Arklow Bank Wind Park 2

Environmental Impact Assessment Report

Volume III, Appendix 12.4: Offshore Ornithology Technical Report - Seabird Collision Risk Model Input Parameters (Revised March 2026)

SSE Renewables

Arklow Bank Wind Park 2

Appendix 12.04 Offshore Ornithology Technical Report

Collision Risk Model Input Parameters (Revised March 2026)

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GLOSSARY

Term	Meaning
Arklow Bank Wind Park 2 – Offshore Infrastructure	"The Proposed Development", Arklow Bank Wind Park 2 Offshore Infrastructure: This includes all elements under the existing Maritime Area Consent.
Arklow Bank Wind Park 2 (ABWP2) (The Project)	Arklow Bank Wind Park 2 (ABWP2) (The Project) is the onshore and offshore infrastructure. This EIAR is being prepared for the Offshore Infrastructure. Consents for the Onshore Grid Infrastructure (Planning Reference 310090) and Operations Maintenance Facility (Planning Reference 211316) has been granted on 26th May 2022 and 20th July 2022, respectively. • Arklow Bank Wind Park 2 Offshore Infrastructure: This includes all elements to be consented in accordance with the Maritime Area Consent. This is the subject of this EIAR and will be referred to as 'the Proposed Development' in the EIAR. • Arklow Bank Wind Park 2 Onshore Grid Infrastructure: This relates to the onshore grid infrastructure for which planning permission has been granted. • Arklow Bank Wind Park 2 Operations and Maintenance Facility (OMF): This includes the onshore and nearshore infrastructure at the OMF, for which planning permission has been granted. • Arklow Bank Wind Park 2 EirGrid Upgrade Works: any non-contestable grid upgrade works, consent to be sought and works to be completed by EirGrid.
Array Area	The Array Area is the area within which the Wind Turbine Generators (WTGs), the Offshore Substation Platforms (OSPs), and associated cables (export, inter- array and interconnector cabling) and foundations will be installed.
Nocturnal Activity Factor	Nocturnal Activity Factors indicate the amount of flight activity at night as a proportion of daytime flight activity. These factors were derived from reviews of seabird activity reported in Garthe and Hüppop (2004) which ranked species from 1 to 5 (1 low, 5 high) for relative nocturnal activity. These rates were subsequently modified for the purposes of CRM into 1 = 0%, 2 = 25%, 3 = 50%, 4 = 75% and 5 = 100% flying activity at night. For example, a nocturnal activity factor of 2 assumes that on average, nocturnal activity is around 25% of daytime level.

ACRONYMS

Term	Meaning
CRM	Collision Risk Model/Modelling
EIA	Environmental Impact Assessment
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
MHW	Mean High Water
MSL	Mean Sea Level
NAF	Nocturnal Activity Factor

Term	Meaning
RPM	Revolutions Per Minute
SNCB	Statutory Nature Conservation Bodies
WTG	Wind Turbine Generator
UK	United Kingdom

UNITS

Unit	Description
Birds/km2	Birds per square kilometre (density)
m	Metre (distance)
m/s	Metres per second (speed)

1 OFFSHORE ORNITHOLOGY TECHNICAL REPORT: COLLISION RISK MODEL INPUT PARAMETERS

1.1 Introduction

1. This Technical Report provides tables of the input parameters used in the Collision Risk Modelling (CRM) for the Array Area to inform the Environmental Impact Assessment (EIA) of the Arklow Bank Wind Park 2 Offshore Infrastructure (hereafter referred to as 'the Proposed Development'). Collisions were estimated using the stochastic Band (2012) CRM, option 2 (generic flight heights) for all species, plus option 1 (site specific flight heights) for kittiwake.

2. Species were selected for inclusion in the CRM on the basis of a combination of factors, including the estimated density of birds recorded in-flight and knowledge of the species typical flight height range. For example, species including guillemot, razorbill and Manx shearwater fly close to the sea surface, well below the lower rotor tip heights, and therefore even at high densities the risk of collision is considered to be negligible. Therefore, these and similar low-flying species have been scoped out of the collision assessment (Johnson *et al*., 2014). However, all other seabird species, even those recorded in very low densities, were included in the assessment to ensure that all potential impacts were considered.

1.2 Collision Risk Model Input Parameters

3. CRM input parameters are provided in the following tables:

   a) Table 12.4.1: counts of kittiwake recorded in height bands at ABWP2, Dublin Array and Codling Wind Park used to estimate site-specific flight heights;

   b) Table 12.4.2: density (birds/km^2) of birds in flight within the Array Area in each month, presented as the mean and upper and lower 95% confidence range derived from 1,000 nonparametric bootstrap simulations (the monthly values were derived as the mean of two months of survey density data and the 95% confidence intervals are derived from bootstrap data);

   c) Table 12.4.3: biometrics for each species modelled (e.g. wingspan, body length, etc.), nocturnal activity factors and avoidance rates; and

   d) Table 12.4.4 and Table 12.4.5: the wind farm and wind turbine operating parameters. Note that three turbine models are under consideration.

4. For all species collisions were estimated using the generic flight height data as provided by Johnston *et al*., (2014). In addition, for kittiwake site-specific flight height data have been collected during boat-based surveys of three sites (ABWP2, Codling, Dublin Array) and the proportion of kittiwake at collision height (PCH) was calculated using each dataset. The sample sizes and estimated kittiwake PCH are provided in Table 12.4.1.

5. The most recent UK guidance on CRM (JNCC 2024) states the following with respect to site specific flight height data:

   We recommend that robust site-specific flight height data is utilised for proposed offshore wind developments, if available.

6. The JNCC guidance also states that alongside option 1 CRM (i.e. using site-specific data) option 2 should be provided for comparison.

7. In the Irish context, Part 2 of the Guidance on Marine Baseline Ecological Assessments & Monitoring Activities for Offshore Renewable Energy Projects (DCCAE 2018) states the following in Box 7 in relation to Bird survey flight height assessment:

   > *Flight height assessment is required for Collision Risk Modelling. Flight heights can be recorded through a range of survey methods and expressed as bird density (e.g. number of birds flying at a given height as in the 'Snapshot' survey method), bird occupancy in a given airspace per unit time, or bird flux as expressed as birds passing an imaginary transect line per unit time. This data should be recorded as accurately as possible, e.g. +/- 10/20m, rather than in generic flight bands. This will ensure the usability of the data regardless of future changes in turbine design. In addition, this will allow a refinement of the collision risk model to reflect the fact that most seabirds fly close to the sea surface and may only be at risk of collision with the lower sweep of the rotor. As detailed flight height data at sea may be difficult to record, typical flight heights gathered from other comparable sites could also be used. Flight height data should be presented in terms of density, bird occupancy, or bird flux e.g. birds/km2, to assess collision risk height with a turbine. At proposed wind farm sites where the collision risk is not negligible, further survey work may be required to assess the significance of the predicted mortality, particularly with regard to impacts on potentially sensitive species. Digital aerial survey techniques, telemetry and altimeters (pressure censors) are becoming increasingly used to gain more accurate flight height data for use in flight height and behavioural assessment.*

8. Both the UK and Irish guidance therefore place an emphasis on the use of site-specific flight height estimates as preferable to generic, if available. The Irish guidance further allows for use of such data from 'comparable sites', although 'comparable' is not further defined.

9. The site-specific kittiwake PCH for a rotor height of 36m above MSL as recorded at ABWP2, Dublin Array and Codling were 0.07%, 0.66% and 1.60%, respectively. To obtain a regional estimate using each of these datasets, and assuming a lower rotor tip height of 35m (since each survey applied slightly different height bands), a weighted average was calculated using the individual PCH values and the sample sizes. This gave a combined PCH of 0.0072 (0.72%).

10. CRM was conducted for kittiwake using:

    - The generic PCH (Band Option 2),
    - Using flight height data collected at ABWP2 only (Band Option 1), and
    - The weighted average estimate (Band Option 1).

11. The weighted average represents the specific flight heights obtained at the site itself as well as at nearby comparable sites in accordance with the Irish guidance (and is therefore the one on which the Proposed Development has concluded), while the estimates obtained using the ABWP2 data only provided for information in the case that these data are considered more appropriate.

Table 12.4.1: Kittiwake flight height data recorded at ABWP2, Codling and Dublin Array and estimated PCH.

Site	Number of surveys	Number of observations in each height band (m; note overlapping bands from different surveys)							Total	Height assumed for PCH (m above MSL)	Proportion at PCH
		0-5	5-10	10-20	20-30	20-40	>30	>40			
Dublin Array	39	956	2161	2776	300	NA	41	NA	6234	30	0.0066
Codling	15	1127	486	345	123	NA	38	6	2119	36	0.0160
ABWP2 *	7	1544	743		NA	76	NA	0	2294	36	0.00076
Weighted average										35	0.0072

* Note that lower rotor tip height at ABWP2 is 37m from LAT with a 1.115m offset to MSL, equating to 35.885m from MSL. For calculations it was assumed that height records in the 20-40m band were uniformly distributed, hence 1 bird between 36-40m (i.e. at PCH)

1.2.1 Avoidance Rate

12. A key parameter in the CRM is the avoidance rate, which accounts for the fact that birds will actively avoid colliding with the rotors (at a range of scales), while the baseline survey data are collected before turbines are installed. United Kingdom (UK) Statutory Nature Conservation Bodies (SNCBs) produced guidance on the rates to use for key collision risk species (Joint Nature Conservation Committee (JNCC) *et al.,* 2014) following a review conducted for Marine Scotland (Cook et al. 2014). Following this a joint industry study was conducted in an operational windfarm, using a combination of direct observations, radar and cameras (Skov *et al.,* 2018), which generated revised (higher) avoidance rates for gannet and kittiwake. Bowgen and Cook (2018) were commissioned by the UK SNCBs to conduct an independent analysis using the same data and generated slightly more conservative avoidance rates.

13. More recently the University of Exeter was commissioned by JNCC to review and update seabird avoidance rates (Ozsanlav-Harris, *et al.,* 2023), which also recommended increases in avoidance for most species. Following this the avoidance rates recommended in joint UK SNCB (2024) guidance are:

- Gannet 99.3% with further consideration to be given to the application of additional macro avoidance (i.e. avoidance of the windfarm as a whole – see Natural England 2022 for further explanation), which was applied at a rate of 70% (as per Natural England guidance) to give an overall avoidance rate of 99.76%;
- Kittiwake 99.3%;
- Herring gull, lesser black-backed gull, great black-backed gull 99.4%;
- Little gull, common gull, black-headed gull 99.5%; and
- All other species 99.1%.

14. The remaining parameters are provided in Table 12.4.2.

Table 12.4.2: Species biometrics used in the CRM. Mean values and standard deviations (where applicable).

Species	Body length[1] (m)	Wingspan[2] (m)	Flight speed[3] (m/s)	Nocturnal Activity Rate [4] (%)	Avoidance rate[5]	Flight type
Arctic tern	0.33 (0)	0.87 (0)	10.5 (0)	0	99.1 (0.04)	Flapping
Black-headed gull	0.37 (0)	1.10 (0)	11.9 (0)	25.0 (0)	99.5 (0.02)	Flapping
Common gull	0.42 (0)	1.30 (0)	13.4 (0)	25.0 (0)	99.5 (0.02)	Flapping
Common tern	0.33 (0)	0.87 (0)	10.5 (0)	0	99.1 (0.04)	Flapping
Fulmar	0.48 (0)	1.07 (0)	13.0 (0)	75 (0)	99.1 (0.04)	Flapping
Gannet	0.94 (0.0325)	1.72 (0.0375)	14.9 (0)	8 (10.0)	99.79 (0.03)	Flapping
Great black-backed gull	0.71 (0.035)	1.58 (0.0375)	13.7 (1.2)	37.5 (6.375)	99.4 (0.04)	Flapping
Herring gull	0.60 (0.0225)	1.44 (0.03)	12.8 (1.8)	37.5 (6.375)	99.4 (0.04)	Flapping
Kittiwake	0.39 (0.05)	1.08 (0.0625)	8.71 (0.4)	37.5 (6.375)	99.3 (0.03)	Flapping
Lesser black-backed gull	0.58 (0.03)	1.42 (0.0375)	13.1 (1.9)	37.5 (6.375)	99.4 (0.04)	Flapping
Little gull	0.26 (0)	0.78 (0)	12.2 (0)	25.0 (0)	99.5 (0.02)	Flapping
Sandwich tern	0.38 (0.005)	1.00 (0.04)	10.3 (3.4)	0 (0)	99.1 (0.04)	Flapping

1. Robinson (2005)
2. Pennycuick (1987), Alerstam (2007), Skov *et al.,* (2018)
3. Garthe and Hüppop (2004), Furness et al. (2018), MacArthur Green (2015)
4. Cook et al. (2014), JNCC *et al*., (2014), Bowgen and Cook (2018)
5. Natural England (2022)

Table 12.4.3: Monthly mean densities (and standard deviation) of birds in flight within the Array Area used in the deterministic CRM.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Arctic tern	0 (0)	0 (0)	0 (0)	1.97 (1.27)	0.93 (0.49)	0 (0)	0 (0)	8.44 (3.59)	0.31 (0.22)	0.31 (0.19)	0 (0)	0 (0)
Black-headed gull	7.16 (3.37)	3.4 (1.87)	0.36 (0.33)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0.04 (0.04)	0.05 (0.05)	0.67 (0.43)	2.01 (1.01)	5.82 (4.22)
Common gull	7.16 (4.04)	13.82 (6.31)	0.31 (0.19)	0.04 (0.04)	0 (0)	0.23 (0.23)	0 (0)	0 (0)	0 (0)	0 (0)	2.01 (0.98)	5.41 (4.35)
Common tern	0 (0)	0 (0)	0 (0)	0.73 (0.33)	1.13 (0.9)	0 (0)	0 (0)	4.07 (1.43)	0.85 (0.33)	0 (0)	0 (0)	0 (0)
Fulmar	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)	0 (0)	0 (0)	0 (0)	0.08 (0.08)	0 (0)	0 (0)	0 (0)
Gannet	0.08 (0.07)	0.15 (0.15)	0.21 (0.17)	0.15 (0.16)	0.12 (0.1)	0.12 (0.12)	0.15 (0.12)	0.54 (0.51)	0.05 (0.05)	0.46 (0.27)	0.08 (0.08)	0.15 (0.15)
Great black-backed gull	0.08 (0.08)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Herring gull	0 (0)	0.04 (0.04)	0.04 (0.04)	0.08 (0.06)	0 (0)	0 (0)	0 (0)	0.12 (0.08)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Kittiwake	12.41 (4.44)	41.97 (14.28)	11.43 (4.05)	8.61 (2.46)	2.82 (1.06)	2.51 (0.88)	1.08 (0.55)	0.89 (0.42)	0.77 (0.43)	2.88 (1.1)	6.02 (2.5)	19.05 (10.02)
Lesser black-backed gull	0 (0)	0 (0)	0.12 (0.09)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Little gull	11.84 (7.13)	2.24 (1.25)	1.39 (0.9)	0.08 (0.08)	0 (0)	0 (0)	0 (0)	0.39 (0.25)	1.75 (1.33)	3.19 (1.92)	7.83 (3.57)	16.47 (7.75)
Sandwich tern	0 (0)	0 (0)	0 (0)	0 (0)	0.08 (0.07)	0 (0)	0 (0)	0.05 (0.05)	0.15 (0.09)	0 (0)	0 (0)	0 (0)

Table 12.4.4: Windfarm and turbine specifications used in the CRM.

Turbine scenario	Average Revolutions Per Minute (RPM)	Rotor radius (m)	Hub height above Lowest Astronomical Tide (LAT) (m)	Max. blade width (m)	Mean blade pitch (°)	No. of turbines	Latitude (°)	Tidal offset (m, LAT to Mean Sea Level (MSL)
1a	6.34	118	155	5.1	3.7	53	52.81	-1.115
1b	5.73	118	155	6.5	4.04	53	52.81	-1.115
2	6.19	125	162	6.9	2.34	47	52.81	-1.115

Table 12.4.5: Wind turbine Monthly percentage operational time used in the CRM.

Turbine scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1a	0.910	0.944	0.917	0.884	0.870	0.881	0.830	0.884	0.895	0.942	0.921	0.928
1b	0.909	0.944	0.916	0.883	0.870	0.880	0.829	0.883	0.895	0.942	0.920	0.927
2	0.916	0.939	0.919	0.890	0.881	0.887	0.842	0.890	0.907	0.943	0.928	0.933

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