# Arklow Bank Wind Park 2

## Environmental Impact Assessment Report

Volume III, Appendix 12.7: Offshore Ornithology Technical Report - Migrant Non-Seabird Collision Risk Modelling

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# Arklow Bank Wind Park 2

# Technical Appendix 12.07 Offshore Ornithology

# Migrant Non-Seabird Collision Risk Modelling


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# CONTENTS



## LIST OF TABLES

## GLOSSARY

| Term | Meaning |
|---|---|
| Array Area | The Array Area is the area within which the Wind Turbine Generators (WTGs), the Offshore Substation Platforms (OSPs), and associated cables (export, inter- array and interconnector cabling) and foundations will be installed. |
| p.collision | Probability of collision for a single rotor transit of a turbine. |
| Strategic Ornithological Support Services Migration Assessment Tool | A geographical information system tool that enables estimation of the proportion of migrating bird populations which could encounter offshore wind farms. |

## ACRONYMS

| Term | Meaning |
|---|---|
| BEIS | Department for Business, Energy and Industrial Strategy (United Kingdom) |
| CRM | Collision Risk Model/Modelling |
| GIS | Geographical Information System |
| PCH | Potential Collision Height |
| SNH | Scottish Natural Heritage (acting under its operating name NatureScot) |
| SOSS | Strategic Ornithological Support Services |
| SOSSMAT | Strategic Ornithological Support Services Migration Assessment Tool |

## UNITS

| Unit | Description |
|---|---|
| m/s | Metres per second (flight speed) |

# 1 OFFSHORE ORNITHOLOGY TECHNICAL REPORT – MIGRANT NON-SEABIRD COLLISION RISK MODELLING

## 1.1 Introduction

1.1.1 This Technical Report provides a collision risk assessment for migrant non-seabird species which are considered to have the potential to cross the Array Area of the Arklow Bank Wind Park 2 Offshore Infrastructure (hereafter referred to as 'the Proposed Development') on migration. The assessment uses the data and methods provided in Wright *et al.*, (2012) combined with the migrant extension of the Band (2012) Collision Risk Model (CRM).

1.1.2 Due to differences in the way that terrestrial migrants encounter offshore wind farms compared with seabirds, the alternative modelling approach used here was developed. The primary difference between the migrant model and the seabird model is in how the species exposure to the wind farm is calculated. The seabird model uses densities of birds in flight adjusted to account for various factors such as flight height and nocturnal activity. The migrant model is based on the assumption that seasonal migrants have the potential to fly through a wind farm twice per year in spring and autumn, and then derives estimates of risk using the population size, frontal area of the wind farm relative to the migration front and various biometric values (the latter in the same manner as the seabird model). Further details can be found in Wright *et al.*, (2012).

## 1.2 Methodology

1.2.1 The species considered in this assessment, on the basis of migration routes across the Irish Sea (Wright *et al.*, 2012) are listed in Table 12.7.1.

**Table 12.7.1: Migrant non-seabird species assessed for collision risk.**

| Common name | Scientific name |
|---|---|
| Bar-tailed godwit | *Limosa lapponica* |
| Bewick's swan | *Cygnus columbianus bewickii* |
| Common scoter | *Melanitta nigra* |
| Curlew | *Numenius arquata* (including breeding and non-breeding) |
| Dunlin | *Calidris alpina* (including three sub-species) |
| Gadwall | *Anas strepera* |
| Golden plover | *Pluvialis apricaria* |
| Goldeneye | *Bucephala clangula* |
| Greenland white-fronted goose | *Anser albifrons flavirostris* |
| Greenshank | *Tringa nebularia* |
| Grey plover | *Pluvialis squatarola* |
| Knot | *Calidris canutus* |
| Lapwing | *Vanellus vanellus* |
| Light-bellied brent goose | *Branta bernicla hrota* |
| Mallard | *Anas platyrhynchos* |

| Common name | Scientific name |
|---|---|
| Oystercatcher | *Haematopus ostralegus* (including breeding and non-breeding) |
| Pochard | *Aythya ferina* |
| Redshank | *Tringa totanus* (including two sub-species) |
| Ringed plover | *Charadrius hiaticula* |
| Ruff | *Philomachus pugnax* |
| Sanderling | *Calidris alba* |
| Scaup | *Aythya marila* |
| Shelduck | *Tadorna tadorna* |
| Short-eared owl | *Asio flammeus* |
| Shoveler | *Anas clypeata* |
| Slavonian grebe | *Podiceps auritus* |
| Snipe | *Gallinago gallinago* |
| Teal | *Anas crecca* |
| Tufted duck | *Aythya fuligula* |
| Turnstone | *Arenaria interpres* |
| Whooper swan | *Cygnus cygnus* |
| Wigeon | *Anas penelope* |
| Wood sandpiper | *Tringa glareola* |

1.2.2 Relevant population sizes and migration routes were obtained from the Strategic Ornithological Support Services (SOSS) Migration Assessment Tool (hereafter referred to as SOSSMAT; Wright *et al.*, 2012). The SOSSMAT Geographical Information System (GIS) tool enables estimation of the proportion of migrating populations which could encounter offshore wind farms. The species-specific migration routes were derived by Wright *et al.*, (2012) from a review of literature, and the tool enables identification of those routes which cross user-defined wind farm footprints. The following steps were taken for this assessment:

a) The Array Area was used to filter the SOSSMAT migration routes to identify those which crossed the wind farm site;

b) The sections of the European coastline defined in the SOSSMAT were reviewed and the relevant ones selected (i.e. for the Proposed Development, these were ones which included a start or end point which bordered the southern Irish Sea);

c) Following the above, for each species the SOSSMAT generated a prediction of the percentage of each population which could encounter the Array Area on migration;

d) The total migrant population for each species considered at risk was obtained from Wright *et al.*, (2012) and was multiplied by the percentage at risk (obtained at step 'c') to estimate the number of individuals which could cross the Array Area in each migration period. This was the at-risk population used as input to the CRM. For all species, a highly precautionary assumption was made that all of the migrant population could cross the southern Irish Sea and was therefore at risk of collision (albeit only the proportion estimated to cross the

footprint of the Array Area was entered into the collision calculation, as per step 3). This assumption was made due to the limited evidence available about the proportions of each population which could potentially be at risk. In most cases this is likely to be considerably smaller; and

e) For all the relevant species, it was assumed that there were two migration periods per year (e.g. spring and autumn) and therefore in order to assess risks annually, the at-risk number was doubled.

1.2.3 This assessment considers potential impacts on the wider populations of each species.

1.2.4 Collision mortality was calculated using the migrant extension of the Band (2012) CRM.

1.2.5 Parameters for the CRM, such as the estimated proportion that each species spends flying at Potential Collision Height (PCH), and flight speed, were as presented in Wright et al., (2012) from a review of literature. The total migrant population for each species considered likely to pass through the Array Area are provided in Table 12.7.2 and the species-specific collision parameters are listed in Table 12.7.3

1.2.6 Table 12.7.2 provides an estimate of the total population likely to cross the southern Irish Sea. The percentage of the total population estimated to cross the Array Area, as calculated by the SOSSMAT, is also listed in Table 12.7.2. These percentages were generated from the GIS files included with the tool to enable selection of routes which cross specified areas (in this case the Array Area).

1.2.7 Wind farm specifications are provided in Volume III, Appendix 12.04: Collision Risk Model Input Parameters.

**Table 12.7.2: Percentage of non-seabird migrant routes with potential to cross the Array Area (obtained from SOSSMAT) and Irish Sea migrant population.**

| Common name | SOSSMAT % crossing Array Area | Population size of total migrants (Wright *et al.*, 2012) | Population estimated to cross Array Area |
|---|---|---|---|
| Bar-tailed godwit | 9.34 | 16,280 | 1,520.6 |
| Bewick's swan | 15.58 | 380 | 59.2 |
| Common scoter | 8.32 | 23,190 | 1,929.4 |
| Curlew (breeding) | 8.32 | 107,000 | 8,902.4 |
| Curlew (non-breeding) | 8.32 | 54,650 | 4,546.9 |
| Dunlin (*alpina*) | 10.41 | 88,480 | 9,210.8 |
| Dunlin (*schinzii* and *arctica*) | 8.32 | 1,005,000 | 83,616.0 |
| Gadwall | 8.82 | 630 | 55.6 |
| Golden plover | 8.32 | 166,700 | 13,869.4 |
| Goldeneye | 8.32 | 9,665 | 804.1 |
| Greenland white-fronted goose | 9.59 | 11,340 | 1,087.5 |
| Greenshank | 8.67 | 1,265 | 109.7 |
| Grey plover | 8.32 | 6,315 | 525.4 |
| Knot | 8.32 | 18,970 | 1,578.3 |
| Lapwing | 8.32 | 207,700 | 17,280.6 |
| Light-bellied brent goose | 8.85 | 21,750 | 1,924.9 |
| Mallard | 8.32 | 38,250 | 3,182.4 |
| Oystercatcher (breeding) | 8.33 | 113,000 | 9,412.9 |
| Oystercatcher (non-breeding) | 8.32 | 67,620 | 5,626.0 |
| Pochard | 8.63 | 37,780 | 3,260.4 |
| Redshank (*britannica*) | 8.32 | 135,000 | 11,232.0 |
| Redshank (*robusta*) | 8.32 | 31,090 | 2,586.7 |
| Ringed plover | 8.32 | 14,580 | 1,213.1 |
| Ruff | 11.76 | 800 | 94.1 |
| Sanderling | 8.32 | 6,680 | 555.8 |
| Scaup | 8.66 | 4,430 | 383.6 |
| Shelduck | 8.32 | 14,610 | 1,215.6 |
| Short-eared owl | 8.32 | 7,000 | 582.4 |
| Shoveler | 8.63 | 2,545 | 219.6 |
| Slavonian grebe | 8.32 | 1,100 | 91.5 |
| Snipe | 8.32 | 1,000,000 | 83,200.0 |
| Teal | 8.32 | 45,010 | 3,744.8 |
| Tufted duck | 8.32 | 36,610 | 3,046.0 |
| Turnstone | 8.32 | 11,810 | 982.6 |
| Whooper swan | 8.5 | 12,730 | 1,082.1 |

| Common name | SOSSMAT % crossing Array Area | Population size of total migrants (Wright *et al.*, 2012) | Population estimated to cross Array Area |
|---|---|---|---|
| Wigeon | 8.32 | 82,370 | 6,853.2 |
| Wood sandpiper | 9.52 | 16 | 1.5 |

**Table 12.7.3: Species-specific biometrics and collision model parameters. Note that the probability of collision for a single rotor transit (p.collision) for each species was calculated using the 'single transit collision risk' tab of the Band (2012) CRM spreadsheet. Biometric values were those reported in APEM (2014).**

| Common name | Length (m) | Wingspan (m) | Flight speed (m/s) | PCH | Probability of collision for single rotor transit (p.collision) |
|---|---|---|---|---|---|
| Bar-tailed godwit | 0.38 | 0.75 | 18.30 | 25 | 0.0482 |
| Bewick's swan | 1.27 | 2.11 | 18.50 | 50 | 0.0711 |
| Common scoter | 0.49 | 0.84 | 22.10 | 1 | 0.0492 |
| Curlew | 0.55 | 0.90 | 13.90 | 25 | 0.0558 |
| Dunlin | 0.18 | 0.40 | 15.30 | 25 | 0.0435 |
| Gadwall | 0.51 | 0.90 | 16.90 | 15 | 0.0522 |
| Golden plover | 0.28 | 0.72 | 17.90 | 25 | 0.0465 |
| Goldeneye | 0.46 | 0.72 | 21.20 | 15 | 0.0484 |
| Greenland white-fronted goose | 0.72 | 1.46 | 16.10 | 30 | 0.0597 |
| Greenshank | 0.315 | 0.69 | 14 | 25 | 0.0486 |
| Grey plover | 0.28 | 0.77 | 17.90 | 25 | 0.0468 |
| Knot | 0.24 | 0.59 | 20.10 | 25 | 0.0446 |
| Lapwing | 0.30 | 0.84 | 11.90 | 25 | 0.0503 |
| Light-bellied brent goose | 0.58 | 1.15 | 17.70 | 30 | 0.0542 |
| Mallard | 0.65 | 0.98 | 18.5 | 15 | 0.0544 |
| Oystercatcher | 0.42 | 0.83 | 13.90 | 25 | 0.0520 |
| Pochard | 0.46 | 0.77 | 21.20 | 15 | 0.0487 |
| Redshank | 0.28 | 0.62 | 18.30 | 25 | 0.0466 |
| Ringed plover | 0.19 | 0.52 | 10.60 | 25 | 0.0467 |
| Ruff | 0.3 | 0.58 | 13.6 | 25 | 0.0480 |
| Sanderling | 0.20 | 0.42 | 17.70 | 25 | 0.0435 |
| Scaup | 0.51 | 0.84 | 21.3 | 15 | 0.0498 |
| Shelduck | 0.67 | 1.33 | 15.4 | 15 | 0.0588 |
| Short-eared owl | 0.38 | 1.02 | 13 | 25 | 0.0524 |
| Shoveler | 0.48 | 0.77 | 16.90 | 15 | 0.0511 |
| Slavonian grebe | 0.45 | 0.86 | 13 | 15 | 0.0538 |
| Snipe | 0.27 | 0.47 | 17.1 | 25 | 0.0453 |

| Common name | Length (m) | Wingspan (m) | Flight speed (m/s) | PCH | Probability of collision for single rotor transit (p.collision) |
|---|---|---|---|---|---|
| Teal | 0.36 | 0.61 | 16.90 | 15 | 0.0478 |
| Tufted duck | 0.44 | 0.70 | 21.20 | 15 | 0.0480 |
| Turnstone | 0.23 | 0.54 | 17.70 | 25 | 0.0446 |
| Whooper swan | 1.525 | 2.305 | 17.3 | 50 | 0.0791 |
| Wigeon | 0.48 | 0.80 | 17.10 | 15 | 0.0511 |
| Wood sandpiper | 0.21 | 0.57 | 9.6 | 25 | 0.0490 |

## 1.3 Collision risk estimates

1.3.1 Collision mortality estimates are presented for all species with a range of avoidance rates from 98% to 99.8% (following Scottish Natural Heritage (SNH) acting under its operating name NatureScot (hereinafter referred to as NatureScot) guidance on collision avoidance rates[1]), with the recommended rate for each species highlighted in the grey cells (Table 12.7.4).

**Table 12.7.4: Migrant non-seabird annual collision risks for the Array Area. These include two migrations for each species (i.e. spring and autumn). Grey cells indicate the mortality for most appropriate avoidance rate (i.e. that advised by the UK Statutory Nature Conservation Bodies).**

| Species | Collision Mortality Estimates (for these % avoidance rates) | | | | Collisions as percentage of total migratory population (Table 12.7.2), calculated using the avoidance rates highlighted in grey |
|---|---|---|---|---|---|
| | 98 | 99 | 99.5 | 99.8 | |
| Bar-tailed godwit | 0.4 | 0.2 | 0.1 | 0.0 | 0.0023 |
| Bewick's swan | 0.0 | 0.0 | 0.01 | 0.0 | 0.0028 |
| Common scoter | 0.02 | 0.0 | 0.0 | 0.0 | 0.0001 |
| Curlew (breeding) | 2.5 | 1.3 | 0.6 | 0.3 | 0.0023 |
| Curlew (non-breeding) | 1.3 | 0.6 | 0.3 | 0.1 | 0.0023 |
| Dunlin (*alpina*) | 2.0 | 1.0 | 0.5 | 0.2 | 0.0023 |
| Dunlin (*schinzii* and *arctica*) | 18.4 | 9.2 | 4.6 | 1.8 | 0.0018 |
| Gadwall | 0.01 | 0.0 | 0.0 | 0.0 | 0.0014 |
| Golden plover | 3.3 | 1.6 | 0.8 | 0.3 | 0.0020 |
| Goldeneye | 0.1 | 0.1 | 0.0 | 0.0 | 0.0012 |
| Greenland white-fronted goose | 0.4 | 0.2 | 0.1 | 0.039 | 0.00035 |
| Greenshank | 0.03 | 0.0 | 0.0 | 0.0 | 0.0021 |
| Grey plover | 0.1 | 0.1 | 0.0 | 0.0 | 0.0020 |

[1] https://www.nature.scot/sites/default/files/2018-09/Wind%20farm%20impacts%20on%20birds%20-%20Use%20of%20Avoidance%20Rates%20in%20the%20SNH%20Wind%20Farm%20Collision%20Risk%20Model.pdf

| Species | Collision Mortality Estimates (for these % avoidance rates) | | | | Collisions as percentage of total migratory population (Table 12.7.2), calculated using the avoidance rates highlighted in grey |
|---|---|---|---|---|---|
| | 98 | 99 | 99.5 | 99.8 | |
| Knot | 0.4 | 0.2 | 0.1 | 0.0 | 0.0019 |
| Lapwing | 4.4 | 2.2 | 1.1 | 0.4 | 0.0021 |
| Light-bellied brent goose | 0.6 | 0.3 | 0.2 | 0.063 | 0.00029 |
| Mallard | 0.5 | 0.3 | 0.1 | 0.1 | 0.0014 |
| Oystercatcher (breeding) | 2.5 | 1.2 | 0.6 | 0.2 | 0.0022 |
| Oystercatcher (non-breeding) | 1.5 | 0.7 | 0.4 | 0.1 | 0.0022 |
| Pochard | 0.5 | 0.2 | 0.1 | 0.0 | 0.0013 |
| Redshank (*britannica*) | 2.6 | 1.3 | 0.7 | 0.3 | 0.0020 |
| Redshank (*robusta*) | 0.6 | 0.3 | 0.2 | 0.1 | 0.0020 |
| Ringed plover | 0.3 | 0.1 | 0.1 | 0.0 | 0.0020 |
| Ruff | 0.02 | 0.0 | 0.0 | 0.0 | 0.0029 |
| Sanderling | 0.1 | 0.1 | 0.0 | 0.0 | 0.0018 |
| Scaup | 0.06 | 0.0 | 0.0 | 0.0 | 0.0013 |
| Shelduck | 0.2 | 0.1 | 0.1 | 0.0 | 0.0015 |
| Short-eared owl | 0.2 | 0.1 | 0.0 | 0.0 | 0.0022 |
| Shoveler | 0.03 | 0.0 | 0.0 | 0.0 | 0.0013 |
| Slavonian grebe | 0.015 | 0.0 | 0.0 | 0.0 | 0.0014 |
| Snipe | 19.0 | 9.5 | 4.8 | 1.9 | 0.0019 |
| Teal | 0.5 | 0.3 | 0.1 | 0.1 | 0.0012 |
| Tufted duck | 0.4 | 0.2 | 0.1 | 0.0 | 0.0012 |
| Turnstone | 0.22 | 0.1 | 0.1 | 0.0 | 0.0019 |
| Whooper swan | 0.9 | 0.4 | 0.2 | 0.1 | 0.0017 |
| Wigeon | 1.1 | 0.5 | 0.3 | 0.1 | 0.0013 |
| Wood sandpiper | 0.00038 | 0.0 | 0.0 | 0.0 | 0.0024 |

1.3.2 Even under the highly precautionary assumption that the entire migrant population under consideration for each species could cross the southern Irish Sea, and therefore could be at risk of collisions within the Array Area, for 26 of the 33 species/populations considered, it was estimated that they would be at risk of one or fewer collisions per year: bar-tailed godwit, Bewick's swan, common scoter, gadwall, goldeneye, Greenland white-fronted goose, greenshank, grey plover, knot, light-bellied brent goose, mallard, pochard, redshank (*robusta*), ringed plover, ruff, sanderling, scaup, shelduck, short-eared owl, shoveler, Slavonian grebe, teal, tufted duck, turnstone, whooper swan and wood sandpiper.

1.3.3 Seven species/populations were estimated to be at risk of between one and ten collisions per year: curlew (breeding and non-breeding), dunlin (*alpina*), golden plover, lapwing, oystercatcher (breeding and non-breeding), redshank (*britannica*) and wigeon.

1.3.4 Two species were estimated to be at risk of >10 collisions per year: dunlin (*schinzii* and *arctica*; 18.4 collisions per year) and snipe (19.0 collisions per year).

1.3.5 When compared against the migrant populations (Table 12.7.4) the total annual collisions for all species represented less than 0.01% of the total, and in many cases the percentage was considerably less than this value.

1.3.6 A broad threshold for consideration of the scale of additional mortality for bird populations is to consider how much the estimated mortality will increase the background mortality rate. The UK Statutory Nature Conservation Bodies apply a threshold of 1%: if the increase in background mortality is less than 1% then it is considered to be undetectable against natural variations and a significant impact can be ruled out. If the increase in background mortality exceeds 1% then further consideration is required to understand the magnitude of potential effect (Department for Business, Energy and Industrial Strategy (United Kingdom) (BEIS), 2020).

1.3.7 For all species, the background mortality rate would only be increased by more than 1% due to the predicted annual collision risks if the natural mortality rate was already very low: less than 1% (i.e. the annual survival rate would need to be at least 99%). This is much lower than the natural mortality rates for any of the species assessed, most have natural mortality rates of at least 10% per year. Thus, the estimated collision mortality would only be expected to exceed the 1% threshold if collision risk was more than ten times higher, and even then, that would only be the case for those species with natural mortality rates at the lower end of the range, such as geese and swans.

1.3.8 Consequently, the collision risk predictions for all the migrant non-seabird species included in the assessment would result in undetectable effects on the populations.

## 1.4 References

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