MONA OFFSHORE WIND PROJECT

Preliminary Environmental Information Report

Volume 6, annex 10.4: Offshore ornithology migratory non-seabird collision risk modelling

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FINAL

Image of an offshore wind farm

Document status

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RPS	**Mona Offshore Wind Ltd.**

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Glossary

Term	Meaning
Air Gap	The gap between the mean sea level and the lowest point of a wind turbine rotor blade.
Avoidance	Probability that a bird takes successful evasive action to avoid collision with a wind turbine.
Collision risk	Risk of a bird lethally colliding with a wind turbine within a wind farm.
Collision risk model	A model that calculates collision risk for a species within a wind farm based on a set of wind turbines and bird species specific parameters. Collision risk models can be run deterministically or stochastically.
Large Array Correction	Adjustment to the probability of bird collision to account for the depletion of bird density in later rows of a wind farm with a large array of wind turbines.
Lowest Astronomical Tide	The lowest level of the sea surface with respect to the land.
Maximum Design Scenario	The wind farm design scenario that is considered the worst case from the perspective of collision risk.
Mean Sea Level	The average level of the sea surface with respect to the land.
Ornithology	Ornithology is a branch of zoology that concerns the study of birds.
Parameter	Parameters are the input elements of a model that together affect the output of a model. In collision risk models, examples of parameters are the number of wind turbines and the length of the bird. All input parameters are described in Table 1.3 and Table 1.4.

Units

Unit	Description
MW	Megawatt
km	Kilometres
m	Metres
m/s	Metres per second
cm	Centimetres

Acronyms

Term	Meaning
BTO	British Trust for Ornithology
CRM	Collision Risk Model
EIA	Environmental Impact Assessment
GIS	Geographical Information System
LAT	Lowest Astronomical Tide
MDS	Maximum Design Scenario
MSL	Mean Sea Level
PEIR	Preliminary Environmental Information Report
RPM	Rotations Per Minute
SOSSMAT	Strategic Ornithological Support Services Migration Assessment Tool
SPA	Special Protection Area

1 Migratory non-seabird collision risk modelling technical report

1.1 Introduction

1.1.1.1 During the operations and maintenance phase of the Mona Offshore Wind Project, the turning rotors of the wind turbines may present a risk of collision for birds that cross the Mona Array Area during their migration. Stationary structures, such as the tower, nacelle or when rotors are not operating, are not expected to result in a material risk of collision. When a collision occurs between the turning rotor blade and the bird, it is assumed to result in direct mortality of the bird, which potentially could result in population level impacts.

1.1.1.2 This migratory non-seabird collision risk modelling technical report provides numbers of predicted collisions of migratory non-seabird species (excluding 'true seabirds', gulls, cormorants and divers) based on the species/populations identified to be at risk of crossing the Mona Array Area. The results of collision risk modelling for seabirds are provided in volume 6, annex 10.3: Offshore ornithology non-migratory seabird collision risk assessment technical report of the Preliminary Environmental Information Report (PEIR).

1.2 Study area

1.2.1.1 The Mona Array Area is located approximately 28.2km (15.2 nautical miles (nm)) from the north coast of Wales and 39.9km (21.5nm) from the northwest coast of England (when measured from Mean High Water Springs (MHWS)) (Figure 1.1). The Mona Array Area covers 449.97km^2.

1.2.1.2 There are two study areas for the Mona Offshore Ornithology Environmental Impact Assessment (EIA). These are:

- The Mona Offshore Ornithology Array Area study area: this includes the Mona Array Area plus a buffer extending 4km to 10km (Figure 1.1)

- The Mona Offshore Ornithology Offshore Cable Corridor study area: this encompasses the Mona Offshore Cable Corridor running between the landfall area on the Welsh Coast and the Mona Array Area, plus a 4km buffer (Figure 1.1).

1.2.1.3 Collision risk is an impact associated with the operation of wind turbines and their associated offshore structures. In the assessment of the collision risk to migratory non-seabird species, the number of collisions is therefore predicted across the Mona Array Area only.

Project Name:	Drawing Title:		Geodetic Information:	Data Sources: Client,	Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community	VER	DATE	DETAILS	BY	CHECK
MONA OFFSHORE WIND PROJECT	OFFSHORE ORNITHOLOGY STUDY AREA		Datum: ETRS 1989 Projection: ETRS 1989 UTM Zone 30N Scale@379mmx231mm: 1:401,898			00	24/05/22	Initial Issue	NG	LuM
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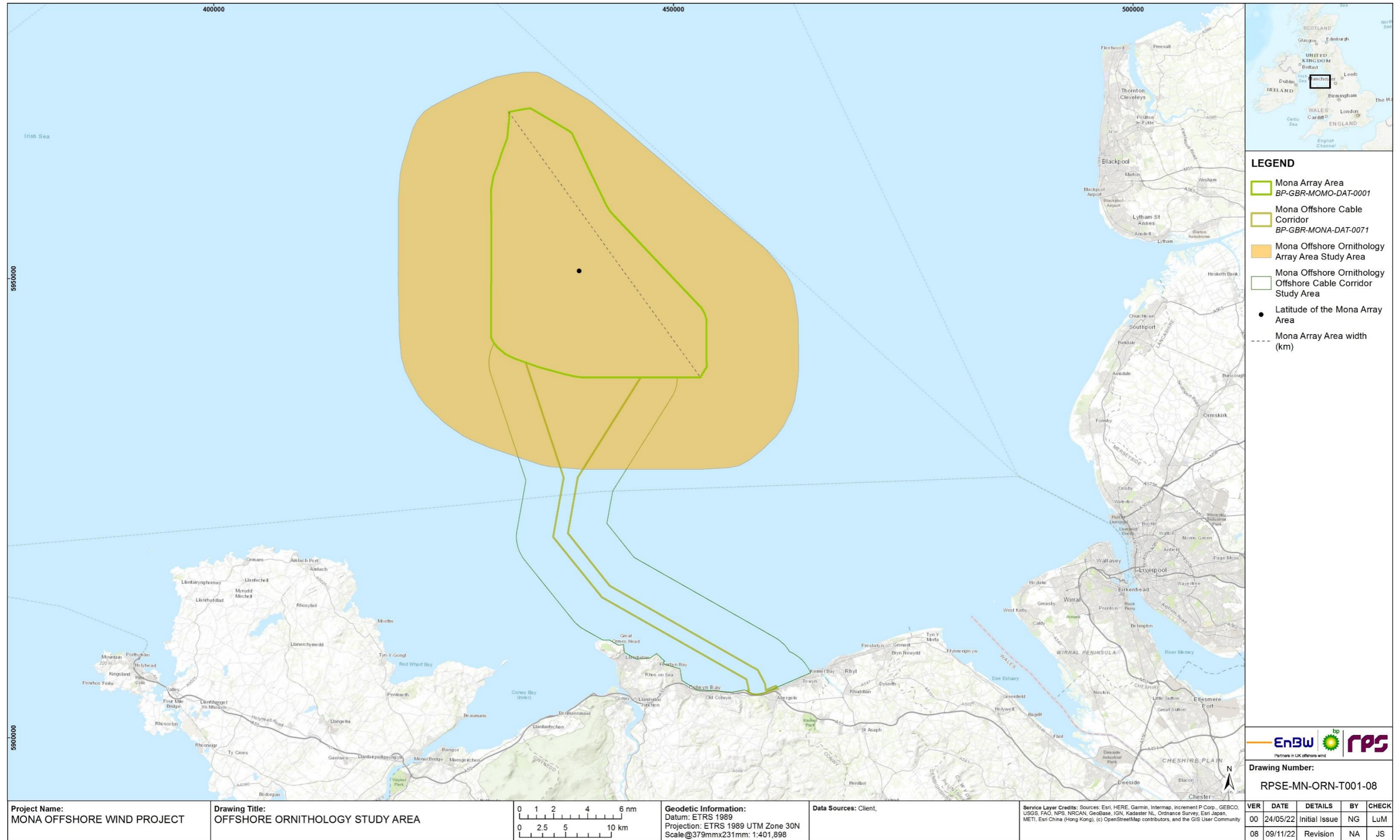**RPSE-MN-ORN-T001-08**

Figure 1.1: Mona Array Area and offshore ornithology study areas.

1.3 Methodology

1.3.1.1 The SOSS Migration Assessment Tool (SOSSMAT) was used to assess the population size of migratory non-seabird species designated as features of the UK Special Protection Area (SPA) network that may cross the Mona Array Area. Instructions are given in Wright *et al.* (2012). The resulting number of birds estimated to cross the Mona Array Area was inputted into the Band (2012) single transit collision risk model.

1.3.2 Selecting connectivity lines with Mona Array Area in SOSSMAT

1.3.2.1 First, the SOSSMAT Geographical Information System (GIS) tool was used to select crossing lines of migration (as identified by Wright *et al.*, 2012) that intersected with the Mona Array Area. According to the sections of the coastline defined in the SOSSMAT tool (Figure 1.2) and the position of the Mona Array Area, a number of migration routes were selected that included a start or end point bordering the Irish Sea in England and Wales. The routes selected are shown in Table 1.1. These routes followed the broad migrating patterns known to occur across the British Isles and are described below:

- Birds from Iceland, Canada and Greenland moving through and overwintering in Ireland

- Birds from the Arctic and sub-Arctic (further to the east) moving through the British Isles and over-wintering in Ireland

- Birds from the Arctic and sub-Arctic moving through Ireland to winter further south (e.g. Spain).

Table 1.1: **Migration routes selected and corresponding SOSSMAT code.**

| SOSSMAT Code	Start Migration	End Migration
EWBEWI	England and Wales Bristol Channel	England and Wales Irish Sea
EWBNIC	England and Wales Bristol Channel	Northern Ireland Celtic Seas coast
EWBSCS	England and Wales Bristol Channel	Scottish mainland Celtic Seas coast
EWINIC	England and Wales Irish Sea	Northern Ireland Celtic Seas coast
EWISCS	England and Wales Irish Sea	Scottish mainland Celtic Seas coast
RIEEWI	Republic of Ireland - Celtic Seas east coast	England and Wales Irish Sea
SPAEWI	Spanish north coast	England and Wales Irish Sea
SPASCS	Spanish north coast	Scottish mainland Celtic Seas coast
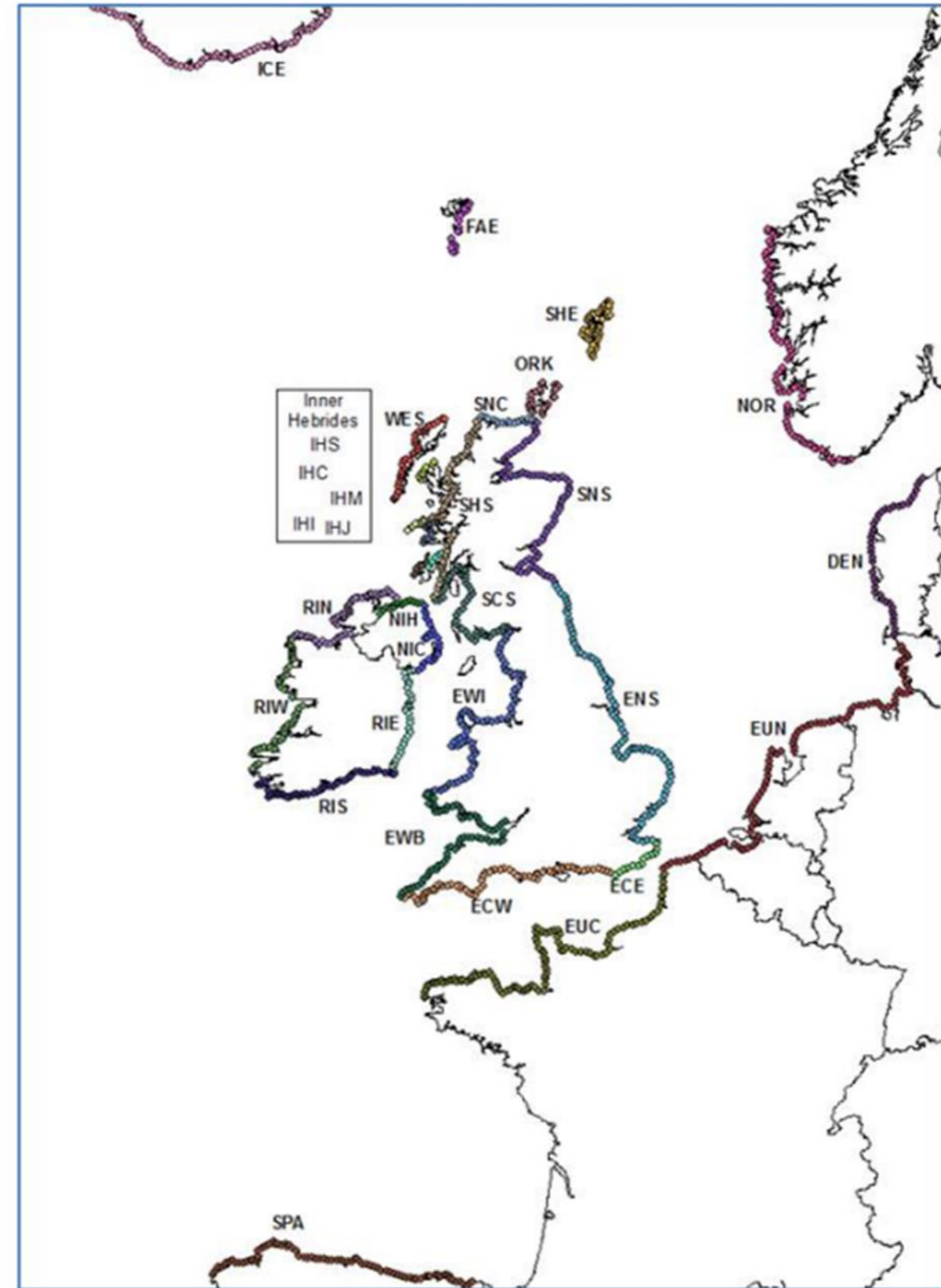
Figure 1.2: **Coastal zones defined for the SOSSMAT. The thirty different coastal zones defined for the purpose of the migration assessment are labelled and shown in different colours in the figure above (Source: Wright *et al.*, 2012).**

1.3.3 Population size and population correction factor

1.3.3.1 The percentage of lines crossing the Mona Array Area was derived for each species known to migrate along the route selected in SOSSMAT. For this assessment, 'true seabirds', all gull species, cormorant and diver species were excluded. In the SOSSMAT worksheets, the number of birds crossing the Mona Array Area was calculated by adding parameters such as population size and population correction factor (% of the population using the relevant sea crossing). Population size estimates are given by Wright *et al.* (2012) and include international population size (Wetlands International, 2012; Birdlife International, 2004), British Population size (Musgrove *et al.*, 2011; Baker *et al.*, 2006) and Irish population size (Crowe *et al.*, 2008).

1.3.3.2 As a precautionary approach, the assumptions in Wright *et al.* (2012) were followed where the scale and magnitude of the migration were unknown. Therefore, in some instances, the entire international population or estimation given by Wright *et al.* (2012) was used. Generally, it was assumed that 100% of the population identified used the migratory route selected except for a few species (Table 1.2). While the assumptions by Wright *et al.* (2012) were followed for Eurasian oystercatcher *Haematopus ostralegus*, some assumptions were made for long-tailed duck *Clangula hyemalis*, merlin *Falco columbarius*, Western osprey *Pandion haliaetus* and Eurasian bittern *Botaurus stellaris* given the lack of evidence and guidance for these species in the SOSSMAT document.

Table 1.2: International name, scientific name, population size, population corrections factor (percent of population estimated to be using relevant sea-crossings), and geographic population selected in the SOSSMAT tool.

International name	Scientific name	Population size	Population correction factor	Population origin
Tundra swan (Bewick's swan)	Cygnus columbianus bewickii	380	100	Ireland
Whooper swan	Cygnus cygnus	12,730	100	Ireland
Greenland white-fronted goose	Anser albifrons flavirostris	11,340	100	Ireland
Light-bellied brent goose (Canadian population)	Branta bernicla hrota	40,000	100	International
Common shelduck	Tadorna tadorna	14,610	100	Ireland
Eurasian wigeon	Mareca penelope	82,370	100	Ireland
Gadwall	Mareca strepera	630	100	Ireland
Eurasian teal	Anas crecca	45,010	100	Ireland
Mallard	Anas platyrhynchos	38,250	100	Ireland
Northern pintail	Anas acuta	1,235	100	Ireland
Northern shoveler	Spatula clypeata	2,545	100	Ireland
Common pochard	Aythya ferina	37,780	100	Ireland

International name	Scientific name	Population size	Population correction factor	Population origin
Tufted duck	Aythya fuligula	36,610	100	Ireland
Greater scaup	Aythya marila	4,430	100	Ireland
Long-tailed duck	Clangula hyemalis	11,000	50	Great Britain
Common scoter	Melanitta nigra	23,190	100	Ireland
Common goldeneye	Bucephala clangula	9,665	100	Ireland
Red-breasted merganser	Mergus serrator	3,390	100	Ireland
Eurasian bittern	Botaurus stellaris	1,200	25	Great Britain
Great crested grebe	Podiceps cristatus	5,385	100	Ireland
Horned grebe (Slavonian grebe)	Podiceps auritus	1,100	100	Great Britain
Hen harrier	Circus cyaneus	100	100	Estimation
Western osprey	Pandion haliaetus	296	50	Great Britain
Merlin	Falco columbarius	49,000	50	International
Corncrake	Crex crex	1,178	100	United Kingdom
Eurasian oystercatcher (breeding)	Haematopus ostralegus	113,000	50	Great Britain
Eurasian oystercatcher (non-breeding)	Haematopus ostralegus	67,720	100	Ireland
Common ringed plover (breeding)	Charadrius hiaticula	5,438	100	Great Britain
Common ringed plover (non-breeding)	Charadrius hiaticula	73,000	100	International
Eurasian dotterel	Charadrius morinellus	1,500	50	Great Britain
European golden plover (breeding)	Pluvialis apricaria	400,000	100	Ireland
European golden plover (non-breeding)	Pluvialis apricaria	166,700	100	Ireland
Grey plover	Pluvialis squatarola	6,315	100	Ireland
Northern lapwing	Vanellus vanellus	207,700	100	Ireland
Red knot	Calidris canutus	18,970	100	Ireland
Sanderling	Calidris alba	6,680	100	Ireland
Purple sandpiper	Calidris maritima	3,300	100	Ireland
Dunlin (sub-species *schinzii* and *arctica*)	Calidris alpina schinzii & C.a.arctica	1,000,500	100	International
Dunlin (sub-species *alpina*)	Calidris alpina alpina	88,480	100	International
Ruff	Philomachus pugnax	1,600	100	Great Britain
Common snipe	Gallinago gallinago	100,000,000	100	Estimation

International name	Scientific name	Population size	Population correction factor	Population origin
Black-tailed godwit (Icelandic race)	*Limosa limosa islandica*	13,880	100	Ireland
Bar-tailed godwit	*Limosa lapponica*	16,280	100	Ireland
Whimbrel	*Numenius phaeopus*	3,840	100	Great Britain
Eurasian curlew (breeding)	*Numenius arquata*	107,000	100	Great Britain
Eurasian curlew (non-breeding)	*Numenius arquata*	54,650	100	Ireland
Common greenshank	*Tringa nebularia*	1,265	100	Ireland
Wood sandpiper	*Tringa glareola*	16	100	Great Britain
Common redshank (breeding)	*Tringa totanus britannica*	38,800	100	United Kingdom/Great Britain
Common redshank (Icelandic race - non-breeding)	*Tringa totanus robusta*	400,000	100	Iceland and Faeroes
Ruddy turnstone	*Arenaria interpres*	11,810	100	Ireland
Short-eared owl	*Asio flammeus*	7,000	100	Great Britain

1.3.4 Collision risk modelling and avoidance rates

1.3.4.1 As recommended in the SOSSMAT guidance, the Band (2012) single transit collision risk model was used. Input parameters for the wind turbine specifications used within the CRM are shown in Table 1.3. These values are based on the Maximum Design Scenario (MDS) parameter values for the worst-case collision risk. Species/populations input parameters are shown in Table 1.4. While species biometrics (length and wingspan) were taken from the BTO BirdFacts resource (Robinson, 2005), flight speeds were taken from Alerstam *et al.* (2007) for most species. For some species (Table 1.3), there were no estimations in Alerstam *et al.* (2007). As such, the same assumptions were followed as those used by Marine Scotland (2014) in their document *Strategic assessment of collision risk of Scottish offshore wind farms to migrating birds.* In this document, flight speed of species for which insufficient evidence existed were derived from species of similar genus and flight characteristics (e.g. European golden plover *Pluvialis apricaria* and American golden plover *Pluvialis dominica*).

1.3.4.2 The CRMs used the proportion flying at rotor height given for species group (e.g. wildfowl, wader etc.) from Wright *et al.* (2012). The at risk-population resulted from the calculations in the SOSSMAT worksheet.

Table 1.3: The Mona Array Area configuration and wind turbines parameters.

[1] In the absence of data in Alerstam *et al.* (2007), the flight speed was from a bird species of a similar genus/group and with similar biometrics (i.e. wingspan and length).

Parameter[a]	Parameter value	Source/Reference
Max. number of wind turbines	107	Volume 6, chapter 10: Offshore ornithology of the PEIR
Number of rotor blades per wind turbine	3	Volume 6, chapter 10: Offshore ornithology of the PEIR
Max. chord width (m)	6.8	Volume 6, chapter 10: Offshore ornithology of the PEIR
Average blade pitch (degrees)	10	Volume 6, chapter 10: Offshore ornithology of the PEIR
Max. rotor radius (m)	125	Volume 6, chapter 10: Offshore ornithology of the PEIR
Average rotation speed (rpm)	6.4	Volume 6, chapter 10: Offshore ornithology of the PEIR
Tidal offset (m) (MSL)	+/- 4	Volume 6, chapter 10: Offshore ornithology of the PEIR
Lower blade tip height above Lowest Astronomical Tide LAT (m)	34	Volume 6, chapter 10: Offshore ornithology of the PEIR
Air gap (MSL) (m)	30	Air gap relative to Mean Sea Level (MSL) allowing for -4m tidal offset between LAT and MSL
Mona Array Area width (km)	35.64	Calculated in RStudio
Latitude	53.70	Calculated in RStudio
Large array correction	YES	Standard procedure

Table 1.4: Species and population parameters used in the Band (2012) single transit collision risk model. Species are ranked according to their taxonomic order.

International name	Length (m)	Wingspan (m)	Flight speed (ms⁻¹)	Proportion at rotor height (%)	Number crossing the Mona Array Area per annum
Tundra swan (Bewick's swan)	1.210	1.960	18.50	50	86
Whooper swan	1.525	2.305	17.30	50	1,482
Greenland white-fronted goose	0.720	1.460	16.10	30	1,569
Light-bellied brent goose (Canadian population)	0.580	1.150	17.70	30	5,309
Common shelduck	0.670	1.330	15.40	15	1,741
Eurasian wigeon	0.480	0.800	20.60	15	9,814

International name	Length (m)	Wingspan (m)	Flight speed (ms⁻¹)	Proportion at rotor height (%)	Number crossing the Mona Array Area per annum
Gadwall	0.510	0.900	18.50	15	82
Eurasian teal	0.360	0.610	19.70	15	5,363
Mallard	0.650	0.980	18.50	15	4,557
Northern pintail	0.580	0.880	20.60	15	147
Northern shoveler	0.480	0.770	18.50	15	318
Common pochard	0.460	0.770	23.60	15	4,718
Tufted duck	0.440	0.700	21.10	15	4,362
Greater scaup	0.510	0.840	21.30	15	556
Long-tailed duck	0.440	0.760	20.30	15	655
Common scoter	0.490	0.840	22.10	1	2,763
Common goldeneye	0.460	0.720	20.30	15	1,152
Red-breasted merganser	0.550	0.780	19.70	15	408
Eurasian bittern	0.750	1.300	8.80	50	141
Great crested grebe	0.480	0.880	18.60	10	775
Horned grebe (Slavonian grebe)	0.450	0.860	18.60	10	131
Hen harrier	0.480	1.100	9.10	50	13
Western osprey	0.560	1.580	13.30	50	29
Merlin	0.280	0.560	10.10	50	2,920
Corncrake	0.280	0.500	10.00	50	148
Eurasian oystercatcher (breeding)	0.420	0.830	13.00	25	6,738
Eurasian oystercatcher (non-breeding)	0.420	0.830	13.00	25	8,068
Common ringed plover (breeding)	0.190	0.520	19.50	25	649
Common ringed plover (non-breeding)	0.190	0.520	19.50	25	8,698
Eurasian dotterel	0.210	0.600	13.70	25	149
European golden plover (breeding)	0.280	0.720	13.70	25	47,658
European golden plover (non-breeding)	0.280	0.720	13.70	25	19,861
Grey plover	0.280	0.770	17.90	25	752

International name	Length (m)	Wingspan (m)	Flight speed (ms⁻¹)	Proportion at rotor height (%)	Number crossing the Mona Array Area per annum
Northern lapwing	0.300	0.840	11.90	25	24,746
Red knot	0.240	0.590	20.10	25	2,260
Sanderling	0.200	0.420	15.30	25	796
Purple sandpiper	0.210	0.440	15.30	25	400
Dunlin (sub-species *schinzii* and *arctica*)	0.180	0.400	15.30	25	119,204
Dunlin (sub-species *alpina*)	0.180	0.400	15.30	25	14,120
Ruff	0.250	0.530	17.40	25	320
Common snipe	0.270	0.470	17.10	25	119,145
Black-tailed godwit (Icelandic race)	0.420	0.760	18.30	25	1,654
Bar-tailed godwit	0.380	0.750	18.30	25	2,372
Whimbrel	0.410	0.820	16.30	25	458
Eurasian curlew (breeding)	0.550	0.900	16.30	25	12,753
Eurasian curlew (non-breeding)	0.550	0.900	16.30	25	6,511
Common greenshank	0.320	0.690	12.30	25	159
Wood sandpiper	0.200	0.560	9.60	25	2
Common redshank (breeding)	0.280	0.620	12.30	25	4,623
Common redshank (Icelandic race - non-breeding)	0.280	0.620	12.30	25	47,658
Ruddy turnstone	0.230	0.540	14.90	25	1,407
Short-eared owl	0.380	1.020	19.10	50	834

1.3.4.3   As birds may avoid the wind farm (through macro, meso or micro avoidance), an avoidance rate must be applied to the collision risk model theoretical predictions. As there is a paucity of species-specific avoidance rates, a range of avoidance rates (i.e. 95.00%, 98.00%, 99.00% and 99.50%) has been applied, as recommended by Band (2012).

1.4 Results

1.4.1 Migratory non-seabird species

1.4.1.1 The species presented in Table 1.4 were considered in the Band (2012) single transit collision risk model. Wader species, which predominately breed in the Arctic and sub-Arctic regions, were estimated to move through the Mona Array Area in the highest numbers. Table 1.5 presents the number of birds crossing the site annually, considering the spring and autumn passage. For all species, it was assumed that there were two migration periods per year (i.e. spring and autumn) through the area.

Table 1.5: Number of each species and percentage % of the population crossing the Mona Array Area per annum. Species are ranked according to their taxonomic order.

International name	No. crossing the Mona Array Area per annum	Percentage of population crossing the Mona Array Area per annum
Tundra swan (Bewick's swan)	86	0.11
Whooper swan	1,482	0.06
Greenland white-fronted goose	1,569	0.07
Light-bellied brent goose (Canadian population)	5,309	0.07
Common shelduck	1,741	0.06
Eurasian wigeon	9,814	0.06
Gadwall	82	0.07
Eurasian teal	5,363	0.06
Mallard	4,557	0.06
Northern pintail	147	0.06
Northern shoveler	318	0.06
Common pochard	4,718	0.06
Tufted duck	4,362	0.06
Greater scaup	556	0.06
Long-tailed duck	655	0.06
Common scoter	2,763	0.06
Common goldeneye	1,152	0.06
Red-breasted merganser	408	0.06
Eurasian bittern	141	0.12
Great crested grebe	775	0.07
Horned grebe (Slavonian grebe)	131	0.06
Hen harrier	13	0.07

International name	No. crossing the Mona Array Area per annum	Percentage of population crossing the Mona Array Area per annum
Western osprey	29	0.10
Merlin	2,920	0.06
Corncrake	148	0.06
Eurasian oystercatcher (breeding)	6,738	0.06
Eurasian oystercatcher (non-breeding)	8,068	0.06
Common ringed plover (breeding)	649	0.06
Common ringed plover (non-breeding)	8,698	0.06
Eurasian dotterel	149	0.10
European golden plover (breeding)	47,658	0.06
European golden plover (non-breeding)	19,861	0.06
Grey plover	752	0.06
Northern lapwing	24,746	0.06
Red knot	2,260	0.06
Sanderling	796	0.06
Purple sandpiper	400	0.06
Dunlin (sub-species *schinzii* and *arctica*)	119,204	0.06
Dunlin (sub-species *alpina*)	14,120	0.08
Ruff	320	0.10
Common snipe	119,145	0.06
Black-tailed godwit (Icelandic race)	1,654	0.06
Bar-tailed godwit	2,372	0.07
Whimbrel	458	0.06
Eurasian curlew (breeding)	12,753	0.06
Eurasian curlew (non-breeding)	6,511	0.06
Common greenshank	159	0.06
Wood sandpiper	2	0.07
Common redshank (breeding)	4,623	0.06
Common redshank (Icelandic race - non-breeding)	47,658	0.06
Ruddy turnstone	1,407	0.06
Short-eared owl	834	0.06

1.4.2 Numbers of collisions predicted using a range of avoidance rates

1.4.2.1 Even assuming a highly precautionary avoidance rate of 95.00%, the numbers of collisions were low and predicted to be below one bird per annum for the majority of species considered (Table 1.6). The number of collisions however exceeded one bird per annum for whooper swan *Cygnus cygnus*, light-bellied brent goose *Branta bernicla hrota*, Eurasian wigeon *Mareca penelope*, merlin *Falco columbarius*, Eurasian oystercatcher, common ringed plover *Charadrius hiaticula*, European golden plover, Northern lapwing *Vanellus vanellus*, dunlin *Calidris alpina*, common snipe *Gallinago gallinago*, Eurasian curlew *Numenius arquata* and common redshank *Tringa totanus*.

1.4.2.2 Because of their breeding population size and migration routes through the Irish Sea, wader species were at the greatest risk of collision. Of the species/populations considered, dunlin and common snipe were predicted to be above 20 collisions per year, with 21 and 23 collisions, respectively (assuming a 95.00% avoidance rate).

1.4.2.3 Of the wildfowl species, the light-bellied brent goose (Canadian population) had the highest predicted number of collisions (1.58, assuming a 95.00% avoidance rate).

1.4.2.4 Other migrant species considered in the assessment were raptors, and this group included merlin, western osprey, short-eared owl *Asio flammeus* and hen harrier *Circus cyaneus*. For those species, there is insufficient information on migratory routes and population size. Therefore, a highly precautionary approach was taken when assuming population size and proportion of population moving through the Irish Sea. The numbers of collisions were predicted to be low, although 1.04 merlin was predicted to collide per annum (assuming a 95.00% avoidance rate). Unlike wader and wildfowl species, the number of raptors species breeding and wintering in Ireland and the United Kingdom is relatively low.

Table 1.6: **Migrant non-seabird annual collision risk for the Mona Array Area using a range of avoidance rates. Species are ranked according to their taxonomic order.**

International name	No. of collision (no avoidance)	95.00 %	98.00 %	99.00 %	99.50 %
Tundra swan (Bewick's swan)	1.13	0.06	0.02	0.01	0.01
Whooper swan	22.61	1.13	0.45	0.23	0.11
Greenland white-fronted goose	10.12	0.51	0.20	0.10	0.05
Light-bellied brent goose (Canadian population)	31.54	1.58	0.63	0.32	0.16
Common shelduck	5.43	0.27	0.11	0.05	0.03
Eurasian wigeon	27.48	1.37	0.55	0.27	0.14
Gadwall	0.22	0.01	0.00	0.00	0.00
Eurasian teal	13.89	0.69	0.28	0.14	0.07
Mallard	13.82	0.69	0.28	0.14	0.07
Northern pintail	0.43	0.02	0.01	0.00	0.00
Northern shoveler	0.87	0.04	0.02	0.01	0.00
Common pochard	13.27	0.66	0.27	0.13	0.07

International name	No. of collision (no avoidance)	95.00 %	98.00 %	99.00 %	99.50 %
Tufted duck	11.94	0.60	0.24	0.12	0.06
Greater scaup	1.58	0.08	0.03	0.02	0.01
Long-tailed duck	1.80	0.09	0.04	0.02	0.01
Common scoter	7.85	0.39	0.16	0.08	0.04
Common goldeneye	3.17	0.16	0.06	0.03	0.02
Red-breasted merganser	1.17	0.06	0.02	0.01	0.01
Eurasian bittern	1.77	0.09	0.04	0.02	0.01
Great crested grebe	1.45	0.07	0.03	0.01	0.01
Horned grebe (Slavonian grebe)	0.25	0.01	0.00	0.00	0.00
Hen harrier	0.13	0.01	0.00	0.00	0.00
Western osprey	0.30	0.02	0.01	0.00	0.00
Merlin	20.83	1.04	0.42	0.21	0.10
Corncrake	1.06	0.05	0.02	0.01	0.01
Eurasian oystercatcher (breeding)	28.41	1.42	0.57	0.28	0.14
Eurasian oystercatcher (non-breeding)	34.02	1.70	0.68	0.34	0.17
Common ringed plover (breeding)	2.58	0.13	0.05	0.03	0.01
Common ringed plover (non-breeding)	34.39	1.72	0.69	0.34	0.17
Eurasian dotterel	0.53	0.03	0.01	0.01	0.00
European golden plover (breeding)	180.61	9.03	3.61	1.81	0.90
European golden plover (non-breeding)	75.27	3.76	1.51	0.75	0.38
Grey plover	3.13	0.16	0.06	0.03	0.02
Northern lapwing	93.24	4.66	1.86	0.93	0.47
Red knot	9.29	0.46	0.19	0.09	0.05
Sanderling	2.85	0.14	0.06	0.03	0.01
Purple sandpiper	1.45	0.07	0.03	0.01	0.01
Dunlin (sub-species *schinzii* and *arctica*)	421.36	21.07	8.43	4.21	2.11
Dunlin (sub-species *alpina*)	49.91	2.50	1.00	0.50	0.25
Ruff	1.25	0.06	0.03	0.01	0.01
Common snipe	468.44	23.42	9.37	4.68	2.34
Black-tailed godwit (Icelandic race)	7.37	0.37	0.15	0.07	0.04
Bar-tailed godwit	10.36	0.52	0.21	0.10	0.05
Whimbrel	1.98	0.10	0.04	0.02	0.01
Eurasian curlew (breeding)	60.57	3.03	1.21	0.61	0.30

International name	No. of collision (no avoidance)	95.00 %	98.00 %	99.00 %	99.50 %
Eurasian curlew (non-breeding)	30.93	1.55	0.62	0.31	0.15
Common greenshank	0.59	0.03	0.01	0.01	0.00
Wood sandpiper	0.00	0.00	0.00	0.00	0.00
Common redshank (breeding)	16.83	0.84	0.34	0.17	0.08
Common redshank (Icelandic race - non-breeding)	173.54	8.68	3.47	1.74	0.87
Ruddy turnstone	5.18	0.26	0.10	0.05	0.03
Short-eared owl	7.60	0.38	0.15	0.08	0.04

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