East Anglia TWO Offshore Windfarm

Appendix 12.3

Supplementary Information for the Cumulative Assessment

Environmental Statement
Volume 3

Applicant: East Anglia TWO Limited
Document Reference: 6.3.12.3
SPR Reference: EA2-DWF-ENV-REP-IBR-000904_003 Rev 01
Pursuant to APFP Regulation: 5(2)(a)

Author: Royal HaskoningDHV
Date: October 2019
Revision: Version 1

Revision Summary				
Rev	**Date**	**Prepared by**	**Checked by**	**Approved by**
01	08/10/2019	Paolo Pizzolla	Julia Bolton	Helen Walker

Description of Revisions			
Rev	**Page**	**Section**	**Description**
01	n/a	n/a	Final for Submission

Table of Contents

Glossary of Acronyms

CRM	Collision Risk Modelling
EOWDC	European Offshore Wind Development Centre
ERM	Environmental Resources Management
ES	Environmental Statement
GGOWF	Greater Gabbard Offshore Wind Farm
NE	Natural England
NV	Norfolk Vanguard
PEIR	Preliminary Environmental Information Report
UK	United Kingdom

Glossary of Terminology

Applicant	East Anglia TWO Limited
East Anglia TWO project	The proposed project consisting of up to 75 wind turbines, up to four offshore electrical platforms, up to one offshore construction operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
East Anglia TWO windfarm site	The offshore area within which wind turbines and offshore platforms will be located.
Evidence Plan Process (EPP)	A voluntary consultation process with specialist stakeholders to agree the approach to the EIA and the information required to support HRA and Appropriate Assessment.
Horizontal directional drilling (HDD)	A method of cable installation where the cable is drilled beneath a feature without the need for trenching.
Inter-array cables	Offshore cables which link the wind turbines to each other and the offshore electrical platforms, this will include fibre optic cables.
Landfall	The area (from Mean Low Water Springs) where the offshore export cables would make contact with land and connect to the onshore cables.
Meteorological mast	An offshore structure which contains metrological instruments used for wind data acquisition.
Marking buoys	Buoys to delineate spatial features / restrictions within the offshore development area.
Offshore cable corridor	This is the area which will contain the offshore export cables between offshore electrical platforms and transition bays located at landfall.
Offshore development area	The East Anglia TWO windfarm site and offshore cable corridor (up to Mean High Water Springs) (described as the ‘order limits‘ within the Development Consent Order).
Offshore electrical platform	A fixed structure located within the windfarm area, containing electrical equipment to aggregate the power from the wind turbines and convert it into a more suitable form for export to shore.
Offshore export cables	The cables which would bring electricity from the offshore electrical platforms to the landfall. These cables will include fibre optic cables.
Offshore construction, operation and maintenance platform	A fixed structure required for construction operation and maintenance personnel and activities.
Offshore platform	A collective term for the offshore construction operation and maintenance platform and the offshore electrical platforms.
Platform link cable	An electrical cable which links one or more offshore platforms, this will include fibre optic cables.
Safety zones	A marine area declared for the purposes of safety around a renewable energy installation or works / construction area under the Energy Act 2004.
Scour protection	Protective materials to avoid sediment being eroded away from the base of the foundations as a result of the flow of water

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12.3 Supplementary Information for the Cumulative Assessment

12.3.1 Introduction

1. This Appendix provides the background information to support the cumulative impact assessment for ***Chapter 12 Offshore Ornithology***.

2. ***Sections 12.3.2*** and ***12.3.3*** provide the audit trail for the cumulative collision risk and cumulative displacement assessments respectively. Given the complexity of the number of projects in the cumulative assessment and the evolution of project envelopes and assumptions over time it is considered that a full explanation of how the cumulative totals have been derived is required.

3. The tables in ***sections 12.3.2*** and ***12.3.3*** therefore provide a species by species, impact by impact account of the mortalities attributable to each project considered, together with the source of information for each project. These numbers are described in terms of both season and annual totals (as appropriate).

4. The numbers used in the assessment are the totals provided in the '***TOTALS FOR CIA***' cell. These numbers are either:

   - The consented total as taken from the Environmental Statement (ES) or subsequent submissions to the consenting process (e.g. materials taken from Planning Inspectorate Examination responses) upon which the consent is based; or
   - The consented total as taken from a varied consent such as a non-material change (England) or a varied marine licence (Scotland). Note that for Neart na Gaoithe and Inch Cape, although the original 2014 consents are still theoretically able to be used, these represent options that would in practice never be taken forward as they are based on uneconomic Rochdale Envelopes. In addition, given that these projects are due to commence construction based on the designs within the new consents it is considered appropriate to use the new consent numbers; or
   - For older projects where the original numbers are unclear from the ES (or were not broken down into the required detail) accepted totals used within Planning Inspectorate Examination responses (in particular Natural England 2013) are used.

5. In addition to the '***TOTALS FOR CIA***' the tables also provide a '***THEORETICAL TOTALS***' cell where appropriate. This theoretical total provides context for those projects for which no 'official' information (i.e. not covered by one of the definitions included in the '***TOTALS FOR CIA***') beyond the original consent is available but for which it is clear that the assumptions from the original assessments have been

superseded. Notes are there provided where it is believed that numbers could be reduced but where there is not sufficient agreement on figures to carry through to the '***TOTALS FOR CIA***'. These projects include:

- Projects which have been constructed differently from, but within the worst case assumptions of, the existing consent but for which no revised consent is available (e.g. Triton Knoll which was consented at 288 wind turbines but is only installing 90, no updated ornithological assessment was provided); and
- Projects where a revised consent is expected but has not been determined (e.g. Seagreen).

6. In these cases, the source for the revised total is provided and the revised figures are presented in parentheses for season and annual totals. These numbers are then used to generate the '***THEORETICAL TOTALS***'.

7. The difference between the '***TOTALS FOR CIA***' and '***THEORETICAL TOTALS***' provides and indication of one of the sources of conservatism and overestimation within the cumulative totals (not withstanding other sources of overestimation such as nocturnal activity or precautionary avoidance rates).

8. ***Table A12.3.1*** summarises the projects used in the cumulative assessment, which version of the project is used and whether an alternative number is available and used in the theoretical total.

Table A12.3.1 Projects used in the Cumulative Assessment

Windfarm	Source of Information and Notes	Theoretical also included
Aberdeen (EOWDC)	Taken from various examination responses	No
Beatrice Demonstrator	Taken from various examination responses	No
Blyth Demonstration	Taken from various examination responses	No
Dudgeon	Based on original consent (168 x 3MW), collison risk modelling (CRM) never officially resubmitted	Yes
Galloper	Based on original consent (140 x 3.6MW), CRM never officially resubmitted	Yes
Greater Gabbard	Taken from various examination responses	Yes
Gunfleet Sands	Taken from various examination responses	No

Windfarm	Source of Information and Notes	Theoretical also included
Humber Gateway	Taken from various examination responses	No
Hywind	Based on ES	No
Kentish Flats	Taken from various examination responses	Yes
Lincs	Taken from various examination responses	No
London Array	Taken from various examination responses	No
Lynn and Inner Dowsing	Taken from various examination responses	No
Race Bank	Taken from various examination responses, based on original consent	Yes
Rampion	Taken from various examination responses, including NE based on original envelope	Yes
Scroby Sands	Taken from various examination responses	No
Sheringham Shoal	Taken from various examination responses, based on original consent	Yes
Teesside	Taken from various examination responses	No
Thanet	Taken from various examination responses	No
Westermost Rough	Taken from various examination responses	No
Beatrice	Taken from various examination responses, based on original consent	Yes
East Anglia ONE	Based on 150 wind turbine non-material change (NMC) consent	Yes
Hornsea Project One	Based on NMC	No
Kincardine	Based on ES	No
Dogger Bank Creyke Beck Projects A and B	Based on NMC	No

Windfarm	Source of Information and Notes	Theoretical also included
Dogger Bank Teesside A and B (now Sofia)	Based on NMC	No
East Anglia THREE	Based on NMC	No
Seagreen Alpha and Bravo	Taken from various examination responses, based on original consent	Yes (based on Inch Cape 2018 assumptions)
Hornsea Project Two	Based on ES	No
Inch Cape	Based on 2018 ES	No
Moray Firth East	Based on original consent, CRM never officially resubmitted	No
Neart na Gaoithe	Based on 2018 ES	No
Triton Knoll	Based on original consent, CRM never officially resubmitted	Yes
Hornsea Project Three	Based on ES	n/a
Moray Firth West	Based on ES	n/a
Norfolk Boreas	Based on ES	n/a
Norfolk Vanguard	Revised CRM with draft height raised by 5m, scenario of half wind turbines in each of NV East and NV West	n/a
Thanet Extension	Based on ES	n/a
East Anglia ONE North	ES	n/a
East Anglia TWO	ES	n/a

12.3.2 Cumulative Collision Risk

12.3.2.1 Gannet

Table A12.3.2 Gannet Cumulative Collision Risk

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
1	Aberdeen (EOWDC)	4.2	5.1	0.1	9.4	(Band, 2012)	2	98.9	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015a).
1	Beatrice Demonstrator	0.6	0.9	0.7	2.2	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016), from (Natural England, 2013).
1	Beatrice	37.4	48.8	9.5	95.7	(Band et al., 2007)	1	98.9	(Royal HaskoningDHV, 2016), calculated from (Arcus Consultancy Services, 2013). This was calculated for 277 turbines, but only 84 were installed. Smart Wind (2015) revises their total to 42 collisions, but it is unclear how these calculations were carried out.
		(22.7)	***(29.6)***	***(5.8)***	***(58.1)***	(Band, 2012)	1	98.9	Recently recalculated at 58.1 birds per year (Macarthur Green and Royal HaskoningDHV, 2019)
1	Blyth Demonstration	3.5	2.1	2.8	8.4	(Band et al., 2007)	1	98.9	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015a).
1	Dudgeon	22.3	38.9	19.1	80.3	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2013). This was calculated for 168 x 3MW turbines.

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
									The site consists of 67 x 6MW turbines. Smart Wind (2015) revises their total to 36.6 collisions, but it is unclear how these calculations were carried out.
		(10.3)	***(18.0)***	***(8.8)***	***(37.1)***	(Band, 2012)	1	98.9	Recently recalculated at 37.1 birds per year (Macarthur Green and Royal HaskoningDHV 2019)
1	Galloper	18.1	30.9	12.6	61.6	(Band et al., 2007)	1	98.9	(Royal HaskoningDHV 2016), from (Smart Wind 2015a). This was calculated for 140 turbines, but the site actually consists of 56 x 6.3MW turbines.
		(7.8)	***(13.4)***	***(5.5)***	***(26.7)***	(Band, 2012)	1	98.9	Recently recalculated at 26.7 birds per year (Macarthur Green and Royal HaskoningDHV 2019).
1	Greater Gabbard	14	8.8	4.8	27.6	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015a). These numbers are also in (Forewind, 2014), which appear to have originated from the EA1 examination. There, NE submitted a table quoting a total of 50 birds at 98% avoidance. The EA1 ES chapter (ERM, 2012) says no birds for

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
									GGOWF, which is repeated in the Technical Report (Banks et al., 2006). The method employed appears to be based on a directional model.
		(13.4)	***(8.4)***	***(4.6)***	***(26.4)***	(Band, 2012)	1	98.9	Recently recalculated at 26.4 birds per year (Macarthur Green and Royal HaskoningDHV 2019).
1	Gunfleet Sands	0	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV 2016), from (Natural England 2013).
1	Humber Gateway	1.9	1.1	1.5	4.5	Unknown	1	98.9	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015a).
1	Hywind	5.6	0.8	0.8	7.2	(Band, 2012)	1	98.9	(Statoil, 2014).
1	Kentish Flats	1.4	0.8	1.1	3.3	(Band, 2012)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2013).
		(1.1)	***(0.7)***	***(0.9)***	***(2.7)***	(Band, 2012)	1	98.9	Recently recalculated at 2.7 birds per year (Macarthur Green and Royal HaskoningDHV 2019).
1	Lincs	2.1	1.3	1.7	5.1	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015a).

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
1	London Array	2.3	1.4	1.8	5.5	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015a).
1	Lynn and Inner Dowsing	0.2	0.1	0.2	0.5	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015a).
1	Race Bank	33.7	11.7	4.1	49.5	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015a). This was calculated for 206 turbines, but the site actually consists of 91 x 6MW turbines.
		(18.0)	***(6.2)***	***(2.2)***	***(26.4)***	(Band, 2012)	1	98.9	Recently recalculated at 26.4 birds per year (Macarthur Green and Royal HaskoningDHV 2019)
1	Rampion	36.2	63.5	2.1	101.8	(Band, 2012) – draft 2011 version	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2013). This was calculated for 175 x 4MW turbines; the site consists of 116 x 3.4MW turbines.
		(25)	***(43.9)***	***(1.5)***	***(70.4)***	(Band, 2012)	1	98.9	Recently recalculated at 70.4 birds per year (Macarthur Green and Royal HaskoningDHV 2019)
1	Scroby Sands	0	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016), from (Natural England, 2013).

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
1	Sheringham Shoal	14.1	3.5	0	17.6	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015a). This was originally carried out using a 108 x 3MW turbine layout, compared with the 88 x 3.6MW turbines that were installed.
		(13.2)	***(3.3)***	***(0)***	***(16.5)***	(Band, 2012)	1	98.9	Recently recalculated at 16.5 birds per year (Macarthur Green and Royal HaskoningDHV 2019)
1	Teeside	4.9	1.7	0	6.6	(Band, 2000)	1	98.9	(Royal HaskoningDHV 2016), from (Smart Wind 2015a).
1	Thanet	1.1	0	0	1.1	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015a).
1	Westermost Rough	0.2	0.1	0.2	0.5	(Band et al., 2007)	1	98.9	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015a).
2	East Anglia ONE	3.4	131	6.3	140.7	(Band, 2012)	1	98.9	(Macarthur Green, 2019a).
		(2.3)	***(88.9)***	***(4.3)***	***(95.5)***	(Band, 2012)	1	98.9	If the 102 wind turbine as in construction is used, annual estimated mortality is 95.5 total.
2	Hornsea Project One	5.0	14.1	9.9	29	(Band, 2012)	2	98.9	(Hornsea Offshore Wind Farm Project One, 2016)

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
2	Kincardine	3	0	0	3	(Band, 2012)	1	98.9	(Pilot Renewables, 2016).
2	Moray Firth East	80.6	35.4	8.9	124.9	(Band, 2012)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2013).
3	Dogger Bank Creyke Beck Projects A and B	66.7	68.7	44.7	180.1	(Band, 2012)	1	98.9	(Royal HaskoningDHV, 2018a).
3	Dogger Bank Teeside A and B (now Sofia)	14.8	8.8	9.4	33	(Band, 2012)	2	98.9	(Innogy Renewables UK, 2018). For now, this is the consented Teeside A and B total with seasonal numbers based on the proportion of the old numbers in each season. This is due to the lack of availability for revised Teeside A numbers. Only small reductions in total anticipated.
3	East Anglia THREE	5.7	31.1	9.0	45.8	(Band, 2012)	1	98.9	(Macarthur Green, 2019b)
3	Hornsea Project Two	7	14	6	27	(Band, 2012)	2	98.9	(Smart Wind, 2015b).
3	Inch Cape	46	1	1	48	(Band, 2012)	1	98.9	(Inch Cape Offshore, 2018).

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
3	Moray Firth West	10	2	1	13	Unknown	Unknown	Unknown	(Macarthur Green, 2019a).
3	Neart na Gaoithe	93	7	7	107	(Band, 2012)	2	98.9	(GoBe Consultants, 2018).
3	Triton Knoll	26.8	64.1	30.1	121	(Band, 2012)	1	98.9	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015a). This was calculated for 288 turbines. The site will consist of 90 turbines. .
		(9.4)	***(22.5)***	***(10.5)***	***(42.4)***	(Band, 2012)	1	98.9	Recently recalculated at 42.4 birds per year (Macarthur Green and Royal HaskoningDHV, 2019)
4	Forth (Seagreen) Alpha and Bravo	800.8	49.3	65.8	915.9	(Band, 2012)	3	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2013).
		Alpha (278) ***Bravo (175)***	***Alpha (11)*** ***Bravo (13)***	***Alpha (12)*** ***Bravo (13)***	***Seagreen Alpha and Bravo (502)***	(Band, 2012)	2	98.9	At the moment, there is nothing in the public domain from Seagreen. Recalculated figures from (Inch Cape Offshore (2018).
4	Hornsea Project Three	18	12	8	38	Unknown	Unknown	Unknown	(Macarthur Green, 2019a).

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
4	Norfolk Boreas	54.13	48.5	14.99	117.62	(Band, 2012)	2	98.9	(Royal HaskoningDHV, 2018b).
4	Norfolk Vanguard	16.97	38.44	10.89	66.3	(Band, 2012)	2	98.9	(Norfolk Vanguard 2019b). Revised CRM with draft height raised by 5m, scenario of half WTGs in each of NV East and NV West
4	Thanet Extension	0	11.1	22.9	34	Unknown	Unknown	Unknown	(Macarthur Green, 2019a).
4	East Anglia ONE North	11.02	12.85	3.4	27.27	(Band, 2012)	2	98.9	(Scottish Power Renewables 2019b)
4	East Anglia TWO	12.66	28.74	5.6	47.02	(Band, 2012)	2	98.9	(Scottish Power Renewables, 2019a).
TOTALS FOR CIA		**1479.4**	**799.6**	**328.0**	**2607.0**	**TOTALS FOR CIA are the numbers used in the CIA, *THEORETICAL TOTALS* show the reductions if as-built/ as planned (but not consented) numbers are used**			
THEORETICAL TOTALS		***1047.4***	***607.2***	***241.6***	***1896.1***				

12.3.2.2 Kittiwake

Table A12.3 3 Kittiwake Cumulative Collision Risk

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
1	Aberdeen (EOWDC)	11.8	5.8	1.1	18.7	(Band, 2012)	2	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015)
1	Beatrice Demonstrator	1.15	2.1	1.7	4.95	(Band, 2000)	1	99.2	(Royal HaskoningDHV, 2016), from (Natural England, 2015).
1	Beatrice	37.66	4.3	15.9	57.86	(Band et al., 2007)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015). This figure is taken directly from NE's Hornsea Project Two document. Based on the previous value (circa 145 from original ES), it seems that this has been corrected to account for the reduction in turbines (277 to 84).
1	Blyth Demonstration	1.69	2.3	1.4	5.39	(Band et al., 2007)	1	98.9	(Royal HaskoningDHV, 2016), based on data from (Natural England, 2015).
1	Dudgeon	0	0	0	0	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015).
1	Galloper	6.29	27.8	31.8	65.89	(Band et al., 2007)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015). This was calculated for 140 turbines, but the site actually consists of 56 x 6.3MW turbines.

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
		(2.1)	***(9.2)***	***(10.5)***	***(21.7)***	(Band, 2012)	1	98.9	Recently recalculated at 21.7 birds per year (Macarthur Green and Royal HaskoningDHV, 2019)..
1	Greater Gabbard	1.1	15	11.4	27.5	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015). The exact origin of this number is unknown
		(0.8)	***(11.1)***	***(8.5)***	***(20.4)***	(Band, 2012)	1	98.9	Recently been recalculated at 20.4 birds per year (Macarthur Green and Royal HaskoningDHV, 2019).
1	Gunfleet Sands	0	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016), from (Natural England, 2013).
1	Humber Gateway	2.55	3.19	1.9	7.64	Unknown	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015).
1	Hywind	16.6	0.85	0.85	18.3	(Band, 2012)	1	98.9	(Statoil, 2014).
1	Kentish Flats	0.6	0.9	0.7	2.2	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015).
1	Lincs	0.92	1.16	0.69	2.77	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015).

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
1	London Array	1.4	2.3	1.8	5.5	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015).
1	Lynn and Inner Dowsing	0	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016), from (Natural England, 2013).
1	Race Bank	1.86	23.9	5.59	31.35	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015).This was calculated for 206 turbines, but the site actually consists of 91 x 6MW turbines.
		(0.8)	***(10)***	***(2.3)***	***(13.1)***	(Band, 2012)	1	98.9	Recently recalculated at 13.1 birds per year (Macarthur Green and Royal HaskoningDHV, 2019).
1	Rampion	54.4	37.4	29.7	121	(Band, 2012) – draft 2011 version	1	98.9	(Royal HaskoningDHV, 2016). This was calculated for 175 x 4MW turbines, but the site consists of 116 x 3.4MW turbines.
		(28.8)	***(19.8)***	***(15.7)***	***(64.1)***	(Band, 2012)	1	98.9	Recently recalculated at 64.1 birds per year (Macarthur Green and Royal HaskoningDHV, 2019)
1	Scroby Sands	0	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016), from (Natural England, 2013).

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
1	Sheringham Shoal	0	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016), from (Natural England, 2013).
1	Teeside	50.58	24	2.5	77.08	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015).
1	Thanet	0.2	0.5	0.4	1.2	(Band, 2000)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015).
1	Westermost Rough	0.18	0.22	0.13	0.53	(Band et al., 2007)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015).
2	East Anglia ONE	46.7	1.5	161.0	209.2	(Band, 2012)	1	98.9	(Macarthur Green, 2019a).
		(24.7)	***(0.8)***	***(85)***	***(110.5)***	(Band, 2012)	1	98.9	If a 102 turbine (as built) layout is used, mortalities 110.5 total.
2	Hornsea Project One	6.9	8.1	3.0	18.0	(Band, 2012)	2	98.9	(Hornsea Offshore Wind Farm Project One, 2016).
2	Kincardine	22	9	3	34	(Band, 2012)	1	98.9	(Pilot Renewables, 2016).
2	Moray Firth East	24.1	2.0	19.3	45.4	(Band, 2012)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015).
3	Dogger Bank Creyke Beck	55.4	25.9	56.7	138	(Band, 2012)	3	98.9	(Royal HaskoningDHV, 2018a).

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
	Projects A and B								
3	Dogger Bank Teeside A and B (now Sofia)	88.7	67.1	202.2	358	(Band, 2012)	2	98.9	(Innogy Renewables UK, 2018).
3	East Anglia THREE	6.1	68.4	37.2	111.6	(Band, 2012)	1	98.9	(Macarthur Green, 2019b)
3	Forth (Seagreen) Alpha and Bravo	153.2	313.5	247.8	714.45	(Band, 2012)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015).
		Alpha (74) ***Bravo (80)***	***Alpha (112)*** ***Bravo (62)***	***Alpha (42)*** ***Bravo (45)***	***Seagreen Alpha and Bravo (415)***	(Band, 2012)	2	98.9	At the moment, there is nothing in the public domain from Seagreen. The recalculated Inch Cape figures (Inch Cape Offshore, 2018).
3	Hornsea Project Two	16	9	3	28	(Band, 2012)	1	98.9	(Smart Wind, 2015b).
3	Inch Cape	40	26	6	72	(Band, 2012)	2	98.9	(Inch Cape Offshore, 2018).
3	Moray Firth West	79	24	7	110	Unknown	Unknown	Unknown	(Macarthur Green, 2019a).

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
3	Neart na Gaoithe	9	17	2	28	(Band, 2012)	2	98.9	(GoBe Consultants, 2018).
3	Triton Knoll	24.6	139	45.4	209	(Band, 2012)	1	98.9	(Royal HaskoningDHV, 2016), from (Natural England, 2015). This was calculated for 288 turbines. The site will consist of 90 turbines.
		(6.8)	***(38.5)***	***(12.6)***	***(57.9)***	(Band, 2012)	1	98.9	Recently recalculated at 57.9 birds per year (Macarthur Green and Royal HaskoningDHV, 2019)
4	Hornsea Project Three	165.3	61.3	11.4	238	Unknown	Unknown	Unknown	(Macarthur Green, 2019a).
4	Norfolk Boreas	29.92	116.59	56.29	202.8	(Band, 2012)	2	98.9	(Royal HaskoningDHV, 2018b).
4	Norfolk Vanguard	43.81	32.93	38.66	115.4	(Band 2012)	2	98.9	(Norfolk Vanguard 2019). Revised CRM with draft height raised by 5m, scenario of half WTGs in each of NV East and NV West
4	Thanet Extension	2.3	5.3	15.3	23.0	Unknown	Unknown	Unknown	(Macarthur Green, 2019a).
4	East Anglia ONE North	18.65	12.05	27.31	57.99	(Band, 2012)	2	98.9	(Scottish Power Renewables 2019b)

Tier	Windfarm	Number of Collisions				Band Model Parameters			Source of Information and Notes
		Breeding	Autumn	Spring	Annual	Iteration	Option	Avoidance Rate	
4	East Anglia TWO	19.77	9.29	20.88	49.93	(Band, 2012)	2	98.9	(Scottish Power Renewables, 2019a).
TOTALS FOR CIA		**1040.4**	**1099.7**	**1071**	**3210.6**	**TOTALS FOR CIA are the numbers used in the CIA, THEORETICAL TOTALS show the reductions if as-built / as planned (but not consented) numbers are used**			
THEORETICAL TOTALS		***970.3***	***805***	***759.9***	***2534.9***				

12.3.2.3 Lesser Black-backed Gull

Table A12.3.4 Lesser Black-backed Gull Cumulative Collision Risk

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
1	Aberdeen (EOWDC)	0	0	0	N/A	N/A	N/A	(Royal HaskoningDHV, 2016).
1	Beatrice Demonstrator	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016), from (E.ON, 2013).
1	Beatrice	0	0	0	N/A	N/A	N/A	(Arcus Consultancy Services, 2013)
1	Blyth Demonstration	0	0	0	N/A	N/A	N/A	(Royal HaskoningDHV, 2016).

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
1	Dudgeon	7.7	30.6	38.3	(Band, 2000)	1	99.5	(Royal HaskoningDHV, 2016), from (E.ON, 2013). This was calculated for 168 x 3MW turbines. The site consists of 67 x 6MW turbines.
		(3.1)	***(12.2)***	***(15.3)***	(Band, 2012)	1	99.5	Recently recalculated at 15.3 birds per year (Macarthur Green and Royal HaskoningDHV, 2019)
1	Galloper	27.8	111.0	138.8	(Band et al., 2007)	1	99.5	(Royal HaskoningDHV, 2016). This was calculated for 140 turbines, but the site actually consists of 56 x 6.3MW turbines.
		(10.5)	***(41.7)***	***(52.2)***	(Band, 2012)	1	99.5	Recently recalculated at 52.2 birds per year (Macarthur Green and Royal HaskoningDHV, 2019).
1	Greater Gabbard	12.4	49.6	62	(Band, 2000)	1	99.5	(Royal HaskoningDHV, 2016), from (E.ON, 2013; Smart Wind, 2015c).
1	Gunfleet Sands	1	1	2	Unknown	Unknown	99	(Royal HaskoningDHV, 2016), from (E.ON, 2013).
1	Humber Gateway	0.3	1.1	1.3	Unknown	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c).
1	Hywind	0	0	0	N/A	N/A	N/A	(Statoil, 2014).

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
1	Kentish Flats	0.3	1.3	1.6	(Band et al., 2007)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c).
1	Lincs	1.7	6.8	8.5	(Band, 2000)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c).
1	London Array	0	0	0	N/A	N/A	N/A	(Royal HaskoningDHV, 2016).
1	Lynn and Inner Dowsing	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016), from (E.ON, 2013).
1	Race Bank	43.2	10.8	54.0	(Band, 2000)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c). This was calculated for 206 turbines, but the site actually consists of 91 x 6MW turbines.
		(20.5)	***(5.1)***	***(25.6)***	(Band, 2012)	1	99.5	Recently recalculated at 25.6 birds per year (Macarthur Green and Royal HaskoningDHV, 2019)
1	Rampion	1.6	6.3	7.9	(Band, 2012) – draft 2011 version	1	99.5	(Royal HaskoningDHV, 2016). This was calculated for 175 x 4MW turbines, but the site consists of 116 x 3.4MW turbines. .
		(1.0)	***(3.8)***	***(4.8)***	(Band, 2012)	1	99.5	Recently recalculated at 4.8 birds per year (Macarthur Green and Royal HaskoningDHV, 2019)
1	Scroby Sands	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016), from (E.ON, 2013).

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
1	Sheringham Shoal	2	6	8	(Band, 2000)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c).
1	Teeside	0	0	0	N/A	N/A	N/A	(Royal HaskoningDHV, 2016).
1	Thanet	3.2	12.8	16	(Band, 2000)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c).
1	Westermost Rough	0.1	0.3	0.3	(Band, 2000)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c).
2	East Anglia ONE	5.9	33.8	39.7	(Band, 2012)	1	99.5	(Macarthur Green, 2019a).
		(3.6)	***(20.7)***	***(24.3)***	(Band, 2012)	1	99.5	If 102 wind turbine in construction calculation is used, mortalities are 24.3 total.
2	Hornsea Project One	4.4	17.4	21.8	(Band, 2012)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c) and (Macarthur Green, 2019a).
2	Kincardine	0	0	0	N/A	N/A	N/A	(Atkins, 2016)
2	Moray Firth East	0	0	0	N/A	N/A	N/A	(Royal HaskoningDHV, 2016).
3	Dogger Bank Creyke Beck Projects A and B	2.6	10.4	13	(Band, 2012)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c). The NMC (Royal HaskoningDHV, 2018a) did not include this species.

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
3	Dogger Bank Teeside A and B (now Sofia)	2.4	9.6	12	(Band, 2012)	2	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c).
3	East Anglia THREE	1.6	7.4	9	(Band, 2012)	1	99.5	(Macarthur Green, 2019b)
3	Forth (Seagreen) Alpha and Bravo	2.1	8.4	10.5	(Band, 2012)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c).
3	Hornsea Project Two	2	2	4	(Band, 2012)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c).
3	Inch Cape	0	0	0	N/A	N/A	N/A	(Royal HaskoningDHV, 2016).
3	Moray Firth West	0	0	0	Unknown	Unknown	Unknown	(Macarthur Green, 2019a).
3	Neart na Gaoithe	0	0	0	(Band, 2012)	1	99.5	(GoBe Consultants, 2018).
3	Triton Knoll	7.4	29.6	37	(Band, 2012)	1	99.5	(Macarthur Green, 2019a).
		(2.3)	***(9.3)***	***(11.6)***	(Band, 2012)	1	99.5	Recently recalculated at 11.6 birds per year (Option 1, 99.5% avoidance) (Macarthur Green and Royal HaskoningDHV, 2019). Proportionally, this is 2.3 breeding and 9.3 non-breeding.

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
4	Hornsea Project Three	17.3	0	17.3	Unknown	Unknown	Unknown	(Macarthur Green, 2019a).
4	Norfolk Boreas	8.02	31.76	39.78	(Band, 2012)	2	99.5	(Royal HaskoningDHV, 2018b).
4	Norfolk Vanguard	15.57	7.47	23.05	(Band, 2012)	2	99.5	(Norfolk Vanguard Ltd, 2019b
4	Thanet Extension	1.5	0.8	2.3	Unknown	Unknown	Unknown	(Macarthur Green, 2019a).
4	East Anglia ONE North	0.95	0.63	1.56	(Band, 2012)	2	99.5	(Scottish Power Renewables, 2019b)
4	East Anglia TWO	4.72	0.46	5.18	(Band, 2012)	2	99.5	(Scottish Power Renewables, 2019a).
TOTALS FOR CIA		**177.8**	**397.3**	**574.9**	**TOTALS FOR CIA are the numbers used in the CIA, *THEORETICAL TOTALS* show the reductions if as-built / as planned (but not consented) numbers are used**			
THEORETICAL TOTALS		***138.8***	***271.0***	***409.5***				

12.3.2.4 Great Black-backed Gull

Table A12.3.5 Great Black-backed Gull Cumulative Collision Risk

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
1	Aberdeen (EOWDC)	0.6	0.4	1.0	(Band, 2012)	2	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c).
1	Beatrice Demonstrator	0	0	0	N/A	N/A	N/A	(Royal HaskoningDHV, 2016).
1	Beatrice	30.2	120.8	151	(Band et al., 2007)	1	99.5	(Arcus Consultancy Services, 2013)
		(26.1)	***(104.5)***	***(130.6)***	(Band, 2012)	1	99.5	Recently recalculated at 130.6 birds per year (Macarthur Green and Royal HaskoningDHV, 2019).
1	Blyth Demonstration	1.3	5.1	6.3	(Band et al., 2007)	1	99.5	(Royal HaskoningDHV, 2016).
1	Dudgeon	0	0	0	N/A	N/A	N/A	(Royal HaskoningDHV, 2016).
1	Galloper	4.5	18	22.5	(Band et al., 2007)	1	99.5	(Royal HaskoningDHV, 2016). This was calculated for 140 turbines, but the site actually consists of 56 x 6.3MW turbines.
		(1.8)	***(7.2)***	***(9.0)***	(Band, 2012)	1	99.5	Recently recalculated at 9.0 birds per year (Macarthur Green and Royal HaskoningDHV, 2019).

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
1	Greater Gabbard	15.0	60.0	75.0	(Band, 2000)	1	99.82	(Royal HaskoningDHV, 2016), from (Banks et al., 2006), verified by (Macarthur Green and Royal HaskoningDHV, 2019).
		(13.4)	***(53.5)***	***(66.9)***	(Band, 2012)	1	99.5	Recently been recalculated at 66.9 birds per year (Macarthur Green and Royal HaskoningDHV, 2019).
1	Gunfleet Sands	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016), from (Smart Wind, 2014).
1	Humber Gateway	1.3	5.1	6.3	Unknown	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2014).
		(0.6)	***(2.3)***	***(2.9)***	(Band, 2012)	1	99.5	Recently recalculated at 2.9 birds per year ((Macarthur Green and Royal HaskoningDHV, 2019).
1	Hywind	0.3	4.5	4.8	(Band, 2012)	1	99.5	(Statoil, 2014).
1	Kentish Flats	0.1	0.2	0.3	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016), from (Smart Wind, 2014).
1	Lincs	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016), from (Smart Wind, 2014).

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
1	London Array	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016), from (Smart Wind, 2014).
1	Lynn and Inner Dowsing	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016).
1	Race Bank	0	0	0	N/A	N/A	N/A	(Royal HaskoningDHV, 2016).
1	Rampion	5.2	20.8	26.0	(Band, 2012) – draft 2011 version	1	99.5	(Royal HaskoningDHV, 2016). This was calculated for 175 x 4MW turbines, but the site consists of 116 x 3.4MW turbines. .
		(3.3)	***(13.4)***	***(16.7)***	(Band, 2012)	1	99.5	Recently recalculated at 16.7 birds per year (Macarthur Green and Royal HaskoningDHV, 2019)
1	Scroby Sands	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016).
1	Sheringham Shoal	0	0	0	Unknown	Unknown	Unknown	(Royal HaskoningDHV, 2016).
1	Teeside	8.7	34.8	43.6	(Band, 2000)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c).
		(5.5)	***(22.0)***	***(27.6)***	(Band, 2012)	1	99.5	Recently recalculated at 27.6 birds per year (Option 1, 99.5% avoidance) (Macarthur Green and Royal HaskoningDHV, 2019).

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
1	Thanet	0.1	0.4	0.5	(Band, 2000)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c).
1	Westermost Rough	0	0	0.1	(Band et al., 2007)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2014).
2	East Anglia ONE	0.5	31.5	32.0	(Band, 2012)	1	99.5	(Macarthur Green, 2016). Seasonal proportions calculated from (Royal HaskoningDHV, 2016).
2	Hornsea Project One	17.2	68.6	85.8	(Band, 2012)	1	99.5	(Royal HaskoningDHV, 2016), based on data from (Natural England, 2015). This was calculated for 332 turbines. The site will consist of 174 turbines once construction is finished (scheduled to be late summer 2019).
2	Kincardine	0	0	0	N/A	N/A	N/A	(Atkins, 2016).
2	Moray Firth East	9.5	25.5	35.0	(Band, 2012)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c).
3	Dogger Bank Creyke Beck Projects A and B	5.8	23.3	29.1	(Band, 2012)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c).
3	Dogger Bank Teeside A and B (now Sofia)	11	26	37	(Band, 2012)	2	99.5	(Smart Wind, 2015c).

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
3	East Anglia THREE	4.3	32.1	36.4	(Band, 2012)	1	99.5	(Macarthur Green, 2019b)
3	Forth (Seagreen) Alpha and Bravo	13.4	53.4	66.8	(Band, 2012)	1	99.5	(Royal HaskoningDHV, 2016).
3	Hornsea Project Two	3	20	23	(Band, 2012)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c) and (Macarthur Green and Royal HaskoningDHV, 2019).
3	Inch Cape	0	36.8	36.8	(Band, 2012)	1	99.5	(Royal HaskoningDHV, 2016), from (Smart Wind, 2015c) and (Macarthur Green and Royal HaskoningDHV, 2019).
3	Moray Firth West	4	5	9	(Band, 2012)	2	99.5	(Moray Offshore Windfarm (West), 2018).
3	Neart na Gaoithe	0	3	3	(Band, 2012)	2	99.5	(GoBe Consultants, 2018).
3	Triton Knoll	24.4	97.6	122.0	(Band, 2012)	1	99.5	(Royal HaskoningDHV, 2016), from (Natural England, 2015). This was calculated for 288 turbines. The site will consist of 90 turbines.
		(8.0)	***(32.1)***	***(40.1)***	(Band, 2012)	1	99.5	Recently recalculated at 40.1 birds per year (Macarthur Green and Royal HaskoningDHV, 2019).
4	Hornsea Project Three	7	25	32	(Band, 2012)	2	99.5	(NIRAS Consulting, 2019), (Macarthur Green and Royal HaskoningDHV, 2019).

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
4	Norfolk Boreas	7.75	85.35	93.11	(Band, 2012)	2	99.5	(Royal HaskoningDHV, 2018b).
4	Norfolk Vanguard	8.09	39.25	46.84	(Band, 2012)	2	99.5	(Norfolk Vanguard Ltd 2019b)
4	Thanet Extension	2	20	22	(Band, 2012)	2	99.5	(APEM, 2018; Macarthur Green and Royal HaskoningDHV, 2019)
4	East Anglia ONE North	3.92	1.28	5.2	(Band, 2012)	2	99.5	(Scottish Power Renewables, 2019b)
4	East Anglia TWO	3.84	3.73	7.56	(Band, 2012)	2	99.5	(Scottish Power Renewables, 2019a).
TOTALS FOR CIA		**193.0**	**867.5**	**1060.0**	**TOTALS FOR CIA are the numbers used in the CIA, THEORETICAL TOTALS show the reductions if as-built / as planned (but not consented) numbers are used**			
THEORETICAL TOTALS		***154.5***	***713.9***	***868.0***				

12.3.2.5 Herring Gull

Table A12.3.6 Herring Gull Cumulative Collision Risk

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
1	Aberdeen (EOWDC)	4.8	0	4.8	(Band, 2012)	1	99.5	(Macarthur Green, 2019a).
1	Beatrice Demonstrator	0	0	0	Unknown	Unknown	Unknown	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019)
1	Beatrice	26.1	104.4	130.6	(Band, 2012)	1	99.5	(Macarthur Green and Royal HaskoningDHV, 2019), based on as-built scenario of 84 turbines as opposed to 140 consented.
1	Blyth Demonstration	7.9	34.5	42.4	(Band, 2012)	1	99.5	(Macarthur Green and Royal HaskoningDHV, 2019), based on consented scenario of 15 turbines as opposed to 5 as built.
1	Dudgeon	0	0	0	N/A	N/A	N/A	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019).
1	Galloper	10.4	0	10.4	(Band, 2012)	1	99.5	(Macarthur Green and Royal HaskoningDHV, 2019), based on as-built scenario of 56 turbines as opposed to 140 consented.
1	Greater Gabbard	0	0	0	Unknown	Unknown	Unknown	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019)
1	Gunfleet Sands	0	0	0	Unknown	Unknown	Unknown	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019)

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
1	Humber Gateway	0.2	0.5	0.7	(Band, 2012)	1	99.5	(Macarthur Green and Royal HaskoningDHV, 2019), based on as-built scenario of 73 turbines as opposed to 83 consented (but larger rotor swept area).
1	Hywind	0.6	7.8	8.4	(Band, 2012)	1	99.5	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019; Statoil, 2014).
1	Kentish Flats	0.5	1.7	2.2	(Band, 2012)	1	99.5	(Macarthur Green, 2019a)
1	Lincs	0	0	0	Unknown	Unknown	Unknown	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019)
1	London Array	0	0	0	N/A	N/A	N/A	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019).
1	Lynn and Inner Dowsing	0	0	0	N/A	N/A	N/A	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019).
1	Race Bank	0	0	0	N/A	N/A	N/A	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019).
1	Rampion	48	48	96	(Band, 2012)	1	99.5	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019).
1	Scroby Sands	0	0	0	N/A	N/A	N/A	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019).

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
1	Sheringham Shoal	0	0	0	N/A	N/A	N/A	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019).
1	Teeside	5.2	20.7	26.0	(Band, 2012)	1	99.5	(Macarthur Green and Royal HaskoningDHV, 2019), based on as-built scenario of 27 turbines as opposed to consented 30 turbines.
1	Thanet	2.5	9.9	12.3	(Band, 2012)	1	99.5	(Macarthur Green and Royal HaskoningDHV, 2019), based on as-built scenario of 100 turbines as opposed to 60 consented (but larger rotor swept area).
1	Westermost Rough	0.1	0	0.1	(Band, 2012)	1	99.5	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019).
2	East Anglia ONE	0	28	28	(Band, 2012)	1	99.5	(Macarthur Green, 2019a)
2	Hornsea Project One	2.9	11.6	14.5	(Band, 2012)	1	99.5	(Macarthur Green, 2019a)
2	Kincardine	1	0	1	(Band, 2012)	1	99.5	(Atkins, 2016; Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019).
2	Moray Firth East	52	0	52	N/A	N/A	N/A	Norfolk Vanguard ltd (2019a)

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
3	Dogger Bank Creyke Beck Projects A and B	0	0	0	N/A	N/A	N/A	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019).
3	Dogger Bank Teeside A and B (now Sofia)	0	0	0	N/A	N/A	N/A	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019).
3	East Anglia THREE	0	0	24	(Band, 2012)	1	99.5	(Macarthur Green, 2016).
3	Forth (Seagreen) Alpha and Bravo	10	21	31	(Band, 2012)	1	99.5	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019).
3	Hornsea Project Two	23.8	0	23.8	(Band, 2012)	1	99.5	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019).
3	Inch Cape	1	1	2	(Band, 2012)	1	99.5	(Inch Cape Offshore, 2018).
3	Moray Firth West	12	1	13	(Band, 2012)	1	99.5	(Moray Offshore Windfarm (West), 2018)
3	Neart na Gaoithe	2	4	6	(Band, 2012)	1	99.5	(GoBe Consultants, 2018)
3	Triton Knoll	0	0	0	N/A	N/A	N/A	(Macarthur Green, 2019a; Macarthur Green and Royal HaskoningDHV, 2019).

Tier	Windfarm	Number of Collisions			Band Model Parameters			Source of Information and Notes
		Breeding	Non-breeding	Annual	Iteration	Option	Avoidance Rate	
4	Hornsea Project Three	0	22.7	22.7	(Band, 2012)	2	99.5	(Macarthur Green, 2019b)
4	Norfolk Boreas	1.18	17.26	18.44	(Band, 2012)	1	99.5	(Royal HaskoningDHV, 2018b)
4	Norfolk Vanguard	0.76	12.69	13.45	(Band, 2012)	2	99.5	(Norfolk Vanguard Ltd 2019b
4	Thanet Extension	5	9	14	(Band, 2012)	2	99.5	(APEM, 2018).
4	East Anglia ONE North	0	0	0	(Band, 2012)	1	99.5	(Scottish Power Renewables, 2019b)
4	East Anglia TWO	0	0.52	0.52	(Band, 2012)	1	99.5	(Scottish Power Renewables, 2019a)
TOTALS FOR CIA		**217.9**	**356.3**	**598.3**	**TOTALS FOR CIA are the numbers used in the CIA, *THEORETICAL TOTALS* show the reductions if as-built / as planned (but not consented) numbers are used**			
THEORETICAL TOTALS		***N/A***	***N/A***	***N/A***				

12.3.3 Cumulative Displacement Risk

12.3.3.1 Red-throated Diver

12.3.3.1.1 Standard Assessment

9. **Table A12.3.7** below summarises the red-throated diver assessments that have been carried out for offshore wind farms in the Southern North Sea BDMPS area (Furness 2015). The information is taken from Norfolk Boreas Ltd (2019) and excludes former East Anglia Zone windfarms.

Table A12.3.7 Red-throated Diver Assessments in the Southern North Sea

Windfarm	Red-throated diver assessment method	Estimated no. of red-throated diver mortalities due to displacement	Source
Scroby Sands	None	No number presented	Nprfolk Boreas Ltd 2019
Kentish Flats	Qualitative	No number presented	Norfolk Boreas Ltd 2019
Lynn & Inner Dowsing	Qualitative	No number presented	Norfolk Boreas Ltd 2019
Gunfleet Sands	Qualitative	very small'	Norfolk Boreas Ltd 2019
Thanet	Quantitative	<1-2	Norfolk Boreas Ltd 2019
Sheringham Shoal	None	No number presented	Norfolk Boreas Ltd 2019
Greater Gabbard	Quantitative	4-40	Norfolk Boreas Ltd 2019
London Array	Qualitative	No number presented	Norfolk Boreas Ltd 2019
Lincs	Qualitative	No number presented	Norfolk Boreas Ltd 2019
Kentish Flats Extension	Qualitative	No number presented	Norfolk Boreas Ltd 2019
Galloper	Quantitative	1-14	Norfolk Boreas Ltd 2019
Dudgeon	Not assessed	No number presented	Norfolk Boreas Ltd 2019

Windfarm	Red-throated diver assessment method	Estimated no. of red-throated diver mortalities due to displacement	Source
Race Bank	Not assessed	No number presented	Norfolk Boreas Ltd 2019
Triton Knoll	Not assessed	No number presented	Norfolk Boreas Ltd 2019
Thanet Extension	Quantitative	1-9	Norfolk Boreas Ltd 2019
Dogger Bank Creyke Beck A & B	Not assessed	No number presented	Norfolk Boreas Ltd 2019
Dogger Bank Teesside A / Sofia	Not assessed	No number presented	Norfolk Boreas Ltd 2019
Blyth Demonstrator	Not assessed	No number presented	Norfolk Boreas Ltd 2019
Teesside	Not assessed	No number presented	Norfolk Boreas Ltd 2019
Westermost Rough	Not assessed	No number presented	Norfolk Boreas Ltd 2019
Humber Gateway	Not assessed	No number presented	Norfolk Boreas Ltd 2019
Hornsea Project 1	Not assessed	No number presented	Norfolk Boreas Ltd 2019
Hornsea Project 2	Not assessed	No number presented	Norfolk Boreas Ltd 2019
Hornsea Project 3	Not assessed	No number presented	Norfolk Boreas Ltd 2019

10. ***Table A12.3.8*** below presents estimated cumulative displacement mortality of red-throated divers at offshore windfarms within the Southern North Sea BDMPS region (Furness 2015), on the bases of the precautionary assumption of 90-100% displacement within the windfarm and 4km buffer and 1-10% mortality of displaced individuals.

Table A12.3.8 Estimated Cumulative Displacement Risk of Red-Throated Divers At Offshore Wind Farms within the Southern North Sea BDMPS Region

Windfarm	Number of birds at risk of displacement mortality (wind farms and 4km buffers) Autumn Migration	Winter	Spring Migration	Annual	Source of Information
Wider region projects (see table above)	N/A	N/A	N/A	6 – 56	Norfolk Boreas Ltd 2019
Thanet Extension	0	4 - 43	2 – 26	6 - 69	Norfolk Boreas Ltd 2019
East Anglia ONE	0.4 - 5	1 - 10	1.4 - 15	2.8 - 30	Norfolk Boreas Ltd 2019
East Anglia THREE	0.4 - 5	0.2 – 2	2 - 20	2.6 - 27	Norfolk Boreas Ltd 2019
Norfolk Vanguard East	0.4 - 5	0.2 - 3	1 - 12	1.6 - 20	Norfolk Boreas Ltd 2019
Norfolk Vanguard West	0 – 3	3 - 36	2 – 20	5 – 59	Norfolk Boreas Ltd 2019
Norfolk Boreas	0 - 1	1 - 15	5 - 62	6 – 78	Norfolk Boreas Ltd 2019
East Anglia ONE North	0 - 1	1 - 7	3 - 34	4 - 42	Scottish Power Renewables 2019b
East Anglia TWO	0	0 - 2	2 - 25	3 - 28	Chapter 12, Table 12.36
Totals	1.2 – 20	10.4 – 118	18.4 – 214	37 - 409	

12.3.3.1.2 Context for Assessment using SeaMAST Dataset

11. The Seabird Mapping and Sensitivity Tool (SeaMAST) (Bradbury et al., 2014) provides a common dataset covering the majority of English waters, describing seabird densities in 3x3km squares using both boat-based and visual aerial surveys. This dataset was used to assess the potential relative contribution of UK OWFs in the southern North Sea to displacement of red-throated divers during the non-breeding season. The remainder of this document describes work undertaken to achieve this, which was based on a similar exercise previously undertaken for the Thanet Extension OWF (APEM 2019).

12. The "BDMPS_Non_Breeding_Boat_Plus_Aerial_D" SeaMAST dataset was selected to describe red-throated diver densities during the non-breeding season (henceforth referred to as "the SeaMAST dataset"). This dataset provides estimated seabird non-breeding season densities (sitting and flying birds summed) from a density surface model (DSM) of Wildfowl and Wetlands Trust (WWT) visual aerial survey data collected between 2001 - 2011, and JNCC European Seabirds At Sea (ESAS) boat-based survey data collected between 1979 - 2011.

13. The Table below includes all UK offshore wind farms in the North Sea. Most wind farm boundaries were obtained from the Crown Estate, with any known changes to site boundaries accounted for prior to data processing. All 3x3 km grid squares that had been allocated the value "-99", indicating a low confidence in the density generated by the DSM for that square, were excluded from the analysis. This led to a number of wind farms in English waters being excluded from the analysis as no abundance data were available. These were Dudgeon, Hornsea Projects One, Two and Three, Dogger Bank Creyke Beck A and B, Sofia, Teeside A and Triton Knoll. As the SeaMAST dataset does not include Scottish Territorial Waters, Scottish OWFs in the North Sea (i.e. Aberdeen (EOWDC), Beatrice, Beatrice Demonstrator, Hywind, Kincardine, Seagreen Alpha and Bravo, Inch Cape and Neart na Gaoithe) were not included in the assessment.

14. The red-throated diver non-breeding season is defined as September to February (Furness, 2015; WWT Consulting, 2015), and the SeaMAST dataset included data collected throughout this time period. As the SeaMAST dataset is a collation of available data, which at the time was not collected for the purpose of a wider regional analysis, across some areas, survey effort may have occurred disproportionally over particular months or seasons depending on the original purpose of the surveys. The red-throated diver non-breeding season was further subdivided by Furness (2015) into post-breeding migration (September to November), migration-free winter season (December to January) and return migration (February to April). During the two migration seasons, the north-western and south-western North Sea areas are considered to hold a single

population of red-throated divers. During the migration-free winter season, it is considered that the north-western and south-western North Sea area populations are separate (Furness, 2015).

15. To calculate the number of red-throated divers occurring within a given area, the red-throated diver density for each grid square was converted to an abundance by multiplying density by area. For areas inside wind farm red line boundaries, the SeaMAST dataset encompassing the area of interest was clipped to the boundary of each wind farm. When repeating the exercise for the 4km OWF buffers, where there were instances of overlap between the buffers, and sometimes other OWFs, a system was devised to allocate red-throated divers to a particular OWF based on the tiered system for CIA based on advice from UK SNCBs (Scottish Power Renewables, 2016).

16. For overlapping OWFs and buffers occurring within tiers 1 and/or 2 (e.g. Greater Gabbard and Galloper OWFs), buffers were amalgamated into a single polygon. Where a similar situation occurred for OWFs in tier 3 or above, OWF red line boundaries were prioritised over buffers. For overlapping buffers within the same tier, the abundance of red-throated divers within the overlapping area was calculated and split equally between the two buffers.

17. The results of this assessment are presented in the tables below. It should be noted that recent advice from Natural England is that digital aerial surveys are considered the new standard for monitoring this red-throated divers. Large increases in the numbers of red-throated divers recorded within the Outer Thames estuary SPA in 2013 and 2018 (Irwin et al. 2019), compared with the population as estimated at the time of designation in 2010, were thought to reflect these improved survey techniques. Natural England's view was that previous survey methods (i.e. boat based and visual aerial surveys) had under-estimated the numbers present in the SPA. Thus the SEaMAST data set is based on survey methods which may underestimate the numbers of red-throated divers present. Population estimates presented in the table below for offshore windfarms and 4km buffers are therefore likely to be underestimates, and thus are not intended to provide robust estimates, but a basis for comparison of the relative numbers and proportions of birds in each offshore wind farm in relation to the estimated population in the reference area. The reference area was based on the South Western North Sea biogeographic area, as identified by Furness (2015). The reference population size used here for the non-breeding season was 19,978 based on the SeaMAST data set (not the BDMPS estimate for the winter period for the South West North Sea, as presented in Furness 2015).

Table A12.3.9 Estimated Cumulative Displacement Risk of Red-throated Divers for UK offshore wind farms in the North Sea

Tier	Windfarm	% of Reference Population (OWF)	OWF Red-throated Diver Abundance	% of Reference Population (4km Buffer)	4km Buffer Red-throated Diver Abundance	Total Site % Of Reference Population	Total Site Abundance	Notes
1	Aberdeen (EOWDC)	-	-	-	-	-	-	Scottish Territorial Waters - not included
1	Beatrice Demonstrator	-	-	-	-	-	-	Scottish Territorial Waters - not included
1	Blyth Demonstration	0.000	0.044	0.003	0.534	0.003	0.577	Site consists of three polygons; 4km buffers amalgamated
1	Dudgeon							Beyond extent of viable SeaMAST data - not included
1	Greater Gabbard & Galloper	0.177	35.404	0.390	77.930	0.567	113.334	4km buffer overlap with East Anglia TWO; Greater Gabbard/Galloper prioritised
1	Gunfleet Sands	0.270	54.038	2.439	487.209	2.709	541.246	-
1	Humber Gateway	0.000	0.079	0.004	0.744	0.004	0.823	-
1	Hywind	-	-	-	-	-	-	Scottish Territorial Waters - not included
1	Kentish Flats	0.243	48.552	1.721	343.744	1.964	392.296	-
1	London Array	1.689	337.438	5.832	1165.117	7.521	1502.555	-

Tier	Windfarm	% of Reference Population (OWF)	OWF Red-throated Diver Abundance	% of Reference Population (4km Buffer)	4km Buffer Red-throated Diver Abundance	Total Site % Of Reference Population	Total Site Abundance	Notes
1	Lincs, Lynn and Inner Dowsing	0.015	3.075	0.092	18.419	0.108	21.495	-
1	Race Bank	0.003	0.672	0.014	2.700	0.017	3.372	Northeastern edge of buffer not covered by SeaMAST data
1	Scroby Sands	0.048	9.661	0.400	79.961	0.449	89.622	-
1	Sheringham Shoal	0.000	0.097	0.003	0.588	0.003	0.685	Northern section of OWF and buffer not covered by SeaMAST data
1	Teeside	0.000	0.046	0.004	0.816	0.004	0.863	-
1	Thanet	0.029	5.721	0.174	34.824	0.203	40.545	-
1	Westermost Rough	0.001	0.118	0.004	0.785	0.005	0.903	Northeastern edge of buffer not covered by SeaMAST data
1	Beatrice	-	-	-	-	-	-	Scottish Territorial Waters - not included
2	East Anglia ONE	0.029	5.752	0.081	16.118	0.109	21.870	4km buffer overlap with East Anglia ONE North; East Anglia ONE buffer prioritised
2	Hornsea Project One	-	-	-	-	-	-	Beyond extent of viable SeaMAST data - not included
2	Kincardine	-	-	-	-	-	-	Scottish Territorial Waters - not included

Tier	Windfarm	% of Reference Population (OWF)	OWF Red-throated Diver Abundance	% of Reference Population (4km Buffer)	4km Buffer Red-throated Diver Abundance	Total Site % Of Reference Population	Total Site Abundance	Notes
3	Dogger Bank Creyke Beck Projects A and B	-	-	-	-	-	-	Beyond extent of viable SeaMAST data - not included
3	Dogger Bank Teeside A and B (now Sofia)	-	-	-	-	-	-	Beyond extent of viable SeaMAST data - not included
3	East Anglia THREE	0.029	5.852	0.066	13.222	0.095	19.074	4km buffer overlap with Norfolk Vanguard East; East Anglia THREE buffer prioritised
3	Forth (Seagreen) Alpha and Bravo	-	-	-	-	-	-	Scottish Territorial Waters - not included
3	Hornsea Project Two	-	-	-	-	-	-	Beyond extent of viable SeaMAST data - not included
3	Inch Cape	-	-	-	-	-	-	Scottish Territorial Waters - not included
2	Moray Firth East	-	-	-	-	-	-	Scottish Territorial Waters - not included
3	Neart na Gaoithe	-	-	-	-	-	-	Scottish Territorial Waters - not included

Tier	Windfarm	% of Reference Population (OWF)	OWF Red-throated Diver Abundance	% of Reference Population (4km Buffer)	4km Buffer Red-throated Diver Abundance	Total Site % Of Reference Population	Total Site Abundance	Notes
3	Triton Knoll	-	-	-	-	-	-	Beyond extent of viable SeaMAST data - not included
4	Hornsea Project Three	-	-	-	-	-	-	Beyond extent of viable SeaMAST data - not included
3	Moray Firth West	-	-	-	-	-	-	Scottish Territorial Waters - not included
4	Norfolk Boreas	0.015	2.900	0.017	3.455	0.023	4.628	Northern and eastern sections of OWF and 4km buffer beyond extent of viable SeaMAST data; 4km buffer overlap with Norfolk Vanguard East (4km buffers amalgamated)
4	Norfolk Vanguard East	0.015	2.978			0.024	4.706	Eastern section of OWF and 4km buffer beyond extent of viable SeaMAST data; 4km buffer overlap with Norfolk Boreas and East Anglia THREE (East Anglia THREE prioritised, Norfolk Vanguard East and Boreas 4km buffer amalgamated)
4	Norfolk Vanguard West	0.032	6.410	0.068	13.514	0.100	19.924	-
4	Thanet Extension	0.009	1.754	0.299	59.648	0.307	61.402	-

Tier	Windfarm	% of Reference Population (OWF)	OWF Red-throated Diver Abundance	% of Reference Population (4km Buffer)	4km Buffer Red-throated Diver Abundance	Total Site % Of Reference Population	Total Site Abundance	Notes
4	East Anglia ONE North	0.484	96.598	1.053	210.292	1.536	306.890	4km buffer overlap with East Anglia ONE; East Anglia ONE buffer prioritised
4	East Anglia TWO	0.095	18.982	0.358	71.439	0.453	90.421	4km buffer overlap with Greater Gabbard/Galloper; Greater Gabbard/Galloper prioritised
	TOTALS	**3.2**	**636.2**	**13.0**	**2601.1**	**16.2**	**3237.2**	-

18. ***Table A12.3.10*** below summarises the estimated total abundance of red-throated divers in offshore wind farms and 4km buffers for Tiers 1 to 4, based on the SeaMAST dataset. For each Tier, the percentage contribution to the total estimated population of red-throated divers within offshore wind farms and 4km buffers is also given. Under the worst case scenario of 100% displacement of red-throated divers from each wind farm and 4km buffer, this table gives the relative contribution of each Tier to the total numbers of birds likely to be displaced from offshore windfarms.

Table A12.3.10 Estimated Total Abundance of Red-Throated Divers in Offshore Windfarms and 4km Buffers for Tiers 1 to 4

Tier/Exception	Total Red-throated Diver Abundance (OWF and 4km Buffer)	Percentage of Reference population	Relative Contribution to Potential Displacement within Reference Population Area
1	2708.3	13.6%	83.7%
2	21.9	0.1%	0.7%
3	19.1	0.1%	0.6%

Tier/Exception	Total Red-throated Diver Abundance (OWF and 4km Buffer)	Percentage of Reference population	Relative Contribution to Potential Displacement within Reference Population Area
4 (minus EA2)	397.6	2%	12.3%
EA2	90.4	0.45%	2.8%

12.3.3.2 Razorbill

Table A12.3.11 Estimated Cumulative Displacement Risk of Razorbill

Tier	Windfarm	Birds at risk of displacement				Source of Information and Notes
		Breeding	Autumn Migration	Winter	Spring Migration	
1	Aberdeen (EOWDC)	161	64.4	7.3	25.7	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Beatrice Demonstrator	No data	No data	No data	No data	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Blyth Demonstration	121	90.9	60.6	90.9	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Dudgeon	256	346.1	745.4	346.1	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Galloper	44	43	105.5	394	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Greater Gabbard	0	0	387.3	83.8	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Gunfleet Sands	No data	No data	No data	No data	(Macarthur Green, 2019a; Smart Wind, 2015d).

Tier	Windfarm	Birds at risk of displacement				Source of Information and Notes
		Breeding	Autumn Migration	Winter	Spring Migration	
1	Humber Gateway	27	20	13.4	20	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Hywind	30	719	10	0	(Macarthur Green, 2019a).
1	Kentish Flats	No data	No data	No data	No data	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Lynn and Inner Dowsing & Lincs	45	33.5	22.3	33.5	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	London Array	14	20.4	13.6	20.4	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Race Bank	28	42	28	42	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Scroby Sands	No data	No data	No data	No data	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Sheringham Shoal	106	1343	211.3	30.2	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Teeside	16	61.5	1.9	20	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Thanet	3	0	13.6	20.9	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Westermost Rough	91	121.3	151.6	90.9	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Beatrice	873	833	555.3	833	(Macarthur Green, 2019a; Smart Wind, 2015d).
2	East Anglia ONE	16	26	154.5	336	(Macarthur Green, 2019a; Smart Wind, 2015d).
2	Hornsea Project One	1109	4812.3	1517.5	1802.8	(Macarthur Green, 2019a; Smart Wind, 2015d).

Tier	Windfarm	Birds at risk of displacement				Source of Information and Notes
		Breeding	Autumn Migration	Winter	Spring Migration	
2	Kincardine	22	0	0	0	(Macarthur Green, 2019a).
3	Dogger Bank Creyke Beck Projects A and B	2788	3673	3871	9267.7	(Macarthur Green, 2019a; Smart Wind, 2015d).
3	Dogger Bank Teeside A and B (now Sofia)	1987	902.6	2384.5	4872.3	(Macarthur Green, 2019a; Smart Wind, 2015d).
3	East Anglia THREE	1807	1122	1499	1524	(Macarthur Green, 2019a).
3	Forth (Seagreen) Alpha and Bravo	9574	853.1	568.8	853.1	(Macarthur Green, 2019a) – total was 2275 (non-breeding season); divided equally by month according to BDMPS seasons (Furness, 2015).
3	Hornsea Project Two	2511	4220.5	719.5	1668	(Macarthur Green, 2019a; Smart Wind, 2015d).
3	Inch Cape	4671	1839.4	1226.3	1839.4	(Inch Cape Offshore, 2018) - total was 4905 (non-breeding season); divided equally by month according to BDMPS seasons (Furness, 2015).
3	Moray Firth East	2423	1102.6	30.2	168.3	(Macarthur Green, 2019a; Smart Wind, 2015d).
3	Neart na Gaoithe	1248	1162.9	775.3	1162.9	(GoBe Consultants, 2018) - total was 3101 (non-breeding season); divided equally by month according to BDMPS seasons (Furness, 2015).
3	Triton Knoll	40	253.7	854.5	116.7	(Macarthur Green, 2019a; Smart Wind, 2015d).

Tier	Windfarm	Birds at risk of displacement				Source of Information and Notes
		Breeding	Autumn Migration	Winter	Spring Migration	
4	East Anglia ONE North	403	85	54	207	(Scottish Power Renewables, 2019b).
4	East Anglia TWO	280.9	44.1	136.4	229.9	(Scottish Power Renewables, 2019a).
4	Hornsea Project Three	630	2020	3649	1236	(Macarthur Green, 2019a).
4	Moray Firth West	2808	3544	184	3585	(Macarthur Green, 2019a).
4	Norfolk Boreas	345	630	263	1065	(Royal HaskoningDHV, 2018b).
4	Norfolk Vanguard	879	866	839	769	(Macarthur Green, 2019a).
4	Thanet Extension	0	6	56	124	Vattenfall Wind Power Ltd (2018)
TOTALS FOR CIA		35,285	30,901	21,110	32,879	TOTALS FOR CIA are the numbers used in the CIA, AS BUILT TOTALS show the reductions if as-built (but not consented) numbers are used
AS BUILT TOTALS		*N/A*	*N/A*	*N/A*	*N/A*	

12.3.3.3 Guillemot

Table A12.3.12 Estimated Cumulative Displacement Risk of Guillemot

Tier	Windfarm	Birds at risk of displacement		Source of Information and Notes
		Breeding	Non-breeding	
1	Aberdeen (EOWDC)	547	225	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Beatrice Demonstrator	No data	No data	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Blyth Demonstration	1220	1321	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Dudgeon	334	542	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Galloper	305	593	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Greater Gabbard	345	548	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Gunfleet Sands	No data	No data	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Humber Gateway	99	138	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Hywind	249	2136	(Macarthur Green, 2019a).
1	Kentish Flats	No data	No data	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Lynn and Inner Dowsing & Lincs	582	814	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	London Array	192	377	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Race Bank	361	708	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Scroby Sands	No data	No data	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Sheringham Shoal	390	715	(Macarthur Green, 2019a; Smart Wind, 2015d).

Tier	Windfarm	Birds at risk of displacement		Source of Information and Notes
		Breeding	Non-breeding	
1	Teeside	267	901	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Thanet	18	124	(Macarthur Green, 2019a; Smart Wind, 2015d).
1	Westermost Rough	347	486	(Macarthur Green, 2019a; Smart Wind, 2015d).
2	Beatrice	13610	2755	(Macarthur Green, 2019a; Smart Wind, 2015d).
2	East Anglia ONE	274	640	(Macarthur Green, 2019a; Smart Wind, 2015d).
2	Hornsea Project One	9836	8097	(Macarthur Green, 2019a; Smart Wind, 2015d).
2	Kincardine	632	0	(Macarthur Green, 2019a).
3	Dogger Bank Creyke Beck Projects A and B	14886	16763	(Macarthur Green, 2019a; Smart Wind, 2015d).
3	Dogger Bank Teeside A and B (now Sofia)	8494	5969	(Macarthur Green, 2019a; Smart Wind, 2015d).
3	East Anglia THREE	1744	2859	(Macarthur Green, 2019a; Smart Wind, 2015d).
3	Forth (Seagreen) Alpha and Bravo	24724	8800	(Macarthur Green, 2019a).
3	Hornsea Project Two	7735	13164	(Macarthur Green, 2019a; Smart Wind, 2015d).
3	Inch Cape	8184	3912	(Inch Cape Offshore, 2018).
3	Moray Firth East	9820	547	(Macarthur Green, 2019a; Smart Wind, 2015d).
3	Neart na Gaoithe	4894	7618	(GoBe Consultants, 2018).

Tier	Windfarm	Birds at risk of displacement		Source of Information and Notes
		Breeding	Non-breeding	
3	Triton Knoll	425	746	(Macarthur Green, 2019a; Smart Wind, 2015d).
4	East Anglia ONE North	4183	1888	(Scottish Power Renewables, 2019b).
4	East Anglia TWO	2077	1675	(Scottish Power Renewables, 2019a).
4	Hornsea Project Three	13374	17772	(Macarthur Green, 2019a).
4	Moray Firth West	24426	38174	(Macarthur Green, 2019a).
4	Norfolk Boreas	7767	13777	(Royal HaskoningDHV, 2018b).
4	Norfolk Vanguard	4320	4776	(Macarthur Green, 2019a).
4	Thanet Extension	12	1105	(Macarthur Green, 2019a).
TOTALS FOR CIA		**166,673**	**160,665**	**TOTALS FOR CIA are the numbers used in the CIA, AS BUILT TOTALS show the reductions if as-built (but not consented) numbers are used**
AS BUILT TOTALS		*N/A*	*N/A*	

12.3.3.4 Gannet

19. All data for cumulative gannet displacement are taken from (Macarthur Green, 2019a), except for East Anglia ONE North (Scottish Power Renewables, 2019b), East Anglia TWO (Scottish Power Renewables, 2019a) and Norfolk Boreas (Royal HaskoningDHV, 2018b).

Table A12.3.13 Estimated Cumulative Displacement Risk of Gannet

Tier	Windfarm	Buf km	Birds at risk of displacement				60% Displacement, 1% Mortality				80% Displacement, 1% Mortality			
			Sp'g	Br'g	Aut'm	Ann'l	Sp'g	Br'g	Aut'm	Ann'l	Sp'g	Br'g	Aut'm	Ann'l
1	Aberdeen (EOWDC)	2	0	35	5	40	0.0	0.2	0.0	0.2	0.0	0.3	0.0	0.3
1	Beatrice Dem.	No data					No data				No data			
1	Blyth Dem.	No data	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Dudgeon	1	11	53	25	89	0.1	0.3	0.2	0.5	0.1	0.4	0.2	0.7
1	Galloper	4	276	360	907	1543	1.7	2.2	5.4	9.3	2.2	2.9	7.3	12.3
1	Greater Gabbard	0	105	252	69	426	0.6	1.5	0.4	2.6	0.8	2.0	0.6	3.4
1	Gunfleet Sands	No data	9	0	12	21	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.2
1	Humber Gateway	No data					No data				No data			
1	Hywind	1	4	10	0	14	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1
1	Kentish Flats	No data					No data				No data			
1	Kentish Flats Ext.	2	0	0	13	13	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1

Tier	Windfarm	Buf km	Birds at risk of displacement				60% Displacement, 1% Mortality				80% Displacement, 1% Mortality			
			Sp'g	Br'g	Aut'm	Ann'l	Sp'g	Br'g	Aut'm	Ann'l	Sp'g	Br'g	Aut'm	Ann'l
1	London Array	No data					No data				No data			
1	Lynn and Inner Dowsing & Lincs	No data					No data				No data			
1	Race Bank	1	29	92	32	153	0.2	0.6	0.2	0.9	0.2	0.7	0.3	1.2
1	Rampion	No data	0	0	590	590	0	0	3.5	3.5	0	0	4.7	4.7
1	Scroby Sands	No data					No data				No data			
1	Sher'm Shoal	No data	2	47	31	80	0.0	0.3	0.2	0.5	0.0	0.4	0.2	0.6
1	Teeside	No data	0	1	0	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	Thanet	No data					No data				No data			
1	Westermost Rough	No data					No data				No data			
2	Beatrice	0.5	0	151	0	151	0.0	0.9	0.0	0.9	0.0	1.2	0.0	1.2

Tier	Windfarm	Buf km	Birds at risk of displacement				60% Displacement, 1% Mortality				80% Displacement, 1% Mortality			
			Sp'g	Br'g	Aut'm	Ann'l	Sp'g	Br'g	Aut'm	Ann'l	Sp'g	Br'g	Aut'm	Ann'l
2	East Anglia ONE	4	76	161	3638	3875	0.5	1.0	21.8	23.3	0.6	1.3	29.1	31.0
2	Hornsea Project One	4	250	671	694	1615	1.5	4.0	4.2	9.7	2.0	5.4	5.6	12.9
2	Kincardine	1	0	120	0	120	0.0	0.7	0.0	0.7	0.0	1.0	0.0	1.0
3	Dogger Bank Creyke Beck Projects A and B	2	394.0	1155.0	2048.0	3597.0	2.4	6.9	12.3	21.6	3.2	9.2	16.4	28.8
3	Dogger Bank Teeside A and B (now Sofia)	2	464.0	2250.0	887.0	3601.0	2.8	13.5	5.3	21.6	3.7	18.0	7.1	28.8
3	East Anglia THREE	4	524	412	1269	2205	3.1	2.5	7.6	13.2	4.2	3.3	10.2	17.6
3	Forth (Seagreen) Alpha and Bravo	0	332.0	2956.0	664.0	3952.0	2.0	17.7	4.0	23.7	2.7	23.6	5.3	31.6

Tier	Windfarm	Buf km	Birds at risk of displacement				60% Displacement, 1% Mortality				80% Displacement, 1% Mortality			
			Sp'g	Br'g	Aut'm	Ann'l	Sp'g	Br'g	Aut'm	Ann'l	Sp'g	Br'g	Aut'm	Ann'l
3	Hornsea Project Two	4	124	457	1140	1721	0.7	2.7	6.8	10.3	1.0	3.7	9.1	13.8
3	Inch Cape	4	212	2398	703	3313	1.3	14.4	4.2	19.9	1.7	19.2	5.6	26.5
3	Moray Firth East	4	27	564	292	883	0.2	3.4	1.8	5.3	0.2	4.5	2.3	7.1
3	Neart na Gaoithe	2	281	1987	552	2820	1.7	11.9	3.3	16.9	2.2	15.9	4.4	22.6
3	Triton Knoll	1	24	211	15	250	0.1	1.3	0.1	1.5	0.2	1.7	0.1	2.0
4	Hornsea Project Three	4	1099	1203	1494	3796	6.6	7.2	9.0	22.8	8.8	9.6	12.0	30.4
4	Moray Firth West	4	144	2827	439	3410	0.9	17.0	2.6	20.5	1.2	22.6	3.5	27.3
4	Norfolk Vanguard	2	437.0	271.0	2453.0	3161.0	2.6	1.6	14.7	19.0	3.5	2.2	19.6	25.3
4	Norfolk Boreas	2	526	1229	1723	3478	3.2	7.4	10.3	20.9	4.2	9.8	13.8	27.8
4	Thanet Extension	4	384	27	324	735	2.3	0.2	1.9	4.4	3.1	0.2	2.6	5.9

Tier	Windfarm	Buf km	Birds at risk of displacement				60% Displacement, 1% Mortality				80% Displacement, 1% Mortality			
			Sp'g	Br'g	Aut'm	Ann'l	Sp'g	Br'g	Aut'm	Ann'l	Sp'g	Br'g	Aut'm	Ann'l
4	East Anglia TWO	2	192	192	891	1275	1.2	1.2	5.3	7.6	1.5	1.5	7.1	10.2
4	East Anglia ONE North	2	44	149	468	661	0.3	0.9	2.8	4.0	0.4	1.2	3.7	5.3
TOTALS FOR CIA		N/A	5970	20241	21378	47589	36	122	128	286	48	162	171	381
AS BUILT TOTALS		*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*

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