapter 5: Project Description.	Reversible	Not significant	None	None	None
Injury and/or fatality (Nathusius' pipistrelle, common pipistrelle, soprano pipistrelle, and Leisler's bat)	×	✓	×	N/A	Unknown	Potential injury and/or fatality of an unknown numbers of bats during migration	Operational lifetime of the Project (40 years).	Operational turbine parameters defined in volume 2A, chapter 5: Project Description.	Potentially irreversible	Significant	Turbine curtailment criteria will be established based on a combination of conditions (i.e. ideal conditions for bats) to stop or slow down the turbines during peak bat migration periods. Bat data will be collected at the lowest blade tip height and at the nacelle height, and upon agreement with the NPWS, an adjustment to the curtailment criteria may be made based on the results of bat migration records during the first year of operation. Static bat detectors will be re-deployed evenly across the 25 wind turbine offshore wind farm area. Upon agreement with the NPWS, static detector survey results from year one and year two will be used as an average to update the curtailment criteria, and no further acoustic surveys will be undertaken. Another survey may be useful to check any changes in bat migration after several years.	None	A competent and experienced Ecologist shall be appointed to ensure that the mitigation measures and monitoring scheme are implemented in full. Bat data collection will be undertaken pre and post construction at five locations across the offshore wind farm area. An annual detailed report will be submitted to the NPWS for discussion
Injury and/or fatality (Brown long-eared bat and Daubenton's bat)	×	✓	×	N/A	Unknown	Potential injury and/or fatality of an unknown numbers of bats during migration	Operational lifetime of the Project (40 years).	Operational turbine parameters defined in volume 2A, chapter 5: Project Description.	Reversible	Not significant	None	None	None

Table 31-9: Summary of potential cumulative environment effects, mitigation and monitoring.

Potential impact	Phase C	Phase O	Phase D	Measures included in the Project	Extent	Magnitude	Duration	Timing/Frequency	Reversibility	Significance of effect	Mitigation measures	Residual effect	Proposed monitoring
Disturbance/ ultrasonic emission interference	×	✓	×	N/A	Unknown	A reduction in feeding success	Cumulative operational lifetime of the projects	Operational turbine parameters defined in volume 2A, chapter 5: Project Description.	Reversible	Not significant	None	None	None
Injury and/or fatality (Nathusius' pipistrelle, common pipistrelle, soprano pipistrelle, and Leisler's bat)	×	✓	×	N/A	Unknown	Potential injury and/or fatality of an unknown numbers of bats during migration	Cumulative operational lifetime of the projects	Operational turbine parameters defined in volume 2A, chapter 5: Project Description.	Potentially irreversible	Significant	Turbine curtailment criteria will be established based on a combination of conditions (i.e. ideal conditions for bats) to stop or slow down the turbines during peak bat migration periods. Bat data will be collected at the lowest blade tip height and at the nacelle height, and upon agreement with the NPWS, an adjustment to the curtailment criteria may be made based on the results of bat migration records during the first year of operation. Static bat detectors will be re-deployed evenly across the 25 wind turbine offshore wind farm area. Upon agreement with the NPWS, static detector survey results from year one and year two will be used as an average to update the curtailment criteria, and no further acoustic surveys will be undertaken. Another survey may be useful to check any changes in bat migration after several years.	None	A competent and experienced Ecologist shall be appointed to ensure that the mitigation measures and monitoring scheme are implemented in full. Bat data collection will be undertaken pre and post construction at five locations across the offshore wind farm area. An annual detailed report will be submitted to the NPWS for discussion
Injury and/or fatality (Brown long-eared bat and Daubenton's bat)	×	✓	×	N/A	Unknown	Potential injury and/or fatality of an unknown numbers of bats during migration	Cumulative operational lifetime of the projects	Operational turbine parameters defined in volume 2A, chapter 5: Project Description.	Reversible	Not significant	None	None	None
Alteration of migration routes (Nathusius' pipistrelle, common pipistrelle, soprano pipistrelle, and Leisler's bat)	×	✓	×	N/A	The Irish Sea	The displacement of an unknown numbers of bats during migration	Cumulative operational lifetime of the projects	Operational turbine parameters defined in volume 2A, chapter 5: Project Description.	Potentially irreversible	Significant	Turbine curtailment criteria will be established based on a combination of conditions (i.e. ideal conditions for bats) to stop or slow down the turbines during peak bat migration periods. Bat data will be collected at the lowest blade tip height and at the nacelle height, and upon agreement with the NPWS, an adjustment to the curtailment criteria may be made based on the results of bat migration records during the first year of operation. Static bat detectors will be re-deployed evenly across the 25 wind turbine offshore wind farm area. Upon agreement with the NPWS, static detector survey results from year one and year two will be used as an average to update the curtailment criteria, and no further acoustic surveys will be undertaken. Another survey may be useful to check any changes in bat migration after several years.	None	A competent and experienced Ecologist shall be appointed to ensure that the mitigation measures and monitoring scheme are implemented in full. Bat data collection will be undertaken pre and post construction at five locations across the offshore wind farm area. An annual detailed report will be submitted to the NPWS for discussion
Alteration of migration routes (Brown long-eared bat and Daubenton's bat)	×	✓	×	N/A	The Irish Sea	The displacement of an unknown numbers of bats during migration	Cumulative operational lifetime of the projects	Operational turbine parameters defined in volume 2A, chapter 5: Project Description.	Reversible	Not significant	None	None	None

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