APPENDIX 11

COLLISION RISK ASSESSMENT

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1. INTRODUCTION

This document outlines the methodology used to conduct a collision risk assessment of the proposed Ballydermot Wind Farm (the Proposed Project). This assessment calculates an annual collision rate using a mathematical model to predict the number of birds that may be killed by collision with moving wind turbine rotor blades. The modelling method used is the Collision Risk Model provided by Band (2024) and NatureScot methodology (2024). This method is recommended by NatureScot and provides a standardised approach to collision risk assessment for onshore wind farms. Note that these are theoretical predictions, therefore the results must be interpreted with a degree of caution.

2. METHODOLOGY

2.1 Modelling Process

The collision risk model estimates the number of collisions through the following stages:

- **Stage A Flight activity** - uses bird survey data to establish the density of flying birds in the vicinity of turbines, and the proportion flying at a risk height (between the lowest and highest points of the rotors). Risk was calculated following formulae outlined in Band (2024).
- **Stage B Number of flights through rotors** – makes an estimate, based on the bird density and proportion at risk height, of the potential number of bird passages through rotors. The initial assumption is that birds will continue to make flights within the area at the same intensity as before.
- **Stage C Probability of collision** - calculates the probability of collision during a single bird rotor transit.
- **Stage D Expected collisions** - multiplies the outputs of stage B and C to yield the potential collision rate for the bird species, assuming current levels of bird use of the site but allowing for the proportion of time that turbines are not operational.
- **Stage E Allowing for avoidance and attraction** - takes account of the proportion of birds likely to avoid a wind farm or its turbines, either because they have been displaced from the site or because they take evasive action or are attracted to the wind farm.
- **Stage F Uncertainty** - each of these five stages is followed by a further stage, stage F, which describes how to express the uncertainty surrounding a collision risk estimate.

The general features and assumptions of the collision risk model are discussed in further detail in Band (2024). Using the model, a final predicted annual collision rate can be predicted for each species that can be used in the impact assessment

2.2 Turbine Specifications

There are two turbine dimensions proposed for the Proposed Project, an outer ring of turbines with a tip height of 200m (hereafter referred to as 200m Proposed Turbines) and larger inner turbines with a tip height of 220m (hereafter referred to as 220m Proposed Turbines). A collision risk model was run for each turbine model (one for 200m Proposed Turbines at a suspended layer of 30m and another for 220m Proposed Turbines at a suspended layer of 50m) and the results were summed together to get the final annual collision rate for each species. The turbine specifications used in the model are provided in Table 7 - 6 - 1. The expected operational time of the Proposed Turbines is 85% according to report by the British Wind Energy Association (BWEA; 2007) which identifies the standard operational period of the wind turbines in the UK.

Table 7 - 6 - 1 Turbine specifications – Outer Turbines

Component	Scenario Modelled	
	200m Turbines	220m Turbines
Latitude (°N)	53.284351	
Turbine model	Siemens Gamesa SG170	
Number of turbines	19	27
Hub height (m)	115	135
Rotor diameter (m)	170	
Blade pitch (°)	23	
Maximum blade width (m)	4.5	
Rotational speed (rpm)	10.3	
Number of blades	3	

The turbine blade profile used in the model is presented in Table 7 - 6 - 2. In the absence of a specific blade profile for this turbine model, the blade profile provided in the collision risk model spreadsheet in Band (2024) has been used. This table provides the chord width values at 20 evenly spaced points along the blade, expressed relative to the maximum chord width. The ratio r/R represents the relative radial position along the blade, where 0 corresponds to the hub and 1 corresponds to the blade tip, while the ratio c/C represents the relative chord width. Further information on blade profiles is in Section 4 'Worked Example'.

Table 7 - 6 - 2 Turbine blade profile

r/R	c/C
0.00	0.690
0.05	0.730
0.10	0.790
0.15	0.880
0.20	0.960
0.25	1.000
0.30	0.980
0.35	0.920
0.40	0.850
0.45	0.800
0.50	0.750
0.55	0.700
0.60	0.640
0.65	0.580
0.70	0.520
0.75	0.470
0.80	0.410
0.85	0.370
0.90	0.300
0.95	0.240
1.00	0.000

2.3 Vantage Point Surveys

The assessment is based on vantage point surveys to monitor flight activity undertaken between April 2020 and March 2026. This represents a 72-month period, consisting of six breeding seasons and six winter seasons, which is in full compliance with guidance from NatureScot (formerly Scottish Natural Heritage [SNH]) outlined in SNH (2017), which was revised in NatureScot (2025a). Surveys remain in accordance with the updated guidance.

Surveys were undertaken at 16 vantage points. Viewsheds were calculated using the Visibility Analysis plugin (Version 1.8) over a raster digital terrain model (DTM) in QGIS (Version 3.28). A point 1.75m in height (to represent the height of the surveyor) was created on a map using 10m contours terrain data, accounting for the relative height of any surrounding landscape features (e.g., trees) which were measured using a ForestPro altimeter. Any recorded vegetation heights were merged with a DTM to create a digital elevation model (DEM) to create viewsheds incorporating surrounding landscape features using QGIS (Version 3.28). The software produced a 360° viewshed at 30m (200m turbines) and 50m (220m turbines) from ground level up, and to a 2km radius around the vantage point. The combined viewsheds from these vantage points provided coverage to a 500m radius of the potential turbine positions. There are five turbines (T01, T02, T04, T13 and T46) that are not covered by a vantage point survey at the lowest swept height for the 200m Proposed Turbines, and two turbines (T11 and T15) that are not covered by a vantage point survey at the lowest swept height for the 220m Proposed Turbines. The Band Model (Band, 2024) can account for gaps in the viewshed, therefore this is not a significant limitation on the collision risk model. Furthermore, the habitats throughout the Core Ornithology Study Area are predominantly open peatland and scrub, and therefore, significant differences in the avian distribution and abundance are not anticipated within the viewshed gaps. No ecologically significant gaps were identified i.e. any habitat or landscape feature which could attract birds was suitably covered by viewsheds. Vantage point surveys where no turbines of that dimension were present were excluded from each of the models run. The vantage points and the area watched (i.e., the area of the viewsheds) are listed in Table 7 - 6 - 3.

Table 7 - 6 - 3 Vantage points

Vantage Point	Area Watched (ha)	
	200m Proposed Turbines	220m Proposed Turbines
VP1	515	Not included
VP2	404	579
VP3	Not included	347
VP4	302	Not included
VP5	Not included	Not included
VP6	Not included	Not included
VP7	Not included	638
VP8	150	322
VP9	344	378
VP10	284	Not included
VP11	Not included	400
VP12	Not included	569
VP13	545	638
VP14	205	391
VP15	414	582
VP16	Not included	567

Survey methodology followed SNH (2017; revised in NatureScot, 2025). The surveyor collected data on bird observations and flight activity from the scanning arc of 180° to a 2km radius at the fixed vantage

point locations for two 3-hour watches separated by a minimum 30-minute break (i.e., 6 hours total) per month. Surveys were conducted during optimal weather conditions and visibility at all times possible over the six-year period, however some surveys were undertaken during periods of suboptimal weather/visibility. The overall survey programme provided a sufficient volume and coverage of data to support a robust assessment. As such, the limited number of surveys affected by poor weather conditions is not considered to materially influence the overall conclusions of this assessment. The survey effort summary is presented in Table 7 - 6 - 4, summarising the total survey effort per season, expressed in terms of minimum hours per vantage point. Appendix 7-6-1, Table 7-6-1-1 provides survey effort expressed in terms of hours and seconds per month for each vantage point.

Table 7 - 6 - 4 Survey effort summary

Survey Season and Number of Vantage Points	Effort per Vantage Point
Breeding Season 2020 (16 vantage points)	36 hours per vantage point
Winter Season 2020/2021 (16 vantage points)	36 hours per vantage point
Breeding Season 2021 (16 vantage points)	36 hours per vantage point
Winter Season 2021/2022 (16 vantage points)	36 hours per vantage point
Breeding Season 2022 (16 vantage points)	36 hours per vantage point
Winter Season 2022/2023 (16 vantage points)	36 hours per vantage point
Breeding Season 2023 (16 vantage points)	36 hours per vantage point
Winter Season 2023/2024 (16 vantage points)	36 hours per vantage point
Breeding Season 2024 (16 vantage points)	36 hours per vantage point
Winter Season 2024/2025 (16 vantage points)	36 hours per vantage point
Breeding Season 2025 (16 vantage points)	36 hours per vantage point
Winter Season 2025/2026 (16 vantage points)	36 hours per vantage point

Vantage point surveys should be spread over the full daylight period. Figure 7 - 6 - 1 (breeding season) and Figure 7 - 6 - 2 (winter season) present the spread of survey time over intervals of the day when bird activity may vary (e.g., close to dawn/dusk or morning/evening). During the breeding season, these intervals were categorised into the following: 0-2 hours after sunrise, 2-5 hours after sunrise, 2-5 hours before sunset and 0-2 hours before sunset. Time greater than 5 hours after sunrise but 5 hours before sunset was categorised as 'middle of day'. The number of minutes of survey occurring within each interval is presented in Figure 7 - 6 - 1. It should be noted that the time available for survey 2-5 hours after sunrise/before sunset is greater than that 0-2 hours after sunrise/before sunset, and greater again in the middle of the day. During the winter season, the intervals were categorised into 'sunrise to noon' and 'noon to sunset'. The number of minutes of survey occurring within each interval is presented in Figure 7 - 6 - 2. This figures also shows minutes of survey that occurred before sunrise or after sunset. As before, it should be notes the time available for survey before sunrise/after sunset is much less than that between sunrise and sunset.

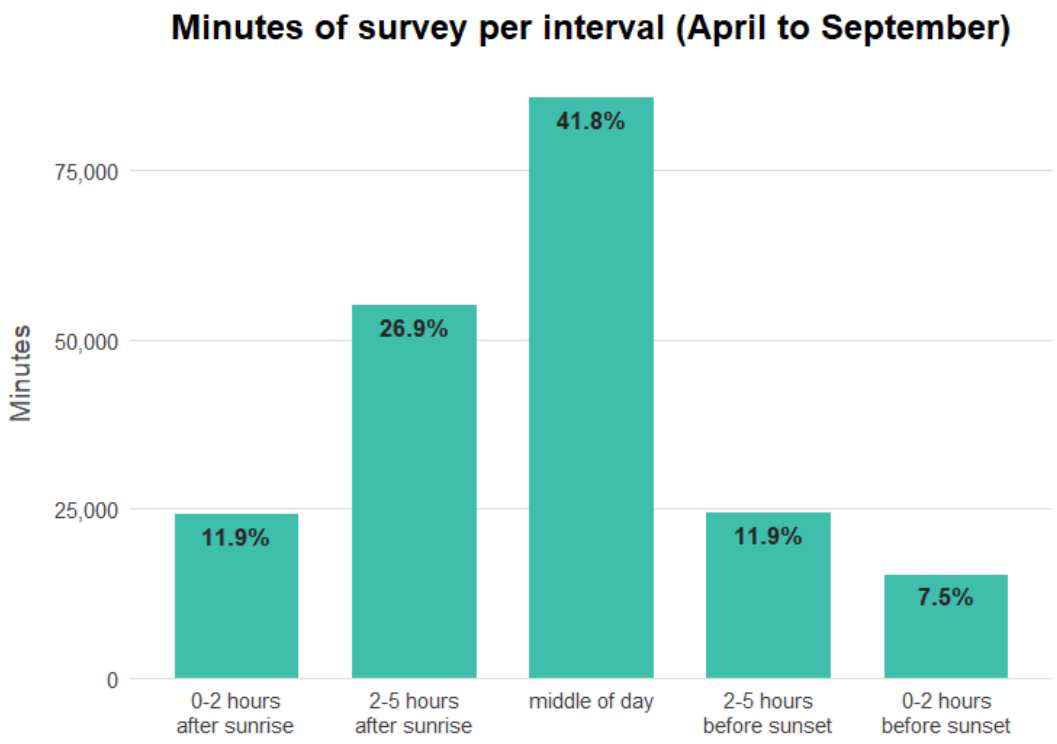


Figure 7 - 6 - 1 Minutes of survey per daytime interval during the breeding season

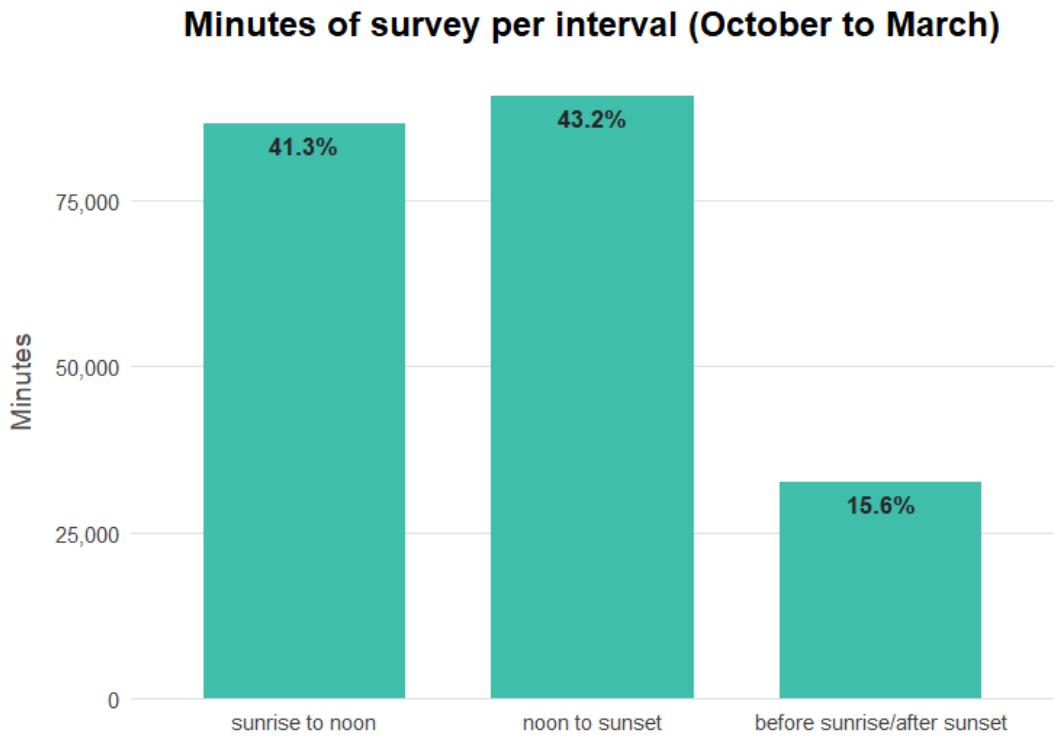


Figure 7 - 6 - 2 Minutes of survey per daytime interval during the winter season

Flight activity of target species was mapped and recorded as per defined flight bands which were chosen in relation to the dimensions of potential turbine models at the outset of surveys. These heights bands were:

- Band 1 = 0-15m
- Band 2 = 15-25m
- Band 3 = 25-50m (September 2022 to March 2026)
- Band 4 = 25-200m (April 2020 to August 2022)
- Band 5 = 50-200m (September 2022 to March 2026)
- Band 6 = 200m+

As the risk height range of the 200m Proposed Turbines is 30-200m, all flight activity in Bands 3, 4 and 5 are considered to be at potential collision height (PCH) for this collision risk model. As the risk height range of the 220m Proposed Turbines is 50-220m, all flight activity in Bands 4, 5 and 6 are considered to be at PCH for this collision risk model.

Some survey data was not collected in the above bands. To account for this, a species-specific correction factor was used. This correction factor was calculated based on the survey data which was collected using the bands outlined above: for each species, the total number of seconds recorded in PCH bands was divided by the total seconds recorded across all bands. Then, the data not collected in the above bands was reassigned to PCH bands: the total number of flight seconds was multiplied by the correction factor and the product was reassigned to PCH bands. The total duration of each flight was then split into band 1 (not within the PCH) and band 4 or 5, depending on the date outlined above (within the PCH). Collision risk was estimated using these corrected values. The correction factor for each species were:

- Buzzard – 72% of flight activity within the PCH
- Curlew – 39% of flight activity within the PCH
- Golden plover – 75% of flight activity within the PCH
- Hen harrier – 19% of flight activity within the PCH
- Kestrel – 48% of flight activity within the PCH
- Lapwing – 75% of flight activity within the PCH
- Lesser black-backed gull – 64% of flight activity within the PCH
- Little egret – 14% of flight activity within the PCH
- Long-eared owl – 9% of flight activity within the PCH
- Merlin – 34% of flight activity within the PCH
- Peregrine – 68% of flight activity within the PCH
- Snipe – 73% of flight activity within the PCH
- Sparrowhawk – 60% of flight activity within the PCH
- Whooper swan – 25% of flight activity within the PCH
- Woodcock – 22% of flight activity within the PCH

2.4 Species Assessed

Collision rates were estimated for the species listed in Table 7 - 6 - 5. The months included for each species are also presented. Bird flight patterns were assessed visually prior to assessment and investigated for indications of biases in flight directions or associations with flight corridors or attractions to landscape features. Records were also investigated for annual variations in observations. Upon conclusion of these assessments, no biases were found and species were assessed using nondirectional models as outlined in Table 7 - 6 - 5 below. In several instances, flight activity recorded during surveys crossed the boundary of a viewshed. Given that the underlying landscape beyond the viewshed boundary was comparable to that within the viewshed, these observations were considered representative of the site. Accordingly, all flight activity intersecting or extending beyond viewshed boundaries was retained within the collision risk modelling dataset.

Table 7 - 6 - 5 Species assessed

Species	Months	Model
Buzzard	Apr-Mar	nondirectional
Curlew	Apr-Sep	nondirectional
Golden Plover	Apr-Mar	nondirectional
Greenland White-fronted Goose	Oct-Mar	nondirectional
Hen Harrier	Apr-Mar	nondirectional
Kestrel	Apr-Mar	nondirectional
Lapwing	Apr-Jul	nondirectional
Lapwing	Aug-Mar	nondirectional
Lesser black-backed gull	Oct-Mar	nondirectional
Little Egret	Apr-Mar	nondirectional
Long-eared Owl	Apr-Mar	nondirectional
Merlin	Apr-Mar	nondirectional
Peregrine Falcon	Apr-Mar	nondirectional
Snipe	Apr-Mar	nondirectional
Sparrowhawk	Apr-Mar	nondirectional
White-tailed Eagle	Apr-Mar	nondirectional
Whooper Swan	Sep-Mar	nondirectional
Woodcock	Apr-Mar	nondirectional

Species biometrics, such as body length, body width (i.e., wingspan) and flight speed, as well as whether a bird typically flaps or glides in flight, are required to calculate collision risk. This information was sourced from the best available literature. In addition, a 'nocturnal activity factor is required'. There is considerable uncertainty about levels of bird flight activity by night (Band, 2024). There are no standard expert rankings available for terrestrial species and levels of activity may vary from season to season. Because of this, each species is ranked with a nocturnal activity factor of 0%, 25%, 50%, 75% and 100%. A ranking of 0% is given to represent hardly any flight activity at night and of 100% for much flight activity at night. As such, the figures used in the collision risk model take both day and night flights into account. The biometrics, flight type and nocturnal activity factor used in the model are presented in Table 7 - 6 - 6.

Table 7 - 6 - 6 Species biometrics, flight type and nocturnal activity factor

Species	Length (cm)	Width (cm)	Flight Speed (m/s)	Nocturnal Activity Factor	Flight Type
Buzzard	54	120.5	11.6	0%	gliding
Curlew	55	90	16.3	50%	flapping
Golden Plover	27.5	71.5	17.9	25%	flapping
Greenland White-fronted Goose	71.5	147.5	16.1	25%	flapping
Hen Harrier	48	110	8	0%	flapping
Kestrel	33.5	75.5	10.1	0%	flapping
Lapwing	29.5	84.5	12.8	50%	flapping
Lesser Black-backed Gull	58	142.5	11.9	25%	flapping
Little Egret	60	91.5	10.2	25%	flapping
Long-eared Owl	36	89.5	9.4	100%	flapping & gliding
Merlin	27.5	56	10.9	0%	flapping
Peregrine Falcon	44.5	105	12.1	0%	flapping
Snipe	25.5	42	17.1	100%	flapping
Sparrowhawk	33	62.5	10	0%	flapping

Species	Length (cm)	Width (cm)	Flight Speed (m/s)	Nocturnal Activity Factor	Flight Type
White-tailed Eagle	80	220	13.6	0%	flapping
Whooper Swan	150	220	17.3	25%	flapping
Woodcock	34	60	17.1	100%	flapping

To prepare the field survey data for analysis, the number of 'bird-seconds' per month per vantage point was calculated for each observation by multiplying the number of birds aloft by the duration of the flight (in seconds). This included time spent in all recorded height bands, not just those bands within potential collision height. These values are presented per vantage point per month for each species in Appendix 7-6-1, Table 7-6-1-2.

2.5 Photoperiod

The photoperiod at the latitude of the turbines was acquired for the survey period. The daylight and nighttime hours per month are shown in Table 7 - 6 - 7. The total daylight hours was 4,487 and night-time hours was 4,273.

Table 7 - 6 - 7 Photoperiod

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daylight Hours	252.1	273.9	366.4	418.4	490.9	506.6	509.6	458.6	382.5	329.9	261.5	236.3
Nighttime Hours	491.9	398.1	377.6	301.6	253.1	213.4	234.4	285.4	337.5	414.1	458.5	507.7

2.6 Deviation from Band Model

The collision risk model for the Proposed Project based on the Band Model was reviewed by Dr. Tom Gittings. This peer review was advisory in nature and was carried out on a pre-submission draft of the CRM report. It does not constitute approval of the final content. The review focused on scientific issues related to the application of the collision risk modelling methodology. However, it did not include a detailed audit of calculations for mathematical or transcription errors. Recommended from this review have been applied to each stage of the model below and the results presented in separate tables. Table 7 - 6 - 36 presents a comparison of both collision risk models, with the theoretical precautionary scenario collision risk for each species being presented within Chapter 7.

3. RESULTS

3.1 Stage A Flight Activity

Stage A of the modelling process uses the field survey data to establish the aerial density of flying birds in the vicinity of the Proposed Turbines and the proportion flying at a risk height (between the lowest and highest points of the rotors). Aerial density was calculated from the mean across all vantage points following the formula provided by Band (2024; also see Section 4 'Worked Example'). Similarly, the proportion flying at risk height was calculated following the method in Band (2024; also see Section 4 'Worked Example'). The aerial density per month and the proportion flying at risk height for each species is shown in Table 7 - 6 - 8 and Table 7 - 6 - 9.

This method assumes that the relative detectability of different height bands is consistent across vantage points. However, this assumption may be unlikely to hold for the lower bands in landscapes where some low altitude flights may be obscured by topography or vegetation. This variation in detectability may bias the estimated proportion of activity at potential risk height according to the visibility conditions at each vantage point, rather than the true distribution of flight heights. In addition, the Band (2024) method assumes that flight activity is uniformly distributed within each height band. This assumption may also be unlikely to hold, especially in the lower bands, where flight height is influenced by topography, vegetation and species-specific behaviours. Assuming a uniform distribution within each height band may over- or under-estimate the proportion of flight activity assigned to PCH. Furthermore, calculating the proportion of flight activity across bands based on the number of flights also risks biasing the estimated proportion of activity at PCH, particularly at low bands where flights may be fragmented as the bird moves between screening topography and vegetation and the resulting number of flights may be affected by the surveyor's judgement and visibility conditions at each vantage point.

To address the above, a second calculation was performed. This used only the flight activity in the bands within PCH in the calculation of aerial density, but with the proportion flying at risk height always considered to be 1. This represents a slight deviation from the methodology outlined in Band (2024) however it reduces the risk of biasing the estimated flight activity at PCH. The aerial density per month for each species when calculated in this way is shown in Tables 7-6-10 to 7-6-11.

Table 7 - 6 - 8 Aerial density and proportion flying at risk height – 200m Proposed Turbines following Band (2024)

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Proportion
Buzzard	0.000462	0.00699	0.0108	0.00358	0.00596	0.0121	0.0052	0.00558	0.00887	0.00349	0.00209	0.000748	0.85
Curlew	-	-	-	0	0	0	0	0.000101	0	-	-	-	0.40
Golden Plover	0.0604	0.0578	0.403	0.0246	0.000149	0	0	0	0.0143	0.223	5.51	0.0214	0.85
Greenland White-	0	0	0.00547	-	-	-	-	-	-	0	0.0000579	0	0.41

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Proportion
fronted Goose													
Hen Harrier	0.000168	0.0000363	0.000161	0.0000514	0.0000116	0	0	0.000205	0.000173	0.000199	0.000159	0.000154	0.38
Kestrel	0.00281	0.00388	0.00216	0.00142	0.000277	0.00132	0.00535	0.0101	0.00405	0.00471	0.00373	0.00221	0.75
Lapwing	-	-	-	0.000469	0.000135	0.000306	0.000191	-	-	-	-	-	0.85
Lapwing	0.00273	0.00178	0.00104	-	-	-	-	0	0.00356	0.00145	0.0101	0.0994	0.88
Little Egret	0.000111	0.0000146	0.000027	0	0	0	0.0000558	0	0.0000634	0.0000715	0.0000376	0	0.31
Lesser Black-backed Gull	0.0000226	0.000711	0.000653	-	-	-	-	-	-	0.00205	0.00492	0.000542	1.03
Long-eared Owl	0.00000219	0	0	0	0.0000166	0	0	0.0000995	0.0000115	0.00000426	0	0	0.15
Merlin	0.0000154	0.0000348	0.000021	0	0	0	0	0	0.00000262	0.0000022	0.0000117	0.0000202	0.13
Peregrine Falcon	0.00011	0.0000631	0.0000143	0.0000275	0.0000132	0.0000769	0.000139	0.000413	0.000284	0.0000593	0.000041	0	0.64
Snipe	0.000113	0.000371	0.0041	0.000516	0.00173	0.00176	0.000304	0.00417	0.000145	0.000862	0.000264	0.000204	0.71
Sparrowhawk	0.000304	0.0000609	0.000268	0.000126	0.000103	0.000335	0.000373	0.000452	0.000719	0.000358	0.000161	0.000302	0.74
White-tailed Eagle	0	0.000228	0	0.0000659	0	0	0	0	0	0	0	0	0.87
Whooper Swan	0.00284	0.00233	0.00282	-	-	-	-	-	0.0000374	0.00208	0.00579	0.00205	0.52
Woodcock	0.0000295	0.0000342	0.000095	0.000428	0.000446	0	0	0	0.0000179	0.00000994	0.00000997	0.0000258	0.64

Table 7 - 6 - 9 Aerial density and proportion flying at risk height – 220m Proposed Turbines following Band (2024)

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Proportion
Buzzard	0.00104	0.00389	0.00654	0.00284	0.00253	0.0059	0.00215	0.00263	0.0031	0.00154	0.00105	0.000569	0.66
Curlew	-	-	-	0.00000518	0	0.00000769	0.0000137	0.00006	0	-	-	-	0.32
Golden Plover	0.0587	0.0442	0.262	0.0124	0.0000868	0	0	0.0000143	0.0268	0.0813	2.79	0.048	0.65
Greenland White-fronted Goose	0	0	0.00312	-	-	-	-	-	-	0	0.0000405	0	0.06
Hen Harrier	0.0000755	0.0000856	0.0000958	0.0000241	0.00000866	0	0	0.0000392	0.000101	0.000128	0.0000884	0.00011	0.32
Kestrel	0.00236	0.00225	0.00165	0.00108	0.0000715	0.000758	0.00383	0.00755	0.00283	0.00225	0.00257	0.00284	0.54
Lapwing	-	-	-	0.000511	0.000804	0.000179	0.000138	-	-	-	-	-	0.71
Lapwing	0.0519	0.0655	0.0189	-	-	-	-	0	0.00844	0.00272	0.0181	0.0104	0.68
Lesser Black-backed Gull	0.0146	0.000528	0.00233	-	-	-	-	-	-	0.0000401	0.000188	0.000403	0.72
Little Egret	0.0000126	0.00000628	0.0000116	0	0	0	0.0000359	0	0	0.0000307	0.0000161	0.0000108	0.24
Long-eared Owl	0	0	0	0.0000194	0.00000945	0	0	0.0000069	0	0.0000011	0.00000045	0	0.09
Merlin	0.0000253	0.0000138	0.0000105	0	0	0	0.00000034	0.000018	0.0000488	0.00000154	0.00000067	0.00000781	0.12
Peregrine Falcon	0.0000552	0.0000249	0.0000276	0.0000459	0	0.0000255	0.000147	0.000106	0.0000893	0.0000289	0.0000419	0.0000221	0.44
Snipe	0.0000939	0.000323	0.00942	0.00393	0.00151	0.000784	0.000216	0.00261	0.000353	0.000594	0.000193	0.000147	0.52

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Proportion
Sparrowhawk	0.000288	0.000109	0.000194	0.000109	0.000174	0.000128	0.0000939	0.000248	0.000728	0.00012	0.000164	0.000248	0.60
White-tailed Eagle	0	0.00017	0.0000112	0	0	0	0	0	0	0	0	0	0.39
Whooper Swan	0.00492	0.00162	0.00105	-	-	-	-	-	0.0000278	0.000923	0.00477	0.00189	0.34
Woodcock	0.000013	0.000017	0.0000684	0.000394	0.000422	0.0000386	0	0.00000836	0.000013	0.00000173	0.00000802	0.000029	0.56

Table 7 - 6 - 10 Aerial density and proportion flying at risk height – calculated using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 and with a range of uncertainty using a multiplicative method - 200m turbines

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Proportion
Buzzard	0.000185	0.0042	0.00772	0.00281	0.00471	0.00871	0.00355	0.00362	0.00663	0.00233	0.00127	0.000527	1.00
Curlew	-	-	-	0	0	0	0	0.000101	0	-	-	-	1.00
Golden Plover	0.0597	0.0496	0.343	0.019	0.000149	0	0	0	0.0138	0.11	3.25	0.0147	1.00
Greenland White-fronted Goose	0	0	0	-	-	-	-	-	-	0	0.0000579	0	1.00
Hen Harrier	0	0	0.0000193	0.00000502	0.00000221	0	0	0.000153	0.0000335	0.0000107	0.0000104	0.0000203	1.00
Kestrel	0.00102	0.00237	0.00127	0.000908	0.00014	0.000764	0.00274	0.00311	0.00227	0.00227	0.00145	0.00146	1.00
Lapwing	-	-	-	0.000311	0.0000918	0.00022	0.000147	-	-	-	-	-	1.00
Lapwing	0.00241	0.00123	0.000325	-	-	-	-	0	0.00168	0.00134	0.00979	0.0993	1.00
Little Egret	0.00000714	0.00000205	0.00000378	0	0	0	0.00000776	0	0.00000888	0	0	0	1.00

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Proportion
Lesser Black-backed Gull	0.0000205	0.00071	0.00036	-	-	-	-	-	-	0.00205	0.00491	0.000542	1.00
Long-eared Owl	0	0	0	0	0.0000127	0	0	0	0	0	0	0	1.00
Merlin	0	0	0.0000015	0	0	0	0	0	0	0	0	0.0000034	1.00
Peregrine Falcon	0.0000696	0.0000343	0.00000624	0.0000241	0.00000901	0.0000591	0.0000431	0.000291	0.000256	0.0000109	0.0000249	0	1.00
Snipe	0.0000144	0.000265	0.00228	0.00033	0.00125	0.00127	0.000175	0.00342	0.0000832	0.000308	0.000138	0.0000481	1.00
Sparrowhawk	0.000155	0.000017	0.000189	0.0000858	0.0000616	0.000221	0.000215	0.000197	0.000378	0.000181	0.000072	0.000135	1.00
White-tailed Eagle	0	0.00016	0	0.0000659	0	0	0	0	0	0	0	0	1.00
Whooper Swan	0.00102	0.000806	0.0000322	-	-	-	-	-	0.0000374	0.00161	0.00107	0.000441	1.00
Woodcock	0.000006	0.0000206	0.0000138	0.0000389	0.000111	0	0	0	0.00000447	0.00000248	0	0	1.00

Table 7 - 6 - 11 Aerial density and proportion flying at risk height – calculated using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 and with a range of uncertainty using a multiplicative method - 220m turbines

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Proportion
Buzzard	0.000319	0.00211	0.0045	0.00202	0.00187	0.00385	0.00118	0.00161	0.00184	0.000774	0.000404	0.00037	1.00
Curlew	-	-	-	0	0	0	0.00000276	0.0000453	0	-	-	-	1.00
Golden Plover	0.0476	0.0311	0.224	0.00876	0.0000868	0	0	0.0000134	0.0236	0.041	2.48	0.0396	1.00

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Proportion
Greenland White-fronted Goose	0	0	0.00312	-	-	-	-	-	-	0	0	0	1.00
Hen Harrier	0	0	0.0000067 5	0.0000027 8	0.0000016 5	0	0	0.0000027 8	0.0000052 2	0.0000078 9	0.0000086 9	0.0000050 8	1.00
Kestrel	0.000864	0.000897	0.000538	0.000465	0.0000376	0.000319	0.00128	0.00144	0.00108	0.000688	0.000531	0.00144	1.00
Lapwing	-	-	-	0.0003	0.000171	0.000111	0.000105	-	-	-	-	-	1.00
Lapwing	0.0441	0.0317	0.0169	-	-	-	-	0	0.00339	0.000219	0.0163	0.00877	1.00
Lesser Black-backed Gull	0.0145	0.000154	0.000356	-	-	-	-	-	-	0.0000089 7	0.000183	0.000403	1.00
Little Egret	0.0000017 6	0.0000000 88	0.0000016 2	0	0	0	0	0	0	0	0	0	1.00
Long-eared Owl	0	0	0	0	0.0000021 8	0	0	0	0	0	0	0	1.00
Merlin	0	0	0.0000010 5	0	0	0	0	0.0000017	0.0000396	0	0	0	1.00
Peregrine Falcon	0	0.0000068 9	0	0.0000053	0	0.0000053 2	0.0000332	0.0000681	0.000088	0.0000026 2	0.0000093	0.0000081 8	1.00
Snipe	0.000023	0.000142	0.00343	0.00227	0.000774	0.000341	0.000113	0.00191	0.0000567	0.00017	0.0000885	0.0000422	1.00
Sparrowhawk	0.000149	0.0000572	0.0000785	0.0000578	0.000124	0.0000613	0.0000487	0.00018	0.000337	0.00007	0.0000978	0.0000511	1.00
White-tailed Eagle	0	0.000122	0	0	0	0	0	0	0	0	0	0	1.00
Whooper Swan	0.00043	0.000179	0.0000627	-	-	-	-	-	0	0.000323	0.000471	0.000296	1.00

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Proportion
Woodcock	0.00000229	0.00000676	0.0000147	0.0000355	0.000105	0	0	0.00000209	0.00000326	0	0.00000132	0.00000317	1.00

3.2 Stage B Number of Flights Through Rotors

Stage B of the modelling process makes an estimate, based on the aerial density and proportion flying at risk height, of the potential number of bird passages through rotors. The projected number of transits through the rotor risk area was calculated following the formula provided by Band (2024; also see Section 4 'Worked Example'). Table 7 - 6 - 12 and Table 7 - 6 - 13 shows the projected number of transits per month for each species based on aerial density and proportion flying at risk height calculated following Band (2024). Table 7-6-14 and Table 7-6-15 shows the projected number of transits based on aerial density using only the flight activity in the bands within PCH and where the proportion flying at risk height was always considered to be 1.

Table 7 - 6 - 12 Projected number of transits following Band (2024)– 200m Proposed Turbines

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Buzzard	10.5	173	358	135	265	554	24	232	307	104	49.4	16	2445.04
Curlew	-	-	-	0	0	0	0	3.61	0	-	-	-	3.61
Golden Plover	3143	2995	25758	1683	11.5	0	0	0	928	1338	287429	1077	336404.32
Greenland White-fronted Goose	0	0	15	-	-	-	-	-	-	0	1.3	0	151.79
Hen Harrier	1.19	0.279	1.65	0.604	0.161	0	0	2.64	1.86	1.85	1.17	1.02	12.43
Kestrel	49	73.6	54.7	41	9.4	46.3	189	322	107	107	67.5	36.1	1102.21
Lapwing	-	-	-	26.4	8.29	18.6	11.9	-	-	-	-	-	65.21
Lapwing	139	86.4	59.2	-	-	-	-	0	201	79.9	506	4992	6064.03
Little Egret	1.21	0.16	0.364	0	0	0	0.926	0	0.865	0.906	0.414	0	4.85
Lesser Black-backed Gull	0.948	29.8	33.7	-	-	-	-	-	-	99.8	208	22	393.76
Long-eared Owl	0.021	0	0	0	0.159	0	0	0.957	0.107	0.041	0	0	1.28

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Merlin	0.05	0.124	0.1	0	0	0	0	0	0.013	0.009	0.04	0.062	0.40
Peregrine Falcon	1.96	1.22	0.37	0.813	0.46	2.76	5.02	13.4	7.7	1.38	0.759	0	35.85
Snipe	9.26	27.5	338	41.1	143	14	25	343	11.5	70.9	21	16.8	1186.57
Sparrowhawk	5.17	1.12	6.63	3.56	3.4	11.4	12.8	14	18.6	7.97	2.83	4.81	92.32
White-tailed Eagle	0	6.77	0	2.99	0	0	0	0	0	0	0	0	9.77
Whooper Swan	87.6	71.8	107	-	-	-	-	-	1.44	74.2	179	61.4	582.57
Woodcock	2.19	2.29	7.04	30.7	33.1	0	0	0	1.28	0.736	0.715	1.91	79.96

Table 7 - 6 - 13 Projected number of transits following Band (2024) – 220m Proposed Turbines

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Buzzard	25.9	106	238	118	123	297	109	12	117	50.2	27.3	13.3	1343.52
Curlew	-	-	-	0.202	0	0.324	0.589	2.48	0	-	-	-	3.59
Golden Plover	3306	2477	18103	921	7.22	0	0	1.14	1879	5288	157518	2617	192117.77
Greenland White-fronted Goose	0	0	18.4	-	-	-	-	-	-	0	0.194	0	18.56
Hen Harrier	0.641	0.79	1.18	0.34	0.143	0	0	0.607	1.3	1.42	0.779	0.876	8.08
Kestrel	42.2	43.8	42.9	32.1	2.49	27.2	138	246	76.7	52.7	47.6	47.6	799.21
Lapwing	-	-	-	34.1	58.2	12.9	10.2	-	-	-	-	-	115.38
Lapwing	291	3483	1183	-	-	-	-	0	524	165	1001	572	9837.41
Lesser Black-backed Gull	607	21.9	119	-	-	-	-	-	-	1.93	7.85	16.3	774.10
Little Egret	0.147	0.073	0.166	0	0	0	0.635	0	0	0.414	0.189	0.122	1.75
Long-eared Owl	0	0	0	0.148	0.074	0	0	0.054	0	0.009	0.003	0	0.29
Merlin	0.108	0.064	0.065	0	0	0	0.003	0.139	0.315	0.009	0.029	0.031	0.76

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Peregrine Falcon	0.956	0.468	0.694	1.32	0	0.886	5.16	3.34	2.35	0.655	0.752	0.359	16.93
Snipe	8.07	25.1	809	327	13	65.2	18.6	224	29.4	51	16	12.7	1715.75
Sparrowhawk	5.68	2.35	5.55	3.57	6.69	5.07	3.74	8.88	21.8	3.09	3.36	4.58	74.35
White-tailed Eagle	0	3.18	0.28	0	0	0	0	0	0	0	0	0	3.46
Whooper Swan	143	46.7	37.3	-	-	-	-	-	1.01	31	139	53.1	450.83
Woodcock	1.19	1.41	6.28	34.9	38.7	3.43	0	0.767	1.16	0.158	0.712	2.66	91.45

Table 7 - 6 - 14 Projected number of transits based on aerial density using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 - 200m Proposed Turbines

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Buzzard	4.94	122	3	124	245	467	192	176	269	81.5	35.3	13.2	2029.44
Curlew	-	-	-	0	0	0	0	9.06	0	-	-	-	9.06
Golden Plover	3663	3026	25804	1532	13.5	0	0	0	105	7779	199681	875	243423.44
Greenland White-fronted Goose	0	0	0	-	-	-	-	-	-	0	3.2	0	3.20
Hen Harrier	0	0	0.517	0.154	0.079	0	0	5.13	0.937	0.257	0.199	0.351	7.63
Kestrel	23.8	60	42.9	35	6.36	35.7	129	132	80.1	69	35	31.7	679.98
Lapwing	-	-	-	20.7	6.63	15.8	10.7	-	-	-	-	-	53.82
Lapwing	14	68.1	21.1	-	-	-	-	0	108	83.8	562	5692	6674.62
Little Egret	0.25	0.071	0.162	0	0	0	0.411	0	0.386	0	0	0	1.28
Lesser Black-backed Gull	0.837	28.8	18	-	-	-	-	-	-	96.4	201	21.4	366.22
Long-eared Owl	0	0	0	0	0.813	0	0	0	0	0	0	0	0.81
Merlin	0	0	0.055	0	0	0	0	0	0	0	0	0.08	0.14
Peregrine Falcon	1.94	1.04	0.252	1.11	0.489	3.31	2.43	14.7	10.8	0.396	0.718	0	37.25

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Snipe	1.67	27.8	265	37.1	145	143	20.3	397	9.35	35.8	15.5	5.59	1102.66
Sparrowhawk	3.58	0.426	6.32	3.28	2.76	10.2	10	8.25	13.2	5.46	1.72	2.9	68.15
White-tailed Eagle	0	5.43	0	3.43	0	0	0	0	0	0	0	0	8.85
Whooper Swan	60.2	47.5	2.35	-	-	-	-	-	2.76	11	63.5	25.3	312.01
Woodcock	0.697	2.16	1.61	4.37	12.9	0	0	0	0.503	0.289	0	0	22.48

Table 7 - 6 - 15 Projected number of transits based on aerial density using only the flight activity in the bands within potential collision risk height and always setting the proportion flying at risk height to 1 - 220m Proposed Turbines

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Buzzard	12.1	87	248	127	138	294	90.8	111	106	38.4	15.9	13.1	1281.64
Curlew	-	-	-	0	0	0	0.366	5.76	0	-	-	-	6.13
Golden Plover	4151	2698	24016	1005	11.2	0	0	1.66	2564	4123	216951	3342	258862.15
Greenland White-fronted Goose	0	0	301	-	-	-	-	-	-	0	0	0	300.84
Hen Harrier	0	0	0.257	0.121	0.084	0	0	0.132	0.207	0.27	0.236	0.125	1.43
Kestrel	28.5	32.2	25.8	25.5	2.42	21.2	85.7	86.4	54	29.8	18.2	44.5	454.28
Lapwing	-	-	-	28.4	17.5	11.3	10.9	-	-	-	-	-	68.08
Lapwing	3651	249	1559	-	-	-	-	0	31	19.6	1327	714	10070.94
Lesser Black-backed Gull	842	8.89	25.3	-	-	-	-	-	-	0.6	10.6	22.6	910.49
Little Egret	0.087	0.043	0.099	0	0	0	0	0	0	0	0	0	0.23
Long-eared Owl	0	0	0	0	0.198	0	0	0	0	0	0	0	0.20
Merlin	0	0	0.054	0	0	0	0	1.15	2.14	0	0	0	3.34
Peregrine Falcon	0	0.296	0	0.348	0	0.424	2.66	4.91	5.29	0.136	0.382	0.303	14.74

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Snipe	3.8	21.2	566	362	128	54.5	18.6	316	9.05	28.1	14.1	6.97	1527.67
Sparrowhawk	4.87	2.03	3.73	3.14	7.93	4.03	3.22	10.7	16.7	3	3.32	1.57	64.28
White-tailed Eagle	0	5.92	0	0	0	0	0	0	0	0	0	0	5.92
Whooper Swan	36.2	15	6.48	-	-	-	-	-	0	31.5	39.8	24.1	153.11
Woodcock	0.378	1.01	2.43	5.68	17.4	0	0	0.345	0.52	0	0.21	0.523	28.46

3.3 Stage C Probability of Collision

Stage C of the modelling process calculates the probability of collision during a single bird rotor transit. The likelihood of a bird colliding with a turbine blade during a single pass through the rotor was calculated using the turbine specifications, species biometrics and flight characteristics outlined in the previous sections.

Collision risk was assessed across different parts of the rotor, as blade speed and width varies from the hub to the tip. Because of the geometry of the blades in relation to the flight direction, the collision risk for upwind flight is higher than for downwind (even if the bird's flight speed relative to the ground is taken to be the same), therefore collision risk probabilities were calculated separately for birds flying upwind and downwind. These were then averaged assuming a 50:50 weighting because both upwind and downwind flights are equally likely (further information in Section 4 'Worked Example'). This produced a probability of collision for a bird during a single transit of the rotor, which is presented for each species in Table 7 - 6 - 16.

Table 7 - 6 - 16 Probability of collision

Species	Upwind	Downwind	Average
Buzzard	0.097	0.046	0.072
Curlew	0.079	0.033	0.056
Golden Plover	0.067	0.024	0.045
Greenland White-fronted Goose	0.086	0.04	0.063
Hen Harrier	0.123	0.068	0.096
Kestrel	0.096	0.044	0.07
Lapwing	0.082	0.033	0.057
Lesser Black-backed Gull	0.098	0.048	0.073

Species	Upwind	Downwind	Average
Little Egret	0.109	0.057	0.083
Long-eared Owl	0.103	0.05	0.076
Merlin	0.088	0.037	0.063
Peregrine Falcon	0.091	0.041	0.066
Snipe	0.067	0.022	0.045
Sparrowhawk	0.096	0.044	0.07
White-tailed Eagle	0.101	0.052	0.076
Whooper Swan	0.106	0.062	0.084
Woodcock	0.07	0.025	0.048

3.4 Stage D Expected Collisions

Stage D of the modelling process multiplies the outputs of stage B and C to yield the expected collision rate for each bird species, accounting for the proportion of time the Proposed Wind Farm is expected to be operational. This is before considering avoidance behaviour, which is stage E. The number of expected collisions per month and the year total for each species are presented in Table 7 - 6 - 17 to Table 7-6-20. Table 7-6-17 and Table 7-6-18 present values based on the aerial density and number of transits calculated following Band (2024), while Table 7-6-19 and Table 7-6-20 present presents values based on the aerial density and number of transits calculated using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1.

Table 7 - 6 - 17 Expected collisions without avoidance following Band (2024)– 200m Proposed Turbines

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Buzzard	0.648	10.7	22	8.33	16.3	34.1	14.8	14.2	18.9	6.41	3.04	0.984	15
Curlew	-	-	-	0	0	0	0	0.172	0	-	-	-	0.172
Golden Plover	121	115	991	64.7	0.441	0	0	0	35.7	515	11054	41.4	12938
Greenland White-fronted Goose	0	0	8.06	-	-	-	-	-	-	0	0.0696	0	8.13
Hen Harrier	0.097	0.0227	0.134	0.0491	0.0131	0	0	0.215	0.151	0.15	0.0949	0.0833	1.01
Kestrel	2.92	4.39	3.26	2.45	0.561	2.76	11.2	19.2	6.39	6.4	4.03	2.15	65.7

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Lapwing	-	-	-	1.28	0.402	0.901	0.577	-	-	-	-	-	3.16
Lapwing	6.77	4.19	2.87	-	-	-	-	0	9.77	3.88	24.5	242	294
Little Egret	0.0854	0.0113	0.0256	0	0	0	0.0651	0	0.0608	0.0637	0.0291	0	0.341
Lesser Black-backed Gull	0.059	1.85	2.1	-	-	-	-	-	-	6.21	12.9	1.37	24.5
Long-eared Owl	0.00136	0	0	0	0.0103	0	0	0.062	0.00693	0.00266	0	0	0.0832
Merlin	0.00267	0.00661	0.00533	0	0	0	0	0	0.000693	0.00048	0.00213	0.00331	0.0212
Peregrine Falcon	0.11	0.0684	0.0207	0.0455	0.0257	0.154	0.281	0.75	0.431	0.0774	0.0425	0	2.01
Snipe	0.351	1.04	12.8	1.56	5.41	5.32	0.948	13	0.438	2.69	0.798	0.637	45
Sparrowhawk	0.308	0.0671	0.396	0.213	0.203	0.683	0.766	0.834	1.11	0.476	0.169	0.287	5.51
White-tailed Eagle	0	0.44	0	0.194	0	0	0	0	0	0	0	0	0.635
Whooper Swan	6.22	5.1	7.6	-	-	-	-	-	0.102	5.27	12.7	4.36	41.4
Woodcock	0.0883	0.0925	0.284	1.24	1.34	0	0	0	0.0518	0.0297	0.0289	0.0772	3.23

Table 7 - 6 - 18 Expected collisions without avoidance following Band (2024)– 220m Proposed Turbines

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Buzzard	1.59	6.5	14.6	7.26	7.56	18.2	6.67	7.37	7.22	3.09	1.68	0.819	82.6
Curlew	-	-	-	0.0096	0	0.0154	0.028	0.118	0	-	-	-	0.171
Golden Plover	127	95.3	696	35.4	0.278	0	0	0.0438	72.3	203	6058	101	7389
Greenland White-fronted Goose	0	0	0.984	-	-	-	-	-	-	0	0.0104	0	0.995
Hen Harrier	0.0521	0.0642	0.0961	0.0276	0.0116	0	0	0.0493	0.106	0.115	0.0633	0.0712	0.657
Kestrel	2.52	2.61	2.56	1.91	0.148	1.62	8.25	14.6	4.57	3.14	2.84	2.84	47.7
Lapwing	-	-	-	1.66	2.83	0.624	0.494	-	-	-	-	-	5.6
Lapwing	141	169	57.4	-	-	-	-	0	25.4	7.98	48.6	27.8	477

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Lesser Black-backed Gull	37.8	1.36	7.4	-	-	-	-	-	-	0.12	0.488	1.01	48.1
Little Egret	0.0103	0.00513	0.0117	0	0	0	0.0447	0	0	0.0291	0.0133	0.00858	0.123
Long-eared Owl	0	0	0	0.00959	0.00479	0	0	0.0035	0	0.000583	0.000194	0	0.0187
Merlin	0.00576	0.00341	0.00347	0	0	0	0.00016	0.00741	0.0168	0.00048	0.00155	0.00165	0.0407
Peregrine Falcon	0.0535	0.0262	0.0388	0.0738	0	0.0496	0.289	0.187	0.131	0.0367	0.0421	0.0201	0.948
Snipe	0.306	0.951	30.7	12.4	4.93	2.47	0.704	8.5	1.11	1.94	0.609	0.48	65.1
Sparrowhawk	0.339	0.14	0.331	0.213	0.399	0.302	0.223	0.53	1.3	0.184	0.2	0.273	4.44
White-tailed Eagle	0	0.206	0.0182	0	0	0	0	0	0	0	0	0	0.225
Whooper Swan	10.1	3.32	2.65	-	-	-	-	-	0.0715	2.2	9.87	3.78	32
Woodcock	0.0482	0.0568	0.254	1.41	1.56	0.139	0	0.031	0.0467	0.00638	0.0288	0.108	3.69

Table 7 - 6 - 19 Expected collisions without avoidance using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 - 200m

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Buzzard	0.304	7.49	18.4	7.65	15.1	28.7	11.8	10.8	16.5	5.01	2.17	0.811	125
Curlew	-	-	-	0	0	0	0	0.431	0	-	-	-	0.431
Golden Plover	141	116	992	58.9	0.52	0	0	0	40.4	299	768	33.7	9362
Greenland White-fronted Goose	0	0	0	-	-	-	-	-	-	0	0.172	0	0.172
Hen Harrier	0	0	0.042	0.0125	0.00642	0	0	0.417	0.0761	0.0209	0.0162	0.0285	0.62
Kestrel	1.42	3.58	2.56	2.09	0.379	2.13	7.67	7.86	4.78	4.11	2.08	1.89	40.5
Lapwing	-	-	-	1	0.321	0.764	0.521	-	-	-	-	-	2.61
Lapwing	6.81	3.31	1.02	-	-	-	-	0	5.24	4.07	27.3	276	324

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Little Egret	0.0176	0.00499	0.0114	0	0	0	0.0289	0	0.0271	0	0	0	0.09
Lesser Black-backed Gull	0.0521	1.79	1.12	-	-	-	-	-	-	6	12.5	1.33	22.8
Long-eared Owl	0	0	0	0	0.0527	0	0	0	0	0	0	0	0.0527
Merlin	0	0	0.00293	0	0	0	0	0	0	0	0	0.00427	0.0072
Peregrine Falcon	0.109	0.0582	0.0141	0.0624	0.0274	0.185	0.136	0.825	0.606	0.0222	0.0402	0	2.08
Snipe	0.0635	1.05	10	1.41	5.49	5.41	0.769	15.1	0.355	1.36	0.588	0.212	41.8
Sparrowhawk	0.213	0.0254	0.377	0.196	0.165	0.61	0.598	0.492	0.788	0.326	0.103	0.173	4.07
White-tailed Eagle	0	0.353	0	0.223	0	0	0	0	0	0	0	0	0.575
Whooper Swan	4.28	3.38	0.167	-	-	-	-	-	0.196	7.84	4.51	1.8	22.2
Woodcock	0.0282	0.0872	0.0649	0.177	0.519	0	0	0	0.0203	0.0117	0	0	0.908

Table 7 - 6 - 20 Expected collisions without avoidance using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 - 220m

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Buzzard	0.744	5.35	15.3	7.82	8.5	18.1	5.58	6.83	6.51	2.36	0.979	0.808	78.8
Curlew	-	-	-	0	0	0	0.0174	0.274	0	-	-	-	0.291
Golden Plover	16	104	924	38.6	0.43	0	0	0.0637	98.6	159	8344	129	9956
Greenland White-fronted Goose	0	0	16.1	-	-	-	-	-	-	0	0	0	16.1
Hen Harrier	0	0	0.0209	0.00983	0.00683	0	0	0.0107	0.0168	0.0219	0.0192	0.0102	0.116
Kestrel	1.7	1.92	1.54	1.52	0.144	1.26	5.11	5.15	3.22	1.77	1.09	2.66	27.1
Lapwing	-	-	-	1.38	0.849	0.548	0.528	-	-	-	-	-	3.3
Lapwing	177	121	75.6	-	-	-	-	0	15.1	0.949	64.4	34.7	489
Lesser Black-backed Gull	52.4	0.553	1.58	-	-	-	-	-	-	0.0373	0.662	1.41	56.6
Little Egret	0.00612	0.00302	0.00696	0	0	0	0	0	0	0	0	0	0.0161

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Long-eared Owl	0	0	0	0	0.0128	0	0	0	0	0	0	0	0.0128
Merlin	0	0	0.00288	0	0	0	0	0.0611	0.114	0	0	0	0.178
Peregrine Falcon	0	0.0166	0	0.0195	0	0.0237	0.149	0.275	0.296	0.00761	0.0214	0.017	0.825
Snipe	0.144	0.803	21.5	13.7	4.85	2.07	0.706	12	0.343	1.06	0.536	0.264	57.9
Sparrowhawk	0.291	0.121	0.223	0.187	0.473	0.241	0.192	0.64	0.997	0.179	0.198	0.0935	3.84
White-tailed Eagle	0	0.385	0	0	0	0	0	0	0	0	0	0	0.385
Whooper Swan	2.58	1.06	0.461	-	-	-	-	-	0	2.24	2.83	1.72	10.9
Woodcock	0.0153	0.0407	0.0982	0.229	0.702	0	0	0.0139	0.021	0	0.00848	0.0211	1.15

3.5 Stage E Allowing for Avoidance and Attraction

Stage E of the modelling process takes account of the proportion of birds likely to avoid the Proposed Turbines, either because they have been displaced from the Proposed Wind Farm site or because they take evasive action or are attracted to the Proposed Wind Farm. Band (2024) states that the collision rate estimate should show potential collision mortality using a range of assumed avoidance rates. In the absence of specific avoidance information for the species in question, it is recommended that collision risks be evaluated assuming avoidance factors of 95%, 98%, 99%, 99.5%, 99.6% and 99.8%. An avoidance rate of 99.6% was used for golden plover (Gittings, 2022), presented in Appendix 7-6-2. Table 7-6-21 and Table 7-6-22 present values based on the aerial density and number of transits calculated following Band (2024), while Table 7-6-23 and Table 7-6-24 present presents values based on the aerial density and number of transits calculated using only the flight activity in the bands within potential collision risk height and always setting the proportion flying at risk height to 1. For each species, the values corresponding to the recommended avoidance factor are presented. The values for all avoidance factors modelled are presented in Appendix 7-6-1, Table 7-6-1-3 to Table 7-6-1-6.

Table 7 - 6 - 21 Expected collisions with avoidance following Band (2024) – 200m Proposed Turbines

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Buzzard	0.98	0.013	0.213	0.44	0.167	0.326	0.682	0.295	0.285	0.378	0.128	0.0607	0.0197	3.01
Curlew	0.98	-	-	-	0	0	0	0	0.00343	0	-	-	-	0.00343

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Golden Plover	0.996	0.483	0.461	3.96	0.259	0.0017 6	0	0	0	0.143	2.06	44.2	0.166	51.8
Greenland White-fronted Goose	0.998	0	0	0.0161	-	-	-	-	-	-	0	0.0001 4	0	0.0163
Hen Harrier	0.99	0.0009 7	0.0002 3	0.0013 4	0.0004 9	0.0001 3	0	0	0.0021 5	0.0015 1	0.0015	0.0009 5	0.0008 3	0.0101
Kestrel	0.95	0.146	0.219	0.163	0.122	0.028	0.138	0.562	0.959	0.319	0.32	0.201	0.107	3.29
Lapwing	0.98	-	-	-	0.0257	0.0080 4	0.018	0.0116	-	-	-	-	-	0.0633
	0.98	0.135	0.0838	0.0575	-	-	-	-	0	0.195	0.0775	0.491	4.84	5.88
Little Egret	0.98	0.0017 1	0.0002 3	0.0005 1	0	0	0	0.0013	0	0.0012 2	0.0012 7	0.0005 8	0	0.0068 2
Lesser Black-backed Gull	0.995	0.0002 9	0.0092 6	0.0105	-	-	-	-	-	-	0.031	0.0645	0.0068 6	0.122
Long-eared Owl	0.98	0.0000 3	0	0	0	0.0002 1	0	0	0.0012 4	0.0001 4	0.0000 5	0	0	0.0016 6
Merlin	0.98	0.0000 5	0.0001 3	0.0001 1	0	0	0	0	0	0.0000 1	0.0000 1	0.0000 4	0.0000 7	0.0004 2
Peregrine Falcon	0.98	0.0022	0.0013 7	0.0004 1	0.0009 1	0.0005 1	0.0030 9	0.0056 2	0.015	0.0086 1	0.0015 5	0.0008 5	0	0.0401
Snipe	0.98	0.0070 2	0.0209	0.256	0.0312	0.108	0.106	0.019	0.26	0.0087 6	0.0538	0.016	0.0127	0.9
Sparrowhawk	0.98	0.0061 7	0.0013 4	0.0079 2	0.0042 5	0.0040 6	0.0137	0.0153	0.0167	0.0221	0.0095 1	0.0033 8	0.0057 4	0.11
White-tailed Eagle	0.95	0	0.022	0	0.0097 2	0	0	0	0	0	0	0	0	0.0317
Whooper Swan	0.995	0.0311	0.0255	0.038	-	-	-	-	-	0.0005 1	0.0264	0.0636	0.0218	0.207
Woodcock	0.98	0.0017 7	0.0018 5	0.0056 9	0.0248	0.0267	0	0	0	0.0010 4	0.0005 9	0.0005 8	0.0015 4	0.0646

Table 7 - 6 - 22 Expected collisions with avoidance following Band (2024) – 220m Proposed Turbines

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Buzzard	0.98	0.0319	0.13	0.292	0.145	0.151	0.365	0.133	0.147	0.144	0.0618	0.0336	0.0164	1.65
Curlew	0.98	-	-	-	0.0001 9	0	0.0003 1	0.0005 6	0.0023 6	0	-	-	-	0.0034 2
Golden Plover	0.996	0.509	0.381	2.78	0.142	0.0011 1	0	0	0.0001 8	0.289	0.814	24.2	0.403	29.6
Greenland White-fronted Goose	0.998	0	0	0.0019 7	-	-	-	-	-	-	0	0.0000 2	0	0.0019 9
Hen Harrier	0.99	0.0005 2	0.0006 4	0.0009 6	0.0002 8	0.0001 2	0	0	0.0004 9	0.0010 6	0.0011 5	0.0006 3	0.0007 1	0.0065 7
Kestrel	0.95	0.126	0.13	0.128	0.0956	0.0074 2	0.0812	0.412	0.732	0.229	0.157	0.142	0.142	2.38
Lapwing	0.98	-	-	-	0.0331	0.0565	0.0125	0.0098 8	-	-	-	-	-	0.112
	0.98	2.82	3.38	1.15	-	-	-	-	0	0.508	0.16	0.971	0.555	9.55
Lesser Black-backed Gull	0.995	0.189	0.0068 1	0.037	-	-	-	-	-	-	0.0006	0.0024 4	0.0050 6	0.241
Little Egret	0.98	0.0002 1	0.0001	0.0002 3	0	0	0	0.0008 9	0	0	0.0005 8	0.0002 7	0.0001 7	0.0024 6
Long-eared Owl	0.98	0	0	0	0.0001 9	0.0001	0	0	0.0000 7	0	0.0000 1	0	0	0.0003 7
Merlin	0.98	0.0001 2	0.0000 7	0.0000 7	0	0	0	0	0.0001 5	0.0003 4	0.0000 1	0.0000 3	0.0000 3	0.0008 1
Peregrine Falcon	0.98	0.0010 7	0.0005 2	0.0007 8	0.0014 8	0	0.0009 9	0.0057 8	0.0037 4	0.0026 2	0.0007 3	0.0008 4	0.0004	0.019
Snipe	0.98	0.0061 2	0.019	0.614	0.248	0.0986	0.0495	0.0141	0.17	0.0223	0.0387	0.0122	0.0096	1.3
Sparrowhawk	0.98	0.0067 8	0.0028	0.0066 3	0.0042 6	0.0079 8	0.0060 5	0.0044 7	0.0106	0.026	0.0036 9	0.0040 1	0.0054 7	0.0887

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
White-tailed Eagle	0.95	0	0.0103	0.00091	0	0	0	0	0	0	0	0	0	0.0112
Whooper Swan	0.995	0.0507	0.0166	0.0133	-	-	-	-	-	0.00036	0.011	0.0494	0.0189	0.16
Woodcock	0.98	0.00096	0.00114	0.00507	0.0282	0.0313	0.00277	0	0.00062	0.00093	0.00013	0.00058	0.00215	0.0739

Table 7 - 6 - 23 Expected collisions with avoidance using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 - 200m

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Buzzard	0.98	0.00607	0.15	0.369	0.153	0.301	0.575	0.236	0.217	0.331	0.1	0.0434	0.0162	2.5
Curlew	0.98	-	-	-	0	0	0	0	0.00861	0	-	-	-	0.00861
Golden Plover	0.996	0.564	0.465	3.97	0.236	0.00208	0	0	0	0.161	1.2	30.7	0.135	37.4
Greenland White-fronted Goose	0.998	0	0	0	-	-	-	-	-	-	0	0.00034	0	0.00034
Hen Harrier	0.99	0	0	0.00042	0.00013	0.00006	0	0	0.00417	0.00076	0.00021	0.00016	0.00029	0.0062
Kestrel	0.95	0.0709	0.179	0.128	0.104	0.019	0.107	0.383	0.393	0.239	0.206	0.104	0.0946	2.03
Lapwing	0.98	-	-	-	0.0201	0.00643	0.0153	0.0104	-	-	-	-	-	0.0522
	0.98	0.136	0.0661	0.0204	-	-	-	-	0	0.105	0.0814	0.545	5.52	6.48
Little Egret	0.98	0.00035	0.0001	0.00023	0	0	0	0.00058	0	0.00054	0	0	0	0.0018
Lesser Black-backed Gull	0.995	0.00026	0.00896	0.00561	-	-	-	-	-	-	0.03	0.0624	0.00665	0.114
Long-eared Owl	0.98	0	0	0	0	0.00105	0	0	0	0	0	0	0	0.00105
Merlin	0.98	0	0	0.00006	0	0	0	0	0	0	0	0	0.00009	0.00014
Peregrine Falcon	0.98	0.00217	0.00116	0.00028	0.00125	0.00055	0.0037	0.00272	0.0165	0.0121	0.00044	0.0008	0	0.0417
Snipe	0.98	0.00127	0.0211	0.201	0.0282	0.11	0.108	0.0154	0.301	0.00709	0.0272	0.0118	0.00424	0.837
Sparrowhawk	0.98	0.00427	0.00051	0.00754	0.00391	0.0033	0.0122	0.012	0.00985	0.0158	0.00652	0.00205	0.00347	0.0813
White-tailed Eagle	0.95	0	0.0176	0	0.0111	0	0	0	0	0	0	0	0	0.0288
Whooper Swan	0.995	0.0214	0.0169	0.00083	-	-	-	-	-	0.00098	0.0392	0.0226	0.00899	0.111

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Woodcock	0.98	0.00056	0.00174	0.0013	0.00353	0.0104	0	0	0	0.00041	0.00023	0	0	0.0182

Table 7 - 6 - 24 Expected collisions with avoidance using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 - 220m

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Buzzard	0.98	0.0149	0.107	0.305	0.156	0.17	0.361	0.112	0.137	0.13	0.0473	0.0196	0.0162	1.58
Curlew	0.98	-	-	-	0	0	0	0.00035	0.00548	0	-	-	-	0.00582
Golden Plover	0.996	0.639	0.415	3.69	0.155	0.00172	0	0	0.00025	0.394	0.634	33.4	0.514	39.8
Greenland White-fronted Goose	0.998	0	0	0.0322	-	-	-	-	-	-	0	0	0	0.0322
Hen Harrier	0.99	0	0	0.00021	0.0001	0.00007	0	0	0.00011	0.00017	0.00022	0.00019	0.0001	0.00116
Kestrel	0.95	0.0851	0.096	0.077	0.076	0.00722	0.0632	0.256	0.258	0.161	0.0887	0.0543	0.133	1.35
Lapwing	0.98	-	-	-	0.0276	0.017	0.011	0.0106	-	-	-	-	-	0.0661
	0.98	3.54	2.42	1.51	-	-	-	-	0	0.301	0.019	1.29	0.693	9.77
Lesser Black-backed Gull	0.995	0.262	0.00276	0.00788	-	-	-	-	-	-	0.00019	0.00331	0.00704	0.283
Little Egret	0.98	0.00012	0.00006	0.00014	0	0	0	0	0	0	0	0	0	0.00032
Long-eared Owl	0.98	0	0	0	0	0.00026	0	0	0	0	0	0	0	0.00026
Merlin	0.98	0	0	0.00006	0	0	0	0	0.00122	0.00229	0	0	0	0.00357
Peregrine Falcon	0.98	0	0.00033	0	0.00039	0	0.00047	0.00298	0.00549	0.00592	0.00015	0.00043	0.00034	0.0165
Snipe	0.98	0.00288	0.0161	0.429	0.275	0.0969	0.0413	0.0141	0.239	0.00687	0.0213	0.0107	0.00529	1.16

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Sparrowhawk	0.98	0.00582	0.00242	0.00445	0.00375	0.00946	0.00481	0.00384	0.0128	0.0199	0.00358	0.00396	0.00187	0.0767
White-tailed Eagle	0.95	0	0.0192	0	0	0	0	0	0	0	0	0	0	0.0192
Whooper Swan	0.995	0.0129	0.00532	0.0023	-	-	-	-	-	0	0.0112	0.0141	0.00858	0.0544
Woodcock	0.98	0.00031	0.00081	0.00196	0.00459	0.014	0	0	0.00028	0.00042	0	0.00017	0.00042	0.023

3.6 Stage F Uncertainty

There are many sources of variability or uncertainty in the output of the Collision Risk Model. The main sources of uncertainty outlined in Band (2024) are:

- survey data is sampled, often both in time and space, and usually exhibits a high degree of variability. Mean estimates can only be representative of flight activity;
- survey data is unavailable for certain conditions, including nighttime and storm conditions;
- natural variability in bird populations, over time and space, for ecological reasons;
- flight height information may be subject to observer bias;
- the collision risk model uses a simplified geometry for turbine blades and bird shape;
- it does not include any risk of collision with turbine towers;
- details of blade dimension and pitch may be unavailable when making the estimate;
- turbines deployed may differ from those used in the collision risk analysis;
- bird parameters (length, wingspan, flight speed) are not fixed but have a distribution;
- bird speed is not a constant but is dependent on wind speed;
- insufficient knowledge about bird displacement and attraction effects;
- there is limited firm information on bird avoidance behaviour.

Because of this, a range of uncertainty is calculated for the predicted collision rates. The range of uncertainty should reflect:

- uncertainty or variability in flight activity data (including imprecision on flight height estimates and lack of knowledge about night-time behaviour);

- uncertainty due to the limitations of the collision model, including the variability of bird dimensions and flight speed, the simplification in shape of a bird and turbine blades;
- uncertainty arising from turbine options yet to be decided, in number, size and speed. These options should include a 'worst case' in terms of the option likely to present greatest bird collision risk.

It should be noted that other additional sources of uncertainty exist. These include errors in allocation of flight activity to height bands (Largey *et al.,* 2026) and errors in the nocturnal activity factors (discussed in Section 2.4). Each of these may result in over- or underestimation of flight activity at potential collision height. It is not possible to quantify these uncertainties to provide a measure of uncertainty, but these effects should be considered during interpretation of the results.

To provide a measure of uncertainty in aerial density, the mean and relative standard deviation for the monthly values was calculated (see Section 4 'Worked Example'). To quantify uncertainty arising from the correction factor described in Section 2.3 that may arise from sampling variation, a non-parametric bootstrap was applied to the flight records that were collected according to the assigned bands (Table 7-6-25). For each species, the records were resampled (5000 replicates). The correction factor was recalculated as the sum of PCH seconds divided by the sum of total seconds across the resampled flights. The standard deviation and bias (difference between the mean of the replicated bootstrap estimates and the original correction factor estimate) was calculated. These values were used to calculate the 95% confidence intervals of the replicate distribution. Collisions in the model are directly proportional to the time spent at PCH, so the effect of the upper confidence interval of the correction factor on the collision estimate was calculated as the ratio of total PCH seconds under the upper confidence interval to total PCH seconds under the original correction factor and expressed as a proportion for each species. Figures for the calculation of the correction factor and proportion uplift are presented in Appendix 7-6-1 Table 7-6-1-7. This value was then included as a component of the flight activity uncertainty alongside the relative standard deviation described above (the square root of the relative standard deviation squared plus the confidence factor uncertainty squared). It assumes that flights assigned and not assigned to the height bands share the same expected proportion of time at PCH within a species. To correct for potential under-detection of flightlines over 1km from the vantage point location, a second correction factor from Gittings (2024; within Table 1) was also applied in the calculation of uncertainty in aerial density. These correction factors provide an indication of the potential underestimation of the collision risk due to under-detection. For each species size class (small, medium or large; method of classification in Gittings [2024]), the average correction factor was calculated and incorporated as another component of the flight activity uncertainty. These values were 4.4, 3.3 and 2.0 respectively. This method assumes that relative standard deviation and the correction factor uncertainties are independent.

Uncertainty due to simplifications in the collision risk model was assumed to be 0.20 (Band, 2024). Finally, uncertainty due to design options (including the blade profile, pitch, rotational speed and expected time operational) was considered to be 0.28. The overall range of uncertainty for each species is presented in Table 7 - 6 - 26 and Table 7 - 6 - 27.

The Band (2024) method assumes that the uncertainties combine additively. However, the components of the model are multiplied rather than summed, therefore the uncertainty values should also be multiplied to avoid underestimating overall uncertainty that could occur when using the root sum of squares method. To address the above, a second calculation was performed to calculate the overall range of uncertainty for each species using a multiplicative method and is presented in Table 7-6-28 and Table 7-6-

29 for the expected collisions calculated using only the flight activity in the bands within potential collision risk height and always setting the proportion flying at risk height to 1 (see Section 4 'Worked Example' for further details).

Table 7 - 6 - 25 Results of bootstrap

Species	% uplift
Buzzard	0.009636
Curlew	0.487822
Golden Plover	0.005016
Greenland White-fronted Goose	NA
Hen Harrier	0.150625
Kestrel	0.008722
Lapwing	0.018625
Little Egret	0.220867
Lesser Black-backed Gull	0.007021
Long-eared Owl	NA
Merlin	0.062784
Peregrine Falcon	0.039013
Snipe	0.01185
Sparrowhawk	0.027723
White-tailed Eagle	NA
Whooper Swan	0.029308
Woodcock	0.058931

Table 7 - 6 - 26 Range of uncertainty following Band (2024)– 200m Proposed Turbines

Species	Months	Model	Mean	Standard Deviation	Relative Standard Deviation	Uncertainty
Buzzard	Apr-Mar	non-directional	0.00549	0.00357	0.64992	3.38
Curlew	Apr-Sep	non-directional	0.00002	0.00004	2.23607	4.03
Golden Plover	Apr-Mar	non-directional	0.52623	1.50726	2.86426	5.26

Species	Months	Model	Mean	Standard Deviation	Relative Standard Deviation	Uncertainty
Greenland White-fronted Goose	Oct-Mar	non-directional	0.00092	0.00204	2.2081	3.99
Hen Harrier	Apr-Mar	non-directional	0.00011	0.00008	0.71464	3.4
Kestrel	Apr-Mar	non-directional	0.0035	0.00246	0.70325	4.47
Lapwing	Apr-Jul	non-directional	0.00028	0.00013	0.46284	4.44
Lapwing	Aug-Mar	non-directional	0.015	0.03203	2.13462	4.9
Little Egret	Apr-Mar	non-directional	0.00003	0.00004	1.10666	3.5
Lesser Black-backed Gull	Oct-Mar	non-directional	0.00148	0.00166	1.11618	3.5
Long-eared Owl	Apr-Mar	non-directional	0.00001	0.00003	2.42878	4.11
Merlin	Apr-Mar	non-directional	0.00001	0.00001	1.23286	4.58
Peregrine Falcon	Apr-Mar	non-directional	0.0001	0.00012	1.15223	3.51
Snipe	Apr-Mar	non-directional	0.00121	0.00142	1.16867	4.57
Sparrowhawk	Apr-Mar	non-directional	0.0003	0.00017	0.57958	4.45
White-tailed Eagle	Apr-Mar	non-directional	0.00002	0.00006	2.61244	3.31
Whooper Swan	Sep-Mar	non-directional	0.00256	0.00158	0.61581	2.12
Woodcock	Apr-Mar	non-directional	0.00009	0.00016	1.71432	4.74

Table 7 - 6 - 27 Range of uncertainty following Band (2024)– 220m Proposed Turbines

Species	Months	Model	Mean	Standard Deviation	Relative Standard Deviation	Uncertainty
Buzzard	Apr-Mar	non-directional	0.00281	0.00178	0.63358	3.38
Curlew	Apr-Sep	non-directional	0.00001	0.00002	1.45037	3.65
Golden Plover	Apr-Mar	non-directional	0.27698	0.76101	2.74754	5.2
Greenland White-fronted Goose	Oct-Mar	non-directional	0.00053	0.00116	2.20195	3.98
Hen Harrier	Apr-Mar	non-directional	0.00006	0.00004	0.69774	3.39
Kestrel	Apr-Mar	non-directional	0.0025	0.00181	0.723	4.47

Species	Months	Model	Mean	Standard Deviation	Relative Standard Deviation	Uncertainty
Lapwing	Apr-Jul	non-directional	0.00041	0.00027	0.66288	4.46
Lapwing	Aug-Mar	non-directional	0.02201	0.02232	1.01428	4.53
Lesser Black-backed Gull	Oct-Mar	non-directional	0.00301	0.00523	1.73675	3.74
Little Egret	Apr-Mar	non-directional	0.00001	0.00001	1.13812	3.51
Long-eared Owl	Apr-Mar	non-directional	0.0000031	0.00001	1.85473	3.8
Merlin	Apr-Mar	non-directional	0.00001	0.00001	1.24755	4.59
Peregrine Falcon	Apr-Mar	non-directional	0.00005	0.00004	0.79122	3.41
Snipe	Apr-Mar	non-directional	0.00168	0.00259	1.5418	4.68
Sparrowhawk	Apr-Mar	non-directional	0.00022	0.00017	0.76324	4.48
White-tailed Eagle	Apr-Mar	non-directional	0.00002	0.00005	3.09955	3.7
Whooper Swan	Sep-Mar	non-directional	0.00217	0.00178	0.81881	2.19
Woodcock	Apr-Mar	non-directional	0.00008	0.00015	1.72832	4.74

Table 7 - 6 - 28 Range of uncertainty using a multiplicative method for the expected collisions calculated using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 - 200m

Species	Months	Model	Mean	Standard Deviation	Relative Standard Deviation	Uncertainty
Buzzard	Apr-Mar	non-directional	0.00386	0.00261	0.67726	6.71
Curlew	Apr-Sep	non-directional	0.00002	0.00004	2.23607	7.7
Golden Plover	Apr-Mar	non-directional	0.32143	0.88717	2.76009	9.51
Greenland White-fronted Goose	Oct-Mar	non-directional	0.00001	0.00002	2.23607	7.66
Hen Harrier	Apr-Mar	non-directional	0.00002	0.00004	1.93446	7.42
Kestrel	Apr-Mar	non-directional	0.00165	0.00086	0.52105	8.34
Lapwing	Apr-Jul	non-directional	0.00019	0.00008	0.42781	8.33
Lapwing	Aug-Mar	non-directional	0.01451	0.03219	2.2181	9.1
Little Egret	Apr-Mar	non-directional	0.000002	0.000003	1.36156	7.03

Species	Months	Model	Mean	Standard Deviation	Relative Standard Deviation	Uncertainty
Lesser Black-backed Gull	Oct-Mar	non-directional	0.00143	0.00168	1.17354	6.92
Long-eared Owl	Apr-Mar	non-directional	0.000001	0.000004	3.31662	8.72
Merlin	Apr-Mar	non-directional	0.0000004	0.0000009	2.42961	9.26
Peregrine Falcon	Apr-Mar	non-directional	0.00007	0.00009	1.36074	7.02
Snipe	Apr-Mar	non-directional	0.0008	0.00103	1.29156	8.58
Sparrowhawk	Apr-Mar	non-directional	0.00016	0.00009	0.57687	8.35
White-tailed Eagle	Apr-Mar	non-directional	0.00002	0.00005	2.45642	6.4
Whooper Swan	Sep-Mar	non-directional	0.00072	0.00054	0.75173	4.82
Woodcock	Apr-Mar	non-directional	0.00002	0.00003	1.86207	8.88

Table 7 - 6 - 29 Range of uncertainty using a multiplicative method for the expected collisions calculated using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 - 220m

Species	Months	Model	Mean	Standard Deviation	Relative Standard Deviation	Uncertainty
Buzzard	Apr-Mar	non-directional	0.00174	0.00127	0.72915	6.73
Curlew	Apr-Sep	non-directional	0.00001	0.00002	2.08576	7.58
Golden Plover	Apr-Mar	non-directional	0.24161	0.67843	2.80792	9.55
Greenland White-fronted Goose	Oct-Mar	non-directional	0.00052	0.00116	2.23607	7.66
Hen Harrier	Apr-Mar	non-directional	0.000003	0.000003104	0.912	6.8
Kestrel	Apr-Mar	non-directional	0.0008	0.00043	0.53848	8.34
Lapwing	Apr-Jul	non-directional	0.00017	0.00008	0.45859	8.33
Lapwing	Aug-Mar	non-directional	0.01517	0.01479	0.97463	8.46
Lesser Black-backed Gull	Oct-Mar	non-directional	0.00261	0.00534	2.04712	7.5
Little Egret	Apr-Mar	non-directional	0.0000004	0.00000064	1.81557	7.33
Long-eared Owl	Apr-Mar	non-directional	0.0000002	0.0000006	3.31662	8.72
Merlin	Apr-Mar	non-directional	0.000005	0.00001	2.37523	9.22

Species	Months	Model	Mean	Standard Deviation	Relative Standard Deviation	Uncertainty
Peregrine Falcon	Apr-Mar	non-directional	0.00002	0.00003	1.48465	7.09
Snipe	Apr-Mar	non-directional	0.00078	0.00108	1.38729	8.62
Sparrowhawk	Apr-Mar	non-directional	0.00011	0.00008	0.72681	8.39
White-tailed Eagle	Apr-Mar	non-directional	0.00001	0.00003	3.31662	7.48
Whooper Swan	Sep-Mar	non-directional	0.00025	0.00017	0.65736	4.77
Woodcock	Apr-Mar	non-directional	0.00001	0.00003	1.9963	8.96

3.7 Predicted Collision Rates

To provide a best estimate of the collision rate for each species, the guidance on avoidance rates provided in NatureScot (2025b) was consulted. This guidance suggests the most appropriate avoidance rate for each species; however, it should be noted that the lack of research on most species' avoidance rates means that the confidence interval of the prediction may extend from the lowest to the highest avoidance rate in Table 7 - 6 - 21 to Table 7 - 6 - 24. For each species, the predicted number of collisions corresponding to the recommended avoidance rate was identified. These are presented in Table 7 - 6 - 30 to Table 7 - 6 - 32, along with the range of uncertainty, the predicted number of collisions over the operational lifetime of the facility and an estimation of the number of years for one collision to occur based on the Band (2024) method (details on these calculations are shown in Section 4 'Worked Example'). Table 7 - 6 - 33 to Table 7 - 6 - 35 presents the final predicted annual collision rates calculated using only the flight activity in the bands within potential collision risk height and always setting the proportion flying at risk height to 1 respectively and uncertainty calculated using the multiplicative method. The results should be considered as a best estimate of collision risk, rather than a precise figure. The lowest value given for the range of uncertainty is zero, as it is not possible for less than zero collisions to occur. Table 7 - 6 - 36 presents a comparison of the predicted annual collision rate calculated following the Band (2024) model and the model using only the flight activity in the bands within potential collision risk height and always setting the proportion flying at risk height to 1 and with a range of uncertainty using a multiplicative method.

Table 7 - 6 - 30 Predicted collision rates following Band (2004)– 200m Proposed Turbines

Species	Months	Model	Avoidance Factor	Annual Collision Rate	Range of Uncertainty	Collisions Over Lifetime	Years to One Collision
Buzzard	Apr-Mar	non-directional	0.98	3.007	0-13.171	105.245	<1
Curlew	Apr-Sep	non-directional	0.98	0.003	0-0.017	0.105	>35
Golden Plover	Apr-Mar	non-directional	0.996	51.751	0-323.964	1811.285	<1

Species	Months	Model	Avoidance Factor	Annual Collision Rate	Range of Uncertainty	Collisions Over Lifetime	Years to One Collision
Greenland White-fronted Goose	Oct-Mar	non-directional	0.998	0.016	0-0.081	0.56	>35
Hen Harrier	Apr-Mar	non-directional	0.99	0.01	0-0.044	0.35	>35
Kestrel	Apr-Mar	non-directional	0.95	3.286	0-17.976	115.01	<1
Lapwing	Apr-Jul	non-directional	0.98	0.063	0-0.344	2.205	16
Lapwing	Aug-Mar	non-directional	0.98	5.885	0-34.719	205.975	<1
Little Egret	Apr-Mar	non-directional	0.98	0.007	0-0.031	0.245	>35
Lesser Black-backed Gull	Oct-Mar	non-directional	0.995	0.122	0-0.551	4.27	8
Long-eared Owl	Apr-Mar	non-directional	0.98	0.002	0-0.008	0.07	>35
Merlin	Apr-Mar	non-directional	0.98	0.00042	0-0.002	0.0147	>35
Peregrine Falcon	Apr-Mar	non-directional	0.98	0.04	0-0.181	1.4	25
Snipe	Apr-Mar	non-directional	0.98	0.9	0-5.014	31.5	1
Sparrowhawk	Apr-Mar	non-directional	0.98	0.11	0-0.600	3.85	9
White-tailed Eagle	Apr-Mar	non-directional	0.95	0.032	0-0.137	1.12	31
Whooper Swan	Sep-Mar	non-directional	0.995	0.207	0-0.646	7.245	5
Woodcock	Apr-Mar	non-directional	0.98	0.065	0-0.371	2.275	15

Table 7 - 6 - 31 Predicted collision rates following Band (2024) – 220m Proposed Turbines

Species	Months	Model	Avoidance Factor	Annual Collision Rate	Range of Uncertainty	Collisions Over Lifetime	Years to One Collision
Buzzard	Apr-Mar	non-directional	0.98	1.652	0-7.238	57.82	<1
Curlew	Apr-Sep	non-directional	0.98	0.003	0-0.016	0.105	>35
Golden Plover	Apr-Mar	non-directional	0.996	29.555	0-183.240	1034.425	<1
Greenland White-fronted Goose	Oct-Mar	non-directional	0.998	0.002	0-0.010	0.07	>35
Hen Harrier	Apr-Mar	non-directional	0.99	0.007	0-0.029	0.245	>35
Kestrel	Apr-Mar	non-directional	0.95	2.383	0-13.034	83.405	<1
Lapwing	Apr-Jul	non-directional	0.98	0.112	0-0.611	3.92	9
Lapwing	Aug-Mar	non-directional	0.98	9.546	0-52.791	334.11	<1
Lesser Black-backed Gull	Oct-Mar	non-directional	0.995	0.241	0-1.141	8.435	4
Little Egret	Apr-Mar	non-directional	0.98	0.002	0-0.011	0.07	>35
Long-eared Owl	Apr-Mar	non-directional	0.98	0.00037	0-0.002	0.01295	>35
Merlin	Apr-Mar	non-directional	0.98	0.001	0-0.005	0.035	>35
Peregrine Falcon	Apr-Mar	non-directional	0.98	0.019	0-0.084	0.665	>35
Snipe	Apr-Mar	non-directional	0.98	1.302	0-7.393	45.57	<1
Sparrowhawk	Apr-Mar	non-directional	0.98	0.089	0-0.486	3.115	11
White-tailed Eagle	Apr-Mar	non-directional	0.95	0.011	0-0.053	0.385	>35
Whooper Swan	Sep-Mar	non-directional	0.995	0.16	0-0.511	5.6	6
Woodcock	Apr-Mar	non-directional	0.98	0.074	0-0.424	2.59	14

Table 7 - 6 - 32 Predicted collision rates following Band (2024) – Total

Species	Months	Model	Avoidance Factor	Annual Collision Rate	Range of Uncertainty	Collisions Over Lifetime	Years to One Collision
Buzzard	Apr-Mar	non-directional	0.98	4.659	0-20.409	163.065	<1
Curlew	Apr-Sep	non-directional	0.98	0.006	0-0.033	0.21	>35
Golden Plover	Apr-Mar	non-directional	0.996	81.306	0-507.204	2845.71	<1
Greenland White-fronted Goose	Oct-Mar	non-directional	0.998	0.018	0-0.026	0.63	>35
Hen Harrier	Apr-Mar	non-directional	0.99	0.017	0-0.073	0.595	>35
Kestrel	Apr-Mar	non-directional	0.95	5.669	0-31.01	198.415	<1
Lapwing	Apr-Jul	non-directional	0.98	0.175	0-0.955	6.125	6
Lapwing	Aug-Mar	non-directional	0.98	15.431	0-58.676	540.085	<1
Little Egret	Apr-Mar	non-directional	0.98	0.009	0-0.042	0.315	>35
Lesser Black-backed Gull	Oct-Mar	non-directional	0.995	0.363	0-1.692	12.705	3
Long-eared Owl	Apr-Mar	non-directional	0.98	0.00237	0-0.01	0.08295	>35
Merlin	Apr-Mar	non-directional	0.98	0.00142	0-0.007	0.0497	>35
Peregrine Falcon	Apr-Mar	non-directional	0.98	0.059	0-0.265	2.065	17
Snipe	Apr-Mar	non-directional	0.98	2.202	0-12.407	77.07	<1
Sparrowhawk	Apr-Mar	non-directional	0.98	0.199	0-1.086	6.965	5

Species	Months	Model	Avoidance Factor	Annual Collision Rate	Range of Uncertainty	Collisions Over Lifetime	Years to One Collision
White-tailed Eagle	Apr-Mar	non-directional	0.95	0.043	0-0.19	1.505	23
Whooper Swan	Sep-Mar	non-directional	0.995	0.367	0-1.157	12.845	3
Woodcock	Apr-Mar	non-directional	0.98	0.139	0-0.795	4.865	7

Table 7 - 6 - 33 Predicted annual collision rate calculated using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 and with a range of uncertainty using a multiplicative method - 200m Proposed Turbines

Species	Months	Model	Avoidance Factor	Annual Collision Rate	Range of Uncertainty	Collisions Over Lifetime	Years to One Collision
Buzzard	Apr-Mar	non-directional	0.98	2.496	0.372-16.748	87.36	<1
Curlew	Apr-Sep	non-directional	0.98	0.009	0.001-0.066	0.315	>35
Golden Plover	Apr-Mar	non-directional	0.996	37.447	3.938-356.126	1310.645	<1
Greenland White-fronted Goose	Oct-Mar	non-directional	0.998	0.0003	0-0.003	0.0119	>35
Hen Harrier	Apr-Mar	non-directional	0.99	0.006	0.001-0.046	0.21	>35
Kestrel	Apr-Mar	non-directional	0.95	2.027	0.243-16.908	70.945	<1
Lapwing	Apr-Jul	non-directional	0.98	0.052	0.006-0.435	1.82	19
Lapwing	Aug-Mar	non-directional	0.98	6.477	0.712-58.941	226.695	<1
Little Egret	Apr-Mar	non-directional	0.98	0.002	0.000-0.013	0.07	>35
Lesser Black-backed Gull	Oct-Mar	non-directional	0.995	0.114	0.016-0.788	3.99	9

Species	Months	Model	Avoidance Factor	Annual Collision Rate	Range of Uncertainty	Collisions Over Lifetime	Years to One Collision
Long-eared Owl	Apr-Mar	non-directional	0.98	0.001	0-0.009	0.035	>35
Merlin	Apr-Mar	non-directional	0.98	0.00014	0-0.001	0.0049	>35
Peregrine Falcon	Apr-Mar	non-directional	0.98	0.042	0.006-0.293	1.47	24
Snipe	Apr-Mar	non-directional	0.98	0.837	0.098-7.178	29.295	1
Sparrowhawk	Apr-Mar	non-directional	0.98	0.081	0.010-0.679	2.835	12
White-tailed Eagle	Apr-Mar	non-directional	0.95	0.029	0.004-0.184	1.015	34
Whooper Swan	Sep-Mar	non-directional	0.995	0.111	0.023-0.534	3.885	9
Woodcock	Apr-Mar	non-directional	0.98	0.018	0.002-0.161	0.63	>35

Table 7 - 6 - 34 Predicted annual collision rate calculated using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 and with a range of uncertainty using a multiplicative method - 220m Proposed Turbines

Species	Months	Model	Avoidance Factor	Annual Collision Rate	Range of Uncertainty	Collisions Over Lifetime	Years to One Collision
Buzzard	Apr-Mar	non-directional	0.98	1.576	0.234-10.608	55.16	<1
Curlew	Apr-Sep	non-directional	0.98	0.006	0.001-0.044	0.21	>35
Golden Plover	Apr-Mar	non-directional	0.996	39.823	4.170-380.305	1393.805	<1
Greenland White-fronted Goose	Oct-Mar	non-directional	0.998	0.032	0.004-0.247	1.12	31
Hen Harrier	Apr-Mar	non-directional	0.99	0.001	0-0.008	0.035	>35

Species	Months	Model	Avoidance Factor	Annual Collision Rate	Range of Uncertainty	Collisions Over Lifetime	Years to One Collision
Kestrel	Apr-Mar	non-directional	0.95	1.354	0.162-11.296	47.39	<1
Lapwing	Apr-Jul	non-directional	0.98	0.066	0.008-0.550	2.31	15
Lapwing	Aug-Mar	non-directional	0.98	9.773	1.155-82.678	342.055	<1
Lesser Black-backed Gull	Oct-Mar	non-directional	0.995	0.283	0.038-2.124	9.905	4
Little Egret	Apr-Mar	non-directional	0.98	0.00032	0-0.002	0.0112	>35
Long-eared Owl	Apr-Mar	non-directional	0.98	0.00026	0-0.002	0.0091	>35
Merlin	Apr-Mar	non-directional	0.98	0.004	0-0.033	0.14	>35
Peregrine Falcon	Apr-Mar	non-directional	0.98	0.016	0.002-0.117	0.56	>35
Snipe	Apr-Mar	non-directional	0.98	1.159	0.134-9.990	40.565	<1
Sparrowhawk	Apr-Mar	non-directional	0.98	0.077	0.009-0.644	2.695	13
White-tailed Eagle	Apr-Mar	non-directional	0.95	0.019	0.003-0.144	0.665	>35
Whooper Swan	Sep-Mar	non-directional	0.995	0.054	0.011-0.259	1.89	19
Woodcock	Apr-Mar	non-directional	0.98	0.023	0.003-0.206	0.805	>35

Table 7 - 6 - 35 Predicted annual collision rate calculated using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 and with a range of uncertainty using a multiplicative method – Total

Species	Months	Model	Avoidance Factor	Annual Collision Rate	Range of Uncertainty	Collisions Over Lifetime	Years to One Collision
Buzzard	Apr-Mar	non-directional	0.98	4.072	0.234-10.608	142.52	<1
Curlew	Apr-Sep	non-directional	0.98	0.015	0.001-0.044	0.525	>35
Golden Plover	Apr-Mar	non-directional	0.996	77.27	4.170-380.305	2704.45	<1
Greenland White-fronted Goose	Oct-Mar	non-directional	0.998	0.0323	0.004-0.247	1.1319	31
Hen Harrier	Apr-Mar	non-directional	0.99	0.007	0.000-0.008	0.245	>35
Kestrel	Apr-Mar	non-directional	0.95	3.381	0.162-11.296	118.335	<1
Lapwing	Apr-Jul	non-directional	0.98	0.118	0.008-0.550	4.13	8
Lapwing	Aug-Mar	non-directional	0.98	16.25	1.155-82.678	568.75	<1
Lesser Black-backed Gull	Oct-Mar	non-directional	0.995	0.397	0.054-2.912	13.895	2
Little Egret	Apr-Mar	non-directional	0.98	0.00232	0-0.015	0.0812	>35
Long-eared Owl	Apr-Mar	non-directional	0.98	0.00126	0.000-0.002	0.0441	>35
Merlin	Apr-Mar	non-directional	0.98	0.00414	0.000-0.033	0.1449	>35
Peregrine Falcon	Apr-Mar	non-directional	0.98	0.058	0.002-0.117	2.03	17
Snipe	Apr-Mar	non-directional	0.98	1.996	0.134-9.990	69.86	<1

Species	Months	Model	Avoidance Factor	Annual Collision Rate	Range of Uncertainty	Collisions Over Lifetime	Years to One Collision
Sparrowhawk	Apr-Mar	non-directional	0.98	0.158	0.009-0.644	5.53	6
White-tailed Eagle	Apr-Mar	non-directional	0.95	0.048	0.003-0.144	1.68	21
Whooper Swan	Sep-Mar	non-directional	0.995	0.165	0.011-0.259	5.775	6
Woodcock	Apr-Mar	non-directional	0.98	0.041	0.003-0.206	1.435	24

Table 7 - 6 - 36 Comparison of the predicted annual collision rate calculated following the Band (2024) model and using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 and with a range of uncertainty using a multiplicative method

Species	Months	Model	Avoidance Factor	Annual Collision Rate Band (2024)	Annual Collision Rate NatureScot Deviation
Buzzard	Apr-Mar	non-directional	0.98	4.659	4.072
Curlew	Apr-Sep	non-directional	0.98	0.006	0.015
Golden Plover	Apr-Mar	non-directional	0.996	81.306	77.27
Greenland White-fronted Goose	Oct-Mar	non-directional	0.998	0.018	0.0323
Hen Harrier	Apr-Mar	non-directional	0.99	0.017	0.007
Kestrel	Apr-Mar	non-directional	0.95	5.669	3.381
Lapwing	Apr-Jul	non-directional	0.98	0.175	0.118
Lapwing	Aug-Mar	non-directional	0.98	15.431	16.25

Species	Months	Model	Avoidance Factor	Annual Collision Rate Band (2024)	Annual Collision Rate NatureScot Deviation
Lesser Black-backed Gull	Oct-Mar	non-directional	0.995	0.363	0.397
Little Egret	Apr-Mar	non-directional	0.98	0.009	0.00232
Long-eared Owl	Apr-Mar	non-directional	0.98	0.00237	0.00126
Merlin	Apr-Mar	non-directional	0.98	0.00142	0.00414
Peregrine Falcon	Apr-Mar	non-directional	0.98	0.059	0.058
Snipe	Apr-Mar	non-directional	0.98	2.202	1.996
Sparrowhawk	Apr-Mar	non-directional	0.98	0.199	0.158
White-tailed Eagle	Apr-Mar	non-directional	0.95	0.043	0.048
Whooper Swan	Sep-Mar	non-directional	0.995	0.367	0.165
Woodcock	Apr-Mar	non-directional	0.98	0.139	0.041

4. WORKED EXAMPLE

This section provides a worked example of the collision rate prediction for sparrowhawk at an imaginary facility. This example is deliberately simplified to assist readers with following the steps. The prediction is made using a short imaginary dataset presented in Section 4.2.

4.1 Proposed Development Scenario

In this example, a wind farm is proposed in farmland at a latitude of 53.4°N. The development consists of seven turbines. Each turbine has a hub height of 105m and rotor diameter of 150m, giving a rotor-swept height range of 30-180m. The turbines have a blade radius (R) of 75m, a blade pitch (λ) of 6°, and a maximum blade chord width (C) of 4.2m. Each turbine has 3 blades (b) and operates at an average rotational speed (Ω) of 11.4rpm. The proposed operational lifetime of 35 years, with turbines expected to be operational approximately 85% of the time.

The blade profile of the turbines is presented in Table 7 - 6 - 37. This table provides the chord width values at 20 evenly spaced points along the blade, expressed relative to the maximum chord width. In this context, r denotes the distance from the hub, and R represents the total blade length (i.e., the rotor radius). The ratio r/R therefore represents the relative radial position along the blade, where 0 corresponds to the hub and 1 corresponds to the blade tip. Similarly, c represents the chord width at a given distance (r) from the hub, and C is the maximum chord width of the blade. Therefore, the ratio c/C represents the relative chord width.

Table 7 - 6 - 37 Blade profile of the turbines

r/R	c/C
0.00	0.690
0.05	0.730
0.10	0.790
0.15	0.880
0.20	0.960
0.25	1.000
0.30	0.980
0.35	0.920
0.40	0.850
0.45	0.800
0.50	0.750
0.55	0.700
0.60	0.640
0.65	0.580
0.70	0.520
0.75	0.470
0.80	0.410
0.85	0.370
0.90	0.300
0.95	0.240
1.00	0.000

4.2 Bird Survey Scenario

In this example, bird surveys were conducted at the proposed wind farm site for a two-year period (April 2023 to March 2025). Vantage point surveys to monitor flight activity were undertaken at two vantage points. The combined viewsheds from these vantage points provided at least 500m coverage around all turbines in addition to coverage of the site and surrounds (Figure 7 - 6 - 1). The total viewshed area was 5.23km^2 for VP1 and 5.92km^2 for VP2.

Both vantage points were surveyed for 6 hours per month throughout the survey period, totalling 144 hours of survey at each location. For each recorded flight, the duration (in seconds) that bird spent within pre-defined height bands was recorded. These heights bands were:

- Band 1 = 0-15m
- Band 2 = 15-25m
- Band 3 = 25-200m
- Band 4 = 200m+

As the risk height range of the turbine is 30-180m, all flight activity in Band 3 is considered to be at potential collision height.

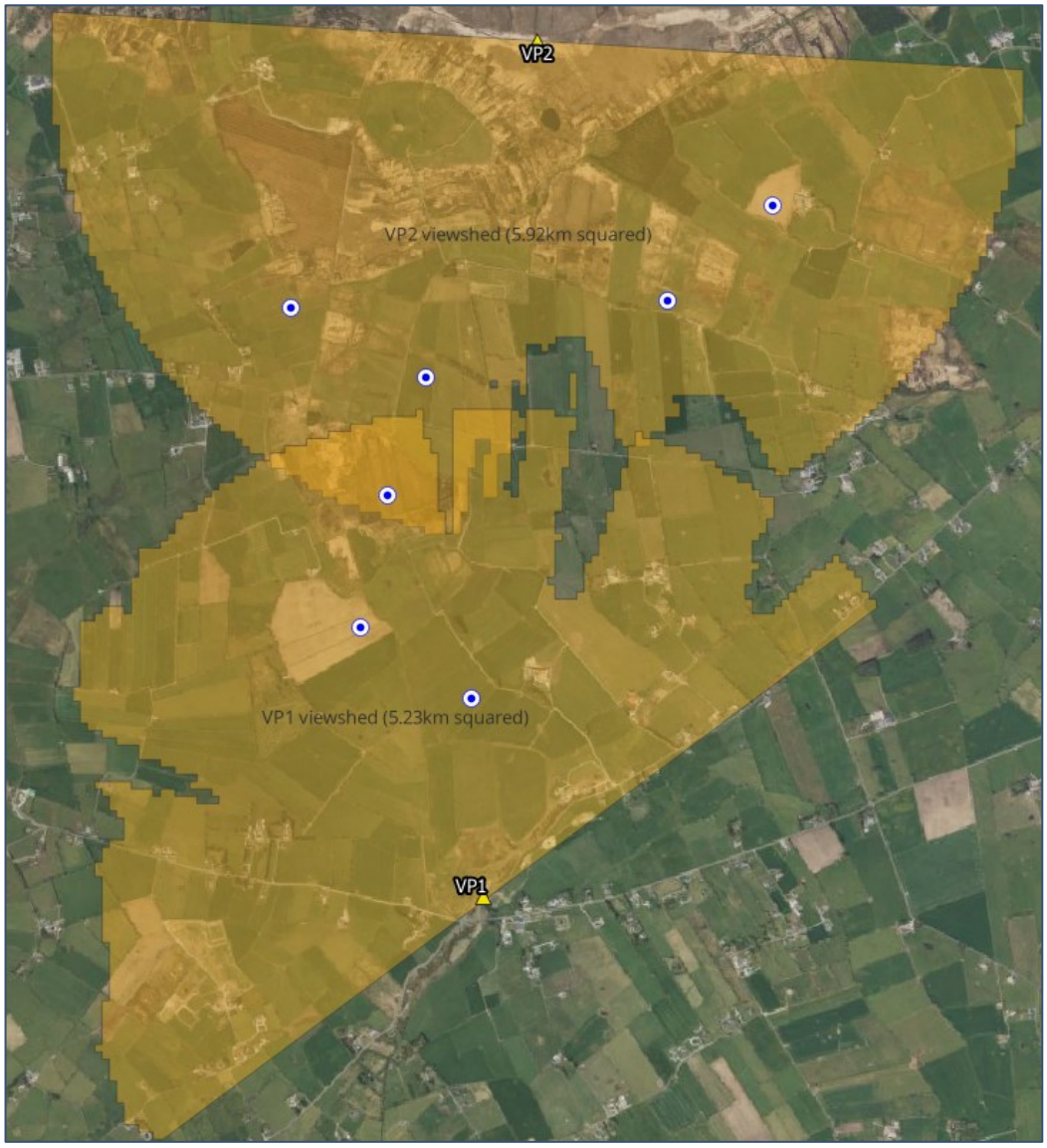


Figure 7 - 6 - 3 Vantage point survey locations and viewshed areas

In this example, a collision risk model will be conducted for the species sparrowhawk. All records for sparrowhawk collected during vantage point surveys are presented in Table 7 - 6 - 38. Records denoted '-' represent non-flight activity, for example when a bird is perched.

The data in Table 7 - 6 - 38 shows that sparrowhawk was present at the site throughout the survey period, in both the breeding and winter season. Therefore, all months of the year will be modelled.

Table 7 - 6 - 38 Sparrowhawk records from vantage point surveys

VP	Date	Time	Species	Number	Band 1	Band 2	Band 3	Band 4
VP2	17/11/2023	07:36	Sparrowhawk	1	17	0	0	0
VP2	17/11/2023	07:43	Sparrowhawk	1	-	-	-	-
VP1	12/12/2023	11:24	Sparrowhawk	1	-	-	-	-
VP1	12/01/2024	12:14	Sparrowhawk	2	14	0	15	0
VP2	30/01/2024	11:34	Sparrowhawk	1	87	0	0	0
VP2	21/02/2024	16:19	Sparrowhawk	1	35	0	0	0
VP1	14/03/2024	11:48	Sparrowhawk	1	50	12	0	0
VP1	03/05/2024	11:25	Sparrowhawk	2	19	0	0	0
VP2	09/05/2024	09:56	Sparrowhawk	1	6	0	0	0
VP1	19/06/2024	10:14	Sparrowhawk	1	15	3	0	0
VP1	19/06/2024	14:22	Sparrowhawk	1	0	0	139	0
VP1	09/07/2024	16:56	Sparrowhawk	1	21	0	0	0
VP2	26/07/2024	13:37	Sparrowhawk	1	17	0	0	0
VP1	03/10/2024	14:02	Sparrowhawk	1	32	9	0	0
VP1	06/11/2024	12:15	Sparrowhawk	1	14	4	0	0
VP1	29/11/2024	13:09	Sparrowhawk	1	0	18	81	0
VP1	29/11/2024	15:57	Sparrowhawk	1	16	0	0	0
VP2	31/01/2025	13:07	Sparrowhawk	1	20	48	0	0
VP2	13/03/2025	08:46	Sparrowhawk	1	0	83	0	0

4.3 Stage A: Flight Activity

Aerial bird density

In order to calculate the aerial bird density (D_A) for sparrowhawk, the following formula was used:

$$DA = b / (t \times A) \text{ bird-seconds } m^2$$

To calculate parameter b, the number of 'bird-seconds' per month per vantage point was calculated by multiplying the number of birds aloft by the duration of the flight (in seconds). This included time spent in all recorded height bands, not just those bands within potential collision height. These values are presented in Table 7 - 6 - 39. Note that sparrowhawk was not recorded in every month, therefore some months are not present in the table.

Table 7 - 6 - 39 Bird-seconds per vantage point per month

Month	Vantage Point	Bird-Seconds	Bird-Seconds at Potential Collision Height
Jan	VP1	58	30
Mar	VP1	62	0
May	VP1	38	38

Month	Vantage Point	Bird-Seconds	Bird-Seconds at Potential Collision Height
Jun	VP1	157	139
Jul	VP1	21	0
Oct	VP1	41	0
Nov	VP1	133	81
Jan	VP2	155	10
Feb	VP2	35	30
Mar	VP2	83	3
May	VP2	6	0
Jul	VP2	17	17
Nov	VP2	17	17

Parameter t, the time that the vantage point was watched, was obtained from the survey effort. The breakdown of survey time at each vantage point is presented in Table 7 - 6 - 40.

Table 7 - 6 - 40 Survey time at each vantage point in hours and seconds according to month

Vantage Point	Month	Time in hours	Time in seconds
VP1	Jan	12	43200
VP2	Jan	12	43200
VP1	Feb	12	43200
VP2	Feb	12	43200
VP1	Mar	12	43200
VP2	Mar	12	43200
VP1	Apr	12	43200
VP2	Apr	12	43200
VP1	May	12	43200
VP2	May	12	43200
VP1	Jun	12	43200
VP2	Jun	12	43200
VP1	Jul	12	43200
VP2	Jul	12	43200
VP1	Aug	12	43200
VP2	Aug	12	43200
VP1	Sep	12	43200
VP2	Sep	12	43200
VP1	Oct	12	43200
VP2	Oct	12	43200
VP1	Nov	12	43200
VP2	Nov	12	43200
VP1	Dec	12	43200
VP2	Dec	12	43200

Parameter A is the entire area of the vantage point viewsheds. As described above, these were:

- VP1 = 5.23km^2
- VP2 = 5.92km^2

The aerial bird density (D_A) was calculated for all vantage points, and then a mean value was obtained for each month. For example, D_A for January was calculated as:

VP1

b = 58
t = 43200
A = 5.23
D_A = 0.0002563467

VP2

b = 155
t = 43200
A = 5.92
D_A = 0.0006055715

Mean D_A for the month of January

(0002563467 X 0.0006055715)/2 = 0.0004309591

D_A for all months is presented in Table 7 - 6 - 41 (calculated using flight activity in all bands) and Table 7-6-41 (calculated using only the flight activity in the bands within potential collision risk height). Zero is input for months in which sparrowhawk was not recorded.

Table 7 - 6 - 41 Aerial bird density

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.0004	0.0001	0.0003	0	0.0001	0.0003	0.0001	0	0	0.0001	0.0003	0

Table 7 - 6 - 42 Aerial bird density calculated using only the flight activity in the bands within potential collision risk height

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.00009	0.00006	0.00001	0	0.00008	0.00031	0.00003	0	0	0	0.00021	0

Proportion of birds flying at risk height

The proportion of sparrowhawk flying at risk height (Q_2R) was calculated from the survey data in Table 7 - 6 - 38. Note that non-flight records are excluded from this calculation.

First, for each height band, the proportion of flights within that band relative to the total number of flights was calculated. Second, the proportion of each height band overlapping the rotor risk height (30-180m) was determined. Finally, these two proportions were multiplied. The workings for Band 3 (25-200m) are below.

Band 3

- Total number of sparrowhawk flights = 17
- Total number of sparrowhawk flights in band = 3
- Proportion of flights in band = 0.176
- Proportion of band overlapping rotor risk height = 0.858
- 0.176 X 0.858 = 0.151

This calculation was made for all bands. Then, the result from each band was summed to provide a total proportion of birds flying at risk height. Note that the result for bands that do not overlap with rotor risk height will be 0. Because Band 3 was the only band that overlapped with rotor risk height in this example, the final proportion of birds flying at risk height (Q_2R) was 0.151 or 15.1%.

A second calculation will be performed in this example in which the proportion of sparrowhawk flying at risk height (Q_2R) is always set to 1 (or 100%).

Photoperiod

The photoperiod at the latitude of the site was acquired for the survey period. The daylight and nighttime hours per month (tday and tnight respectively) are shown in Table 7 - 6 - 43. The total daylight hours was 4,487.093 and night-time hours was 4,272.907.

Table 7 - 6 - 43 Photoperiod

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daylight Hours	251.5	273.7	366.3	418.6	491.5	507.3	510.3	459.0	382.6	329.7	261.0	235.6
Nighttime Hours	492.5	398.3	377.7	301.4	252.5	212.7	233.7	285.0	337.4	414.3	459.0	508.4

4.4 Stage B: Number of Flights Through Rotors

To estimate the number of sparrowhawk flights through the rotors, firstly the total rotor frontal area for all turbines was calculated as:

$$\text{rotor frontal area} = T\ \pi R^2$$

where T is the number of turbines. In this example, that is $7 \text{ X } \pi \text{ X } 75^2 = 123700.2\text{m}^2$

Sparrowhawk biometrics were taken from the best available literature:

- Length (l) = 0.33m
- Wingspan (w) = 0.625m
- Flight speed (v) = 10m/s
- Flight type = flapping
- Nocturnal activity ranking (fnight) = 1 (0% nighttime activity)

Using the values from previous sections, the density (D_V) for each month was calculated as:

$$Dv = (D_A * Q_2R)/(2*R)$$

Then the projected number of transits through the rotor risk area was calculated as:

$$\text{transits} = v * Dv * \text{rotor frontal area} * ((\text{tday} + (\text{tnight} * (\text{fnight}/100))) * 3600)$$

In this example, the density for the month of January was $(0.0004 \text{ X } 0.151)/(2 \text{ X } 75) = 4.349921^{-13}$

The number of transits for the month of January was $10 \text{ X } 4.349921^{-13} \text{ X } 123700.2 \text{ X } ((251.519 + (492.481 \text{ X } (0/100))) \text{ X } 3600) = 0.4872201$. Table 7 - 6 - 44 (calculated using flight activity from all height bands and an estimated Q_2R) and Table 7-6-44 (calculated using only the flight activity in the bands within potential collision risk height and always setting the proportion flying at risk height to 1) shows the projected number of transits for all months. Note that a zero is input for months in which sparrowhawk was not recorded.

Table 7 - 6 - 44 Number of transits per month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.487	0.084	0.493	0	0.211	0.791	0.183	0	0	0.134	0.384	0

Table 7 - 6 - 45 Number of transits per month calculated using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.642	0.477	0.064	0	1.227	4.633	0.503	0	0	0	1.646	0

4.5 Stage C: Probability of Collision

The probability of a sparrowhawk collision during a single rotor transit was calculated. Sparrowhawk biometrics, flight behaviour and the turbine specifications outlined in the previous sections were used to define how the bird interacts with the moving blades and derive the geometric parameters described below. Collision probability was determined separately for upwind and downwind flight directions. It was calculated as a function of radial position across the rotor disc, at increments of 0.05 from 0.05 to 1.0 (excluding the rotor centre).

At each radial position, collision probability was calculated for flight angles at increments of 10° from 0° to 180°, which assumes a uniform distribution of bird approach angles. For each flight angle, the flight angle (Φ) was converted from degrees to radians and turbine rotation speed (Ω) was converted from rpm to radians per second. The dimensionless radial position (radius) was converted to an absolute distance from the hub in metres. Then, the blade chord width at the radial position was estimated by interpolating the blade profile and scaling it by the maximum chord width, to reflect blade width changes from hub to tip. Flight direction (d) was set as 1 for upwind flight directions and -1 for downwind.

A standard dimensionless blade encounter rate multiplier was defined as:

$$b\ \Omega/2\ \pi v$$

where b is number of blades, Ω is rotation speed (now in rad s^{-1}), and v is bird flight speed.

The ratio of bird speed to blade tangential speed (α) was calculated as:

$$\alpha = v/\text{radius}\ \Omega$$

The blade pitch (λ) was converted from degrees to radians to obtain the blade tilt angle (θ) relative to the rotor plane:

$$\theta = \lambda\pi/180$$

Using these values, two collision lengths were calculated. The first was a blade-related component (accounting for blade chord width [c], blade tilt [θ], bird flight direction [d] and the ratio of bird speed to blade tangential speed [α]), which represents the effective 'interaction length' associated with blade motion and geometry:

$$|\ d\ c\ \sin(\theta)+\alpha\ c\ \cos(\theta)|$$

The second was a bird-size-related component (accounting for body length [l], wingspan [w] and flight type):

$$\max(l, w_{eff}\ \alpha)$$

Here, w_{eff} is the effective wingspan. For flapping flight, the full wingspan was used, but for gliding flight, the wingspan would be reduced by the absolute value of the cosine of the flight angle relative to the rotor plane (Φ) to represent the reduced projected cross-section when the bird's wings are angled relative to the rotor plane.

Finally, the collision probability was calculated as the blade encounter rate multiplier multiplied by the sum of the two collision lengths. The result is capped at a maximum of 1 so that probabilities cannot exceed 100%. This collision probability was then averaged over the flight angles at the radial position. The upwind and downwind collision probabilities calculated for each radial position for sparrowhawk are presented in Table 7 - 6 - 46.

Table 7 - 6 - 46 Upwind and downwind collision probabilities

Radial Position	Upwind	Downwind
0.05	0.486082	0.449547
0.1	0.269631	0.230093
0.15	0.204551	0.160508
0.2	0.171557	0.123511
0.25	0.1502	0.100152
0.3	0.130199	0.081152
0.35	0.11173	0.065686
0.4	0.096588	0.054047
0.45	0.086103	0.046065
0.5	0.077465	0.039929
0.55	0.070171	0.035137
0.6	0.06319	0.031159
0.65	0.057052	0.028024
0.7	0.051576	0.025551
0.75	0.047235	0.023713
0.8	0.042698	0.022178
0.85	0.039644	0.021126
0.9	0.035181	0.020167
0.95	0.031534	0.019522
1	0.01881	0.01881

Next, the collision probabilities were averaged for flights through the rotor disk for upwind values and downwind values as follows:

$$P = 2[(i=1\sum n-1 r_i p_i)+2p_n]\Delta r$$

Where P is the mean single-transit collision probability (upwind or downwind), r_i is the radial position, p_i is the collision probability at radial position r_i, p_n is the collision probability at the outermost radial position (i.e., the blade tip), $\Delta r = 0.05$ (i.e., the radial increments) and n is the number of evaluated radial positions

The average collision risk for flights through the rotor when moving upwind was calculated as 0.0672, and for downwind as 0.0402. A 50:50 weighting of upwind and downwind flight was assumed. Thus, the final probability of a sparrowhawk collision during a single rotor transit was calculated as the weighted average of these two estimates. The estimated probability of collision for a sparrowhawk during a single rotor transit was 0.0537.

4.6 Stage D Expected Collisions

The outputs of stage B and C were multiplied to yield the expected collision rate for sparrowhawk, and the product was multiplied by the proportion of time the wind farm is expected to be operational. In this example, the expected collisions for January was calculated as:

$$0.487 \text{ X } 0.0537 \text{ X } 0.85 = 0.02224467$$

The predicted number of collisions for each month is presented in Table 7 - 6 - 47 (calculated using flight activity from all height bands and an estimated Q_2R) and Table 7-6-47 (calculated using only the flight activity in the bands within potential collision risk height and always setting the proportion flying at risk height to 1). Note that these rates assume no avoidance of turbines or wind farms by sparrowhawk.

Table 7 - 6 - 47 Expected collisions per month (without avoidance)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.022	0.004	0.023	0.000	0.010	0.036	0.008	0.000	0.000	0.006	0.018	0.000

Table 7 - 6 - 48 Expected collisions per month (without avoidance) calculated using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.029	0.022	0.003	0	0.056	0.212	0.023	0	0	0	0.075	0

4.7 Stage E Allowing for Avoidance and Attraction

Stage E of the modelling process takes account of the proportion of sparrowhawk likely to avoid the wind farm or its turbines. This is calculated for a range of avoidance factors: 95%, 98%, 99% and 99.5%. The expected collisions per month calculated in stage D are multiplied by the avoidance rates to provide a collision rate with avoidance. These values are presented in Table 7 - 6 - 49 (calculated using flight activity from all height bands and an estimated Q_2R) and Table 7-6-49 (calculated using only the flight activity in the bands within PCH potential collision risk height and always setting the proportion flying at risk height to 1).

Table 7 - 6 - 49 Expected collisions per month (with avoidance)

Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.95	0.0011	0.0002	0.0011	0.0000	0.0005	0.0018	0.0004	0.0000	0.0000	0.0003	0.0009	0.0000
0.98	0.0004	0.0001	0.0005	0.0000	0.0002	0.0007	0.0002	0.0000	0.0000	0.0001	0.0004	0.0000
0.99	0.0002	0.0000	0.0002	0.0000	0.0001	0.0004	0.0001	0.0000	0.0000	0.0001	0.0002	0.0000
0.995	0.0001	0.0000	0.0001	0.0000	0.0001	0.0002	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000

Table 7 - 6 - 50 Expected collisions per month (with avoidance) calculated using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1

Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.95	0.0015	0.0011	0.0002	0.0000	0.0028	0.0106	0.0012	0.0000	0.0000	0.0000	0.0038	0.0000
0.98	0.0006	0.0004	0.0001	0.0000	0.0011	0.0042	0.0005	0.0000	0.0000	0.0000	0.0015	0.0000

Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.0003	0.0002	0.0000	0.0000	0.0006	0.0021	0.0002	0.0000	0.0000	0.0000	0.0008	0.0000
0.995	0.0002	0.0001	0.0000	0.0000	0.0003	0.0011	0.0001	0.0000	0.0000	0.0000	0.0004	0.0000
0.996	0.0001	0.0001	0.0000	0.0000	0.0002	0.0009	0.0001	0.0000	0.0000	0.0000	0.0003	0.0000

4.8 Stage F: Uncertainty

To provide a measure of uncertainty in aerial density (u1), the relative standard deviation for the monthly values was used. First, the mean aerial density ($\overline{D_A}$) for all months was calculated to be 0.0001445. Then, the relative standard deviation (RSD) was calculated as:

$$RSD = s/\overline{D_A}$$

where s is the standard deviation of the monthly values. In this example:

$$0.00015/0.0001445 = 1.038062$$

Note that zero values (i.e., months in which the sparrowhawk was not recorded, such as April) were retained in this equation as they may represent true absence or intermittent use of the site.

Uncertainty due to simplifications in the collision risk model (u2) was assumed to be 20% (Band, 2024). Finally, uncertainty due to design options (u3) was considered to be 28%, as 4 of 14 turbine specifications were either not finalised or were approximate (blade profile, pitch, rotational speed and expected time operational). The overall range of uncertainty (u) was thus:

$$\sqrt{(u1^2 + u2^2 + u3^2)}$$

In this example, that is:

$$\sqrt{(1.038062^2 + 0.2^2 + 0.28^2)} = 1.093605$$

The Band (2024) method assumes that the uncertainties combine additively. However, the components of the model are multiplied rather than summed, therefore the uncertainty values should also be multiplied to avoid underestimating overall uncertainty. In this example, that is:

$$(1 + u1) * (1 + u2) * (1 + u3)$$

$$(1 + 1.038062) * (1 + 0.2) * (1 + 0.28) = 3.130463$$

4.9 Worked Example Collision Rates

To provide a best estimate of the collision rate for sparrowhawk, the guidance on avoidance rates provided by NatureScot in NatureScot (2025b) was consulted. This guidance recommends a 98% avoidance rate for sparrowhawk. As such the predicted number of collisions corresponding to a 98% avoidance rate was identified and is presented in Table 7 - 6 - 51 (calculated using flight activity from all height bands and an estimated Q_2R) and Table 7-6-51 (calculated using only the flight activity in the bands within potential collision risk height and always setting the proportion flying at risk height to 1). The range of uncertainty and an estimation of the number of years for one collision to occur is also presented; Table 7-6-50 presents uncertainty calculated using the root sum of squares and Table 7-6-51 presents uncertainty using the multiplicative method.

The column 'Annual Collision Rate' in Table 7 - 6 - 51 and Table 7-6-52 presents a range for the final predicted annual collision rate for sparrowhawk that would be used in the impact assessment for this proposed development scenario: 0.0025-0.0084 sparrowhawk per year. Due to the uncertainties discussed in stage F, this may range up to 0.0052-0.026 sparrowhawk per year. Dividing 1 by 0.0025 or 0.0084provides the number of years it would be expected for a collision to occur based on the model predictions.

Table 7 - 6 - 51 Predicted annual collision rate

Species	Annual Collision Rate	Range of Uncertainty	Years to one collision
Sparrowhawk	0.0025	0.0011-0.0039	395

Table 7 - 6 - 52 Predicted annual collision rate calculated using only the flight activity in the bands within potential collision risk height and always setting the proportion flying at risk height to 1 and with a range of uncertainty using a multiplicative method

Species	Annual Collision Rate	Range of Uncertainty	Years to one collision
Sparrowhawk	0.0084	0-0.026	119

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APPENDIX 7-6-1

COLLISION RISK SUPPLEMENTARY MATERIAL

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1.1 Survey Effort Summary

Table 7 - 6 - 1 - 1 Survey effort summary

Vantage Point	Month	Hours Survey	Seconds Survey
VP1	Jan	36.00	129,600
VP10	Jan	30.00	108,000
VP11	Jan	30.00	108,000
VP12	Jan	30.00	108,000
VP13	Jan	36.00	129,600
VP14	Jan	36.00	129,600
VP15	Jan	36.00	129,600
VP16	Jan	30.00	108,000
VP2	Jan	36.00	129,600
VP3	Jan	36.00	129,600
VP4	Jan	42.00	151,200
VP5	Jan	36.00	129,600
VP6	Jan	36.00	129,600
VP7	Jan	30.00	108,000
VP8	Jan	30.00	108,000
VP9	Jan	36.00	129,600
VP1	Feb	39.00	140,400
VP10	Feb	42.00	151,200
VP11	Feb	42.00	151,200
VP12	Feb	48.00	172,800
VP13	Feb	36.00	129,600
VP14	Feb	36.00	129,600
VP15	Feb	30.00	108,000
VP16	Feb	36.00	129,600

Vantage Point	Month	Hours Survey	Seconds Survey
VP2	Feb	39.00	140,400
VP3	Feb	36.00	129,600
VP4	Feb	36.00	129,600
VP5	Feb	45.00	162,000
VP6	Feb	39.00	140,400
VP7	Feb	36.00	129,600
VP8	Feb	42.00	151,200
VP9	Feb	36.00	129,600
VP1	Mar	36.00	129,600
VP10	Mar	39.00	140,400
VP11	Mar	45.00	162,000
VP12	Mar	39.00	140,400
VP13	Mar	45.00	162,000
VP14	Mar	39.00	140,400
VP15	Mar	45.00	162,000
VP16	Mar	45.00	162,000
VP2	Mar	36.00	129,600
VP3	Mar	39.00	140,400
VP4	Mar	39.00	140,400
VP5	Mar	30.00	108,000
VP6	Mar	36.00	129,600
VP7	Mar	45.00	162,000
VP8	Mar	39.00	140,400
VP9	Mar	39.00	140,400
VP1	Apr	33.00	118,800
VP10	Apr	33.00	118,800
VP11	Apr	30.00	108,000

Vantage Point	Month	Hours Survey	Seconds Survey
VP12	Apr	30.00	108,000
VP13	Apr	33.00	118,800
VP14	Apr	33.00	118,800
VP15	Apr	33.00	118,800
VP16	Apr	30.00	108,000
VP2	Apr	33.00	118,800
VP3	Apr	30.00	108,000
VP4	Apr	30.00	108,000
VP5	Apr	27.00	97,200
VP6	Apr	27.00	97,200
VP7	Apr	30.00	108,000
VP8	Apr	33.00	118,800
VP9	Apr	30.00	108,000
VP1	May	30.00	108,000
VP10	May	27.00	97,200
VP11	May	24.00	86,400
VP12	May	21.00	75,600
VP13	May	27.00	97,200
VP14	May	27.00	97,200
VP15	May	30.00	108,000
VP16	May	27.00	97,200
VP2	May	30.00	108,000
VP3	May	27.00	97,200
VP4	May	27.00	97,200
VP5	May	21.00	75,600
VP6	May	27.00	97,200
VP7	May	27.00	97,200

Vantage Point	Month	Hours Survey	Seconds Survey
VP8	May	27.00	97,200
VP9	May	27.00	97,200
VP1	Jun	36.00	129,600
VP10	Jun	39.00	140,400
VP11	Jun	33.00	118,800
VP12	Jun	33.00	118,800
VP13	Jun	33.00	118,800
VP14	Jun	33.00	118,800
VP15	Jun	36.00	129,600
VP16	Jun	33.00	118,800
VP2	Jun	36.00	129,600
VP3	Jun	33.00	118,800
VP4	Jun	33.00	118,800
VP5	Jun	39.00	140,400
VP6	Jun	33.00	118,800
VP7	Jun	33.00	118,800
VP8	Jun	33.00	118,800
VP9	Jun	33.00	118,800
VP1	Jul	33.00	118,800
VP10	Jul	39.00	140,400
VP11	Jul	39.00	140,400
VP12	Jul	39.00	140,400
VP13	Jul	39.00	140,400
VP14	Jul	39.00	140,400
VP15	Jul	36.00	129,600
VP16	Jul	39.00	140,400
VP2	Jul	33.00	118,800

Vantage Point	Month	Hours Survey	Seconds Survey
VP3	Jul	36.00	129,600
VP4	Jul	33.00	118,800
VP5	Jul	30.00	108,000
VP6	Jul	30.00	108,000
VP7	Jul	36.00	129,600
VP8	Jul	36.00	129,600
VP9	Jul	39.00	140,400
VP1	Aug	42.00	151,200
VP10	Aug	36.00	129,600
VP11	Aug	45.00	162,000
VP12	Aug	45.00	162,000
VP13	Aug	42.00	151,200
VP14	Aug	42.00	151,200
VP15	Aug	39.00	140,400
VP16	Aug	45.00	162,000
VP2	Aug	36.00	129,600
VP3	Aug	39.00	140,400
VP4	Aug	42.00	151,200
VP5	Aug	54.00	194,400
VP6	Aug	51.00	183,600
VP7	Aug	39.00	140,400
VP8	Aug	39.00	140,400
VP9	Aug	45.00	162,000
VP1	Sep	36.00	129,600
VP10	Sep	36.00	129,600
VP11	Sep	36.00	129,600
VP12	Sep	36.00	129,600

Vantage Point	Month	Hours Survey	Seconds Survey
VP13	Sep	36.00	129,600
VP14	Sep	36.00	129,600
VP15	Sep	36.00	129,600
VP16	Sep	36.00	129,600
VP2	Sep	36.00	129,600
VP3	Sep	39.00	140,400
VP4	Sep	39.00	140,400
VP5	Sep	33.00	118,800
VP6	Sep	36.00	129,600
VP7	Sep	39.00	140,400
VP8	Sep	39.00	140,400
VP9	Sep	36.00	129,600
VP1	Oct	36.00	129,600
VP10	Oct	42.00	151,200
VP11	Oct	36.00	129,600
VP12	Oct	36.00	129,600
VP13	Oct	36.00	129,600
VP14	Oct	36.00	129,600
VP15	Oct	30.00	108,000
VP16	Oct	36.00	129,600
VP2	Oct	36.00	129,600
VP3	Oct	36.00	129,600
VP4	Oct	36.00	129,600
VP5	Oct	36.00	129,600
VP6	Oct	36.00	129,600
VP7	Oct	36.00	129,600
VP8	Oct	36.00	129,600

Vantage Point	Month	Hours Survey	Seconds Survey
VP9	Oct	36.00	129,600
VP1	Nov	42.00	151,200
VP10	Nov	30.00	108,000
VP11	Nov	42.00	151,200
VP12	Nov	42.00	151,200
VP13	Nov	36.00	129,600
VP14	Nov	42.00	151,200
VP15	Nov	42.00	151,200
VP16	Nov	36.00	129,600
VP2	Nov	42.00	151,200
VP3	Nov	42.00	151,200
VP4	Nov	42.00	151,200
VP5	Nov	42.00	151,200
VP6	Nov	36.00	129,600
VP7	Nov	36.00	129,600
VP8	Nov	36.00	129,600
VP9	Nov	36.00	129,600
VP1	Dec	27.00	97,200
VP10	Dec	33.00	118,800
VP11	Dec	21.00	75,600
VP12	Dec	21.00	75,600
VP13	Dec	27.00	97,200
VP14	Dec	33.00	118,800
VP15	Dec	33.00	118,800
VP16	Dec	33.00	118,800
VP2	Dec	27.00	97,200
VP3	Dec	27.00	97,200

Vantage Point	Month	Hours Survey	Seconds Survey
VP4	Dec	27.00	97,200
VP5	Dec	27.00	97,200
VP6	Dec	33.25	119,700
VP7	Dec	33.00	118,800
VP8	Dec	33.00	118,800
VP9	Dec	27.00	97,200

Table 7 - 6 - 1 - 2 Bird seconds per month per vantage point

Species	Month	Vantage Point	Bird-Seconds
Buzzard	Jan	VP1	73.0
	Feb	VP1	507.0
	Mar	VP1	2,363.0
	Apr	VP1	515.0
	May	VP1	2,112.0
	Jun	VP1	8,110.0
	Jul	VP1	2,086.0
	Aug	VP1	1,581.0
	Sep	VP1	1,547.0
	Oct	VP1	751.0
	Nov	VP1	3,293.0
	Dec	VP1	193.0
	Feb	VP10	953.0
	Mar	VP10	15,980.0
	Apr	VP10	5,023.0
	May	VP10	184.0
	Jun	VP10	3,195.0
	Jul	VP10	987.0
	Aug	VP10	2,880.0
	Sep	VP10	13,164.0
	Oct	VP10	320.0
	Nov	VP10	110.0
	Dec	VP10	926.0
	Jan	VP11	130.0
	Feb	VP11	430.0
	Mar	VP11	11,880.2
	Apr	VP11	65.0
	May	VP11	189.0
	Jun	VP11	734.0
	Jul	VP11	1,111.0
	Aug	VP11	1,051.0
	Sep	VP11	2,702.0
	Oct	VP11	488.0
	Nov	VP11	105.0
	Dec	VP11	45.0
	Jan	VP12	15.0
	Feb	VP12	2,054.0
	Mar	VP12	5,685.0
	Apr	VP12	910.0
	May	VP12	225.0
	Jun	VP12	652.0
	Jul	VP12	301.0

Species	Month	Vantage Point	Bird-Seconds
	Aug	VP12	1,325.0
	Sep	VP12	477.0
	Oct	VP12	428.0
	Nov	VP12	125.0
	Jan	VP13	250.0
	Feb	VP13	4,450.0
	Mar	VP13	6,366.0
	Apr	VP13	862.0
	May	VP13	5,156.0
	Jun	VP13	5,519.0
	Jul	VP13	3,211.0
	Aug	VP13	3,886.0
	Sep	VP13	950.0
	Oct	VP13	1,335.0
	Nov	VP13	661.0
	Dec	VP13	171.0
	Jan	VP14	512.0
	Feb	VP14	2,270.0
	Mar	VP14	447.0
	Apr	VP14	400.4
	May	VP14	810.0
	Jun	VP14	1,422.0
	Jul	VP14	720.0
	Aug	VP14	3,257.0
	Sep	VP14	70.0
	Oct	VP14	1,426.0
	Nov	VP14	1,292.0
	Dec	VP14	410.0
	Jan	VP15	90.0
	Feb	VP15	2,641.0
	Mar	VP15	2,160.0
	Apr	VP15	793.0
	May	VP15	210.0
	Jun	VP15	3,268.0
	Jul	VP15	3,755.0
	Aug	VP15	2,574.0
	Sep	VP15	597.0
	Oct	VP15	1,455.0
	Nov	VP15	1,445.0
	Dec	VP15	505.0
	Jan	VP16	2,009.0
	Feb	VP16	3,284.0
	Mar	VP16	2,573.0

Species	Month	Vantage Point	Bird-Seconds
	Apr	VP16	5,330.0
	May	VP16	441.0
	Jun	VP16	5,140.0
	Jul	VP16	485.0
	Aug	VP16	1,584.0
	Sep	VP16	816.0
	Oct	VP16	4,128.0
	Nov	VP16	2,129.0
	Dec	VP16	2,101.0
	Jan	VP2	110.0
	Feb	VP2	430.0
	Mar	VP2	4,238.0
	Apr	VP2	337.0
	May	VP2	784.0
	Jun	VP2	4,438.0
	Jul	VP2	2,230.0
	Aug	VP2	561.0
	Sep	VP2	500.0
	Oct	VP2	674.0
	Nov	VP2	395.0
	Dec	VP2	64.0
	Jan	VP3	345.0
	Feb	VP3	315.0
	Mar	VP3	3,695.4
	Apr	VP3	5,242.0
	May	VP3	1,600.0
	Jun	VP3	3,229.0
	Jul	VP3	1,566.0
	Aug	VP3	550.0
	Sep	VP3	5,645.0
	Oct	VP3	493.0
	Nov	VP3	128.0
	Dec	VP3	221.0
	Jan	VP4	439.0
	Feb	VP4	1,227.0
	Mar	VP4	7,017.0
	Apr	VP4	2,881.0
	May	VP4	4,365.0
	Jun	VP4	2,418.0
	Jul	VP4	6,650.0
	Aug	VP4	2,612.0
	Sep	VP4	7,435.0
	Oct	VP4	6,468.0

Species	Month	Vantage Point	Bird-Seconds
	Nov	VP4	577.0
	Jan	VP5	316.0
	Feb	VP5	662.0
	Mar	VP5	128.0
	Apr	VP5	809.0
	May	VP5	420.0
	Jun	VP5	948.0
	Jul	VP5	7,123.0
	Aug	VP5	5,680.0
	Sep	VP5	5,765.0
	Oct	VP5	1,219.0
	Nov	VP5	118.0
	Dec	VP5	129.0
	Jan	VP6	283.0
	Feb	VP6	470.0
	Mar	VP6	3,658.0
	Apr	VP6	2,294.0
	May	VP6	262.0
	Jun	VP6	5,963.0
	Jul	VP6	4,139.0
	Aug	VP6	2,548.0
	Sep	VP6	798.0
	Oct	VP6	140.0
	Nov	VP6	41.0
	Dec	VP6	865.0
	Jan	VP7	3,558.0
	Feb	VP7	145.0
	Mar	VP7	9,369.0
	Apr	VP7	1,093.0
	May	VP7	97.0
	Jun	VP7	688.0
	Jul	VP7	1,510.0
	Aug	VP7	2,394.0
	Sep	VP7	254.0
	Oct	VP7	250.0
	Nov	VP7	630.0
	Dec	VP7	35.0
	Jan	VP8	35.0
	Feb	VP8	6,204.0
	Mar	VP8	1,540.0
	Apr	VP8	155.0
	May	VP8	2,504.0
	Jun	VP8	9,107.0

Species	Month	Vantage Point	Bird-Seconds
	Jul	VP8	650.0
	Aug	VP8	2,698.0
	Sep	VP8	2,949.0
	Oct	VP8	175.0
	Nov	VP8	943.0
	Dec	VP8	35.0
	Jan	VP9	94.0
	Feb	VP9	3,578.0
	Mar	VP9	4,615.0
	Apr	VP9	545.0
	May	VP9	361.0
	Jun	VP9	753.0
	Jul	VP9	355.0
	Aug	VP9	599.0
	Sep	VP9	2,917.0
	Oct	VP9	145.0
	Nov	VP9	7.0
	Dec	VP9	70.0
Curlew	Mar	VP10	57.0
	Aug	VP11	30.0
	Apr	VP12	35.0
	Aug	VP13	250.0
	Nov	VP13	51.0
	Jun	VP16	57.0
	Jul	VP3	35.0
	Aug	VP3	35.0
	May	VP5	240.0
	Jul	VP5	35.0
	Apr	VP6	60.0
	Jul	VP7	60.0
	Aug	VP8	128.0
Golden Plover	Jan	VP1	1,385.0
	Feb	VP1	4,085.0
	Mar	VP1	1,070,909.0
	Apr	VP1	64,015.0
	Oct	VP1	27,165.0
	Nov	VP1	8,173.0
	Dec	VP1	16,016.0
	Jan	VP10	5,763.0
	Feb	VP10	420.0
	Mar	VP10	93,029.0
	Apr	VP10	13,785.0
	Oct	VP10	19,787.0

Species	Month	Vantage Point	Bird-Seconds
	Nov	VP10	11,396.0
	Dec	VP10	26,241.0
	Jan	VP11	4,420.0
	Mar	VP11	534,295.0
	Apr	VP11	553.0
	Sep	VP11	75,023.0
	Nov	VP11	3,503.0
	Dec	VP11	1,715.0
	Jan	VP12	305,350.0
	Feb	VP12	6,165.0
	Aug	VP12	35.0
	Sep	VP12	1,500.0
	Oct	VP12	5,075.0
	Nov	VP12	41,445.0
	Dec	VP12	490.0
	Sep	VPvp13	60.0
	Jan	VP13	240.0
	Feb	VP13	113,555.0
	Mar	VP13	23,020.0
	Apr	VP13	16,025.0
	Oct	VP13	6,892.0
	Nov	VP13	5,566.0
	Dec	VP13	1,858.0
	Feb	VP14	3,822.0
	Mar	VP14	94,310.0
	Apr	VP14	4,767.0
	Sep	VP14	22,800.0
	Oct	VP14	21,048.0
	Nov	VP14	50,065.0
	Dec	VP14	1,555.0
	Jan	VP15	1,080.0
	Feb	VP15	93,332.0
	Mar	VP15	243,336.0
	Apr	VP15	1,350.0
	May	VP15	600.0
	Sep	VP15	2,648.0
	Oct	VP15	66,465.0
	Nov	VP15	260,415.0
	Jan	VP16	2,545.0
	Feb	VP16	2,100.0
	Mar	VP16	153,800.0
	Apr	VP16	22,155.0
	Sep	VP16	60,000.0

Species	Month	Vantage Point	Bird-Seconds
	Oct	VP16	303,608.0
	Nov	VP16	50,615.0
	Dec	VP16	77,420.0
	Feb	VP2	46,640.0
	Mar	VP2	303,665.0
	Apr	VP2	6,195.0
	Oct	VP2	32,824.0
	Nov	VP2	9,296.0
	Dec	VP2	17,170.0
	Jan	VP3	53,205.0
	Feb	VP3	34,555.0
	Mar	VP3	145,870.0
	Apr	VP3	15,970.0
	Oct	VP3	54,404.0
	Nov	VP3	122,454.0
	Dec	VP3	47,823.0
	Jan	VP4	224,827.0
	Feb	VP4	4,830.0
	Mar	VP4	4,432.0
	Oct	VP4	565,459.0
	Nov	VP4	155,367.0
	Dec	VP4	6,790.0
	Jan	VP5	9,000.0
	Feb	VP5	1,281.0
	Mar	VP5	1,421.0
	Apr	VP5	60,930.0
	Jul	VP5	350.0
	Sep	VP5	20.0
	Oct	VP5	69,520.0
	Nov	VP5	523,201.0
	Dec	VP5	2,275.0
	Jan	VP6	3,869.0
	Feb	VP6	1,350.0
	Mar	VP6	1,700.0
	Apr	VP6	70.0
	Jul	VP6	105.0
	Oct	VP6	74,690.0
	Nov	VP6	233,476.0
	Dec	VP6	102,055.0
	Jan	VP7	1,144.0
	Feb	VP7	14,235.0
	Mar	VP7	309,162.0
	Aug	VP7	107.0

Species	Month	Vantage Point	Bird-Seconds
	Sep	VP7	233.0
	Oct	VP7	47,316.0
	Nov	VP7	6,034,628.0
	Dec	VP7	170,400.0
	Jan	VP8	4,555.0
	Mar	VP8	3,500.0
	Sep	VP8	8,053.0
	Oct	VP8	26,035.0
	Nov	VP8	9,448,730.0
	Dec	VP8	1,055.0
	Feb	VP9	15,754.0
	Mar	VP9	225,138.0
	Apr	VP9	5,845.0
	Oct	VP9	16,759.0
	Nov	VP9	272.0
Greenland White-fronted Goose	Nov	VP13	368.0
	Mar	VP2	25,792.0
Hen Harrier	Mar	VP1	115.0
	Sep	VP1	35.0
	Nov	VP1	12.0
	Feb	VP10	69.0
	Mar	VP10	162.0
	Aug	VP10	568.0
	Sep	VP10	155.0
	Nov	VP10	148.0
	Dec	VP10	85.0
	Feb	VP11	120.0
	Mar	VP11	105.0
	Oct	VP11	45.0
	Nov	VP11	30.0
	Dec	VP11	47.0
	Feb	VP12	280.0
	Mar	VP12	30.0
	Aug	VP12	53.0
	Sep	VP12	117.0
	Oct	VP12	35.0
	Nov	VP12	77.0
	Sep	VP13	360.0
	Oct	VP13	109.0
	Nov	VP13	45.0
	Jan	VP14	59.0
	Feb	VP14	44.0
	Mar	VP14	45.0

Species	Month	Vantage Point	Bird-Seconds
	Apr	VP14	35.0
	Sep	VP14	59.0
	Oct	VP14	318.0
	Nov	VP14	78.0
	Jan	VP15	195.0
	Aug	VP15	15.0
	Dec	VP15	460.0
	Jan	VP16	35.0
	Feb	VP16	188.0
	Mar	VP16	334.0
	Aug	VP16	110.0
	Sep	VP16	100.0
	Nov	VP16	40.0
	Dec	VP16	120.0
	Jan	VP2	121.0
	Aug	VP2	35.0
	Oct	VP2	133.0
	Nov	VP2	3.0
	Jan	VP3	15.0
	Oct	VP3	58.0
	Nov	VP3	105.0
	Jan	VP4	198.0
	Oct	VP4	35.0
	Feb	VP5	40.0
	Mar	VP5	27.0
	Sep	VP5	35.0
	Jan	VP6	94.0
	Feb	VP6	282.0
	Mar	VP6	96.0
	Oct	VP6	20.0
	Jan	VP7	55.0
	Feb	VP7	96.0
	Mar	VP7	43.0
	Oct	VP7	96.0
	Nov	VP7	86.0
	Dec	VP7	50.0
	Jan	VP8	43.0
	Mar	VP8	132.0
	Apr	VP8	40.0
	Sep	VP8	24.0
	Nov	VP8	119.0
	Dec	VP8	15.0
	Mar	VP9	40.0

Species	Month	Vantage Point	Bird-Seconds
	Apr	VP9	35.0
	May	VP9	35.0
	Aug	VP9	116.0
	Sep	VP9	105.0
	Oct	VP9	43.0
	Dec	VP9	39.0
Kestrel	Jan	VP1	408.0
	Feb	VP1	399.0
	Mar	VP1	307.0
	May	VP1	46.0
	Jun	VP1	495.0
	Jul	VP1	1,112.0
	Aug	VP1	2,927.0
	Sep	VP1	1,110.0
	Oct	VP1	1,047.0
	Nov	VP1	864.0
	Dec	VP1	77.0
	Sep	VPvp10	165.0
	Jan	VP10	524.0
	Feb	VP10	830.0
	Mar	VP10	1,775.0
	Apr	VP10	675.0
	May	VP10	105.0
	Jun	VP10	175.0
	Jul	VP10	1,545.0
	Aug	VP10	441.0
	Sep	VP10	2,314.0
	Oct	VP10	1,712.0
	Nov	VP10	870.0
	Dec	VP10	868.0
	Jan	VP11	1,990.0
	Feb	VP11	35.0
	Mar	VP11	35.0
	Apr	VP11	30.0
	May	VP11	53.0
	Jun	VP11	65.0
	Jul	VP11	1,871.0
	Aug	VP11	5,515.0
	Sep	VP11	1,537.0
	Oct	VP11	844.0
	Nov	VP11	1,234.0
	Dec	VP11	640.0
	Jan	VP12	452.0

Species	Month	Vantage Point	Bird-Seconds
	Feb	VP12	995.0
	Mar	VP12	330.0
	Apr	VP12	35.0
	Jun	VP12	45.0
	Jul	VP12	2,729.0
	Aug	VP12	3,916.0
	Sep	VP12	850.0
	Oct	VP12	198.0
	Nov	VP12	807.0
	Dec	VP12	2,269.0
	Sep	VPvp13	165.0
	Jan	VP13	5,554.0
	Feb	VP13	2,830.0
	Mar	VP13	1,528.0
	Apr	VP13	714.0
	Jun	VP13	84.0
	Jul	VP13	1,055.0
	Aug	VP13	2,462.0
	Sep	VP13	1,567.0
	Oct	VP13	1,055.0
	Nov	VP13	1,974.0
	Dec	VP13	1,135.0
	Sep	VPvp14	30.0
	Jan	VP14	1,603.0
	Feb	VP14	1,516.0
	Mar	VP14	105.0
	Apr	VP14	530.0
	Jul	VP14	4,024.0
	Aug	VP14	19,774.0
	Sep	VP14	784.0
	Oct	VP14	317.0
	Nov	VP14	2,265.0
	Sep	VPvp15	120.0
	Jan	VP15	189.0
	Feb	VP15	1,535.0
	Mar	VP15	4,266.0
	Apr	VP15	906.0
	May	VP15	70.0
	Jun	VP15	237.0
	Jul	VP15	3,334.0
	Aug	VP15	2,534.0
	Sep	VP15	666.0
	Oct	VP15	1,886.0

Species	Month	Vantage Point	Bird-Seconds
	Nov	VP15	4,040.0
	Dec	VP15	1,432.0
	Jan	VP16	311.0
	Feb	VP16	2,572.0
	Mar	VP16	1,959.0
	Apr	VP16	258.0
	May	VP16	67.0
	Jun	VP16	510.0
	Jul	VP16	4,126.0
	Aug	VP16	8,032.0
	Sep	VP16	2,654.0
	Oct	VP16	1,226.0
	Nov	VP16	2,044.0
	Dec	VP16	1,164.0
	Jan	VP2	1,043.0
	Feb	VP2	267.0
	Mar	VP2	898.0
	Apr	VP2	1,232.0
	Jun	VP2	1,735.0
	Jul	VP2	3,616.0
	Aug	VP2	2,770.0
	Sep	VP2	2,918.0
	Oct	VP2	5,132.0
	Nov	VP2	1,953.0
	Dec	VP2	774.0
	Jan	VP3	1,836.0
	Feb	VP3	1,213.0
	Mar	VP3	2,902.0
	Apr	VP3	2,050.0
	May	VP3	35.0
	Jun	VP3	1,458.0
	Jul	VP3	2,847.0
	Aug	VP3	6,118.0
	Sep	VP3	1,486.0
	Oct	VP3	1,790.0
	Nov	VP3	2,029.0
	Dec	VP3	2,658.0
	Jan	VP4	553.0
	Feb	VP4	2,492.0
	Mar	VP4	35.0
	Apr	VP4	597.0
	May	VP4	392.0
	Jun	VP4	1,808.0

Species	Month	Vantage Point	Bird-Seconds
	Jul	VP4	3,003.0
	Aug	VP4	505.0
	Sep	VP4	638.0
	Oct	VP4	3,671.0
	Nov	VP4	380.0
	Dec	VP4	124.0
	Jan	VP5	472.0
	Feb	VP5	2,129.0
	Apr	VP5	620.0
	May	VP5	188.0
	Jun	VP5	2,087.0
	Jul	VP5	470.0
	Aug	VP5	3,326.0
	Sep	VP5	871.0
	Oct	VP5	6,671.0
	Nov	VP5	1,611.0
	Dec	VP5	1,616.0
	Jan	VP6	232.0
	Feb	VP6	215.0
	Mar	VP6	112.0
	Apr	VP6	170.0
	May	VP6	575.0
	Jun	VP6	75.0
	Jul	VP6	261.0
	Aug	VP6	2,503.0
	Sep	VP6	2,517.0
	Oct	VP6	1,598.0
	Nov	VP6	160.0
	Dec	VP6	1,383.0
	Jan	VP7	566.0
	Feb	VP7	169.0
	Mar	VP7	105.0
	Apr	VP7	10.0
	Jul	VP7	2,007.0
	Aug	VP7	608.0
	Sep	VP7	1,691.0
	Oct	VP7	65.0
	Dec	VP7	805.0
	Jan	VP8	479.0
	Feb	VP8	1,653.0
	Mar	VP8	833.0
	Apr	VP8	183.0
	May	VP8	63.0

Species	Month	Vantage Point	Bird-Seconds
	Jun	VP8	211.0
	Jul	VP8	579.0
	Aug	VP8	1,152.0
	Sep	VP8	1,633.0
	Oct	VP8	1,900.0
	Nov	VP8	1,170.0
	Dec	VP8	366.0
	Jan	VP9	1,134.0
	Feb	VP9	2,313.0
	Mar	VP9	143.0
	Apr	VP9	80.0
	May	VP9	35.0
	Jun	VP9	248.0
	Jul	VP9	973.0
	Aug	VP9	1,828.0
	Sep	VP9	3,237.0
	Oct	VP9	424.0
	Nov	VP9	1,362.0
	Dec	VP9	2,551.0
Lapwing	Feb	VP1	7,785.0
	Nov	VP1	3,304.0
	Dec	VP1	5,400.0
	Apr	VP10	70.0
	Jun	VP10	245.0
	Jul	VP10	245.0
	Dec	VP10	295,100.0
	Jan	VP11	167,220.0
	Feb	VP11	1,400.0
	Mar	VP11	71,680.0
	Jun	VP11	35.0
	Jul	VP11	17.0
	Nov	VP11	1,050.0
	Dec	VP11	6,025.0
	Feb	VP12	5,863.0
	Mar	VP12	35,880.0
	Sep	VP12	68,500.0
	Oct	VP12	41.0
	Nov	VP12	8,848.0
	Jan	VP13	12,550.0
	May	VP13	34.0
	Jul	VP13	80.0
	Dec	VP13	2,700.0
	Feb	VP14	700.0

Species	Month	Vantage Point	Bird-Seconds
	Mar	VP14	49.0
	May	VP14	15.0
	Jun	VP14	290.0
	Nov	VP14	1,260.0
	Dec	VP14	918.0
	May	VP15	28.0
	Feb	VP16	285,680.0
	Mar	VP16	720.0
	Apr	VP16	125.0
	May	VP16	3,623.0
	Jun	VP16	120.0
	Oct	VP16	15,600.0
	Dec	VP16	1,020.0
	Jan	VP2	2,950.0
	Feb	VP2	1,500.0
	Oct	VP2	4,644.0
	Nov	VP2	49,400.0
	Jan	VP3	20,514.0
	Feb	VP3	143,713.0
	Mar	VP3	21,655.0
	Apr	VP3	662.0
	May	VP3	480.0
	Jun	VP3	95.0
	Jul	VP3	220.0
	Oct	VP3	1,120.0
	Nov	VP3	7,062.0
	Dec	VP3	28,977.0
	Jan	VP4	135.0
	Mar	VP4	430.0
	May	VP4	70.0
	Sep	VP4	13,600.0
	Oct	VP4	1,645.0
	Nov	VP4	630.0
	Jan	VP5	10,248.0
	Feb	VP5	490.0
	Apr	VP5	6.0
	May	VP5	447.0
	Jun	VP5	254.0
	Jul	VP5	136.0
	Dec	VP5	17,521.0
	Feb	VP6	6,285.0
	Mar	VP6	1,055.0
	Apr	VP6	11,606.0

Species	Month	Vantage Point	Bird-Seconds
	May	VP6	1,564.0
	Jun	VP6	92.0
	Jul	VP6	215.0
	Dec	VP6	3,360.0
	Jan	VP7	81,870.0
	Feb	VP7	294.0
	Mar	VP7	24.0
	Nov	VP7	95,456.0
	Dec	VP7	315.0
	Dec	VP8	35.0
	Jan	VP9	399.0
	Mar	VP9	3,955.0
	Apr	VP9	1,490.0
	May	VP9	260.0
	Jun	VP9	386.0
	Jul	VP9	485.0
Lesser Black-backed Gull	Jan	VP1	35.0
	May	VP1	70.0
	Jul	VP1	73.0
	Nov	VP1	24,763.0
	Mar	VP10	680.0
	Apr	VP10	70.0
	Jun	VP10	105.0
	Jul	VP10	189.0
	Feb	VP12	600.0
	Mar	VP12	16,975.0
	Feb	VP13	3,615.0
	Mar	VP13	2,190.0
	Apr	VP13	105.0
	Sep	VP13	14,025.0
	Nov	VP13	45.0
	Jan	VP14	40.0
	Feb	VP14	300.0
	Jul	VP14	35.0
	Oct	VP14	50.0
	Nov	VP14	190.0
	Feb	VP16	120.0
	Jun	VP16	139.0
	Jul	VP16	205.0
	Sep	VP16	120.0
	Oct	VP16	252.0
	Sep	VP2	175.0
	Jan	VP3	72,110.0

Species	Month	Vantage Point	Bird-Seconds
	Mar	VP3	735.0
	Apr	VP3	420.0
	May	VP3	40.0
	Jun	VP3	107.0
	Mar	VP4	105.0
	Apr	VP4	35.0
	May	VP4	250.0
	Jun	VP4	32.0
	Aug	VP4	4,906.0
	Sep	VP4	13,170.0
	Oct	VP4	7,164.0
	Nov	VP4	5,408.0
	Jan	VP5	223.0
	Mar	VP5	6.0
	May	VP5	1,863.0
	Jun	VP5	177.0
	Jul	VP5	1,410.0
	Aug	VP5	794.0
	Sep	VP5	3,644.0
	Nov	VP5	120.0
	Feb	VP6	166.0
	Apr	VP6	264.0
	May	VP6	17.0
	Aug	VP6	2,402.0
	Sep	VP6	140.0
	Dec	VP6	367.0
	May	VP7	385.0
	Jun	VP7	90.0
	Nov	VP7	1,400.0
	Feb	VP8	35.0
	Mar	VP8	280.0
	Apr	VP8	70.0
	Aug	VP8	15.0
	Sep	VP8	304.0
	Mar	VP9	54.0
	Aug	VP9	360.0
	Sep	VP9	65.0
	Dec	VP9	1,630.0
Little Egret	Jan	VP10	225.0
	Jul	VP10	50.0
	Sep	VP10	210.0
	Jul	VP13	288.0
	Jan	VP14	70.0

Species	Month	Vantage Point	Bird-Seconds
	Feb	VP14	35.0
	Mar	VP14	70.0
	Oct	VP14	171.0
	Nov	VP14	105.0
	Dec	VP16	80.0
	Jul	VP3	33.0
	Mar	VP5	10.0
	Nov	VP5	503.0
	Jan	VP6	170.0
	Feb	VP6	20.0
	Mar	VP6	38.0
	Apr	VP6	53.0
	Jun	VP6	47.0
	Oct	VP6	490.0
	Nov	VP6	88.0
Long-eared Owl	Nov	VP11	3.0
	Aug	VP15	62.0
	May	VP2	65.0
	Apr	VP3	80.0
	Jan	VP4	9.0
	Aug	VP4	360.0
	Sep	VP4	44.0
	Oct	VP4	15.0
	Nov	VP6	65.0
	Oct	VP7	10.0
Merlin	Nov	VP1	6.0
	Dec	VP1	45.0
	Sep	VP11	273.0
	Jul	VP12	3.0
	Nov	VP12	10.0
	Jan	VP13	20.0
	Mar	VP13	44.0
	Oct	VP13	14.0
	Mar	VP14	40.0
	Nov	VP14	18.0
	Jan	VP15	59.0
	Nov	VP15	15.0
	Dec	VP15	45.0
	Jan	VP16	10.0
	Dec	VP16	14.0
	Feb	VP2	15.0
	Jan	VP3	72.0
	Sep	VP3	5.0

Species	Month	Vantage Point	Bird-Seconds
	Sep	VP4	10.0
	Apr	VP5	35.0
	Dec	VP5	4.0
	Sep	VP6	10.0
	Oct	VP6	15.0
	Aug	VP7	177.0
	Feb	VP8	65.0
	Nov	VP9	7.0
Peregrine Falcon	Jun	VP1	268.0
	Oct	VP1	35.0
	Jan	VP10	113.0
	Feb	VP10	85.0
	Jul	VP10	35.0
	Aug	VP10	554.0
	Sep	VP10	549.0
	Oct	VP10	52.0
	Jul	VP11	40.0
	Dec	VP11	40.0
	Apr	VP12	59.0
	Feb	VP13	60.0
	Apr	VP13	99.0
	Aug	VP13	65.0
	Oct	VP13	110.0
	Feb	VP14	35.0
	Jun	VP14	40.0
	Jul	VP14	215.0
	Aug	VP14	360.0
	Oct	VP14	34.0
	Jan	VP15	36.0
	Mar	VP15	17.0
	Jun	VP15	68.0
	Jul	VP15	225.0
	Aug	VP15	85.0
	Oct	VP15	34.0
	Nov	VP15	175.0
	Jan	VP16	18.0
	Feb	VP16	66.0
	Mar	VP16	245.0
	Apr	VP16	118.0
	Jun	VP16	70.0
	Sep	VP16	78.0
	Oct	VP16	47.0
	Nov	VP16	30.0

Species	Month	Vantage Point	Bird-Seconds
	Dec	VP16	75.0
	Jul	VP3	368.0
	Nov	VP3	73.0
	Jan	VP4	38.0
	Feb	VP4	60.0
	Mar	VP4	35.0
	May	VP4	35.0
	Sep	VP4	45.0
	Jan	VP5	139.0
	Feb	VP5	17.0
	Mar	VP5	35.0
	Sep	VP5	447.0
	Mar	VP6	10.0
	May	VP6	557.0
	Jul	VP6	335.0
	Jan	VP7	70.0
	Feb	VP7	35.0
	Jul	VP7	35.0
	Aug	VP8	174.0
	Jan	VP9	210.0
	Mar	VP9	10.0
	Apr	VP9	35.0
	Sep	VP9	429.0
	Nov	VP9	40.0
Snipe	Jul	VP1	43.0
	Nov	VP1	3.0
	Jan	VP10	35.0
	Feb	VP10	110.0
	Mar	VP10	13,832.0
	Apr	VP10	320.0
	May	VP10	149.0
	Jun	VP10	3,792.0
	Jul	VP10	314.0
	Aug	VP10	999.0
	Sep	VP10	218.0
	Oct	VP10	453.0
	Nov	VP10	39.0
	Dec	VP10	35.0
	Jan	VP11	34.0
	Feb	VP11	119.0
	Mar	VP11	61,513.0
	Apr	VP11	290.0
	May	VP11	1,114.0

Species	Month	Vantage Point	Bird-Seconds
	Jun	VP11	1,681.0
	Jul	VP11	87.0
	Sep	VP11	814.0
	Oct	VP11	599.0
	Nov	VP11	30.0
	Jan	VP12	57.0
	Feb	VP12	135.0
	Mar	VP12	5,320.0
	Apr	VP12	220.0
	May	VP12	379.0
	Jun	VP12	369.0
	Aug	VP12	130.0
	Sep	VP12	1,239.0
	Oct	VP12	605.0
	Nov	VP12	185.0
	Dec	VP12	60.0
	Jan	VP13	397.0
	Feb	VP13	390.0
	Mar	VP13	675.0
	May	VP13	35.0
	Oct	VP13	70.0
	Nov	VP13	18.0
	Dec	VP13	412.0
	Jan	VP14	30.0
	Feb	VP14	200.0
	Mar	VP14	120.0
	Apr	VP14	445.0
	May	VP14	652.0
	Jun	VP14	444.0
	Jul	VP14	45.0
	Aug	VP14	2,365.0
	Sep	VP14	112.0
	Oct	VP14	166.0
	Nov	VP14	37.0
	Dec	VP14	115.0
	Jan	VP15	72.0
	Feb	VP15	400.0
	Mar	VP15	67.0
	Apr	VP15	30.0
	May	VP15	35.0
	Oct	VP15	1,632.0
	Nov	VP15	95.0
	Dec	VP15	100.0

Species	Month	Vantage Point	Bird-Seconds
	Feb	VP16	765.0
	Mar	VP16	80.0
	Apr	VP16	5.0
	May	VP16	938.0
	Jun	VP16	92.0
	Jul	VP16	310.0
	Aug	VP16	8.0
	Sep	VP16	60.0
	Oct	VP16	32.0
	Nov	VP16	20.0
	Dec	VP16	16.0
	Feb	VP2	32.0
	Apr	VP2	54.0
	May	VP2	478.0
	Jul	VP2	74.0
	Aug	VP2	35.0
	Nov	VP2	33.0
	Jan	VP3	60.0
	Feb	VP3	92.0
	Mar	VP3	70.0
	Apr	VP3	14,970.0
	May	VP3	210.0
	Jun	VP3	35.0
	Jul	VP3	134.0
	Sep	VP3	75.0
	Oct	VP3	147.0
	Nov	VP3	240.0
	Dec	VP3	87.0
	Jan	VP4	5.0
	Feb	VP4	94.0
	Mar	VP4	35.0
	Apr	VP4	80.0
	May	VP4	224.0
	Jun	VP4	295.0
	Aug	VP4	90.0
	Sep	VP4	70.0
	Oct	VP4	158.0
	Nov	VP4	139.0
	Dec	VP4	35.0
	Jan	VP5	30.0
	Feb	VP5	35.0
	Mar	VP5	35.0
	Apr	VP5	7,289.0

Species	Month	Vantage Point	Bird-Seconds
	May	VP5	40.0
	Jun	VP5	178.0
	Jul	VP5	310.0
	Sep	VP5	175.0
	Oct	VP5	45.0
	Nov	VP5	123.0
	Jan	VP6	35.0
	Feb	VP6	15.0
	Mar	VP6	1,560.0
	Apr	VP6	10,079.0
	May	VP6	1,145.0
	Jun	VP6	354.0
	Aug	VP6	105.0
	Oct	VP6	107.0
	Nov	VP6	193.0
	Dec	VP6	35.0
	Jan	VP7	15.0
	Feb	VP7	83.0
	Mar	VP7	90.0
	Apr	VP7	90.0
	May	VP7	145.0
	Jun	VP7	210.0
	Sep	VP7	90.0
	Nov	VP7	173.0
	Dec	VP7	8.0
	Feb	VP8	102.0
	Mar	VP8	22.0
	Apr	VP8	109.0
	May	VP8	498.0
	Jun	VP8	110.0
	Jul	VP8	35.0
	Sep	VP8	18.0
	Oct	VP8	250.0
	Nov	VP8	225.0
	Dec	VP8	6.0
	Jan	VP9	35.0
	Feb	VP9	60.0
	Mar	VP9	372.0
	Apr	VP9	312.0
	May	VP9	2,129.0
	Jun	VP9	1,259.0
	Jul	VP9	669.0
	Aug	VP9	15,003.0

Species	Month	Vantage Point	Bird-Seconds
	Sep	VP9	18.0
	Oct	VP9	284.0
	Nov	VP9	194.0
	Dec	VP9	43.0
Sparrowhawk	Jan	VP1	68.0
	Mar	VP1	41.0
	Apr	VP1	80.0
	May	VP1	145.0
	Jun	VP1	197.0
	Jul	VP1	30.0
	Aug	VP1	283.0
	Sep	VP1	401.0
	Oct	VP1	35.0
	Nov	VP1	30.0
	Dec	VP1	70.0
	Jan	VP10	95.0
	Apr	VP10	35.0
	May	VP10	35.0
	Jun	VP10	70.0
	Jul	VP10	313.0
	Aug	VP10	450.0
	Sep	VP10	17.0
	Nov	VP10	35.0
	Dec	VP10	281.0
	Jan	VP11	201.0
	Mar	VP11	170.0
	Apr	VP11	74.0
	Jun	VP11	10.0
	Aug	VP11	50.0
	Sep	VP11	864.0
	Oct	VP11	115.0
	Nov	VP11	10.0
	Jan	VP12	260.0
	Feb	VP12	35.0
	Mar	VP12	85.0
	Apr	VP12	50.0
	May	VP12	35.0
	Jun	VP12	54.0
	Jul	VP12	80.0
	Sep	VP12	40.0
	Oct	VP12	35.0
	Nov	VP12	131.0
	Dec	VP12	165.0

Species	Month	Vantage Point	Bird-Seconds
	Jan	VP13	160.0
	Apr	VP13	20.0
	Jun	VP13	65.0
	Jul	VP13	139.0
	Aug	VP13	497.0
	Sep	VP13	360.0
	Oct	VP13	40.0
	Nov	VP13	35.0
	Dec	VP13	75.0
	Jan	VP14	45.0
	Feb	VP14	50.0
	Mar	VP14	70.0
	Apr	VP14	47.0
	Aug	VP14	305.0
	Sep	VP14	445.0
	Oct	VP14	180.0
	Nov	VP14	133.0
	Dec	VP14	195.0
	Jan	VP15	833.0
	Mar	VP15	35.0
	Apr	VP15	37.0
	Jun	VP15	281.0
	Jul	VP15	6.0
	Sep	VP15	430.0
	Nov	VP15	130.0
	Dec	VP15	115.0
	Jan	VP16	23.0
	Feb	VP16	220.0
	Mar	VP16	83.0
	Apr	VP16	83.0
	Jun	VP16	50.0
	Sep	VP16	195.0
	Dec	VP16	340.0
	Jan	VP2	78.0
	Feb	VP2	79.0
	Mar	VP2	35.0
	Apr	VP2	195.0
	May	VP2	70.0
	Jun	VP2	35.0
	Jul	VP2	70.0
	Aug	VP2	257.0
	Sep	VP2	82.0
	Oct	VP2	45.0

Species	Month	Vantage Point	Bird-Seconds
	Dec	VP2	122.0
	Jan	VP3	105.0
	Feb	VP3	235.0
	Mar	VP3	216.0
	Apr	VP3	38.0
	May	VP3	388.0
	Jun	VP3	78.0
	Jul	VP3	163.0
	Aug	VP3	169.0
	Sep	VP3	392.0
	Nov	VP3	507.0
	Dec	VP3	250.0
	Jan	VP4	5.0
	Mar	VP4	401.0
	May	VP4	40.0
	Jun	VP4	372.0
	Jul	VP4	650.0
	Sep	VP4	373.0
	Oct	VP4	510.0
	Nov	VP4	77.0
	Dec	VP4	35.0
	Jan	VP5	209.0
	Feb	VP5	10.0
	Apr	VP5	105.0
	May	VP5	65.0
	Jun	VP5	75.0
	Jul	VP5	75.0
	Aug	VP5	210.0
	Sep	VP5	704.0
	Oct	VP5	70.0
	Nov	VP5	62.0
	Dec	VP5	35.0
	Mar	VP6	20.0
	Apr	VP6	35.0
	Jun	VP6	78.0
	Jul	VP6	253.0
	Aug	VP6	418.0
	Sep	VP6	380.0
	Oct	VP6	935.0
	Dec	VP6	35.0
	Jan	VP7	288.0
	Feb	VP7	40.0
	Mar	VP7	514.0

Species	Month	Vantage Point	Bird-Seconds
	Apr	VP7	105.0
	May	VP7	285.0
	Jun	VP7	119.0
	Jul	VP7	35.0
	Aug	VP7	572.0
	Sep	VP7	2,135.0
	Oct	VP7	35.0
	Nov	VP7	42.0
	Dec	VP7	35.0
	Jan	VP8	35.0
	Feb	VP8	50.0
	Mar	VP8	205.0
	Apr	VP8	35.0
	May	VP8	35.0
	Jun	VP8	145.0
	Jul	VP8	35.0
	Aug	VP8	38.0
	Sep	VP8	379.0
	Oct	VP8	180.0
	Nov	VP8	85.0
	Mar	VP9	35.0
	Jul	VP9	95.0
	Aug	VP9	124.0
	Oct	VP9	54.0
	Dec	VP9	46.0
White-tailed Eagle	Apr	VP1	363.0
	Mar	VP3	60.0
	Feb	VP9	915.0
Whooper Swan	Jan	VP1	70.0
	Mar	VP1	12,474.0
	Oct	VP1	2,550.0
	Nov	VP1	1,370.0
	Feb	VP10	1,275.0
	Mar	VP10	105.0
	Oct	VP10	348.0
	Dec	VP10	72.0
	Jan	VP11	2,242.0
	Mar	VP11	1,700.0
	Oct	VP11	360.0
	Nov	VP11	1,780.0
	Jan	VP12	595.0
	Oct	VP12	490.0
	Nov	VP12	602.0

Species	Month	Vantage Point	Bird-Seconds
	Jan	VP13	8,337.0
	Feb	VP13	7,095.0
	Mar	VP13	5,680.0
	Oct	VP13	913.0
	Nov	VP13	12,263.0
	Dec	VP13	7,095.0
	Jan	VP14	2,871.0
	Feb	VP14	518.0
	Oct	VP14	738.0
	Nov	VP14	6,086.0
	Dec	VP14	360.0
	Jan	VP15	540.0
	Oct	VP15	1,626.0
	Nov	VP15	2,834.0
	Jan	VP16	12,478.0
	Feb	VP16	2,679.0
	Mar	VP16	2,435.0
	Nov	VP16	9,140.0
	Dec	VP16	3,536.0
	Jan	VP2	630.0
	Feb	VP2	2,070.0
	Nov	VP2	3,300.0
	Dec	VP2	105.0
	Jan	VP3	4,356.0
	Mar	VP3	360.0
	Oct	VP3	35.0
	Oct	VP5	127.0
	Dec	VP5	141.0
	Oct	VP6	1,330.0
	Nov	VP6	356.0
	Dec	VP6	4,370.0
	Oct	VP7	245.0
	Nov	VP7	1,019.0
	Dec	VP7	350.0
	Feb	VP8	96.0
	Oct	VP8	1,110.0
	Dec	VP8	67.0
	Jan	VP9	272.0
	Feb	VP9	880.0
	Sep	VP9	150.0
	Oct	VP9	300.0
	Nov	VP9	1,511.0
	Dec	VP9	920.0

Species	Month	Vantage Point	Bird-Seconds
Woodcock	Feb	VP1	45.0
	Apr	VP1	70.0
	May	VP1	175.0
	Nov	VP1	45.0
	Mar	VP10	21.0
	Apr	VP10	38.0
	May	VP10	105.0
	Mar	VP11	81.0
	Apr	VP11	115.0
	May	VP11	505.0
	Jun	VP11	202.0
	Aug	VP11	35.0
	Nov	VP11	35.0
	Mar	VP12	70.0
	Apr	VP12	169.0
	May	VP12	210.0
	Aug	VP12	35.0
	Oct	VP12	14.0
	Dec	VP12	74.0
	Jan	VP13	35.0
	Apr	VP13	12.0
	May	VP13	35.0
	Dec	VP13	20.0
	Apr	VP14	90.0
	May	VP14	35.0
	Dec	VP14	30.0
	Apr	VP15	55.0
	May	VP15	10.0
	Nov	VP15	20.0
	Dec	VP15	35.0
	Feb	VP2	30.0
	Apr	VP2	145.0
	May	VP2	245.0
	Feb	VP3	35.0
	Mar	VP3	111.0
	Apr	VP3	786.0
	May	VP3	140.0
	Sep	VP3	35.0
	Nov	VP3	4.0
	Feb	VP4	15.0
	Mar	VP4	179.0
	Apr	VP4	324.0
	May	VP4	109.0

Species	Month	Vantage Point	Bird-Seconds
	Sep	VP4	35.0
	Oct	VP4	35.0
	Mar	VP5	12.0
	Apr	VP5	30.0
	Apr	VP6	153.0
	Mar	VP7	140.0
	Apr	VP7	159.0
	May	VP7	455.0
	Jan	VP8	35.0
	Feb	VP8	35.0
	Mar	VP8	80.0
	Apr	VP8	284.0
	May	VP8	310.0
	Apr	VP9	89.0
	Sep	VP9	35.0

1.2 Expected Collisions with Avoidance

Table 7 - 6 - 1 - 3 Expected collisions with avoidance following Band (2024) – 200m Proposed Turbines

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Buzzard	0.95	0.0324	0.533	1.1	0.416	0.815	1.7	0.738	0.712	0.945	0.321	0.152	0.0492	7.52
	0.98	0.013	0.213	0.44	0.167	0.326	0.682	0.295	0.285	0.378	0.128	0.0607	0.0197	3.01
	0.99	0.00648	0.107	0.22	0.0833	0.163	0.341	0.148	0.142	0.189	0.0641	0.0304	0.00984	1.5
	0.995	0.00324	0.0533	0.11	0.0416	0.0815	0.17	0.0738	0.0712	0.0945	0.0321	0.0152	0.00492	0.752
	0.996	0.00259	0.0427	0.088	0.0333	0.0652	0.136	0.0591	0.057	0.0756	0.0256	0.0121	0.00394	0.601
	0.998	0.0013	0.0213	0.044	0.0167	0.0326	0.0682	0.0295	0.0285	0.0378	0.0128	0.00607	0.00197	0.301
Curlew	0.95	-	-	-	0	0	0	0	0.00858	0	-	-	-	0.00858
	0.98	-	-	-	0	0	0	0	0.00343	0	-	-	-	0.00343
	0.99	-	-	-	0	0	0	0	0.00172	0	-	-	-	0.00172
	0.995	-	-	-	0	0	0	0	0.00086	0	-	-	-	0.00086
	0.996	-	-	-	0	0	0	0	0.00069	0	-	-	-	0.00069
	0.998	-	-	-	0	0	0	0	0.00034	0	-	-	-	0.00034
Golden Plover	0.95	8.02	7.29	59.7	3.73	0.0245	0	0	0	2.11	31.9	721	2.8	837
	0.98	3.21	2.92	23.9	1.49	0.00982	0	0	0	0.843	12.8	288	1.12	335
	0.99	1.6	1.46	11.9	0.746	0.00491	0	0	0	0.421	6.38	144	0.559	167

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.995	0.802	0.729	5.97	0.373	0.00246	0	0	0	0.211	3.19	72.1	0.28	83.7
	0.996	0.642	0.584	4.77	0.298	0.00196	0	0	0	0.169	2.55	57.7	0.224	66.9
	0.998	0.321	0.292	2.39	0.149	0.00098	0	0	0	0.0843	1.28	28.8	0.112	33.5
Greenland White-fronted Goose	0.95	0	0	0.403	-	-	-	-	-	-	0	0.00348	0	0.407
	0.98	0	0	0.161	-	-	-	-	-	-	0	0.00139	0	0.163
	0.99	0	0	0.0806	-	-	-	-	-	-	0	0.0007	0	0.0813
	0.995	0	0	0.0403	-	-	-	-	-	-	0	0.00035	0	0.0407
	0.996	0	0	0.0322	-	-	-	-	-	-	0	0.00028	0	0.0325
	0.998	0	0	0.0161	-	-	-	-	-	-	0	0.00014	0	0.0163
Hen Harrier	0.95	0.00485	0.00113	0.00672	0.00245	0.00065	0	0	0.0107	0.00755	0.0075	0.00475	0.00416	0.0505
	0.98	0.00194	0.00045	0.00269	0.00098	0.00026	0	0	0.00429	0.00302	0.003	0.0019	0.00167	0.0202
	0.99	0.00097	0.00023	0.00134	0.00049	0.00013	0	0	0.00215	0.00151	0.0015	0.00095	0.00083	0.0101
	0.995	0.00049	0.00011	0.00067	0.00025	0.00007	0	0	0.00107	0.00075	0.00075	0.00047	0.00042	0.00505
	0.996	0.00039	0.00009	0.00054	0.0002	0.00005	0	0	0.00086	0.0006	0.0006	0.00038	0.00033	0.00404
	0.998	0.00019	0.00005	0.00027	0.0001	0.00003	0	0	0.00043	0.0003	0.0003	0.00019	0.00017	0.00202
Kestrel	0.95	0.146	0.219	0.163	0.122	0.028	0.138	0.562	0.959	0.319	0.32	0.201	0.107	3.29

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.98	0.0584	0.0877	0.0652	0.0489	0.0112	0.0552	0.225	0.384	0.128	0.128	0.0805	0.043	1.31
	0.99	0.0292	0.0439	0.0326	0.0245	0.00561	0.0276	0.112	0.192	0.0639	0.064	0.0403	0.0215	0.657
	0.995	0.0146	0.0219	0.0163	0.0122	0.0028	0.0138	0.0562	0.0959	0.032	0.032	0.0201	0.0107	0.329
	0.996	0.0117	0.0175	0.013	0.00979	0.00224	0.0111	0.045	0.0767	0.0256	0.0256	0.0161	0.0086	0.263
	0.998	0.00584	0.00877	0.00652	0.00489	0.00112	0.00552	0.0225	0.0384	0.0128	0.0128	0.00805	0.0043	0.131
Lapwing	0.95	-	-	-	0.0642	0.0201	0.0451	0.0289	-	-	-	-	-	0.158
	0.98	-	-	-	0.0257	0.00804	0.018	0.0116	-	-	-	-	-	0.0633
	0.99	-	-	-	0.0128	0.00402	0.00901	0.00577	-	-	-	-	-	0.0316
	0.995	-	-	-	0.00642	0.00201	0.00451	0.00289	-	-	-	-	-	0.0158
	0.996	-	-	-	0.00513	0.00161	0.00361	0.00231	-	-	-	-	-	0.0127
	0.998	-	-	-	0.00257	0.0008	0.0018	0.00115	-	-	-	-	-	0.00633
	0.95	0.338	0.21	0.144	-	-	-	-	0	0.488	0.194	1.23	12.1	14.7
	0.98	0.135	0.0838	0.0575	-	-	-	-	0	0.195	0.0775	0.491	4.84	5.88
	0.99	0.0677	0.0419	0.0288	-	-	-	-	0	0.0977	0.0388	0.246	2.42	2.94
	0.995	0.0338	0.021	0.0144	-	-	-	-	0	0.0488	0.0194	0.123	1.21	1.47
	0.996	0.0271	0.0168	0.0115	-	-	-	-	0	0.0391	0.0155	0.0982	0.969	1.18
	0.998	0.0135	0.00838	0.00575	-	-	-	-	0	0.0195	0.00776	0.0491	0.484	0.588
Little Egret	0.95	0.00427	0.00056	0.00128	0	0	0	0.00326	0	0.00304	0.00319	0.00146	0	0.017

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.98	0.00171	0.00023	0.00051	0	0	0	0.0013	0	0.00122	0.00127	0.00058	0	0.00682
	0.99	0.00085	0.00011	0.00026	0	0	0	0.00065	0	0.00061	0.00064	0.00029	0	0.00341
	0.995	0.00043	0.00006	0.00013	0	0	0	0.00033	0	0.0003	0.00032	0.00015	0	0.00171
	0.996	0.00034	0.00005	0.0001	0	0	0	0.00026	0	0.00024	0.00025	0.00012	0	0.00136
	0.998	0.00017	0.00002	0.00005	0	0	0	0.00013	0	0.00012	0.00013	0.00006	0	0.00068
Lesser Black-backed Gull	0.95	0.00295	0.0926	0.105	-	-	-	-	-	-	0.31	0.645	0.0686	1.22
	0.98	0.00118	0.037	0.0419	-	-	-	-	-	-	0.124	0.258	0.0274	0.49
	0.99	0.00059	0.0185	0.021	-	-	-	-	-	-	0.0621	0.129	0.0137	0.245
	0.995	0.00029	0.00926	0.0105	-	-	-	-	-	-	0.031	0.0645	0.00686	0.122
	0.996	0.00024	0.0074	0.00838	-	-	-	-	-	-	0.0248	0.0516	0.00548	0.098
	0.998	0.00012	0.0037	0.00419	-	-	-	-	-	-	0.0124	0.0258	0.00274	0.049
Long-eared Owl	0.95	0.00007	0	0	0	0.00051	0	0	0.0031	0.00035	0.00013	0	0	0.00416
	0.98	0.00003	0	0	0	0.00021	0	0	0.00124	0.00014	0.00005	0	0	0.00166
	0.99	0.00001	0	0	0	0.0001	0	0	0.00062	0.00007	0.00003	0	0	0.00083
	0.995	0.00001	0	0	0	0.00005	0	0	0.00031	0.00003	0.00001	0	0	0.00042

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.996	0.00001	0	0	0	0.00004	0	0	0.00025	0.00003	0.00001	0	0	0.00033
	0.998	0	0	0	0	0.00002	0	0	0.00012	0.00001	0.00001	0	0	0.00017
Merlin	0.95	0.00013	0.00033	0.00027	0	0	0	0	0	0.00003	0.00002	0.00011	0.00017	0.00106
	0.98	0.00005	0.00013	0.00011	0	0	0	0	0	0.00001	0.00001	0.00004	0.00007	0.00042
	0.99	0.00003	0.00007	0.00005	0	0	0	0	0	0.00001	0	0.00002	0.00003	0.00021
	0.995	0.00001	0.00003	0.00003	0	0	0	0	0	0	0	0.00001	0.00002	0.00011
	0.996	0.00001	0.00003	0.00002	0	0	0	0	0	0	0	0.00001	0.00001	0.00008
	0.998	0.00001	0.00001	0.00001	0	0	0	0	0	0	0	0	0.00001	0.00004
Peregrine Falcon	0.95	0.00549	0.00342	0.00104	0.00228	0.00129	0.00772	0.0141	0.0375	0.0215	0.00387	0.00212	0	0.1
	0.98	0.0022	0.00137	0.00041	0.00091	0.00051	0.00309	0.00562	0.015	0.00861	0.00155	0.00085	0	0.0401
	0.99	0.0011	0.00068	0.00021	0.00046	0.00026	0.00154	0.00281	0.0075	0.00431	0.00077	0.00042	0	0.0201
	0.995	0.00055	0.00034	0.0001	0.00023	0.00013	0.00077	0.00141	0.00375	0.00215	0.00039	0.00021	0	0.01
	0.996	0.00044	0.00027	0.00008	0.00018	0.0001	0.00062	0.00112	0.003	0.00172	0.00031	0.00017	0	0.00802
	0.998	0.00022	0.00014	0.00004	0.00009	0.00005	0.00031	0.00056	0.0015	0.00086	0.00015	0.00008	0	0.00401
Snipe	0.95	0.0176	0.0522	0.64	0.078	0.27	0.266	0.0474	0.651	0.0219	0.134	0.0399	0.0319	2.25

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.98	0.00702	0.0209	0.256	0.0312	0.108	0.106	0.019	0.26	0.00876	0.0538	0.016	0.0127	0.9
	0.99	0.00351	0.0104	0.128	0.0156	0.0541	0.0532	0.00948	0.13	0.00438	0.0269	0.00798	0.00637	0.45
	0.995	0.00176	0.00522	0.064	0.00779	0.027	0.0266	0.00474	0.0651	0.00219	0.0134	0.00399	0.00319	0.225
	0.996	0.0014	0.00418	0.0512	0.00624	0.0216	0.0213	0.00379	0.052	0.00175	0.0108	0.00319	0.00255	0.18
	0.998	0.0007	0.00209	0.0256	0.00312	0.0108	0.0106	0.0019	0.026	0.00088	0.00538	0.0016	0.00127	0.09
Sparrowhawk	0.95	0.0154	0.00336	0.0198	0.0106	0.0101	0.0341	0.0383	0.0417	0.0553	0.0238	0.00845	0.0144	0.275
	0.98	0.00617	0.00134	0.00792	0.00425	0.00406	0.0137	0.0153	0.0167	0.0221	0.00951	0.00338	0.00574	0.11
	0.99	0.00308	0.00067	0.00396	0.00213	0.00203	0.00683	0.00766	0.00834	0.0111	0.00476	0.00169	0.00287	0.0551
	0.995	0.00154	0.00034	0.00198	0.00106	0.00101	0.00341	0.00383	0.00417	0.00553	0.00238	0.00084	0.00144	0.0275
	0.996	0.00123	0.00027	0.00158	0.00085	0.00081	0.00273	0.00306	0.00334	0.00443	0.0019	0.00068	0.00115	0.022
	0.998	0.00062	0.00013	0.00079	0.00043	0.00041	0.00137	0.00153	0.00167	0.00221	0.00095	0.00034	0.00057	0.011
White-tailed Eagle	0.95	0	0.022	0	0.00972	0	0	0	0	0	0	0	0	0.0317
	0.98	0	0.0088	0	0.00389	0	0	0	0	0	0	0	0	0.0127
	0.99	0	0.0044	0	0.00194	0	0	0	0	0	0	0	0	0.00635
	0.995	0	0.0022	0	0.00097	0	0	0	0	0	0	0	0	0.00317

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.996	0	0.00176	0	0.00078	0	0	0	0	0	0	0	0	0.00254
	0.998	0	0.00088	0	0.00039	0	0	0	0	0	0	0	0	0.00127
Whooper Swan	0.95	0.311	0.255	0.38	-	-	-	-	-	0.00511	0.264	0.636	0.218	2.07
	0.98	0.124	0.102	0.152	-	-	-	-	-	0.00204	0.105	0.255	0.0872	0.828
	0.99	0.0622	0.051	0.076	-	-	-	-	-	0.00102	0.0527	0.127	0.0436	0.414
	0.995	0.0311	0.0255	0.038	-	-	-	-	-	0.00051	0.0264	0.0636	0.0218	0.207
	0.996	0.0249	0.0204	0.0304	-	-	-	-	-	0.00041	0.0211	0.0509	0.0174	0.166
	0.998	0.0124	0.0102	0.0152	-	-	-	-	-	0.0002	0.0106	0.0255	0.00872	0.0828
Woodcock	0.95	0.00442	0.00462	0.0142	0.062	0.0668	0	0	0	0.00259	0.00149	0.00144	0.00386	0.162
	0.98	0.00177	0.00185	0.00569	0.0248	0.0267	0	0	0	0.00104	0.00059	0.00058	0.00154	0.0646
	0.99	0.00088	0.00092	0.00284	0.0124	0.0134	0	0	0	0.00052	0.0003	0.00029	0.00077	0.0323
	0.995	0.00044	0.00046	0.00142	0.00621	0.00668	0	0	0	0.00026	0.00015	0.00014	0.00039	0.0162
	0.996	0.00035	0.00037	0.00114	0.00496	0.00535	0	0	0	0.00021	0.00012	0.00012	0.00031	0.0129
	0.998	0.00018	0.00018	0.00057	0.00248	0.00267	0	0	0	0.0001	0.00006	0.00006	0.00015	0.00646

Table 7 - 6 - 1 - 4 Expected collisions with avoidance following Band (2024) – 220m Proposed Turbines

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Buzzard	0.95	0.0797	0.325	0.73	0.363	0.378	0.912	0.334	0.368	0.361	0.155	0.0839	0.041	4.13
	0.98	0.0319	0.13	0.292	0.145	0.151	0.365	0.133	0.147	0.144	0.0618	0.0336	0.0164	1.65
	0.99	0.0159	0.065	0.146	0.0726	0.0756	0.182	0.0667	0.0737	0.0722	0.0309	0.0168	0.00819	0.826
	0.995	0.00797	0.0325	0.073	0.0363	0.0378	0.0912	0.0334	0.0368	0.0361	0.0154	0.00839	0.0041	0.413
	0.996	0.00638	0.026	0.0584	0.029	0.0302	0.073	0.0267	0.0295	0.0289	0.0124	0.00671	0.00328	0.33
	0.998	0.00319	0.013	0.0292	0.0145	0.0151	0.0365	0.0134	0.0147	0.0144	0.00618	0.00336	0.00164	0.165
Curlew	0.95	-	-	-	0.00048	0	0.00077	0.0014	0.00589	0	-	-	-	0.00854
	0.98	-	-	-	0.00019	0	0.00031	0.00056	0.00236	0	-	-	-	0.00342
	0.99	-	-	-	0.0001	0	0.00015	0.00028	0.00118	0	-	-	-	0.00171
	0.995	-	-	-	0.00005	0	0.00008	0.00014	0.00059	0	-	-	-	0.00085
	0.996	-	-	-	0.00004	0	0.00006	0.00011	0.00047	0	-	-	-	0.00068
	0.998	-	-	-	0.00002	0	0.00003	0.00006	0.00024	0	-	-	-	0.00034
Golden Plover	0.95	8.44	6.03	41.9	2.04	0.0155	0	0	0.00248	4.27	12.6	395	6.79	477
	0.98	3.38	2.41	16.8	0.817	0.00619	0	0	0.00099	1.71	5.04	158	2.72	191
	0.99	1.69	1.21	8.39	0.408	0.00309	0	0	0.0005	0.853	2.52	79	1.36	95.5

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.995	0.844	0.603	4.19	0.204	0.00155	0	0	0.00025	0.427	1.26	39.5	0.679	47.7
	0.996	0.675	0.483	3.36	0.163	0.00124	0	0	0.0002	0.341	1.01	31.6	0.543	38.2
	0.998	0.338	0.241	1.68	0.0817	0.00062	0	0	0.0001	0.171	0.504	15.8	0.272	19.1
Greenland White-fronted Goose	0.95	0	0	0.0492	-	-	-	-	-	-	0	0.00052	0	0.0497
	0.98	0	0	0.0197	-	-	-	-	-	-	0	0.00021	0	0.0199
	0.99	0	0	0.00984	-	-	-	-	-	-	0	0.0001	0	0.00995
	0.995	0	0	0.00492	-	-	-	-	-	-	0	0.00005	0	0.00497
	0.996	0	0	0.00394	-	-	-	-	-	-	0	0.00004	0	0.00398
	0.998	0	0	0.00197	-	-	-	-	-	-	0	0.00002	0	0.00199
Hen Harrier	0.95	0.0026	0.00321	0.00481	0.00138	0.00058	0	0	0.00247	0.0053	0.00577	0.00317	0.00356	0.0328
	0.98	0.00104	0.00128	0.00192	0.00055	0.00023	0	0	0.00099	0.00212	0.00231	0.00127	0.00142	0.0131
	0.99	0.00052	0.00064	0.00096	0.00028	0.00012	0	0	0.00049	0.00106	0.00115	0.00063	0.00071	0.00657
	0.995	0.00026	0.00032	0.00048	0.00014	0.00006	0	0	0.00025	0.00053	0.00058	0.00032	0.00036	0.00328
	0.996	0.00021	0.00026	0.00038	0.00011	0.00005	0	0	0.0002	0.00042	0.00046	0.00025	0.00028	0.00263
	0.998	0.0001	0.00013	0.00019	0.00006	0.00002	0	0	0.0001	0.00021	0.00023	0.00013	0.00014	0.00131

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Kestrel	0.95	0.126	0.13	0.128	0.0956	0.00742	0.0812	0.412	0.732	0.229	0.157	0.142	0.142	2.38
	0.98	0.0503	0.0522	0.0512	0.0382	0.00297	0.0325	0.165	0.293	0.0915	0.0629	0.0568	0.0568	0.953
	0.99	0.0252	0.0261	0.0256	0.0191	0.00148	0.0162	0.0825	0.146	0.0457	0.0314	0.0284	0.0284	0.477
	0.995	0.0126	0.013	0.0128	0.00956	0.00074	0.00812	0.0412	0.0732	0.0229	0.0157	0.0142	0.0142	0.238
	0.996	0.0101	0.0104	0.0102	0.00765	0.00059	0.0065	0.033	0.0586	0.0183	0.0126	0.0114	0.0114	0.191
	0.998	0.00503	0.00522	0.00512	0.00383	0.0003	0.00325	0.0165	0.0293	0.00915	0.00629	0.00568	0.00568	0.0953
Lapwing	0.95	-	-	-	0.0828	0.141	0.0312	0.0247	-	-	-	-	-	0.28
	0.98	-	-	-	0.0331	0.0565	0.0125	0.00988	-	-	-	-	-	0.112
	0.99	-	-	-	0.0165	0.0283	0.00624	0.00494	-	-	-	-	-	0.056
	0.995	-	-	-	0.00828	0.0141	0.00312	0.00247	-	-	-	-	-	0.028
	0.996	-	-	-	0.00662	0.0113	0.0025	0.00198	-	-	-	-	-	0.0224
	0.998	-	-	-	0.00331	0.00565	0.00125	0.00099	-	-	-	-	-	0.0112
	0.95	7.06	8.45	2.87	-	-	-	-	0	1.27	0.399	2.43	1.39	23.9
	0.98	2.82	3.38	1.15	-	-	-	-	0	0.508	0.16	0.971	0.555	9.55
	0.99	1.41	1.69	0.574	-	-	-	-	0	0.254	0.0798	0.486	0.278	4.77
	0.995	0.706	0.845	0.287	-	-	-	-	0	0.127	0.0399	0.243	0.139	2.39
	0.996	0.565	0.676	0.23	-	-	-	-	0	0.102	0.0319	0.194	0.111	1.91
	0.998	0.282	0.338	0.115	-	-	-	-	0	0.0508	0.016	0.0971	0.0555	0.955

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Lesser Black-backed Gull	0.95	1.89	0.0681	0.37	-	-	-	-	-	-	0.00601	0.0244	0.0506	2.41
	0.98	0.755	0.0272	0.148	-	-	-	-	-	-	0.0024	0.00977	0.0202	0.963
	0.99	0.378	0.0136	0.074	-	-	-	-	-	-	0.0012	0.00488	0.0101	0.481
	0.995	0.189	0.00681	0.037	-	-	-	-	-	-	0.0006	0.00244	0.00506	0.241
	0.996	0.151	0.00545	0.0296	-	-	-	-	-	-	0.00048	0.00195	0.00405	0.193
	0.998	0.0755	0.00272	0.0148	-	-	-	-	-	-	0.00024	0.00098	0.00202	0.0963
Little Egret	0.95	0.00052	0.00026	0.00058	0	0	0	0.00223	0	0	0.00146	0.00066	0.00043	0.00614
	0.98	0.00021	0.0001	0.00023	0	0	0	0.00089	0	0	0.00058	0.00027	0.00017	0.00246
	0.99	0.0001	0.00005	0.00012	0	0	0	0.00045	0	0	0.00029	0.00013	0.00009	0.00123
	0.995	0.00005	0.00003	0.00006	0	0	0	0.00022	0	0	0.00015	0.00007	0.00004	0.00061
	0.996	0.00004	0.00002	0.00005	0	0	0	0.00018	0	0	0.00012	0.00005	0.00003	0.00049
	0.998	0.00002	0.00001	0.00002	0	0	0	0.00009	0	0	0.00006	0.00003	0.00002	0.00025
Long-eared Owl	0.95	0	0	0	0.00048	0.00024	0	0	0.00017	0	0.00003	0.00001	0	0.00093
	0.98	0	0	0	0.00019	0.0001	0	0	0.00007	0	0.00001	0	0	0.00037
	0.99	0	0	0	0.0001	0.00005	0	0	0.00003	0	0.00001	0	0	0.00019

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.995	0	0	0	0.00005	0.00002	0	0	0.00002	0	0	0	0	0.00009
	0.996	0	0	0	0.00004	0.00002	0	0	0.00001	0	0	0	0	0.00007
	0.998	0	0	0	0.00002	0.00001	0	0	0.00001	0	0	0	0	0.00004
Merlin	0.95	0.00029	0.00017	0.00017	0	0	0	0.00001	0.00037	0.00084	0.00002	0.00008	0.00008	0.00203
	0.98	0.00012	0.00007	0.00007	0	0	0	0	0.00015	0.00034	0.00001	0.00003	0.00003	0.00081
	0.99	0.00006	0.00003	0.00003	0	0	0	0	0.00007	0.00017	0	0.00002	0.00002	0.00041
	0.995	0.00003	0.00002	0.00002	0	0	0	0	0.00004	0.00008	0	0.00001	0.00001	0.0002
	0.996	0.00002	0.00001	0.00001	0	0	0	0	0.00003	0.00007	0	0.00001	0.00001	0.00016
	0.998	0.00001	0.00001	0.00001	0	0	0	0	0.00001	0.00003	0	0	0	0.00008
Peregrine Falcon	0.95	0.00268	0.00131	0.00194	0.00369	0	0.00248	0.0144	0.00934	0.00656	0.00183	0.0021	0.001	0.0474
	0.98	0.00107	0.00052	0.00078	0.00148	0	0.00099	0.00578	0.00374	0.00262	0.00073	0.00084	0.0004	0.019
	0.99	0.00054	0.00026	0.00039	0.00074	0	0.0005	0.00289	0.00187	0.00131	0.00037	0.00042	0.0002	0.00948
	0.995	0.00027	0.00013	0.00019	0.00037	0	0.00025	0.00144	0.00093	0.00066	0.00018	0.00021	0.0001	0.00474
	0.996	0.00021	0.0001	0.00016	0.0003	0	0.0002	0.00116	0.00075	0.00052	0.00015	0.00017	0.00008	0.00379
	0.998	0.00011	0.00005	0.00008	0.00015	0	0.0001	0.00058	0.00037	0.00026	0.00007	0.00008	0.00004	0.0019

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Snipe	0.95	0.0153	0.0476	1.53	0.62	0.246	0.124	0.0352	0.425	0.0557	0.0968	0.0304	0.024	3.25
	0.98	0.00612	0.019	0.614	0.248	0.0986	0.0495	0.0141	0.17	0.0223	0.0387	0.0122	0.0096	1.3
	0.99	0.00306	0.00951	0.307	0.124	0.0493	0.0247	0.00704	0.085	0.0111	0.0193	0.00609	0.0048	0.651
	0.995	0.00153	0.00475	0.153	0.062	0.0246	0.0124	0.00352	0.0425	0.00557	0.00968	0.00304	0.0024	0.325
	0.996	0.00122	0.0038	0.123	0.0496	0.0197	0.00989	0.00282	0.034	0.00445	0.00774	0.00243	0.00192	0.26
	0.998	0.00061	0.0019	0.0614	0.0248	0.00986	0.00495	0.00141	0.017	0.00223	0.00387	0.00122	0.00096	0.13
Sparrowhawk	0.95	0.017	0.007	0.0166	0.0106	0.02	0.0151	0.0112	0.0265	0.065	0.00922	0.01	0.0137	0.222
	0.98	0.00678	0.0028	0.00663	0.00426	0.00798	0.00605	0.00447	0.0106	0.026	0.00369	0.00401	0.00547	0.0887
	0.99	0.00339	0.0014	0.00331	0.00213	0.00399	0.00302	0.00223	0.0053	0.013	0.00184	0.002	0.00273	0.0444
	0.995	0.0017	0.0007	0.00166	0.00106	0.002	0.00151	0.00112	0.00265	0.0065	0.00092	0.001	0.00137	0.0222
	0.996	0.00136	0.00056	0.00133	0.00085	0.0016	0.00121	0.00089	0.00212	0.0052	0.00074	0.0008	0.00109	0.0177
	0.998	0.00068	0.00028	0.00066	0.00043	0.0008	0.0006	0.00045	0.00106	0.0026	0.00037	0.0004	0.00055	0.00887
White-tailed Eagle	0.95	0	0.0103	0.00091	0	0	0	0	0	0	0	0	0	0.0112
	0.98	0	0.00413	0.00036	0	0	0	0	0	0	0	0	0	0.00449
	0.99	0	0.00206	0.00018	0	0	0	0	0	0	0	0	0	0.00225

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.995	0	0.00103	0.00009	0	0	0	0	0	0	0	0	0	0.00112
	0.996	0	0.00083	0.00007	0	0	0	0	0	0	0	0	0	0.0009
	0.998	0	0.00041	0.00004	0	0	0	0	0	0	0	0	0	0.00045
Whooper Swan	0.95	0.507	0.166	0.133	-	-	-	-	-	0.00357	0.11	0.494	0.189	1.6
	0.98	0.203	0.0664	0.053	-	-	-	-	-	0.00143	0.044	0.197	0.0755	0.641
	0.99	0.101	0.0332	0.0265	-	-	-	-	-	0.00071	0.022	0.0987	0.0378	0.32
	0.995	0.0507	0.0166	0.0133	-	-	-	-	-	0.00036	0.011	0.0494	0.0189	0.16
	0.996	0.0406	0.0133	0.0106	-	-	-	-	-	0.00029	0.0088	0.0395	0.0151	0.128
	0.998	0.0203	0.00664	0.0053	-	-	-	-	-	0.00014	0.0044	0.0198	0.00755	0.0641
Woodcock	0.95	0.00241	0.00284	0.0127	0.0706	0.0782	0.00693	0	0.00155	0.00233	0.00032	0.00144	0.00538	0.185
	0.98	0.00096	0.00114	0.00507	0.0282	0.0313	0.00277	0	0.00062	0.00093	0.00013	0.00058	0.00215	0.0739
	0.99	0.00048	0.00057	0.00254	0.0141	0.0157	0.00139	0	0.00031	0.00047	0.00006	0.00029	0.00108	0.0369
	0.995	0.00024	0.00028	0.00127	0.00706	0.00782	0.00069	0	0.00015	0.00023	0.00003	0.00014	0.00054	0.0185
	0.996	0.00019	0.00023	0.00101	0.00565	0.00626	0.00055	0	0.00012	0.00019	0.00003	0.00012	0.00043	0.0148
	0.998	0.0001	0.00011	0.00051	0.00282	0.00313	0.00028	0	0.00006	0.00009	0.00001	0.00006	0.00022	0.00739

Table 7 - 6 - 1 - 5 Expected collisions with avoidance using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 - 200m Proposed Turbines

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Buzzard	0.95	0.0152	0.374	0.922	0.383	0.753	1.44	0.589	0.541	0.826	0.251	0.108	0.0405	6.24
	0.98	0.00607	0.15	0.369	0.153	0.301	0.575	0.236	0.217	0.331	0.1	0.0434	0.0162	2.5
	0.99	0.00304	0.0749	0.184	0.0765	0.151	0.287	0.118	0.108	0.165	0.0501	0.0217	0.00811	1.25
	0.995	0.00152	0.0374	0.0922	0.0382	0.0753	0.144	0.0589	0.0541	0.0826	0.0251	0.0108	0.00405	0.624
	0.996	0.00121	0.03	0.0737	0.0306	0.0603	0.115	0.0471	0.0433	0.0661	0.02	0.00868	0.00324	0.499
	0.998	0.00061	0.015	0.0369	0.0153	0.0301	0.0575	0.0236	0.0217	0.0331	0.01	0.00434	0.00162	0.25
Curlew	0.95	-	-	-	0	0	0	0	0.0215	0	-	-	-	0.0215
	0.98	-	-	-	0	0	0	0	0.00861	0	-	-	-	0.00861
	0.99	-	-	-	0	0	0	0	0.00431	0	-	-	-	0.00431
	0.995	-	-	-	0	0	0	0	0.00215	0	-	-	-	0.00215
	0.996	-	-	-	0	0	0	0	0.00172	0	-	-	-	0.00172
	0.998	-	-	-	0	0	0	0	0.00086	0	-	-	-	0.00086
Golden Plover	0.95	9.35	7.37	59.8	3.4	0.0289	0	0	0	2.38	18.5	501	2.27	604
	0.98	3.74	2.95	23.9	1.36	0.0116	0	0	0	0.953	7.41	2	0.908	242
	0.99	1.87	1.47	12	0.679	0.00579	0	0	0	0.477	3.71	1	0.454	121
	0.995	0.935	0.737	5.98	0.34	0.00289	0	0	0	0.238	1.85	50.1	0.227	60.4

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.996	0.748	0.589	4.78	0.272	0.00232	0	0	0	0.191	1.48	40.1	0.182	48.3
	0.998	0.374	0.295	2.39	0.136	0.00116	0	0	0	0.0953	0.741	20	0.0908	24.2
Greenland White-fronted Goose	0.95	0	0	0	-	-	-	-	-	-	0	0.00858	0	0.00858
	0.98	0	0	0	-	-	-	-	-	-	0	0.00343	0	0.00343
	0.99	0	0	0	-	-	-	-	-	-	0	0.00172	0	0.00172
	0.995	0	0	0	-	-	-	-	-	-	0	0.00086	0	0.00086
	0.996	0	0	0	-	-	-	-	-	-	0	0.00069	0	0.00069
	0.998	0	0	0	-	-	-	-	-	-	0	0.00034	0	0.00034
Hen Harrier	0.95	0	0	0.0021	0.00063	0.00032	0	0	0.0209	0.00381	0.00104	0.00081	0.00143	0.031
	0.98	0	0	0.00084	0.00025	0.00013	0	0	0.00834	0.00152	0.00042	0.00032	0.00057	0.0124
	0.99	0	0	0.00042	0.00013	0.00006	0	0	0.00417	0.00076	0.00021	0.00016	0.00029	0.0062
	0.995	0	0	0.00021	0.00006	0.00003	0	0	0.00209	0.00038	0.0001	0.00008	0.00014	0.0031
	0.996	0	0	0.00017	0.00005	0.00003	0	0	0.00167	0.0003	0.00008	0.00006	0.00011	0.00248
	0.998	0	0	0.00008	0.00003	0.00001	0	0	0.00083	0.00015	0.00004	0.00003	0.00006	0.00124
Kestrel	0.95	0.0709	0.179	0.128	0.104	0.019	0.107	0.383	0.393	0.239	0.206	0.104	0.0946	2.03

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.98	0.0284	0.0715	0.0512	0.0418	0.00758	0.0426	0.153	0.157	0.0955	0.0823	0.0417	0.0378	0.811
	0.99	0.0142	0.0358	0.0256	0.0209	0.00379	0.0213	0.0767	0.0786	0.0478	0.0411	0.0209	0.0189	0.405
	0.995	0.00709	0.0179	0.0128	0.0104	0.0019	0.0106	0.0384	0.0393	0.0239	0.0206	0.0104	0.00946	0.203
	0.996	0.00567	0.0143	0.0102	0.00836	0.00152	0.00852	0.0307	0.0314	0.0191	0.0165	0.00834	0.00757	0.162
	0.998	0.00283	0.00715	0.00512	0.00418	0.00076	0.00426	0.0153	0.0157	0.00955	0.00823	0.00417	0.00378	0.0811
Lapwing	0.95	-	-	-	0.0502	0.0161	0.0382	0.026	-	-	-	-	-	0.131
	0.98	-	-	-	0.0201	0.00643	0.0153	0.0104	-	-	-	-	-	0.0522
	0.99	-	-	-	0.01	0.00321	0.00764	0.00521	-	-	-	-	-	0.0261
	0.995	-	-	-	0.00502	0.00161	0.00382	0.0026	-	-	-	-	-	0.0131
	0.996	-	-	-	0.00402	0.00129	0.00306	0.00208	-	-	-	-	-	0.0104
	0.998	-	-	-	0.00201	0.00064	0.00153	0.00104	-	-	-	-	-	0.00522
	0.95	0.34	0.165	0.0511	-	-	-	-	0	0.262	0.203	1.36	13.8	16.2
	0.98	0.136	0.0661	0.0204	-	-	-	-	0	0.105	0.0814	0.545	5.52	6.48
	0.99	0.068	0.0331	0.0102	-	-	-	-	0	0.0524	0.0407	0.273	2.76	3.24
	0.995	0.034	0.0165	0.00511	-	-	-	-	0	0.0262	0.0203	0.136	1.38	1.62
	0.996	0.0272	0.0132	0.00409	-	-	-	-	0	0.021	0.0163	0.109	1.1	1.3
	0.998	0.0136	0.00661	0.00205	-	-	-	-	0	0.0105	0.00814	0.0545	0.552	0.648

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Little Egret	0.95	0.00088	0.00025	0.00057	0	0	0	0.00145	0	0.00136	0	0	0	0.0045
	0.98	0.00035	0.0001	0.00023	0	0	0	0.00058	0	0.00054	0	0	0	0.0018
	0.99	0.00018	0.00005	0.00011	0	0	0	0.00029	0	0.00027	0	0	0	0.0009
	0.995	0.00009	0.00002	0.00006	0	0	0	0.00014	0	0.00014	0	0	0	0.00045
	0.996	0.00007	0.00002	0.00005	0	0	0	0.00012	0	0.00011	0	0	0	0.00036
	0.998	0.00004	0.00001	0.00002	0	0	0	0.00006	0	0.00005	0	0	0	0.00018
Lesser Black-backed Gull	0.95	0.0026	0.0896	0.0561	-	-	-	-	-	-	0.3	0.624	0.0665	1.14
	0.98	0.00104	0.0358	0.0224	-	-	-	-	-	-	0.12	0.25	0.0266	0.456
	0.99	0.00052	0.0179	0.0112	-	-	-	-	-	-	0.06	0.125	0.0133	0.228
	0.995	0.00026	0.00896	0.00561	-	-	-	-	-	-	0.03	0.0624	0.00665	0.114
	0.996	0.00021	0.00717	0.00449	-	-	-	-	-	-	0.024	0.0499	0.00532	0.0911
	0.998	0.0001	0.00358	0.00224	-	-	-	-	-	-	0.012	0.025	0.00266	0.0456
Long-eared Owl	0.95	0	0	0	0	0.00263	0	0	0	0	0	0	0	0.00263
	0.98	0	0	0	0	0.00105	0	0	0	0	0	0	0	0.00105
	0.99	0	0	0	0	0.00053	0	0	0	0	0	0	0	0.00053

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.995	0	0	0	0	0.00026	0	0	0	0	0	0	0	0.00026
	0.996	0	0	0	0	0.00021	0	0	0	0	0	0	0	0.00021
	0.998	0	0	0	0	0.00011	0	0	0	0	0	0	0	0.00011
Merlin	0.95	0	0	0.00015	0	0	0	0	0	0	0	0	0.00021	0.00036
	0.98	0	0	0.00006	0	0	0	0	0	0	0	0	0.00009	0.00014
	0.99	0	0	0.00003	0	0	0	0	0	0	0	0	0.00004	0.00007
	0.995	0	0	0.00001	0	0	0	0	0	0	0	0	0.00002	0.00004
	0.996	0	0	0.00001	0	0	0	0	0	0	0	0	0.00002	0.00003
	0.998	0	0	0.00001	0	0	0	0	0	0	0	0	0.00001	0.00001
Peregrine Falcon	0.95	0.00543	0.00291	0.00071	0.00312	0.00137	0.00926	0.00679	0.0413	0.0303	0.00111	0.00201	0	0.104
	0.98	0.00217	0.00116	0.00028	0.00125	0.00055	0.0037	0.00272	0.0165	0.0121	0.00044	0.0008	0	0.0417
	0.99	0.00109	0.00058	0.00014	0.00062	0.00027	0.00185	0.00136	0.00825	0.00606	0.00022	0.0004	0	0.0209
	0.995	0.00054	0.00029	0.00007	0.00031	0.00014	0.00093	0.00068	0.00413	0.00303	0.00011	0.0002	0	0.0104
	0.996	0.00043	0.00023	0.00006	0.00025	0.00011	0.00074	0.00054	0.0033	0.00242	0.00009	0.00016	0	0.00834
	0.998	0.00022	0.00012	0.00003	0.00012	0.00005	0.00037	0.00027	0.00165	0.00121	0.00004	0.00008	0	0.00417

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Snipe	0.95	0.00317	0.0527	0.502	0.0704	0.275	0.271	0.0385	0.754	0.0177	0.068	0.0294	0.0106	2.09
	0.98	0.00127	0.0211	0.201	0.0282	0.11	0.108	0.0154	0.301	0.00709	0.0272	0.0118	0.00424	0.837
	0.99	0.00063	0.0105	0.1	0.0141	0.0549	0.0541	0.00769	0.151	0.00355	0.0136	0.00588	0.00212	0.418
	0.995	0.00032	0.00527	0.0502	0.00704	0.0274	0.0271	0.00385	0.0754	0.00177	0.0068	0.00294	0.00106	0.209
	0.996	0.00025	0.00421	0.0402	0.00563	0.022	0.0216	0.00308	0.0603	0.00142	0.00544	0.00235	0.00085	0.167
	0.998	0.00013	0.00211	0.0201	0.00282	0.011	0.0108	0.00154	0.0301	0.00071	0.00272	0.00118	0.00042	0.0837
Sparrowhawk	0.95	0.0107	0.00127	0.0188	0.00978	0.00824	0.0305	0.0299	0.0246	0.0394	0.0163	0.00513	0.00867	0.203
	0.98	0.00427	0.00051	0.00754	0.00391	0.0033	0.0122	0.012	0.00985	0.0158	0.00652	0.00205	0.00347	0.0813
	0.99	0.00213	0.00025	0.00377	0.00196	0.00165	0.0061	0.00598	0.00492	0.00788	0.00326	0.00103	0.00173	0.0407
	0.995	0.00107	0.00013	0.00188	0.00098	0.00082	0.00305	0.00299	0.00246	0.00394	0.00163	0.00051	0.00087	0.0203
	0.996	0.00085	0.0001	0.00151	0.00078	0.00066	0.00244	0.00239	0.00197	0.00315	0.0013	0.00041	0.00069	0.0163
	0.998	0.00043	0.00005	0.00075	0.00039	0.00033	0.00122	0.0012	0.00098	0.00158	0.00065	0.00021	0.00035	0.00813
White-tailed Eagle	0.95	0	0.0176	0	0.0111	0	0	0	0	0	0	0	0	0.0288
	0.98	0	0.00705	0	0.00445	0	0	0	0	0	0	0	0	0.0115
	0.99	0	0.00353	0	0.00223	0	0	0	0	0	0	0	0	0.00575

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.995	0	0.00176	0	0.00111	0	0	0	0	0	0	0	0	0.00288
	0.996	0	0.00141	0	0.00089	0	0	0	0	0	0	0	0	0.0023
	0.998	0	0.00071	0	0.00045	0	0	0	0	0	0	0	0	0.00115
Whooper Swan	0.95	0.214	0.169	0.00834	-	-	-	-	-	0.0098	0.392	0.226	0.0899	1.11
	0.98	0.0855	0.0676	0.00334	-	-	-	-	-	0.00392	0.157	0.0903	0.036	0.443
	0.99	0.0428	0.0338	0.00167	-	-	-	-	-	0.00196	0.0784	0.0451	0.018	0.222
	0.995	0.0214	0.0169	0.00083	-	-	-	-	-	0.00098	0.0392	0.0226	0.00899	0.111
	0.996	0.0171	0.0135	0.00067	-	-	-	-	-	0.00078	0.0314	0.018	0.00719	0.0887
	0.998	0.00855	0.00675	0.00033	-	-	-	-	-	0.00039	0.0157	0.00903	0.0036	0.0443
Woodcock	0.95	0.00141	0.00436	0.00324	0.00883	0.026	0	0	0	0.00102	0.00058	0	0	0.0454
	0.98	0.00056	0.00174	0.0013	0.00353	0.0104	0	0	0	0.00041	0.00023	0	0	0.0182
	0.99	0.00028	0.00087	0.00065	0.00177	0.00519	0	0	0	0.0002	0.00012	0	0	0.00908
	0.995	0.00014	0.00044	0.00032	0.00088	0.0026	0	0	0	0.0001	0.00006	0	0	0.00454
	0.996	0.00011	0.00035	0.00026	0.00071	0.00208	0	0	0	0.00008	0.00005	0	0	0.00363
	0.998	0.00006	0.00017	0.00013	0.00035	0.00104	0	0	0	0.00004	0.00002	0	0	0.00182

Table 7 - 6 - 1 - 6 Expected collisions with avoidance using only the flight activity in the bands within PCH and always setting the proportion flying at risk height to 1 - 220m Proposed Turbines

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Buzzard	0.95	0.0372	0.267	0.763	0.391	0.425	0.903	0.279	0.342	0.325	0.118	0.0489	0.0404	3.94
	0.98	0.0149	0.107	0.305	0.156	0.17	0.361	0.112	0.137	0.13	0.0473	0.0196	0.0162	1.58
	0.99	0.00744	0.0535	0.153	0.0782	0.085	0.181	0.0558	0.0683	0.0651	0.0236	0.00979	0.00808	0.788
	0.995	0.00372	0.0267	0.0763	0.0391	0.0425	0.0903	0.0279	0.0342	0.0325	0.0118	0.00489	0.00404	0.394
	0.996	0.00298	0.0214	0.061	0.0313	0.034	0.0723	0.0223	0.0273	0.026	0.00945	0.00392	0.00323	0.315
	0.998	0.00149	0.0107	0.0305	0.0157	0.017	0.0361	0.0112	0.0137	0.013	0.00473	0.00196	0.00162	0.158
Curlew	0.95	-	-	-	0	0	0	0.00087	0.0137	0	-	-	-	0.0146
	0.98	-	-	-	0	0	0	0.00035	0.00548	0	-	-	-	0.00582
	0.99	-	-	-	0	0	0	0.00017	0.00274	0	-	-	-	0.00291
	0.995	-	-	-	0	0	0	0.00009	0.00137	0	-	-	-	0.00146
	0.996	-	-	-	0	0	0	0.00007	0.0011	0	-	-	-	0.00116
	0.998	-	-	-	0	0	0	0.00003	0.00055	0	-	-	-	0.00058
Golden Plover	0.95	10.6	6.57	55.6	2.23	0.0239	0	0	0.00361	5.82	9.82	544	8.67	644
	0.98	4.24	2.63	22.3	0.891	0.00957	0	0	0.00145	2.33	3.93	218	3.47	257
	0.99	2.12	1.31	11.1	0.445	0.00479	0	0	0.00072	1.16	1.96	109	1.73	129

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.995	1.06	0.657	5.56	0.223	0.00239	0	0	0.00036	0.582	0.982	54.4	0.867	64.4
	0.996	0.848	0.526	4.45	0.178	0.00191	0	0	0.00029	0.466	0.786	43.5	0.694	51.5
	0.998	0.424	0.263	2.23	0.0891	0.00096	0	0	0.00014	0.233	0.393	21.8	0.347	25.7
Greenland White-fronted Goose	0.95	0	0	0.806	-	-	-	-	-	-	0	0	0	0.806
	0.98	0	0	0.322	-	-	-	-	-	-	0	0	0	0.322
	0.99	0	0	0.161	-	-	-	-	-	-	0	0	0	0.161
	0.995	0	0	0.0806	-	-	-	-	-	-	0	0	0	0.0806
	0.996	0	0	0.0645	-	-	-	-	-	-	0	0	0	0.0645
	0.998	0	0	0.0322	-	-	-	-	-	-	0	0	0	0.0322
Hen Harrier	0.95	0	0	0.00104	0.00049	0.00034	0	0	0.00054	0.00084	0.0011	0.00096	0.00051	0.00582
	0.98	0	0	0.00042	0.0002	0.00014	0	0	0.00021	0.00034	0.00044	0.00038	0.0002	0.00233
	0.99	0	0	0.00021	0.0001	0.00007	0	0	0.00011	0.00017	0.00022	0.00019	0.0001	0.00116
	0.995	0	0	0.0001	0.00005	0.00003	0	0	0.00005	0.00008	0.00011	0.0001	0.00005	0.00058
	0.996	0	0	0.00008	0.00004	0.00003	0	0	0.00004	0.00007	0.00009	0.00008	0.00004	0.00047
	0.998	0	0	0.00004	0.00002	0.00001	0	0	0.00002	0.00003	0.00004	0.00004	0.00002	0.00023
Kestrel	0.95	0.0851	0.096	0.077	0.076	0.00722	0.0632	0.256	0.258	0.161	0.0887	0.0543	0.133	1.35
	0.98	0.034	0.0384	0.0308	0.0304	0.00289	0.0253	0.102	0.103	0.0644	0.0355	0.0217	0.0531	0.542

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.99	0.017	0.0192	0.0154	0.0152	0.00144	0.0126	0.0511	0.0515	0.0322	0.0177	0.0109	0.0266	0.271
	0.995	0.00851	0.0096	0.0077	0.0076	0.00072	0.00632	0.0256	0.0258	0.0161	0.00887	0.00543	0.0133	0.135
	0.996	0.00681	0.00768	0.00616	0.00608	0.00058	0.00505	0.0204	0.0206	0.0129	0.0071	0.00434	0.0106	0.108
	0.998	0.0034	0.00384	0.00308	0.00304	0.00029	0.00253	0.0102	0.0103	0.00644	0.00355	0.00217	0.00531	0.0542
Lapwing	0.95	-	-	-	0.0689	0.0425	0.0274	0.0264	-	-	-	-	-	0.165
	0.98	-	-	-	0.0276	0.017	0.011	0.0106	-	-	-	-	-	0.0661
	0.99	-	-	-	0.0138	0.00849	0.00548	0.00528	-	-	-	-	-	0.033
	0.995	-	-	-	0.00689	0.00425	0.00274	0.00264	-	-	-	-	-	0.0165
	0.996	-	-	-	0.00551	0.0034	0.00219	0.00211	-	-	-	-	-	0.0132
	0.998	-	-	-	0.00276	0.0017	0.0011	0.00106	-	-	-	-	-	0.00661
	0.95	8.86	6.04	3.78	-	-	-	-	0	0.753	0.0474	3.22	1.73	24.4
	0.98	3.54	2.42	1.51	-	-	-	-	0	0.301	0.019	1.29	0.693	9.77
	0.99	1.77	1.21	0.756	-	-	-	-	0	0.151	0.00949	0.644	0.347	4.89
	0.995	0.886	0.604	0.378	-	-	-	-	0	0.0753	0.00475	0.322	0.173	2.44
	0.996	0.709	0.483	0.303	-	-	-	-	0	0.0602	0.0038	0.257	0.139	1.95
	0.998	0.354	0.242	0.151	-	-	-	-	0	0.0301	0.0019	0.129	0.0693	0.977
Lesser Black-backed Gull	0.95	2.62	0.0276	0.0788	-	-	-	-	-	-	0.00187	0.0331	0.0704	2.83

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.98	1.05	0.0111	0.0315	-	-	-	-	-	-	0.00075	0.0132	0.0281	1.13
	0.99	0.524	0.00553	0.0158	-	-	-	-	-	-	0.00037	0.00662	0.0141	0.566
	0.995	0.262	0.00276	0.00788	-	-	-	-	-	-	0.00019	0.00331	0.00704	0.283
	0.996	0.21	0.00221	0.0063	-	-	-	-	-	-	0.00015	0.00265	0.00563	0.227
	0.998	0.105	0.00111	0.00315	-	-	-	-	-	-	0.00007	0.00132	0.00281	0.113
Little Egret	0.95	0.00031	0.00015	0.00035	0	0	0	0	0	0	0	0	0	0.00081
	0.98	0.00012	0.00006	0.00014	0	0	0	0	0	0	0	0	0	0.00032
	0.99	0.00006	0.00003	0.00007	0	0	0	0	0	0	0	0	0	0.00016
	0.995	0.00003	0.00002	0.00003	0	0	0	0	0	0	0	0	0	0.00008
	0.996	0.00002	0.00001	0.00003	0	0	0	0	0	0	0	0	0	0.00006
	0.998	0.00001	0.00001	0.00001	0	0	0	0	0	0	0	0	0	0.00003
Long-eared Owl	0.95	0	0	0	0	0.00064	0	0	0	0	0	0	0	0.00064
	0.98	0	0	0	0	0.00026	0	0	0	0	0	0	0	0.00026
	0.99	0	0	0	0	0.00013	0	0	0	0	0	0	0	0.00013
	0.995	0	0	0	0	0.00006	0	0	0	0	0	0	0	0.00006

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.996	0	0	0	0	0.00005	0	0	0	0	0	0	0	0.00005
	0.998	0	0	0	0	0.00003	0	0	0	0	0	0	0	0.00003
Merlin	0.95	0	0	0.00014	0	0	0	0	0.00306	0.00572	0	0	0	0.00892
	0.98	0	0	0.00006	0	0	0	0	0.00122	0.00229	0	0	0	0.00357
	0.99	0	0	0.00003	0	0	0	0	0.00061	0.00114	0	0	0	0.00178
	0.995	0	0	0.00001	0	0	0	0	0.00031	0.00057	0	0	0	0.00089
	0.996	0	0	0.00001	0	0	0	0	0.00024	0.00046	0	0	0	0.00071
	0.998	0	0	0.00001	0	0	0	0	0.00012	0.00023	0	0	0	0.00036
Peregrine Falcon	0.95	0	0.00083	0	0.00097	0	0.00119	0.00745	0.0137	0.0148	0.00038	0.00107	0.00085	0.0413
	0.98	0	0.00033	0	0.00039	0	0.00047	0.00298	0.00549	0.00592	0.00015	0.00043	0.00034	0.0165
	0.99	0	0.00017	0	0.00019	0	0.00024	0.00149	0.00275	0.00296	0.00008	0.00021	0.00017	0.00825
	0.995	0	0.00008	0	0.0001	0	0.00012	0.00074	0.00137	0.00148	0.00004	0.00011	0.00008	0.00413
	0.996	0	0.00007	0	0.00008	0	0.00009	0.0006	0.0011	0.00118	0.00003	0.00009	0.00007	0.0033
	0.998	0	0.00003	0	0.00004	0	0.00005	0.0003	0.00055	0.00059	0.00002	0.00004	0.00003	0.00165
Snipe	0.95	0.0072	0.0402	1.07	0.687	0.242	0.103	0.0353	0.599	0.0172	0.0532	0.0268	0.0132	2.9

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.98	0.00288	0.0161	0.429	0.275	0.0969	0.0413	0.0141	0.239	0.00687	0.0213	0.0107	0.00529	1.16
	0.99	0.00144	0.00803	0.215	0.137	0.0485	0.0207	0.00706	0.12	0.00343	0.0106	0.00536	0.00264	0.579
	0.995	0.00072	0.00402	0.107	0.0687	0.0242	0.0103	0.00353	0.0599	0.00172	0.00532	0.00268	0.00132	0.29
	0.996	0.00058	0.00321	0.0859	0.0549	0.0194	0.00826	0.00282	0.0479	0.00137	0.00426	0.00215	0.00106	0.232
	0.998	0.00029	0.00161	0.0429	0.0275	0.00969	0.00413	0.00141	0.0239	0.00069	0.00213	0.00107	0.00053	0.116
Sparrowhawk	0.95	0.0145	0.00606	0.0111	0.00937	0.0237	0.012	0.00961	0.032	0.0498	0.00894	0.0099	0.00468	0.192
	0.98	0.00582	0.00242	0.00445	0.00375	0.00946	0.00481	0.00384	0.0128	0.0199	0.00358	0.00396	0.00187	0.0767
	0.99	0.00291	0.00121	0.00223	0.00187	0.00473	0.00241	0.00192	0.0064	0.00997	0.00179	0.00198	0.00094	0.0384
	0.995	0.00145	0.00061	0.00111	0.00094	0.00237	0.0012	0.00096	0.0032	0.00499	0.00089	0.00099	0.00047	0.0192
	0.996	0.00116	0.00048	0.00089	0.00075	0.00189	0.00096	0.00077	0.00256	0.00399	0.00072	0.00079	0.00037	0.0153
	0.998	0.00058	0.00024	0.00045	0.00037	0.00095	0.00048	0.00038	0.00128	0.00199	0.00036	0.0004	0.00019	0.00767
White-tailed Eagle	0.95	0	0.0192	0	0	0	0	0	0	0	0	0	0	0.0192
	0.98	0	0.0077	0	0	0	0	0	0	0	0	0	0	0.0077
	0.99	0	0.00385	0	0	0	0	0	0	0	0	0	0	0.00385
	0.995	0	0.00192	0	0	0	0	0	0	0	0	0	0	0.00192
	0.996	0	0.00154	0	0	0	0	0	0	0	0	0	0	0.00154

Species	Avoidance Factor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	0.998	0	0.00077	0	0	0	0	0	0	0	0	0	0	0.00077
Whooper Swan	0.95	0.129	0.0532	0.023	-	-	-	-	-	0	0.112	0.141	0.0858	0.544
	0.98	0.0515	0.0213	0.00921	-	-	-	-	-	0	0.0447	0.0566	0.0343	0.218
	0.99	0.0257	0.0106	0.00461	-	-	-	-	-	0	0.0224	0.0283	0.0171	0.109
	0.995	0.0129	0.00532	0.0023	-	-	-	-	-	0	0.0112	0.0141	0.00858	0.0544
	0.996	0.0103	0.00425	0.00184	-	-	-	-	-	0	0.00895	0.0113	0.00686	0.0435
	0.998	0.00515	0.00213	0.00092	-	-	-	-	-	0	0.00447	0.00566	0.00343	0.0218
Woodcock	0.95	0.00076	0.00204	0.00491	0.0115	0.0351	0	0	0.0007	0.00105	0	0.00042	0.00106	0.0575
	0.98	0.00031	0.00081	0.00196	0.00459	0.014	0	0	0.00028	0.00042	0	0.00017	0.00042	0.023
	0.99	0.00015	0.00041	0.00098	0.00229	0.00702	0	0	0.00014	0.00021	0	0.00008	0.00021	0.0115
	0.995	0.00008	0.0002	0.00049	0.00115	0.00351	0	0	0.00007	0.00011	0	0.00004	0.00011	0.00575
	0.996	0.00006	0.00016	0.00039	0.00092	0.00281	0	0	0.00006	0.00008	0	0.00003	0.00008	0.0046
	0.998	0.00003	0.00008	0.0002	0.00046	0.0014	0	0	0.00003	0.00004	0	0.00002	0.00004	0.0023

Table 7 - 6 - 1 - 7 Results of bootstrap analysis

Species	Records collected according to height bands	Records not collected according to height bands	Proportion records not collected according to height bands	Total bird seconds collected according to height bands	Bird seconds at PCH collected according to height bands	Correction factor	Bias	Standard Deviation	Lower confidence interval	Upper confidence interval	Bird seconds not collected according to height bands	% uplift
Buzzard	1064	761	0.42	216895	156269	0.72048226	-0.00019	0.0220085	0.6736	0.7592	47389	0.009636
Curlew	7	7	0.5	366	141	0.3852459	-0.03803	0.2317935	0	0.7697	350	0.487822
Golden Plover	372	197	0.35	106688	80233	0.75203397	0.00131	0.0280179	0.7001	0.81	7426	0.005016
Greenland White-fronted Goose	2	0	0	not required	not required	not required	not required	not required	not required	not required	not required	not required
Hen Harrier	97	43	0.31	5941	1114	0.18751052	-0.00389	0.0669169	0.0599	0.3203	1605	0.150625
Kestrel	1197	581	0.33	231414	112134	0.48456014	0.000505	0.020224	0.4443	0.5244	27463	0.008722
Lapwing	141	128	0.48	23693	17700	0.74705609	-0.00057	0.0492146	0.6407	0.8349	4459	0.018625
Little Egret	35	10	0.22	1589	228	0.14348647	-0.00408	0.0778591	0.0151	0.3043	390	0.220867
Lesser Black-backed Gull	93	31	0.25	10080	9182	0.9109127	0.000385	0.038236	0.8281	0.9693	1240	0.007021
Long-eared Owl	12	0	0									
Merlin	28	2	0.07	838	287	0.3424821	-0.02903	0.1761563	0	0.6214	70	0.062784
Peregrine Falcon	55	26	0.32	5668	3875	0.68366267	-0.00647	0.066616	0.532	0.799	1705	0.039013
Snipe	422	280	0.4	49897	36249	0.72647654	-0.0017	0.0300334	0.663	0.7793	9715	0.01185
Sparrowhawk	182	162	0.47	17885	10727	0.59977635	-0.00064	0.0352464	0.5277	0.6656	6045	0.027723
White-tailed Eagle	3	0	0	not required	not required	not required	not required	not required	not required	not required	not required	not required
Whooper Swan	168	62	0.27	15321	5616	0.36655571	-0.00125	0.0415614	0.2831	0.4452	2424	0.029308
Woodcock	90	109	0.55	2167	540	0.24919243	0.000705	0.0505774	0.1567	0.3548	350	0.058931

APPENDIX 7-6-2

GOLDEN PLOVER AVOIDANCE RATES

GOLDEN PLOVER
AVOIDANCE RATES

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SUMMARY

This report assesses the evidence for developing a species-specific avoidance rate for wintering Golden Plover populations, and makes recommendations for specifying this rate.

Collision risk modelling for onshore wind farms in Ireland generally follows the latest Scottish Natural Heritage / Natural Scotland avoidance rate guidance. This guidance includes two types of avoidance rates: species-specific avoidance rates; and a default avoidance rate that should be applied to all other species. Based on the latest version of the guidance, the default avoidance rate of 98% applies to wintering Golden Plover populations. However, review of the development of the SNH avoidance rate guidance shows that the default avoidance rate of 98% is not based on any published empirical evidence, the trend is for avoidance rates to increase as more data becomes available, and the guidance does not always reflect the latest evidence on species-specific avoidance rates. Therefore, the lack of a species-specific avoidance rate for Golden Plover in the SNH avoidance rate guidance does not necessarily mean that there is not any robust data available that could be used to develop a species-specific avoidance rate for Golden Plover.

There are reports for four UK wind farms that provide data that can be used to estimate avoidance rates, or which provide their own estimates of avoidance rates, for wintering Golden Plover populations. For three of these wind farms, the collision monitoring methodologies are robust and generally comply with best practice guidance, so the collision fatality estimates can be regarded as reliable. The avoidance rates calculated for the wintering Golden Plover populations at these wind farms range from 99.87-99.98%. For the fourth wind farm, the available information on the collision monitoring methodology was limited, but there may have been some issues with the methodology and results. The avoidance rate for the wintering Golden Plover population given in the relevant reports for this wind farm was 99.6%.

The highest avoidance rate currently recommended by Scottish Natural Heritage / Natural Scotland is 99.8% for geese. The narrow range of the avoidance rate values for wintering Golden Plover populations at the three wind farms with reliable collision fatality estimates would suggest that 99.8% is a suitable avoidance rate for wintering Golden Plover populations. The 99.6% avoidance rate at the other wind farm is lower than this value, although there may be some issues with this avoidance rate. Therefore, I recommend that collision risk modelling for wintering Golden Plover populations use two avoidance rate values: 99.6% and 99.8%. In practice, this will mean two predicted collision rates, with the one calculated with the 99.6% avoidance rate being twice the value of the other calculated with the 99.8% avoidance rate. These predicted collisions will be five times, and ten times, respectively, lower than predicted collisions calculated with the default 98% avoidance rate.

1. INTRODUCTION

This report was commissioned by MKO.

The objective of the report was to assess the evidence for developing a species-specific avoidance rate for wintering Golden Plover populations, and, if appropriate, make recommendations for specifying this rate.

Collision risk modelling for onshore wind farms in Ireland generally follows the latest Scottish Natural Heritage / Natural Scotland avoidance rate guidance (referred to hereafter as the SNH avoidance rate guidance). The latest version of this guidance (SNH, 2018) does not include a species-specific avoidance rate for wintering Golden Plover populations. Therefore, following the SNH avoidance rate guidance would mean that the default 98% avoidance rate should be applied to wintering Golden Plover populations. However, there is apparently robust data available from post-construction monitoring that indicates that a much higher avoidance rate should be applied to wintering Golden Plover populations.

In this report, I first review the development of the SNH avoidance rate guidance and consider whether the history of its development affects the interpretation of the fact that it does not include a species-specific avoidance rate for wintering Golden Plover populations. I then review the methods and results of four post-construction monitoring studies, and use the data from these studies to derive empirical avoidance rates for the wintering Golden Plover population in each study. I then assess the overall weight of evidence for applying a species-specific avoidance rate to wintering Golden Plover populations and make recommendations for avoidance rate values that should be used in collision risk modelling for such populations.

2. THE SNH AVOIDANCE RATE GUIDANCE

2.1. TYPES OF AVOIDANCE RATES

The SNH avoidance rate guidance includes two types of avoidance rates: specific avoidance rates for individual species, or groups of closely-related species (e.g., swans or geese); and a default avoidance rate that should be applied to all other species.

2.2. THE EVOLUTION OF THE SNH AVOIDANCE RATES

The latest version of the SNH avoidance rate guidance (SNH, 2018) includes a default 98% avoidance rate for species not listed in their guidance. However, this default avoidance rate does not appear to have any empirical basis.

In 2000, the first guidance from Scottish Natural Heritage on avoidance rates recommended a precautionary avoidance rate of 95%, which was "based solely on expert opinion and has little or no empirical basis, as no sound, relevant data were available at the time" (SNH, 2010). In 2010, Scottish Natural Heritage updated their guidance on avoidance rates to included species-specific avoidance rates where relevant data was available (SNH, 2010). They also updated the default avoidance rate for other species to 98% because "in the majority of cases where avoidance rates have been derived from empirical data, the avoidance rates are higher than 95%" (SNH, 2010). Further revisions of the SNH avoidance rate guidance were published in 2016 and 2018 (SNH, 2016; 2018). Comparison of the first species-specific avoidance rates published by Scottish Natural Heritage with the latest species-specific avoidance rates (Table 2.1) shows that as the knowledge base has developed there has been an increase in the recommended avoidance rates. Most species-specific avoidance rates are 99% or higher. The only species with species-specific avoidance rates of less than 99% are White-tailed Eagle and Kestrel.

Table 2.1. Species-specific avoidance rates defined in SNH guidance

Species	SNH Guidance	
	2010	2018
Divers	98%	99.5%
Swans	98%	99.5%
Geese	99%	99.8%
Red Kite	98%	99%
Hen Harrier	99%	99%
Golden Eagle	99%	99%
White-tailed Eagle	95%	95%
Kestrel	95%	95%
Skuas	98%	99.5%

Sources: SNH (2010, 2018). Divers: the 2010 guidance gives a species-specific avoidance rate for Red-throated Diver and a default avoidance rate for Black-throated Diver. Swans: the 2010 guidance gives a species-specific avoidance rate for Whooper Swan, and does not provide avoidance rates for other swan species, while the 2018 guidance gives a species-specific avoidance rate for all swan species. Geese: the 2010 guidance gives separate (but identical) species-specific avoidance rates for Greylag, Pink-footed, Greenland White-fronted and Barnacle Geese, while the 2018 guidance gives a single species-specific avoidance rate for all geese species. Skuas: the 2010 guidance gives a single default avoidance rate for all skua species, while the 2018 guidance gives separate (but identical) species-specific avoidance rates for Great Skua and Arctic Skua.

2.3. EXAMPLES OF SPECIES-SPECIFIC AVOIDANCE RATES IN THE SNH AVOIDANCE RATE GUIDANCE

The 95% avoidance rate for White-tailed Eagle is described as being based on: "sufficient evidence from flight behaviour and collision monitoring studies in Norway for vulnerability to collisions; see May *at al.* (2011)" (SNH, 2018). However, this appears to include a citation error as May *at al.* (2011) provides an estimate for a year-round avoidance rate of 98%, with a confidence interval of 95-99%, based on satellite telemetry data. Presumably, the intended citation was May *at al.* (2010), which included an estimated avoidance rate of 95.8%, based on VP survey data,

corrected for the observed wind speed distribution at the study site. This latter reference also included avoidance rates of 97.8% and 97.9% for fixed rotation speeds, and an avoidance rate of 92.5% when the collision risk was modelled using uncertainty levels. The SNH avoidance rate guidance on avoidance rates does not discuss these differing estimates of White-tailed Eagle avoidance rates, and the recommended 95% avoidance rate has remained unchanged since 2010 without any caveats added to reflect the various avoidance rates indicated by the May *at al.* (2010 and 2011) studies.

The 95% avoidance rate for Kestrel is described as being based on: *"*sufficient evidence from flight behaviour (including hovering) and collision monitoring studies for vulnerability to collisions*"* (SNH, 2018). The cited source (Whitfield and Madders, 2006) is, in fact, a review of avoidance rates for Red Kite. The information on Kestrel is derived from an analysis which finds a significant correlation between the *"*numbers of individuals seen*"* against numbers of carcasses found for 16 raptor species at a single wind farm in Spain. Kestrel is a large outlier above the regression line, and this appears to be the only empirical evidence that has been used by SNH to support the 95% avoidance rate for Kestrel. However, even taken at face value, all this analysis does is indicate that Kestrel has a lower avoidance rate than other raptor species, but it does not provide any quantitative data that can be used to estimate the avoidance rate. More seriously, this analysis does not account for behavioural and ecological differences between species that may affect the relationship between recorded bird activity and collisions. It is also subject to the perennial problem with analyses of collision rates: the small absolute numbers of collisions which means that random sampling error may have significant effects.

These two examples show that the species-specific avoidance rates in the SNH avoidance rate guidance do not necessarily reflect all the available evidence (White-tailed Eagle) and can be based on rather sketchy evidence (Kestrel).

2.4. UPDATING THE SNH AVOIDANCE RATE GUIDANCE

The SNH avoidance rate guidance states that *"*it is updated when robust new information becomes available*"* (SNH, 2018). However, while this may be an aspiration, it may not necessarily happen quickly. For example, the SNH avoidance rate guidance currently does not give species-specific avoidance rates for gulls, so the default avoidance rate of 98% applies to all gull species. This guidance refers specifically to onshore wind farms, while separate guidance has been developed for offshore wind farms (JNCC *at al.*, 2014). The latter guidance recommends an avoidance rate of 99.5% for large gulls, based on a review by Cook *at al.* (2014). The discrepancy between the recommended avoidance rates for large gulls between offshore and onshore wind farms, was not addressed until a review by Furness (2019), which was commissioned by SNH. This review recommended that the 99.5% avoidance rate for large gulls at offshore wind farms should also be adopted for onshore wind farms. The review also recommended an avoidance rate of 99.2% for small gulls, which was also based on the data in Cook *at al.* (2014). However, as of June 2022, Scottish Natural Heritage / NatureScot have not updated their guidance on avoidance rates for onshore wind farms to reflect the robust evidence that has been available about species-specific avoidance rates for gulls since at least 2014.

2.5. CONCLUSIONS

The above analysis of the development of the SNH avoidance rate guidance and its treatment of avoidance rates for White-tailed Eagle, Kestrel and gulls, shows that the default avoidance rate of 98% is not based on any published empirical evidence, the trend is for avoidance rates to increase as more data becomes available, and the guidance does not always reflect the latest evidence on species-specific avoidance rates. Therefore, the lack of a species-specific avoidance rate for Golden Plover in the SNH avoidance rate guidance does not necessarily mean that there is not any robust data available that could be used to develop a species-specific avoidance rate for Golden Plover.

3. REVIEW OF GOLDEN PLOVER AVOIDANCE RATES

3.1. SOURCES

I found post-construction monitoring reports for three UK wind farms that provide robust data on Golden Plover collision fatality rates, and, for which, there was appropriate data available that could be used to estimate avoidance rates. These reports were for the Blood Hill Wind Farm (Percival *at al.*, 2008), the Goole Fields I Wind Farm (Percival *at al.*, 2018a) and the Goole Fields II Wind Farm (Percival *at al.*, 2018b, 2019). In addition, information on Golden Plover collision fatality rates and avoidance rates is included in the Habitats Regulations Assessment reports for another UK wind farm site (Haverigg II and III[1]; Percival, 2020a, 2020b), although the reports do not contain sufficient detail to allow full review of the collision monitoring methods and results. Unless otherwise stated, all information and data used in this report for each wind farm was taken from the relevant references cited above.

The characteristics of these wind farms are summarised in Table 3.1.

Table 3.1. Characteristics of the wind farms.

Wind farm	Location	Commissioned	Number of turbines	Hub height (m)	Turbine dimeter (m)
Blood Hill Wind Farm	Norfolk	1992	10	30	27
Goole Fields I	Yorkshire	2014	16	80	92
Goole Fields II	Yorkshire	2016	17	80	92
Haverigg II	Cumbria	1998	4	62.5	42
Haverigg III	Cumbria	2005	4	76	52

Sources: Percival (2020a, 2020 b); Percival *at al.* (2008, 2018a, 2018b, 2019).

3.2. COLLISION MONITORING

3.2.1. Methods

The post-construction monitoring for the Blood Hill and Goole Fields I and II wind farms were carried out by the same consultancy and used the similar methodology for collision monitoring. These included weekly searches for carcasses, and searcher efficiency trials and carcass removal trials (Table 3.2). The weekly carcass searches included detailed searches of radii of 100 m (Blood Hill and Goole Fields I), or 130 m (Goole Fields II) around each turbine, with an additional 250 m scanned for large carcasses (Goole Fields I and Goole Fields II). The carcasses found were left in situ to provide data on searcher efficiency and removal rates. In addition, dedicated searcher efficiency, and carcass removal, trials were carried out at all three wind farms. These involved putting out a number of carcasses. A separate observer then tried to locate these carcasses the same day, while the carcasses were also monitored by trail cameras to investigate removal rates.

Table 3.2. Collision monitoring methods.

Wind farm	Seasons	Search frequency	Search radius	Searcher efficiency / carcass removal trials
Blood Hill	2006/07-2007/08	weekly	100 m	67 carcasses
Goole Fields I	2015/16-2018/19	weekly	100 m detailed search 250 m large carcass search	18 carcasses
Goole Fields II	2017/18-2018/19	weekly	130 m detailed search 250 m large carcass search	48 carcasses

Sources: Percival *at al.* (2008, 2018a, 2018b, 2019).

[1] Haverigg I and II are separate, but adjacent, wind farms. However, the reports combine the data for the two wind farms to calculate a single avoidance rate.

The post-construction monitoring for the Haverigg II and III wind farms was carried out between September 2018 and February 2019, with approximately monthly visits. Detailed information about the methodology of this monitoring was not available to me for this review. However, it included searcher efficiency and carcass removal trials.

3.2.2. Results

No Golden Plover fatalities were recorded at the Blood Hill Wind Farm, single fatalities were recorded at the Goole Fields I and Goole Fields II Wind Farms, and one probable Golden Plover fatality and another probable wader fatality were recorded at the Haverigg II and III Wind Farms (Table 3.3). At Blood Hill, searcher efficiency was very high, and the report notes that conditions were good for searching with winter cereals or bare ploughed ground under the turbines. At Goole Fields I and Goole Fields II, crop growth prevented full coverage of the search area on each visit, with overall coverage levels of 60-88% across the five winters covered at these two wind farms. Searcher efficiency was lower than at Blood Hill but still relatively high.

Table 3.3. Collision monitoring results.

Wind farm	Seasons	Golden Plover / wader fatalities recorded	Coverage	Searcher efficiency	% of carcasses missed due to scavengers
Blood Hill	2006/07	0	100%	> 99%	38%
	2007/08	0	100%		
Goole Fields I	2015/16	1	60%	82%	14%
	2016/17	0	81%		
	2018/19	0	79%		
Goole Fields II	2017/18	1	81%	91%	17%
	2018/19	0	88%		
Haverigg II and III	2018/19	2	no data	93%	33%

All data taken from the relevant reports cited in Section 3.1. The fatalities at Goole Fields I and Goole Fields II were confirmed Golden Plover fatalities. The fatalities at Haverigg II and III were one probable Golden Plover and one probable wader.

3.3. DERIVATION OF AVOIDANCE RATES

3.3.1. Avoidance rate calculations

Table 3.4 shows the predicted number of collisions using the SNH default 98% avoidance rate, the estimated number of collision fatalities, and the empirical avoidance rates for each site. The estimated number of collision fatalities are the actual number of collision fatalities recorded adjusted for coverage, searcher efficiency and carcass removal. Note that the data for Haverigg II and III is a combined estimate for Golden Plover and Curlew. At Blood Hill, Goole Fields I and Goole Fields II, the estimated numbers of collision fatalities were 30-90 times lower than the predicted collisions. The difference was lower at Haverigg II and III, but the estimated numbers of collision fatalities number of collision fatalities was still around six times lower than the predicted collisions. The empirical avoidance rates vary from 99.6% to 99.98%.

For the Blood Hill Wind Farm, there does not appear to be any pre-construction collision risk estimates available. Instead, collision risk estimates were obtained from post-construction vantage point surveys. The reports for the Haverigg II and III Wind Farms were for lifetime extension applications, so the collision risk estimates were also obtained from post-construction vantage point surveys. As noted in the reports, comparison of these estimates with the collision monitoring results may underestimate the avoidance rate, as birds avoiding the wind farm (macro-avoidance) will not be included in the collision risk predictions. However, the monitoring data does not indicate any significant displacement impacts to Golden Plover, so macro-avoidance may not be a significant factor for this species. For the Goole Fields I and Goole Fields II Wind Farms, the post-construction monitoring reports include the pre-construction collision risk predictions from the Environmental Statements for the projects.

No Golden Plover fatalities were recorded in the post-construction monitoring at Blood Hill. However, it would be incorrect to assume a 100% avoidance rate as, where collision rates are low, zero fatalities will be expected in some years ("false negatives"; SNH, 2009). The study by Fijn et al. (2012), which was used by Whitfield and Urquhart (2015) to derive an avoidance rate for Whooper Swan, also did not record any fatalities. To derive an avoidance rate, they assumed that one swan had been killed, and Whitfield and Urquhart (2015) followed that assumption. Therefore, to obtain an avoidance rate estimate for Blood Hill, I used a nominal value of 0.7 Golden Plover fatalities at Blood Hill (equal to one Golden Plover carcass found over two years, corrected for the expected percentage of carcasses missed due to scavenger removal).

Table 3.4. Comparison of collision risk predictions with collision monitoring results.

Wind farm	Predicted collisions (98% avoidance rate) per year	Golden Plover / wader fatalities per year	Avoidance rate
Blood Hill	62	0.7	99.98%
Goole Fields I	56	0.6	99.98%
Goole Fields II	53	1.7	99.94%
Haverigg II and III	28	5.0	99.6%

The data in this table for Haverigg II and III are combined calculations for Golden Plover and Curlew.

The predicted collisions were obtained from the data reported in the post-construction monitoring reports (see Section 3.1). In those reports, the predicted collisions were calculated from post-construction vantage point survey data for Blood Hill and Haverigg II and III, and from pre-construction vantage point survey data for Goole Fields I and Goole Fields II. For Blood Hill, the post-construction monitoring report includes the predicted collisions with an avoidance rate of 0% and the predicted collisions with a 98% avoidance rate were calculated from this figure. For Goole Fields I and Goole Fields II, the post-construction monitoring reports include the predicted collisions with a 99% avoidance rate, and the predicted collisions with a 98% avoidance rate were calculated from these figures.

The Golden Plover / wader fatalities (excluding Blood Hill) were obtained from the data reported in the post-construction monitoring reports (see Section 3.1). In those reports, the Golden Plover / wader fatalities are estimated figures that were calculated from the recorded collisions, adjusted for coverage, searcher efficiency and carcass removal. For Blood Hill, as no Golden Plover fatalities were recorded, a nominal value of 0.7 Golden Plover fatalities is used here to calculate the avoidance rate (see text). For Haverigg II and III, the recorded collisions used for the calculations comprised one probable Golden Plover and one probable wader.

The avoidance rates for Blood Hill, Goole Fields I and Goole Fields II were calculated from the predicted collisions and Golden Plover fatality data provided in the relevant post-construction monitoring reports (see Section 3.1). The avoidance rate for Haverigg II and III is the avoidance rate figure provided in the relevant reports (see Section 3.1).

3.3.2. Correction factors

There are some complicating factors that need to be taken into account in assessing the reliability of the avoidance rate estimates in Table 3.4.

The maps of Golden Plover flightlines in the Blood Hill post-construction monitoring report show a concentration of flightlines in the western section of the 500 m buffer used for the collision risk model, with relatively few flightlines actually crossing the central part of the buffer where the turbines are located. This pattern suggests that the assuming random distribution of flight activity within the 500 m buffer will overestimate the actual collision risk.

For the Goole Fields I and Goole Fields II Wind Farms, the use of pre-construction vantage point survey data for the collision risk predictions means that the accuracy of the avoidance rate estimates is dependent on the pre-construction Golden Plover flight activity being representative of the post-construction Golden Plover flight activity (allowing for any macro-avoidance effects). At Goole Fields II, the mean Golden Plover bird-days/km^2 were around 2.1 times higher in the pre-construction surveys, compared to the post-construction surveys (Figure 15 in Percival *at al.*, 2019), while the mean Golden Plover count within the 600 m buffer zone was around 2.2 times higher during the pre-construction surveys, compared to the post-construction surveys (Table 22 in Percival *at al.*, 2019). These differences seem unlikely to be due to macro-avoidance effects as any displacement impacts to wintering Golden Plover would be likely to be contained within the 600 m buffer zone (and the mean Golden Plover bird-days/km^2 included counts outside the 600 m buffer zone).

The collision risk predictions used for the avoidance rate calculation for the Haverigg II and III Wind Farms used post-construction vantage point survey data. However, this was from a different winter (2014/15) than the winter used for the collision monitoring (2018/19). Therefore, the accuracy of

the avoidance rate estimates is dependent on the Golden Plover flight activity patterns being similar in the two winters.

To allow for the above issues, I have used correction factors of 2.0 for the Blood Hill non-avoidance rate estimate, and 2.15 for the Goole Fields II non-avoidance rate estimate. The correction factor of 2.0 for the Blood Hill non-avoidance rate estimate is based on a visual estimate of differences in flightline densities in the western section of the buffer, compared to the central and eastern sections. The correction factor of 2.15 for the Goole Fields II non-avoidance rate estimate is the mean of the pre-construction / post-construction ratio of Golden Plover bird-days/km^2 and the pre-construction / post-construction ratio of Golden Plover counts within the 600 m buffer zone.

Applying correction factors of 2.0 to the Blood Hill non-avoidance rate estimate, and 2.15 to the Goole Fields II non-avoidance rate estimate, gives corrected avoidance rate estimates of 99.87-99.98%, while sufficient information is not available to assess whether a correction factor should be applied to the 99.6% avoidance rate for Haverigg II and III (Table 3.5).

Table 3.5. Corrected avoidance rate estimates.

Wind farm	Avoidance rate		Correction factor	Reason
	original	corrected		
Blood Hill	99.98%	99.96%	2.0	Uneven distribution of flight activity relative to turbine locations
Goole Fields I	99.98%	99.98%	1.0	-
Goole Fields II	99.94%	99.87%	2.15	Reduction in Golden Plover numbers
Haverigg II and III	99.6%	-	-	No data available to assess whether correction factor is needed (see text)

Note that the correction factor is applied to the non-avoidance rate. See text for further details of the reasons for the avoidance rate correction factors.

4. CONCLUSIONS

The collision monitoring methodologies used in the Blood Hill, Goole Fields I and Goole Fields II post-construction monitoring studies are robust and generally comply with best practice guidance (SNH, 2009). Therefore, I consider that the Golden Plover collision fatality estimates for the Goole Fields I and Goole Fields II Wind Farms from these studies are reliable. The reported zero collision fatality estimate for the Blood Hill Wind Farm does not include any correction for "false negatives" (cf., SNH, 2009), but I have allowed for this by using a nominal estimate in my calculations of avoidance rates.

The avoidance rates derived from these studies are very high, and even when I corrected two of them by doubling the non-avoidance rate to reflect uneven distribution of flight activity (Blood Hill) and apparent reductions in Golden Plover numbers (Goole Fields II), they remain around, or higher than, 99.9%. However, a degree of caution is necessary in applying these figures. Due to the low collision rate, very few collision fatalities are found. This means that random variation in the number of collision fatalities found will can cause significant changes in the avoidance rate estimate. For example, if a second fatality had been found at Goole Fields II, then the corrected avoidance rate estimate would decrease from 99.87%-99.74%. While this change may seem small, it would cause a doubling in the predicted collision risk.

Detailed information about the collision monitoring methodology used for the Haverigg II and III Wind Farms post-construction monitoring study was not available to me for this review. However, I note that there was a lower frequency of monitoring (approximately monthly) compared to the other studies (weekly). This will have made the collision fatality estimate less reliable. The avoidance rate calculation for this wind farm used combined data for Golden Plover and Curlew, while the two collision fatalities were a probable Golden Plover and a probable wader. Also, the avoidance rate calculations used flight activity and collision fatality data from different winters, and, unlike with Goole Fields I and Goole Fields II it was not possible for me to assess whether differences in Golden Plover flight activity patterns between the winters could have affected the calculations[2]. Therefore, it is possible that the significantly lower avoidance rate calculated for this wind farm, compared to the avoidance rates for Blood Hill, Goole Fields I and Goole Fields II, reflects methodological issues.

These avoidance rates are only derived from four studies, with two of these studies carried out at adjoining wind farms. However, these still represent a much stronger evidence base for a species-specific avoidance rate than the evidence used for Kestrel in the SHN avoidance rate guidance (see Section 2.3). Also, other species-specific avoidance rates in the SHN avoidance rate guidance are based on data from limited numbers of sites: e.g., both the White-tailed Eagle avoidance rate (see Section 2.3) and the Whooper Swan avoidance rate (Whitfield and Urquhart, 2015) are based on data from single sites. Therefore, the evidence base for a species-specific avoidance rate is relatively strong for Golden Plover compared to some of the species for which the SNH avoidance rate guidance does include species-specific avoidance rates. The lack of a species-specific avoidance rate for Golden Plover in the SNH avoidance rate guidance may reflect the fact that the conservation concern about Golden Plover and wind farms in Scotland is focussed on breeding populations. Data from wintering populations (such as in the studies reviewed here) may not be applicable to breeding populations due to the differences in their behaviour and ecology.

The highest avoidance rate currently recommended by SNH (2018) is 99.8% for geese. The narrow range of the corrected avoidance rates for Blood Hill, Goole Fields I and Goole Fields II (99.87-99.98%) would suggest that 99.8% is a suitable avoidance rate for wintering Golden Plover populations. The 99.6% avoidance rate at Haverigg II and III is lower than this value, although

[2] Note that, while my assessment of this issue for the Goole Fields II Wind Farm resulted in an increase in the corrected avoidance rate, compared to the original value, it is equally plausible that differences in flight activity between winters could cause a decrease in the corrected avoidance rate, compared to the original value.

there may be some issues with this avoidance rate. Therefore, I recommend that collision risk modelling for wintering Golden Plover populations use two avoidance rate values: 99.6% and 99.8%. In practice, this will mean two predicted collision rates, with the one calculated with the 99.6% avoidance rate being twice the value of the other calculated with the 99.8% avoidance rate. These predicted collisions will be five times, and ten times, respectively, lower than predicted collisions calculated with the default 98% avoidance rate.

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