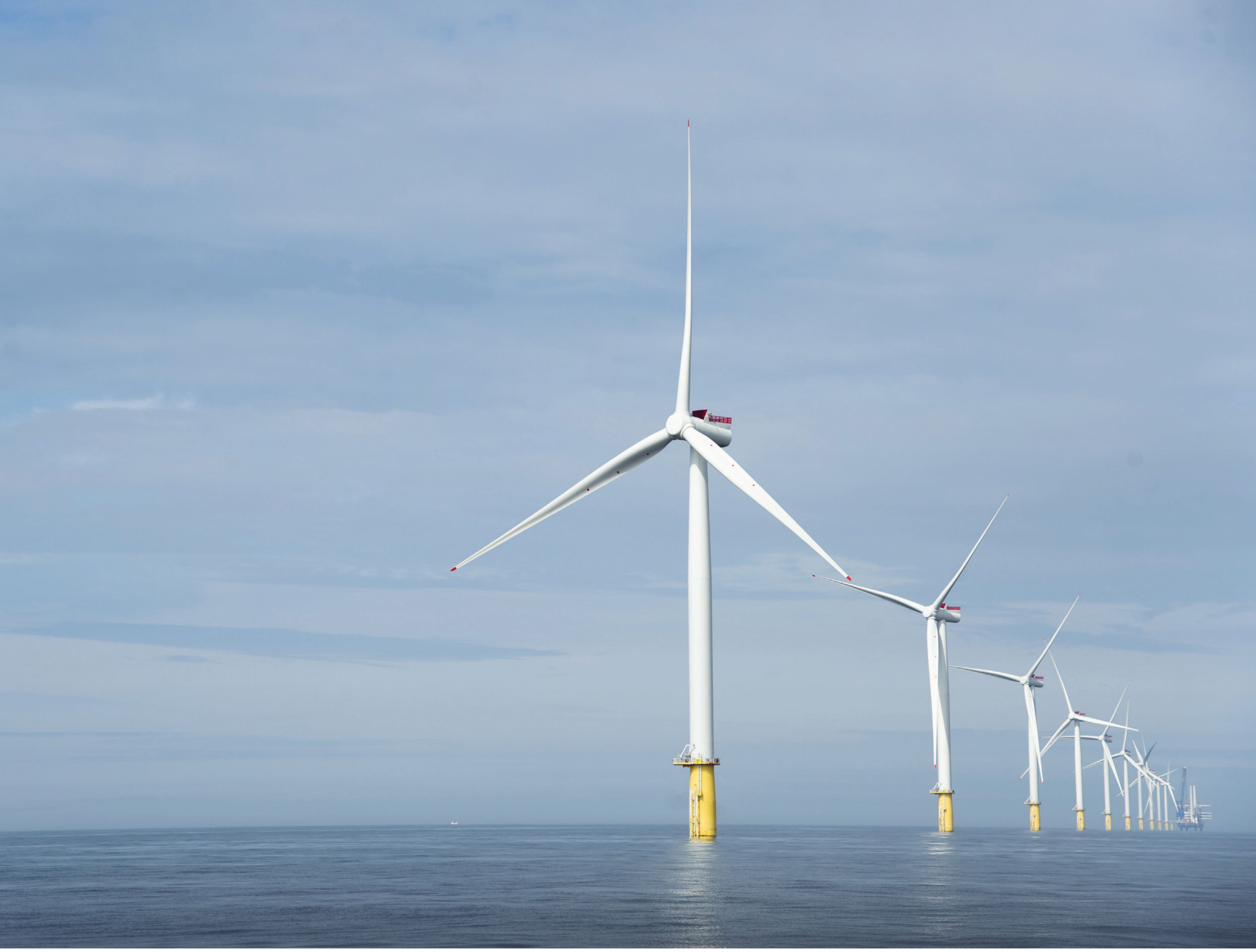

Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects

Collision Risk Modelling (CRM) Updates (EIA Context) Technical Note (Revision B) (Tracked)

Revision B
Deadline 3
May 2023
Document Reference: 13.2.1

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Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects Examination submission Collision Risk Modelling (CRM) Updates (EIA Context) Technical Note (Revision B) (Tracked)		
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Hannah Adams, Equinor	**~~February~~ May 2023**	

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Glossary of Acronyms

CIA	Cumulative Impact Assessment
DEP	Dudgeon Offshore Wind Farm Extension Project
DOW	Dudgeon Offshore Wind Farm
EC	European Commission
EIA	Environmental Impact Assessment
JNCC	Joint Nature Conservation Committee
OWF	Offshore Wind Farm
RB	Race Bank Offshore Wind Farm
RR	Relevant Representation
SEP	Sheringham Offshore Wind Farm Extension Project
SOW	Sheringham Shoal Offshore Wind Farm
TK	Triton Knoll Offshore Wind Farm
SEL	Scira Extension Limited
DEL	Dudgeon Extension Limited
ES	Environmental Statement
BDMPS	Biologically Defined Minimum Population Size
CI	Confidence interval
UCI	Upper Confidence interval
LCI	Lower Confidence Interval

Glossary of Terms

Dudgeon Offshore Wind Farm Extension Project (DEP)	The Dudgeon Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.
Sheringham Shoal Offshore Wind Farm Extension Project (SEP)	The Sheringham Shoal Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.
The Applicant	Equinor New Energy Limited. As the owners of SEP and DEP, Scira Extension Limited (SEL) and Dudgeon Extension Limited (DEL) are the named undertakers that have the benefit of the DCO. References in this document to obligations on, or commitments by, 'the Applicant' are given on behalf of SEL and DEL as the undertakers of SEP and DEP.

1 Revision B Updates at Deadline 3

1. This document has been updated at Deadline 3 to address comments received from Natural England in December 2022 on a draft version of this report (**Section 2.1**), which was subsequently issued at Deadline 1 [REP1-056]. The first comment relates to the calculation of cumulative values for gannet and gull species, as set out in ID 2 of **Table 2-1**. The Revision B updates address this comment.

2. In addition, as requested by Natural England (ID 3 of **Table 21**), a new scenario has been included for the cumulative collision risk estimates for Sandwich tern presented in **Section 4.1.2** (i.e. Scenario F – as consented values but with Dudgeon Offshore Wind Farm (DOW) as-built and secured via the **Draft Development Consent Order (DCO) (Revision F)** [document reference 3.1]).

12 Introduction

1.3. This document presents an update to the Collision Risk Modelling (CRM) work undertaken as part of the assessment of the Sheringham Shoal Offshore Wind Farm Extension Project (SEP) and Dudgeon Offshore Wind Farm Extension Project (DEP) on offshore ornithology receptors. This update has been undertaken at the suggestion of Natural England, who in a Discretionary Advice Service (DAS) letter of 16/09/2022 (and subsequently in the Natural England Relevant Representation (RR) [RR-063]), indicated that potential collision estimates should be recalculated for the following species to account for Natural England's draft updated advice on CRM parameters, as provided in Appendix B1 of the Natural England RR [RR-063]:

- Sandwich tern;
- Gannet;
- Kittiwake;
- Great black-backed gull;
- Lesser black-backed gull; and
- Little gull.

2.4. The recalculated annual collision estimates for SEP, DEP, and SEP and DEP combined are considered in the context of appropriate background populations and published mortality rates (**Section 3.2**). The updated SEP and DEP CRM outputs by month are provided in **Appendix 1**. Whilst it was agreed with Natural England at a meeting on 22 November 2022 to use a correction factor to recalculate collision risk mortalities, the Applicant has instead taken the more comprehensive approach to re-run the CRM for the above species to enable full transparency of the revised assessments.

3.5. In addition to project-alone collision rates, cumulative collision rates have been recalculated and presented for the relevant species (i.e. all except little gull). The findings are put into context in a similar manner to the recalculated project-alone collision rates. The updated cumulative collision CRM outputs are provided in **Appendix 2** for all species (except Sandwich tern); these values have been updated for Revision B of this document to address Natural England's comment at ID 3 of

Table 2-1. Sandwich tern cumulative collision rates are provided in **Section 4.1** with further details on the approach provided within **Section 3.3**.

1.12.1 Consultation on this document

4.6. Natural England was consulted on a draft of this document in December 2022. **Table 2-1** provides a summary of comments received from Natural England in February 2023, together with responses to these comments from the Applicant. ~~There has been insufficient time to address these comments prior to the submission of this document at Deadline 1. Information has therefore been included in **Table 1-1** to indicate how it is proposed these comments will be addressed in an update submitted at Deadline 2 or 3.~~

Table 2-1: Natural England consultation summary

ID	Section	Natural England comment	Natural England's advice	Applicant response
1	Section 1, point 2	NE notes "the Applicant has instead taken the more comprehensive approach to re-run the CRM for the above species to enable full transparency of the revised assessments.	If possible, please supply the log files of these re-run models.	It should be noted that the CRM has been undertaken using the deterministic (Band) approach, which does not generate log files *per se*. However, the Applicant ~~will~~ can provide the original Band CRM spreadsheets ~~for Deadline 2 or 3,~~ should these be required.
2	2.3 Cumulative Impact Assessment - para 9	NE note that the applicant has updated the collision totals for a number of species for the Cumulative Impact Assessment (CIA) as follows: 'A correction factor was applied for each CIA to update the avoidance rates from those previously used (SNCBs, 2014) to the latest avoidance rates (Ozsanlev-Harris et al., in prep).' NE agree that in the case where Avoidance Rates (AR) have changed, it is technically possible to update collision totals that has been previously produced using Collison Risk Modelling (CRM), by applying a correction factor. However as the correction factor needs to be calculated using the original AR and the new AR, it is essential that the original AR is known for each project corrected. Ultimately, when the Cumulative Effects Framework (CEF) tool is released, it should enable full transparency and accessibility in terms of the input parameters for each consented windfarm, and the ability to apply 'wholesale' changes to impact modelling parameters (such as AR) when the evidence base changes. Until this tool	NE recognise that in the case of Sandwich tern in the Greater Wash the Applicant has run a new CRM for each wind farm. This means the cumulative totals are appropriate, and no action is required. In the case of Kittiwake, Lesser Black-Backed Gull, Great Black-backed Gull, Little Gull and Gannet, NE recommend either reverting to the original cumulative totals (un-corrected for the updated ARs other than for SEP&DEP) or presenting significantly more detail on the application of the correction factors, including detail on the original modelling approach and AR applied to each project. There has, in previous OWF cases, been considerable work done on the cumulative totals for the North Sea wind farms. It may be that the totals being corrected have already been standardised to be the recommended	Natural England's comment in respect of Sandwich tern is noted. ~~Further detail on the approach used and correction factors applied to the CIA will be provided for Deadline 2 or 3.~~ Updated cumulative collision risk estimates have been calculated to address Natural England's comment. The approach to the updated calculations is set out in **Section 3.3**, and results are presented in **Appendix 2**.

ID	Section	Natural England comment	Natural England's advice	Applicant response
		is available, if there is a desire to apply correction factors to previous projects collision totals, Natural England considers it will be necessary to present sufficient details on the CRM for each project, and the correction factor applied to enable NE to assess whether this is appropriate. It is worth noting that prior to 2014 there was no joint SNCB guidance on advised ARs and prior to 2012 (when guidance and spreadsheets were issued on use of the Band Model) there were a variety of interpretations of how to apply CRM. We highlight that Natural England's pre-application guidance to Round 4 and unsubmitted extension projects on this matter has been as follows: *NE recognise that there is interest in using the avoidance rates in the interim advice to update cumulative/in-combination assessments as well as 'project alone' assessments. Our recommendation is that for the time being projects utilise the interim advice for their 'project alone' assessments, but refrain from updating existing cumulative/in-combination totals, instead simply adding their project alone values to the existing cumulative/in-combination totals presented in the latest relevant OWF examination. This reflects the fact that the SNCBs have not yet reached a position on how to go about updating such totals, and also the anticipated use of the CEF in the future, which will hopefully allow cumulative/in-combination*	ARs (as per 2014 guidance) and submitted into an OWF Examination. If this previous work is being relied on, it would need to be clearly demonstrated and referenced within this report.	

ID	Section	Natural England comment	Natural England's advice	Applicant response
		assessments to take account of changes such as updated parameter information in an efficient and consistent way.		
3	2.3 Cumulative Impact Assessment - Para 10	Scenarios. At present the report presents 5 different scenarios reflecting different possible turbine numbers and sizes for the Greater Wash windfarms, which in turn dictates the total predicted mortality. However none of the scenarios reflect NEs requirements. Our position is that we assess the legally secured worse case design (as per the Rochdale Envelope) for each windfarm. In the case of most of the Greater Wash windfarms this would be the consented design (as presented in scenario A). We understand that the applicant considers that they have legally secured the 'as built design' for Dudgeon Offshore windfarm Article 45 of the DCO is clear in its intention of preventing DOW from building further (capacity and turbines), however Natural England queries whether this DCO can legally change an already granted Section 36 consent under the Electricity Act 1989. We recommend that Equinor seek legal advice on this matter and consider submitting a summary into the Examination, to demonstrate that this is a realistic scenario. If it can be demonstrated that the DCO can effect such a change, a second scenario we would require to be presented is consented	We consider a number of the scenarios are somewhat redundant and suggest simplifying by removing D. And provided that it can be satisfactorily demonstrated that the DCO can indeed change an extant consent granted under another consenting regime, replacing E with a scenario that reflects consented designs unless legally secured (i.e. DOW).	~~The Applicant will present updated scenarios, as suggested by Natural England, at Deadline 2 or 3.~~An additional scenario (Scenario F – as consented values but with DOW as-built and secured via the **Draft DCO (Revision F)** [document reference 3.1]~~DCO~~) has been included for the cumulative collision risk estimates presented in **Section 4.1.2**. For consistency the existing scenarios, as previously presented, have not been excluded. The Applicant has provided further detail on modification of the DOW section 36 consent through Article 45 in its answers to Q1.5.11 and Q1.11.3.12 of **The Applicant's Responses to the Examining Authority's First Written Questions** [document reference 12.4].

ID	Section	Natural England comment	Natural England's advice	Applicant response
		designs for all wind farms other than DOW, which should be the legally secured one.		
4	3.1.2 (Cumulative) Table 3-5	NE notes that Scenario C for DOW generates a greater impact than is consented (as per Scenario A). This level of impact would seemingly breach the predictions of the DOW ES and HRA and it is therefore doubtful whether that is actually a viable scenario to consider.	NE recommend SEP&DEP check that this value is accurate.	The Applicant confirms that the presented theoretical CRM value for DOW under Scenario C (as built, with unbuilt capacity using consented designs) is correct. The value is greater than Scenario A (as consented) due to the different turbine parameters used for the as-built project. The consented CRM assumed a 63m radius rotor (6.15MW) for the turbines (as presented in Annex A of the S.36 Consent for DOW; DECC, 2012), whereas the as-built used 77m radius rotors (6.0MW). The total consented capacity for DOW is 560MW, and as-built capacity is 402MW, i.e. an unused capacity of 158MW. It has been assumed that 24 x 6.15MW turbines would be used to utilise the unused capacity. As the theoretical capacity of the smaller, as consented turbines is greater than the larger as-built turbines, this results in a small increase in the collision risk under Scenario C when compared to Scenario A.

~~2~~3 Methods

~~2.1~~3.1 CRM Inputs

~~2.1.1~~3.1.1 Seabird Densities

~~5.~~7. Updated CRM has been undertaken using both model-based and design-based density estimates for Sandwich tern, and design-based density estimates for all other species. The density estimates are unchanged from the original assessment and are presented in Environmental Statement (ES) **Appendix 11.1** of **Chapter 11 Offshore Ornithology** [APP-195]. CRMs have been presented that utilise the mean density and 95% lower and upper confidence intervals.

~~2.1.2~~3.1.2 Flight Height

~~6.~~8. All updated CRMs use Option 2 of the Band Model (Band, 2012). For Sandwich tern, the flight height distribution was obtained from Harwood (Harwood, 2021). All other species used data from previously published flight height distributions ("Corrigendum," 2014; Johnston *et al*., 2014).

~~2.1.3~~3.1.3 Avoidance Rates

~~7.~~9. Avoidance rates for the updated CRMs were taken from Appendix B1 of the Natural England RR [RR-063]. The source of these avoidance rates is a JNCC report that is currently in preparation (Ozsanlev-Harris *et al.*, in prep). These are presented in **Table 3-1**.

~~2.1.4~~3.1.4 Biometric and Other Parameters

~~8.~~10. The biometric and other parameters required for the updated CRM were taken from either Appendix B1 of the Natural England RR [RR-063] or **Appendix 11.1** of **Chapter 11 Offshore Ornithology** [APP-195]. They are presented in **Table 3-1**. With regard to the two flight speeds for Sandwich tern, these are discussed in detail in the original assessment (ES **Chapter 11 Offshore Ornithology** [APP-097]).

Table 3-1: Avoidance rates and other input parameters used in updated CRM

Species	Avoidance rate[1]	Flight speed (m/s)[2]	Nocturnal activity[3]	Body length[1]	Wingspan[1]	Flight type[1]	% flights upwind[1]
Sandwich tern	0.990	8.2 or 10.3	2%	0.39	1.00	Flapping	50
Gannet	0.992[4]	14.9	8%	0.94	1.72	Flapping	50
Kittiwake	0.992	13.1	50%	0.39	1.08	Flapping	50
Great black-backed gull	0.994	13.7	50%	0.71	1.58	Flapping	50
Lesser black-backed gull	0.994	13.1	50%	0.58	1.42	Flapping	50

Species	Avoidance rate[1]	Flight speed (m/s)[2]	Nocturnal activity[3]	Body length[1]	Wingspan[1]	Flight type[1]	% flights upwind[1]
Little gull	0.990	12.2	25%	0.26	0.78	Flapping	50

Notes
1 From Appendix B1 of the Natural England RR [RR-063]
2 From Appendix B1 of the Natural England RR [RR-063], except 8.2m/s Sandwich tern flight speed, from Fijn and Collier (2020)
3 From Appendix B1 of the Natural England RR [RR-063], except 2% Sandwich tern nocturnal activity, from **Appendix 11.1** of **Chapter 11 Offshore Ornithology** [APP-195]
4 In addition to this avoidance rate, a macro-avoidance correction factor of 0.7 has been applied, as per Appendix B1 of the Natural England RR [RR-063]

~~2.2~~3.2 Background Populations for Environmental Impact Assessment (EIA)

~~9.~~11. In terms of EIA, the key population and time period is an annual assessment of impact at the largest relevant population size. These are presented in **Table 3-2**.

Table 3-2: Background populations and mortality rates used for year round EIA assessment

Species	Largest Biologically Defined Minimum Population Size (BDMPS) and season[1]	Biogeographic population[1]	Published all age mortality rate[2]
Sandwich tern	38,051 (UK North Sea and Channel, non-breeding)	148,000	0.240
Gannet	456,298 (UK North Sea and Channel, non-breeding)	1,180,000	0.191
Kittiwake	839,456 (UK North Sea, breeding)	5,100,000	0.156
Great black-backed gull	91,399 (UK North Sea, non-breeding)	235,000	0.185
Lesser black-backed gull	209,007 (UK North Sea and Channel, non-breeding)	864,000	0.126
Little gull	N/A, not included in study	75,000	0.200

Notes
1 From Appendix B1 of the Natural England RR [RR-063], except little gull, from ES **Chapter 11 Offshore Ornithology** [APP-097]
2 From Horswill and Robinson (2015)

~~2.3~~3.3 Cumulative Impact Assessment

12. The information presented in the original assessment for the Cumulative Impact Assessment (CIA) was reviewed, and impacts from one offshore wind farm (OWF) that was not included in the original assessment (Rampion 2) was added for relevant species (GoBe Consultants and Wood Group UK, 2021a, 2021b).

13. The comment from Natural England (~~reference 2.3~~ID 2 of **Table 2-1**) in relation to use of correction factors that were applied to existing OWF projects in the previous version of this note [REP1-056], have been addressed in the updated outputs presented in **Appendix 2.** These present cumulative collision estimates utilising both the avoidance rates used in **Chapter 11 Offshore Ornithology** [APP-195]~~)~~ (i.e from SNCBs, 2014), and updated avoidance rates recommended by Natural

England and documented in Appendix B1 of the Natural England RR [RR-063] (from Ozsanlev-Harris *et al*., in prep). In order to provide additional clarity, therefore, **Appendix 2** presents both the corrected and uncorrected values, as follows:

- Cumulative totals using uncorrected values for existing projects (as originally presented in **Chapter 11 Offshore Ornithology** [APP-195]), but with values for SEP and DEP using updated avoidance rates (as recommended by Natural England).
- Cumulative totals using corrected values for existing projects (i.e. using updated avoidance rates (as recommended by Natural England), as presented in the **Collision Risk Modelling (CRM) Updates (EIA Context) Technical Note** [REP1-056]), with values for SEP and DEP also using updated avoidance rates.
- In respect of gannet, the corrected values are also presented assuming 70% macro-avoidance for this species, as advised by Natural England. This correction is applied irrespective of whether it was possible to establish the avoidance rate on which the original collision estimates were (on the basis that a separate macro-avoidance rate has not previously been applied in assessments of gannet collision risk).

14. **Appendix 2** also confirms the avoidance rates that were used for each project considered in the cumulative assessment, where these are available. This information has been taken from information presented for the East Anglia ONE North offshore windfarm (Royal HaskoningDHV, 2019), which reviewed the rates used in all wind farms that were available at that time. For more recent projects (e.g. Hornsea Project Four and Rampion 2), rates have been taken from relevant application documents for those projects.

15. For projects where avoidance rates are available, a simple correction has been applied to generate the updated values based on the revised avoidance rates – i.e. dividing the collision estimate by 1 minus the original avoidance rate and then multiplying by 1 minus the revised avoidance rate. For example, where a 0.989 avoidance rate was originally applied (e.g. for gannet), collision mortality for the revised 0.992 avoidance rate was calculated as (x / (1-0.989)) * (1-0.992), where x is the original collision mortality value for the 0.989 avoidance rate.

16. For projects where the original avoidance rate is not known, no correction has been applied, i.e. existing published values have been used for the updated cumulative totals.

~~10.~~17. ~~A correction factor was applied for each CIA to update the avoidance rates from those previously used (SNCBs, 2014) to the latest avoidance rates (Ozsanlev-Harris *et al*., in prep).~~ All other aspects of the CIA remain as per ES **Chapter 11 Offshore Ornithology** [APP-097].

~~11.~~18. For Sandwich tern, the CRMs for SEP, DEP and other OWFs included in the assessment (which were all produced from scratch for the SEP and DEP assessment) were updated in light of the information presented in **Table 3-1**. The other OWFs included were DOW, Race Bank (RB), Sheringham Shoal (SOW) and

Triton Knoll (TK). ~~Five~~ Six scenarios are presented, which incorporate different OWF designs as follows:

- Scenario A: Consented OWF designs
- Scenario B: As-built OWF designs
- Scenario C: As-built OWF designs, with unbuilt capacity built out using turbines of the same specification as the consented design
- Scenario D: As-built OWF designs, with unbuilt capacity built out using turbines of the same specification as the as-built design
- Scenario E: As per scenario D, but with the assumption that the as-built layout of DOW is legally secured through a mechanism within the DCO[1]
- Scenario F: As per Scenario A (consented OWF designs) but with the as-built layout of DOW legally secured through a mechanism within the DCO.

~~3~~4 Results

~~12.~~19. Recalculated collision risk estimates are presented in the sections below. For Sandwich tern, gannet, kittiwake and little gull, predicted collision rates have reduced compared with those presented within ES **Chapter 11 Offshore Ornithology** [APP-097], whilst estimates for lesser black-backed gull and great black-backed gull have increased. These changes have been driven by the changes in the recommended avoidance rates. However, in all cases **the assessment conclusions as stated in the ES are not changed by these updated collision estimates**.

~~3.1~~4.1 Sandwich tern

~~3.1.1~~4.1.1 SEP and DEP

~~3.1.1.1~~4.1.1.1 Model-based density estimates

Table 4-1: Estimated annual collision risk based on model-based density for Sandwich tern at DEP, SEP, and SEP and DEP combined, along with associated increases in mortality within largest population size, using the flight speed of Fijn and Collier (2020) as a model input

OWF	Output	Annual collision rate	% increase to annual mortality of largest BDMPS population	% increase to annual mortality of biogeographic population
DEP	95% UCI	7.77	0.09	0.02
	Mean	4.46	0.05	0.01
	95% LCI	2.45	0.03	0.01

[1] See Article 45 (Modification of DOW section 36 consent) of the **Draft DCO** (AS-009)

OWF	Output	Annual collision rate	% increase to annual mortality of largest BDMPS population	% increase to annual mortality of biogeographic population
SEP	95% UCI	2.63	0.03	0.01
	Mean	1.41	0.02	0.00
	95% LCI	0.78	0.01	0.00
SEP and DEP	95% UCI	10.41	0.11	0.03
	Mean	5.87	0.06	0.02
	95% LCI	3.23	0.04	0.01

Table 4-2: Estimated annual collision risk based on model-based density for Sandwich tern at DEP, SEP, and SEP and DEP combined, along with associated increases in mortality within largest population size, using the flight speed of Fijn and Gyimesi (2018) as a model input

OWF	Output	Annual collision rate	% increase to annual mortality of largest BDMPS population	% increase to annual mortality of biogeographic population
DEP	95% UCI	9.22	0.10	0.03
	Mean	5.35	0.06	0.02
	95% LCI	2.94	0.03	0.01
SEP	95% UCI	3.16	0.03	0.01
	Mean	1.69	0.02	0.00
	95% LCI	0.93	0.01	0.00
SEP and DEP	95% UCI	12.38	0.14	0.03
	Mean	7.04	0.08	0.02
	95% LCI	3.88	0.04	0.01

~~3.1.1.2~~4.1.1.2 Design-based density estimates

Table 4-3: Estimated annual collision risk based on design-based density for Sandwich tern at DEP, SEP, and SEP and DEP combined, along with associated increases in mortality within largest population size, using the flight speed of Fijn and Collier (2020) as a model input

OWF	Output	Annual collision rate	% increase to annual mortality of largest BDMPS population	% increase to annual mortality of biogeographic population
DEP	95% UCI	11.33	0.12	0.03
	Mean	3.79	0.04	0.01
	95% LCI	0.45	0.00	0.00

OWF	Output	Annual collision rate	% increase to annual mortality of largest BDMPS population	% increase to annual mortality of biogeographic population
SEP	95% UCI	3.13	0.03	0.01
	Mean	0.94	0.01	0.00
	95% LCI	0.05	0.00	0.00
SEP and DEP	95% UCI	14.46	0.19	0.05
	Mean	4.73	0.06	0.02
	95% LCI	0.50	0.01	0.00

Table 4-4: Estimated annual collision risk based on design-based density for Sandwich tern at DEP, SEP, and SEP and DEP combined, along with associated increases in mortality within largest population size, using the flight speed of Fijn and Gyimesi (2018) as a model input

OWF	Output	Annual collision rate	% increase to annual mortality of largest BDMPS population	% increase to annual mortality of biogeographic population
DEP	95% UCI	13.59	0.15	0.04
	Mean	4.55	0.05	0.01
	95% LCI	0.54	0.01	0.00
SEP	95% UCI	3.75	0.04	0.01
	Mean	1.13	0.01	0.00
	95% LCI	0.06	0.00	0.00
SEP and DEP	95% UCI	17.34	0.19	0.05
	Mean	5.67	0.06	0.02
	95% LCI	0.60	0.01	0.00

~~3.1.2~~4.1.2 Cumulative

Table 4-5: Estimated annual collision risk for Sandwich tern at OWFs in the wider Wash area, under six different consented/as-built scenarios, using model-based density estimates and the flight speed of Fijn and Collier (2020) as a model input

OWF	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E	Scenario F
DOW	20.05	16.65	22.26	21.31	16.65	16.65
RB	45.73	15.47	15.93	15.63	15.63	45.73
SOW	8.67	8.67	8.67	8.67	8.67	8.67
TK	8.92	3.03	5.61	3.91	3.91	8.92
DEP	4.46	4.46	4.46	4.46	4.46	4.46

OWF	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E	Scenario F
SEP	1.41	1.41	1.41	1.41	1.41	1.41
Total	89.24	49.69	58.34	55.39	50.73	85.84
% increase to annual mortality of largest BDMPS population	0.98	0.54	0.64	0.61	0.56	0.94
% increase to annual mortality of biogeographic population	0.25	0.14	0.16	0.16	0.14	0.24

Table 4-6: Estimated annual collision risk for Sandwich tern at OWFs in the wider Wash area, under six different consented/as-built scenarios, using model-based density estimates and the flight speed of Fijn and Gyimesi (2018) as a model input

OWF	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E	Scenario F
DOW	23.25	18.68	25.19	23.92	18.68	18.68
RB	51.62	19.44	19.95	19.63	19.63	51.62
SOW	10.10	10.10	10.10	10.10	10.10	10.1
TK	10.54	3.48	6.54	4.49	4.49	10.54
DEP	4.46	4.46	4.46	4.46	4.46	4.46
SEP	1.41	1.41	1.41	1.41	1.41	1.41
Total	101.38	57.57	67.65	64.01	58.77	96.81
% increase to annual mortality of largest BDMPS population	1.11	0.63	0.74	0.70	0.64	1.06
% increase to annual mortality of biogeographic population	0.29	0.16	0.19	0.18	0.17	0.27

Table 4-7: Estimated annual collision risk for Sandwich tern at OWFs in the wider Wash area, under six different consented/as-built scenarios, using design-based density estimates and the flight speed of Fijn and Collier (2020) as a model input

OWF	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E	Scenario F
DOW	20.05	16.65	22.26	21.31	16.65	16.65
RB	45.73	15.47	15.93	15.63	15.63	45.73
SOW	8.67	8.67	8.67	8.67	8.67	8.67
TK	8.92	3.03	5.61	3.91	3.91	8.92

OWF	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E	Scenario F
DEP	3.79	3.79	3.79	3.79	3.79	3.79
SEP	0.94	0.94	0.94	0.94	0.94	0.94
Total	88.1	48.55	57.2	54.25	49.59	84.7
% increase to annual mortality of largest BDMPS population	0.96	0.53	0.63	0.59	0.54	0.93
% increase to annual mortality of biogeographic population	0.25	0.14	0.16	0.15	0.14	0.24

Table 4-8: Estimated annual collision risk for Sandwich tern at OWFs in the wider Wash area, under six different consented/as-built scenarios, using design-based density estimates and the flight speed of Fijn and Gyimesi (2018) as a model input

OWF	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E	Scenario F
DOW	23.25	18.68	25.19	23.92	18.68	18.68
RB	51.62	19.44	19.95	19.63	19.63	51.62
SOW	10.10	10.10	10.10	10.10	10.10	10.1
TK	10.54	3.48	6.54	4.49	4.49	10.54
DEP	4.55	4.55	4.55	4.55	4.55	4.55
SEP	1.13	1.13	1.13	1.13	1.13	1.13
Total	101.19	57.38	67.46	63.82	58.58	96.62
% increase to annual mortality of largest BDMPS population	1.11	0.63	0.74	0.70	0.64	1.06
% increase to annual mortality of biogeographic population	0.28	0.16	0.19	0.18	0.16	0.27

3.24.2 Gannet

3.2.14.2.1 SEP and DEP

Table 4-9: Estimated annual collision risk for gannet at DEP, SEP, and SEP and DEP combined, along with associated increases in mortality within largest population size

OWF	Output	Annual collision rate	% increase to annual mortality of largest BDMPS population	% increase to annual mortality of biogeographic population
DEP	95% UCI	2.63	0.00	0.00

OWF	Output	Annual collision rate	% increase to annual mortality of largest BDMPS population	% increase to annual mortality of biogeographic population
	Mean	0.90	0.00	0.00
	95% LCI	0.02	0.00	0.00
SEP	95% UCI	0.60	0.00	0.00
	Mean	0.16	0.00	0.00
	95% LCI	0.00	0.00	0.00
SEP and DEP	95% UCI	3.23	0.00	0.00
	Mean	1.06	0.00	0.00
	95% LCI	0.02	0.00	0.00

4.2.2 Cumulative

13.20. Refer to **Appendix 2** for updated cumulative collision estimates.

Table 4-10: Estimated annual cumulative collision risk for gannet

Tier/OWF	Spring migration	Breeding	Autumn migration	Annual
1 to 3	70.9	391.0	179.5	641.4
Hornsea Project Four (Tier 4)	0.3	3.4	1.1	4.8
SEP and DEP (Tier 4)	0.0	0.4	0.6	1.1
Rampion 2 (Tier 5)	0.2	2.6	0.6	3.3
Total	71.4	397.4	181.9	650.6
% increase to annual mortality of largest BDMPS population	-	-	-	0.7
% increase to annual mortality of biogeographic population	-	-	-	0.3

3.34.3 Kittiwake

3.3.14.3.1 SEP and DEP

Table 4-10: Estimated annual collision risk for kittiwake at DEP, SEP, and SEP and DEP combined, along with associated increases in mortality within largest population size

OWF	Output	Annual collision rate	% increase to annual mortality of largest BDMPS population	% increase to annual mortality of biogeographic population
DEP	95% UCI	27.82	0.02	0.00
	Mean	10.94	0.01	0.00
	95% LCI	1.25	0.00	0.00
SEP	95% UCI	6.66	0.01	0.00

OWF	Output	Annual collision rate	% increase to annual mortality of largest BDMPS population	% increase to annual mortality of biogeographic population
	Mean	1.47	0.00	0.00
	95% LCI	0.00	0.00	0.00
SEP and DEP	95% UCI	34.48	0.03	0.00
	Mean	12.41	0.01	0.00
	95% LCI	1.25	0.00	0.00

4.3.2 Cumulative

~~14.~~21. Refer to **Appendix 2** for updated cumulative collision estimates.

~~*Table 4-12: Estimated annual cumulative collision risk for kittiwake*~~

~~Tier/OWF~~	~~Spring migration~~	~~Breeding~~	~~Autumn migration~~	~~Annual~~
~~1 to 3~~	~~867.7~~	~~927.5~~	~~1124.6~~	~~2919.9~~
~~Hornsea Project Four (Tier 4)~~	~~3.3~~	~~54.2~~	~~10.1~~	~~67.6~~
~~SEP and DEP (Tier 4)~~	~~0.9~~	~~7.2~~	~~4.3~~	~~12.4~~
~~Rampion 2 (Tier 5)~~	~~4.9~~	~~1.6~~	~~1.2~~	~~7.7~~
~~Total~~	~~877.3~~	~~990.1~~	~~1140.1~~	~~3007.5~~
~~% increase to annual mortality of largest BDMPS population~~	~~-~~	~~-~~	~~-~~	~~2.3~~
~~% increase to annual mortality of biogeographic population~~	~~-~~	~~-~~	~~-~~	~~0.4~~

~~3.4~~4.4 Great black-backed gull

~~3.4.1~~4.4.1 SEP and DEP

Table 4-11: Estimated annual collision risk for great black-backed gull at DEP, SEP, and SEP and DEP combined, along with associated increases in mortality within largest population size

OWF	Output	Annual collision rate	% increase to annual mortality of largest BDMPS population	% increase to annual mortality of biogeographic population
DEP	95% UCI	7.31	0.04	0.02
	Mean	1.57	0.01	0.00
	95% LCI	0.00	0.00	0.00
SEP	95% UCI	23.35	0.14	0.05
	Mean	4.41	0.03	0.01
	95% LCI	0.00	0.00	0.00

OWF	Output	Annual collision rate	% increase to annual mortality of largest BDMPS population	% increase to annual mortality of biogeographic population
SEP and DEP	95% UCI	30.67	0.18	0.07
	Mean	5.97	0.04	0.01
	95% LCI	0.00	0.00	0.00

4.4.2 Cumulative

~~15.~~22. Refer to **Appendix 2** for updated cumulative collision estimates.

~~*Table 4-14: Estimated annual cumulative collision risk for great black-backed gull*~~

~~Tier/OWF~~	~~Breeding~~	~~Non-breeding~~	~~Annual~~
~~1 to 3~~	~~220.7~~	~~954.5~~	~~1175.3~~
~~Hornsea Project Four (Tier 4)~~	~~1.0~~	~~10.6~~	~~11.5~~
~~SEP and DEP (Tier 4)~~	~~5.7~~	~~0.3~~	~~6.0~~
~~Rampion 2 (Tier 5)~~	~~1.1~~	~~3.7~~	~~4.8~~
~~Total~~	~~228.4~~	~~969.0~~	~~1197.6~~
~~% increase to annual mortality of largest BDMPS population~~	~~-~~	~~-~~	~~7.1~~
~~% increase to annual mortality of biogeographic population~~	~~-~~	~~-~~	~~2.8~~

~~3.5~~4.5 Lesser black-backed gull

~~3.5.1~~4.5.1 SEP and DEP

Table 4-12: Estimated annual collision risk for lesser black-backed gull at DEP, SEP, and SEP and DEP combined, along with associated increases in mortality within largest population size

OWF	Output	Annual collision rate	% increase to annual mortality of largest BDMPS population	% increase to annual mortality of biogeographic population
DEP	95% UCI	8.04	0.03	0.01
	Mean	1.57	0.01	0.00
	95% LCI	0.00	0.00	0.00
SEP	95% UCI	2.93	0.01	0.00
	Mean	0.64	0.00	0.00
	95% LCI	0.00	0.00	0.00
SEP and DEP	95% UCI	10.97	0.04	0.01
	Mean	2.21	0.01	0.00
	95% LCI	0.00	0.00	0.00

4.5.2 Cumulative

16.23. Refer to **Appendix 2** for updated cumulative collision estimates.

Table 4-16: Estimated annual cumulative collision risk for lesser black-backed gull

Tier/OWF	Breeding	Non-breeding	Annual
1 to 3	189.7	445.9	635.6
Hornsea Project Four (Tier 4)	1.0	0.0	1.0
SEP and DEP (Tier 4)	1.9	0.3	2.2
Rampion 2 (Tier 5)	0.7	1.4	2.2
Total	193.3	447.7	641.0
% increase to annual mortality of largest BDMPS population	-	-	2.4
% increase to annual mortality of biogeographic population	-	-	0.6

3.64.6 Little gull

3.6.14.6.1 SEP and DEP

Table 4-13: Estimated annual collision risk for little gull at DEP, SEP, and SEP and DEP combined, along with associated increases in mortality within largest population size

OWF	Output	Annual collision rate	% increase to annual mortality of largest BDMPS population	% increase to annual mortality of biogeographic population
DEP	95% UCI	8.08	-	0.05
	Mean	2.36	-	0.02
	95% LCI	0.00	-	0.00
SEP	95% UCI	1.80	-	0.01
	Mean	0.53	-	0.00
	95% LCI	0.00	-	0.00
SEP and DEP	95% UCI	9.88	-	0.07
	Mean	2.89	-	0.02
	95% LCI	0.00	-	0.00

Appendix 1: SEP and DEP Updated CRM Outputs by Month

Sandwich tern

Estimated monthly collision risk for Sandwich tern at DEP, using the flight speed of Fijn and Collier (2020)

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.00	2.01	2.01	1.08	1.62	0.30	0.75	0.00	0.00	0.00	7.77
Mean	0.00	0.00	0.00	1.02	1.31	0.59	1.10	0.13	0.31	0.00	0.00	0.00	4.46
95% LCI	0.00	0.00	0.00	0.45	0.81	0.29	0.74	0.05	0.11	0.00	0.00	0.00	2.45

Estimated monthly collision risk for Sandwich tern at SEP, using the flight speed of Fijn and Collier (2020)

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.00	0.09	0.58	0.80	0.86	0.16	0.15	0.00	0.00	0.00	2.63
Mean	0.00	0.00	0.00	0.02	0.33	0.36	0.59	0.05	0.05	0.00	0.00	0.00	1.41
95% LCI	0.00	0.00	0.00	0.00	0.19	0.14	0.42	0.01	0.01	0.00	0.00	0.00	0.78

Estimated monthly collision risk for Sandwich tern at SEP and DEP combined, using the flight speed of Fijn and Collier (2020)

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.00	2.10	2.59	1.88	2.49	0.46	0.90	0.00	0.00	0.00	10.41
Mean	0.00	0.00	0.00	1.04	1.64	0.95	1.69	0.18	0.37	0.00	0.00	0.00	5.87
95% LCI	0.00	0.00	0.00	0.45	1.00	0.43	1.16	0.06	0.12	0.00	0.00	0.00	3.23

Estimated monthly collision risk for Sandwich tern at DEP, using the flight speed of Fijn and Gyimesi (2018)

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.00	2.37	2.39	1.29	1.93	0.36	0.89	0.00	0.00	0.00	9.22
Mean	0.00	0.00	0.00	1.22	1.57	0.71	1.32	0.16	0.38	0.00	0.00	0.00	5.35
95% LCI	0.00	0.00	0.00	0.54	0.98	0.35	0.88	0.06	0.13	0.00	0.00	0.00	2.94

Estimated monthly collision risk for Sandwich tern at SEP, using the flight speed of Fijn and Gyimesi (2018)

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.00	0.11	0.69	0.96	1.04	0.19	0.17	0.00	0.00	0.00	3.16
Mean	0.00	0.00	0.00	0.03	0.40	0.43	0.71	0.06	0.06	0.00	0.00	0.00	1.69
95% LCI	0.00	0.00	0.00	0.00	0.22	0.17	0.50	0.02	0.02	0.00	0.00	0.00	0.93

Estimated monthly collision risk for Sandwich tern at SEP and DEP combined, using the flight speed of Fijn and Gyimesi (2018)

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.00	2.48	3.08	2.25	2.96	0.55	1.06	0.00	0.00	0.00	12.38
Mean	0.00	0.00	0.00	1.25	1.97	1.14	2.02	0.22	0.44	0.00	0.00	0.00	7.04

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% LCI	0.00	0.00	0.00	0.54	1.20	0.52	1.39	0.08	0.15	0.00	0.00	0.00	3.88

Gannet

Estimated monthly collision risk for gannet at DEP

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.21	0.38	0.09	0.12	0.09	0.08	0.18	0.83	0.52	0.13	2.63
Mean	0.00	0.00	0.04	0.16	0.02	0.02	0.02	0.02	0.07	0.24	0.26	0.03	0.90
95% LCI	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02

Estimated monthly collision risk for gannet at SEP

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.00	0.10	0.00	0.00	0.06	0.05	0.07	0.00	0.32	0.00	0.60
Mean	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.01	0.01	0.00	0.11	0.00	0.16
95% LCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Estimated monthly collision risk for gannet at SEP and DEP combined

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.21	0.48	0.09	0.12	0.14	0.13	0.25	0.83	0.84	0.13	3.23
Mean	0.00	0.00	0.04	0.19	0.02	0.02	0.03	0.03	0.08	0.24	0.38	0.03	1.06
95% LCI	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02

Kittiwake

Estimated monthly collision risk for kittiwake at DEP

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	1.39	0.92	0.81	7.18	3.79	0.59	0.95	3.00	5.73	1.96	0.54	0.97	27.82
Mean	0.57	0.38	0.21	3.94	1.15	0.11	0.36	0.85	1.93	0.86	0.10	0.49	10.94
95% LCI	0.00	0.00	0.00	1.07	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	1.25

Estimated monthly collision risk for kittiwake at SEP

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.00	2.59	0.00	0.36	0.00	0.00	1.60	0.00	0.77	1.35	6.66
Mean	0.00	0.00	0.00	0.54	0.00	0.06	0.00	0.00	0.41	0.00	0.20	0.26	1.47
95% LCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Estimated monthly collision risk for kittiwake at SEP and DEP combined

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	1.39	0.92	0.81	9.76	3.79	0.95	0.95	3.00	7.33	1.96	1.31	2.32	34.48
Mean	0.57	0.38	0.21	4.48	1.15	0.17	0.36	0.85	2.34	0.86	0.30	0.75	12.41
95% LCI	0.00	0.00	0.00	1.07	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	1.25

Great black-backed gull

Estimated monthly collision risk for great black-backed gull at DEP

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	1.60	0.00	0.00	1.01	0.00	0.00	1.00	0.00	1.92	0.00	1.78	7.31
Mean	0.00	0.30	0.00	0.00	0.11	0.00	0.00	0.16	0.00	0.68	0.00	0.31	1.57
95% LCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Estimated monthly collision risk for great black-backed gull at SEP

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.81	1.60	18.34	23.35
Mean	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.84	2.99	4.41
95% LCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Estimated monthly collision risk for great black-backed gull at SEP and DEP combined

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	1.60	1.60	0.00	0.00	1.01	0.00	0.00	1.00	0.00	3.73	1.60	20.12	30.67
Mean	0.29	0.30	0.00	0.00	0.11	0.00	0.00	0.16	0.00	0.96	0.84	3.31	5.97
95% LCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Lesser black-backed gull

Estimated monthly collision risk for lesser black-backed gull at DEP

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.00	0.49	0.00	2.60	2.91	0.18	0.63	0.00	0.00	1.23	8.04
Mean	0.00	0.00	0.00	0.07	0.00	0.49	0.63	0.04	0.11	0.00	0.00	0.22	1.57
95% LCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Estimated monthly collision risk for lesser black-backed gull at SEP

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.00	0.00	0.00	0.58	1.54	0.81	0.00	0.00	0.00	0.00	2.93
Mean	0.00	0.00	0.00	0.00	0.00	0.07	0.32	0.25	0.00	0.00	0.00	0.00	0.64
95% LCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Estimated monthly collision risk for lesser black-backed gull at SEP and DEP combined

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.00	0.49	0.00	3.18	4.45	0.99	0.63	0.00	0.00	1.23	10.97
Mean	0.00	0.00	0.00	0.07	0.00	0.57	0.95	0.29	0.11	0.00	0.00	0.22	2.21
95% LCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Little gull

Estimated monthly collision risk for little gull at DEP

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.08	0.00	0.00	8.08

	J	F	M	A	M	J	J	A	S	O	N	D	Total
Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.36	0.00	0.00	2.36
95% LCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Estimated monthly collision risk for little gull at SEP

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.42	1.19	0.00	1.80
Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.08	0.41	0.00	0.53
95% LCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Estimated monthly collision risk for little gull at SEP and DEP combined

	J	F	M	A	M	J	J	A	S	O	N	D	Total
95% UCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	8.50	1.19	0.00	9.88
Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	2.44	0.41	0.00	2.89
95% LCI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 2: Updated Cumulative Collision Outputs

Gannet

Cumulative collision risk for gannet, consented OWF parameters

Tier	OWF	CRM iteration	CRM Option	Avoidance Rate (%)	Estimated gannet collisions (using original avoidance rate (0.989 in most cases[1] (SEP and DEP: 0.992)) no macro-avoidance correction factor)				Estimated updated gannet collisions (0.992 avoidance rate in most cases[2], no macro-avoidance correction factor)				Estimated updated gannet collisions (0.992 avoidance rate in most cases[2], with 0.7 macro-avoidance correction factor[3])			
					Spring	Breeding	Autumn	Annual	Spring	Breeding	Autumn	Annual	Spring	Breeding	Autumn	Annual
1	Beatrice	Band et al., 2007	1	98.9	9.5	37.4	48.8	95.7	6.9	27.2	35.5	69.6	2.1	8.2	10.6	20.9
1	Beatrice (demonstrator)	Unknown	Unknown	Unknown	0.7	0.6	0.9	2.2	0.7	0.6	0.9	2.2	0.2	0.2	0.3	0.7
1	Blyth Demonstration	Band et al., 2007	1	98.9	2.8	3.5	2.1	8.4	2.0	2.5	1.5	6.1	0.6	0.8	0.5	1.8
1	Dudgeon	Band, 2000	1	98.9	19.1	22.3	38.9	80.3	13.9	16.2	28.3	58.4	4.2	4.9	8.5	17.5
1	East Anglia ONE	Band, 2012	1	98.9	6.3	3.4	131	141	4.6	2.5	95.3	102.5	1.4	0.7	28.6	30.8
1	EOWDC (Aberdeen OWF)	Band, 2012	2	98.9	0.1	4.2	5.1	9.3	0.1	3.1	3.7	6.8	0.0	0.9	1.1	2.0
1	Galloper	Band et al., 2007	1	98.9	12.6	18.1	30.9	61.6	9.2	13.2	22.5	44.8	2.7	3.9	6.7	13.4
1	Greater Gabbard	Band, 2000	1	98.9	4.8	14	8.8	27.5	3.5	10.2	6.4	20.0	1.0	3.1	1.9	6.0
1	Gunfleet Sands	Unknown	Unknown	Unknown	-	-	-	-	-	-	-	-	-	-	-	-
1	Hornsea Project One	Band, 2012	2	98.9	22.5	11.5	32	66	16.4	8.4	23.3	48.0	4.9	2.5	7.0	14.4
1	Humber Gateway	Unknown	1	98.9	1.5	1.9	1.1	4.5	1.1	1.4	0.8	3.3	0.3	0.4	0.2	1.0
1	Hywind	Band, 2012	1	98.9	0.8	5.6	0.8	7.2	0.6	4.1	0.6	5.2	0.2	1.2	0.2	1.6
1	Kentish Flats	Band, 2012	1	98.9	1.1	1.4	0.8	3.3	0.8	1.0	0.6	2.4	0.2	0.3	0.2	0.7
1	Kentish Flats Extension	Unknown	Unknown	Unknown	-	-	-	-	-	-	-	-	-	-	-	-
1	Kincardine	Band, 2012	1	98.9	0	3	0	3	0.0	2.2	0.0	2.2	0.0	0.7	0.0	0.7
1	Lincs	Band, 2000	1	98.9	1.7	2.1	1.3	5	1.2	1.5	0.9	3.6	0.4	0.5	0.3	1.1
1	London Array	Band, 2000	1	98.9	1.8	2.3	1.4	5.5	1.3	1.7	1.0	4.0	0.4	0.5	0.3	1.2
1	Lynn and Inner Dowsing	Unknown	Unknown	Unknown	0.2	0.2	0.1	0.5	0.2	0.2	0.1	0.5	0.1	0.1	0.0	0.2
1	Methil	Unknown	Unknown	Unknown	0.0	6.0	0.0	6.0	0.0	6.0	0.0	6.0	0.0	1.8	0.0	1.8
1	Moray Firth (EDA)	Band, 2012	1	98.9	8.9	80.6	35.4	124.9	6.5	58.6	25.7	90.8	1.9	17.6	7.7	27.3

Tier	OWF	CRM iteration	CRM Option	Avoidance Rate (%)	Estimated gannet collisions (using original avoidance rate (0.989 in most cases[1] (SEP and DEP: 0.992)) no macro-avoidance correction factor)				Estimated updated gannet collisions (0.992 avoidance rate in most cases[2], no macro-avoidance correction factor)				Estimated updated gannet collisions (0.992 avoidance rate in most cases[2], with 0.7 macro-avoidance correction factor[3])			
					Spring	Breeding	Autumn	Annual	Spring	Breeding	Autumn	Annual	Spring	Breeding	Autumn	Annual
1	Race Bank	Band, 2000	1	98.9	4.1	33.7	11.7	49.5	3.0	24.5	8.5	36.0	0.9	7.4	2.6	10.8
1	Rampion	Band, 2012	2	98.9	2.1	36.2	63.5	101.8	1.5	26.3	46.2	74.0	0.5	7.9	13.9	22.2
1	Scroby Sands	Unknown	Unknown	Unknown	-	-	-	-	-	-	-	-	-	-	-	-
1	Sheringham Shoal	Band, 2000	1	98.9	0	14.1	3.5	17.6	0.0	10.3	2.5	12.8	0.0	3.1	0.8	3.8
1	Teesside	Band, 2000	1	98.9	0	4.9	1.7	6.7	0.0	3.6	1.2	4.9	0.0	1.1	0.4	1.5
1	Thanet	Band, 2000	1	98.9	0	1.1	0	1.1	0.0	0.8	0.0	0.8	0.0	0.2	0.0	0.2
1	Triton Knoll	Band, 2012	1	98.9	30.1	26.8	64.1	121	21.9	19.5	46.6	88.0	6.6	5.8	14.0	26.4
1	Westermost Rough	Band et al., 2007	1	98.9	0.1	0.1	0.2	0.5	0.1	0.1	0.1	0.4	0.0	0.0	0.0	0.1
2	Dogger Bank A and B	Band, 2012	1	98.9	54.4	81.1	83.5	219	39.6	59.0	60.7	159.3	11.9	17.7	18.2	47.8
2	Dogger Bank C and Sofia	Band, 2012	2	98.9	10.8	14.8	10.1	35.7	7.9	10.8	7.3	26.0	2.4	3.2	2.2	7.8
2	Forth (Seagreen) Alpha and Bravo	Band, 2012	3	98.9	65.8	800.8	49.3	915.9	47.9	582.4	35.9	666.1	14.4	174.7	10.8	199.8
2	Hornsea Project Two	Band, 2012	2	98.9	6.0	7.0	14.0	27.0	4.4	5.1	10.2	19.6	1.3	1.5	3.1	5.9
2	Moray West	Band, 2012	2	98.9	1.0	10.0	2.0	13.0	0.7	7.3	1.5	9.5	0.2	2.2	0.4	2.8
2	Neart na Gaoithe	Band, 2012	2	98.9	23	143	47	213	16.7	104.0	34.2	154.9	5.0	31.2	10.3	46.5
3	East Anglia ONE North	Band, 2012	2	98.9	1.1	12.4	11	24.5	0.8	9.0	8.0	17.8	0.2	2.7	2.4	5.3
3	East Anglia THREE	Band, 2012	1	98.9	9.6	6.1	33.3	49	7.0	4.4	24.2	35.6	2.1	1.3	7.3	10.7
3	East Anglia TWO	Band, 2012	2	98.9	4.0	12.5	23.1	39.6	2.9	9.1	16.8	28.8	0.9	2.7	5.0	8.6
3	Hornsea Project Three	Band, 2012	1	98.9	4.0	10	5.0	19	2.9	7.3	3.6	13.8	0.9	2.2	1.1	4.1
3	Inch Cape	Band, 2012	1	98.9	5.2	336.9	29.2	371.3	3.8	245.0	21.2	270.0	1.1	73.5	6.4	81.0
3	Norfolk Boreas	Band, 2012	2	98.9	3.9	14.1	12.7	30.7	2.8	10.3	9.2	22.3	0.9	3.1	2.8	6.7
3	Norfolk Vanguard	Band, 2012	2	98.9	5.3	8.2	18.6	32.1	3.9	6.0	13.5	23.3	1.2	1.8	4.1	7.0
4	Hornsea Project Four	Band, 2012	2	98.9	1.3	15.6	5.2	22.1	0.9	11.3	3.8	16.1	0.3	3.4	1.1	4.8
4	SEP and DEP	Band, 2012	2	99.2	0.1	1.4	2.1	3.5	0.1	1.4	2.1	3.5	0.0	0.4	0.6	1.1

Tier	OWF	CRM iteration	CRM Option	Avoidance Rate (%)	Estimated gannet collisions (using original avoidance rate (0.989 in most cases[1] (SEP and DEP: 0.992)) no macro-avoidance correction factor)				Estimated updated gannet collisions (0.992 avoidance rate in most cases[2], no macro-avoidance correction factor)				Estimated updated gannet collisions (0.992 avoidance rate in most cases[2], with 0.7 macro-avoidance correction factor[3])			
					Spring	Breeding	Autumn	Annual	Spring	Breeding	Autumn	Annual	Spring	Breeding	Autumn	Annual
5	Rampion 2	Band, 2012	2	98.9	0.7	11.9	2.6	15.1	0.5	8.7	1.9	11.0	0.2	2.6	0.6	3.3
TOTAL					327.0	1820.8	832.8	**2980.6**	238.1	1326.4	606.5	**2171.1**	71.4	397.9	181.9	**651.3**
% increase to annual mortality of largest BDMPS population								3.4%				2.5%				0.7%
% increase to annual mortality of biogeographic population								1.3%				1.0%				0.3%

[1] The majority of existing OWFs have used an avoidance rate of 0.989. Avoidance rate is unknown for Beatrice (demonstrator), Lynn and Inner Dowsing and Methil,.

[2] Collision estimates for 0.992 avoidance rate calculated by applying correction factor to 0.989 avoidance values (x); i.e. corrected value = (x / (1-0.989)) * (1-0.992). Existing values have been retained for projects where avoidance rate is unknown, as per (1) above.

[3] 0.7 macro-avoidance calculated by multiplying the predicted collision mortality by 0.3 (i.e. 1-0.7)

Kittiwake

Cumulative collision risk for kittiwake, consented OWF parameters

Tier	OWF	CRM iteration	CRM Option	Avoidance Rate (%)	Estimated kittiwake collisions (using original avoidance rate (0.989 in most cases[1] (SEP and DEP: 0.992))				Estimated updated kittiwake collisions (0.992 avoidance rate in most cases[2])			
					Spring	Breeding	Autumn	Annual	Spring	Breeding	Autumn	Annual
1	Beatrice	Band et al., 2007	1	98.9	39.8	94.7	10.7	145.2	28.9	68.9	7.8	105.6
1	Beatrice (demonstrator)	Band, 2000	1	99.2	1.7	0	2.1	3.8	1.7	0.0	2.1	3.8
1	Blyth Demonstration	Band et al., 2007	1	98.9	1.4	1.7	2.3	5.4	1.0	1.2	1.7	3.9
1	Dudgeon	Band, 2000	1	98.9	-	-	-	-	-	-	-	-
1	East Anglia ONE	Band, 2012	1	98.9	46.8	1.8	160.4	209	34.0	1.3	116.7	152.0
1	EOWDC (Aberdeen OWF)	Band, 2012	2	98.9	1.1	11.8	5.8	18.7	0.8	8.6	4.2	13.6
1	Galloper	Band et al., 2007	1	98.9	31.8	6.3	27.8	65.9	23.1	4.6	20.2	47.9
1	Greater Gabbard	Band, 2000	1	98.9	11.4	1.1	15	27.5	8.3	0.8	10.9	20.0
1	Gunfleet Sands	Unknown	Unknown	Unknown	-	-	-	-	-	-	-	-
1	Hornsea Project One	Band, 2012	2	98.9	20.9	44	55.9	120.8	15.2	32.0	40.7	87.9
1	Humber Gateway	Unknown	1	98.9	1.9	1.9	3.2	7	1.4	1.4	2.3	5.1
1	Hywind	Band, 2012	1	98.9	0.9	16.6	0.9	18.3	0.7	12.1	0.7	13.3

Tier	OWF	CRM iteration	CRM Option	Avoidance Rate (%)	Estimated kittiwake collisions (using original avoidance rate (0.989 in most cases[1] (SEP and DEP: 0.992))				Estimated updated kittiwake collisions (0.992 avoidance rate in most cases[2])			
					Spring	Breeding	Autumn	Annual	Spring	Breeding	Autumn	Annual
1	Kentish Flats	Band, 2000	1	98.9	0.7	0	0.9	1.6	0.5	0.0	0.7	1.2
1	Kentish Flats Extension	Unknown	Unknown	Unknown	2.7	0	0	2.7	2.7	0.0	0.0	2.7
1	Kincardine	Band, 2012	1	98.9	1	22	9	32	0.7	16.0	6.5	23.3
1	Lincs	Band, 2000	1	98.9	0.7	0.7	1.2	2.6	0.5	0.5	0.9	1.9
1	London Array	Band, 2000	1	98.9	1.8	1.4	2.3	5.5	1.3	1.0	1.7	4.0
1	Lynn and Inner Dowsing	Unknown	Unknown	Unknown	-	-	-	-	-	-	-	-
1	Methil	Unknown	Unknown	Unknown	0	0.4	0	0.4	0.0	0.4	0.0	0.4
1	Moray East	Band, 2012	1	98.9	19.3	43.6	2	64.9	14.0	31.7	1.5	47.2
1	Race Bank	Band, 2000	1	98.9	5.6	1.9	23.9	31.4	4.1	1.4	17.4	22.8
1	Rampion	Band, 2012	1	98.9	29.7	54.4	37.4	121.5	21.6	39.6	27.2	88.4
1	Scroby Sands	Unknown	Unknown	Unknown	-	-	-	-	-	-	-	-
1	Sheringham Shoal	Unknown	Unknown	Unknown	-	-	-	-	-	-	-	-
1	Teesside	Band, 2000	1	98.9	2.5	38.4	24	64.9	1.8	27.9	17.5	47.2
1	Thanet	Band, 2000	1	98.9	0.4	0.2	0.5	1.1	0.3	0.1	0.4	0.8
1	Triton Knoll	Band, 2012	1	98.9	45.4	24.6	139	209	33.0	17.9	101.1	152.0
1	Westermost Rough	Band et al., 2007	1	98.9	0.1	0.1	0.2	0.5	0.1	0.1	0.1	0.4
2	Dogger Bank A and B	Band, 2012	3	98.9	295.4	288.6	135	719	214.8	209.9	98.2	522.9
2	Dogger Bank C and Sofia	Band, 2012	2	98.9	216.9	136.9	90.7	444.5	157.7	99.6	66.0	323.3
2	Forth (Seagreen) Alpha and Bravo	Band, 2012	1	98.9	247.6	153.1	313.1	713.8	180.1	111.3	227.7	519.1
2	Hornsea Project Two	Band, 2012	1	98.9	3	16	9	28	2.2	11.6	6.5	20.4
2	Moray West	Band, 2012	2	98.9	7	79	24	110	5.1	57.5	17.5	80.0
2	Neart na Gaoithe	Band, 2012	2	98.9	4.4	32.9	56.1	93.4	3.2	23.9	40.8	67.9
3	East Anglia ONE North	Band, 2012	2	98.9	3.5	40.4	8.1	52	2.5	29.4	5.9	37.8
3	East Anglia THREE	Band, 2012	1	98.9	37.6	6.1	69	112.7	27.3	4.4	50.2	82.0
3	East Anglia TWO	Band, 2012	2	98.9	7.4	29.5	5.4	42.3	5.4	21.5	3.9	30.8

Tier	OWF	CRM iteration	CRM Option	Avoidance Rate (%)	Estimated kittiwake collisions (using original avoidance rate (0.989 in most cases[1] (SEP and DEP: 0.992))				Estimated updated kittiwake collisions (0.992 avoidance rate in most cases[2])			
					Spring	Breeding	Autumn	Annual	Spring	Breeding	Autumn	Annual
3	Hornsea Project Three	Band, 2012	2	98.9	8	77	38	123	5.8	56.0	27.6	89.5
3	Inch Cape	Band, 2012	2	98.9	63.5	13.1	224.8	301.4	46.2	9.5	163.5	219.2
3	Norfolk Boreas	Band, 2012	2	98.9	11.9	13.3	32.2	57.5	8.7	9.7	23.4	41.8
3	Norfolk Vanguard	Band, 2012	2	98.9	19.3	21.8	16.4	57.5	14.0	15.9	11.9	41.8
4	Hornsea Project Four	Band, 2012	2	98.9	4.6	74.5	13.9	93	3.3	54.2	10.1	67.6
4	SEP and DEP	Band, 2012	2	99.2	0.9	7.2	4.3	12.4	0.9	7.2	4.3	12.4
5	Rampion 2	Band, 2012	2	98.9	7.3	1.7	1.6	10.6	5.3	1.3	1.2	7.7
TOTAL					**1205.9**	**1358.8**	**1566.1**	**4130.8**	**878.5**	**990.3**	**1140.7**	**3009.5**
% increase to annual mortality of largest BDMPS population								3.2%				2.3%
% increase to annual mortality of biogeographic population								0.5%				0.4%

[1] The majority of existing OWFs have used an avoidance rate of 0.989. A value of 0.992 was used for Beatrice (Demonstrator). Avoidance rate is unknown for Kentish Flats Extension and Methil.

[2] Collision estimates for 0.992 avoidance rate calculated by applying correction factor to 0.989 avoidance values (x); i.e. corrected value = (x / (1-0.989)) * (1-0.992). Existing values have been retained for projects where avoidance rate is unknown, as per (1) above.

Great black-backed gull

Cumulative collision risk for great black-backed gull, consented OWF parameters

Tier	OWF	CRM iteration	CRM Option	Avoidance Rate (%)	Estimated great black-backed gull collisions (using original avoidance rate (0.995 in most cases[1] (SEP and DEP: 0.994))			Estimated updated great black-backed gull collisions (0.994 avoidance rate in most cases[2])		
					Breeding	Non-breeding	Annual	Breeding	Non-breeding	Annual
1	Beatrice	Band et al., 2007	1	99.5	30.2	120.8	151	36.2	145.0	181.2
1	Beatrice (demonstrator)	n/a	n/a	n/a	0	0	0	0.0	0.0	0.0
1	Blyth Demonstration	Band et al., 2007	1	99.5	1.3	5.1	6.3	1.6	6.1	7.6
1	Dudgeon	n/a	n/a	n/a	0	0	0	0.0	0.0	0.0
1	East Anglia ONE	Band, 2012	1	99.5	0	46	46	0.0	55.2	55.2
1	EOWDC (Aberdeen OWF)	Band, 2012	2	99.5	0.6	2.4	3	0.7	2.9	3.6
1	Galloper	Band et al., 2007	1	99.5	4.5	18	22.5	5.4	21.6	27.0
1	Greater Gabbard	Band, 2000	1	99.82	15	60	75	50.0	200.0	250.0

Tier	OWF	CRM iteration	CRM Option	Avoidance Rate (%)	Estimated great black-backed gull collisions (using original avoidance rate (0.995 in most cases[1] (SEP and DEP: 0.994))			Estimated updated great black-backed gull collisions (0.994 avoidance rate in most cases[2])		
					Breeding	Non-breeding	Annual	Breeding	Non-breeding	Annual
1	Gunfleet Sands	Unknown	Unknown	Unknown	-	-	-	-	-	-
1	Hornsea Project One	Band, 2012	1	99.5	17.2	68.6	85.8	20.6	82.3	103.0
1	Humber Gateway	Unknown	1	99.5	1.3	5.1	6.3	1.6	6.1	7.6
1	Hywind	Band, 2012	1	99.5	0.3	4.5	4.8	0.4	5.4	5.8
1	Kentish Flats	Unknown	Unknown	Unknown	-	-	-	-	-	-
1	Kentish Flats Extension	Unknown	Unknown	Unknown	0.1	0.2	0.3	0.1	0.2	0.3
1	Kincardine	n/a	n/a	n/a	0	0	0	0.0	0.0	0.0
1	Lincs	Unknown	Unknown	Unknown	0	0	0	0.0	0.0	0.0
1	London Array	Unknown	Unknown	Unknown	-	-	-	-	-	-
1	Lynn and Inner Dowsing	Unknown	Unknown	Unknown	0	0	0	0.0	0.0	0.0
1	Methil	Unknown	Unknown	Unknown	0.8	0.8	1.6	0.8	0.8	1.6
1	Moray Firth (EDA)	Band, 2012	1	99.5	9.5	25.5	35.0	11.4	30.6	42.0
1	Race Bank	n/a	n/a	n/a	0.0	0.0	0.0	0.0	0.0	0.0
1	Rampion	Band, 2012	1	99.5	5.2	20.8	26.0	6.2	25.0	31.2
1	Scroby Sands	Unknown	Unknown	Unknown	-	-	-	-	-	-
1	Sheringham Shoal	Unknown	Unknown	Unknown	0.0	0.0	0.0	0.0	0.0	0.0
1	Teesside	Band, 2000	1	99.5	8.7	34.8	43.6	10.4	41.8	52.3
1	Thanet	Band, 2000	1	99.5	0.1	0.4	0.5	0.1	0.5	0.6
1	Triton Knoll	Band, 2012	1	99.5	24.4	97.6	122.0	29.3	117.1	146.4
1	Westermost Rough	Band et al., 2007	1	99.5	0.0	0.0	0.1	0.0	0.0	0.1
2	Dogger Bank A and B	Band, 2012	1	99.5	5.8	23.3	29.1	7.0	28.0	34.9
2	Dogger Bank C and Sofia	Band, 2012	2	99.5	6.4	25.5	31.9	7.7	30.6	38.3
2	Forth (Seagreen) Alpha and Bravo	Band, 2012	1	99.5	13.4	53.4	66.8	16.1	64.1	80.2
2	Hornsea Project Two	Band, 2012	1	99.5	3.0	20.0	23.0	3.6	24.0	27.6
2	Moray West	Band, 2012	2	99.5	4.0	5.0	9.0	4.8	6.0	10.8

Tier	OWF	CRM iteration	CRM Option	Avoidance Rate (%)	Estimated great black-backed gull collisions (using original avoidance rate (0.995 in most cases[1] (SEP and DEP: 0.994))			Estimated updated great black-backed gull collisions (0.994 avoidance rate in most cases[2])		
					Breeding	Non-breeding	Annual	Breeding	Non-breeding	Annual
2	Neart na Gaoithe	Band, 2012	2	99.5	0.9	3.6	4.5	1.1	4.3	5.4
3	East Anglia ONE North	Band, 2012	2	99.5	3.7	1.2	5.0	4.4	1.4	6.0
3	East Anglia THREE	Band, 2012	1	99.5	4.6	34.4	39.0	5.5	41.3	46.8
3	East Anglia TWO	Band, 2012	2	99.5	3.5	3.4	6.9	4.2	4.1	8.3
3	Hornsea Project Three	Band, 2012	2	99.5	8.0	28.0	36.0	9.6	33.6	43.2
3	Inch Cape	Band, 2012	1	99.5	0.0	36.8	36.8	0.0	44.2	44.2
3	Norfolk Boreas	Band, 2012	2	99.5	6.9	28.7	35.6	8.3	34.4	42.7
3	Norfolk Vanguard	Band, 2012	2	99.5	4.5	21.5	26.0	5.4	25.8	31.2
4	Hornsea Project Four	Band, 2012	2	99.5	0.8	8.8	9.6	1.0	10.6	11.5
4	SEP and DEP	Band, 2012	2	99.4	5.7	0.3	6.0	5.7	0.3	6.0
5	Rampion 2	Band, 2012	2	99.5	0.9	3.1	4.0	1.1	3.7	4.8
TOTAL					**191.3**	**807.6**	**999.0**	**260.2**	**1096.8**	**1357.2**
% increase to annual mortality of largest BDMPS population							5.9%			8.0%
% increase to annual mortality of biogeographic population							2.3%			3.1%

[1] The majority of existing OWFs have used an avoidance rate of 0.995. A value of 0.9982 was used for Greater Gabbard. Avoidance rate is unknown for Kentish Flats Extension and Methil.

[2] Collision estimates for 0.994 avoidance rate calculated by applying correction factor to original avoidance rate, e.g. for 0.995 avoidance values (x) corrected value = (x / (1-0.995)) * (1-0.994). Existing values have been retained for projects where avoidance rate is unknown, as per (1) above.

Lesser black-backed gull

Cumulative collision risk for lesser black-backed gull, consented OWF parameters

Tier	OWF	CRM iteration	CRM Option	Avoidance Rate (%)	Estimated lesser black-backed gull collisions (using original avoidance rate (0.995 in most cases[1] (SEP and DEP: 0.994))			Estimated updated lesser black-backed gull collisions (avoidance rate 0.994 in most cases[2])		
					Breeding	Non-breeding	Annual			
1	Beatrice	n/a	n/a	n/a	0.0	0.0	0.0	0.0	0.0	0.0
1	Beatrice (demonstrator)	Unknown	Unknown	Unknown	-	-	-	-	-	-
1	Blyth Demonstration	n/a	n/a	n/a	0.0	0.0	0.0	0.0	0.0	0.0
1	Dudgeon	Band, 2000	1	99.5	7.7	30.6	38.3	9.2	36.7	46.0

Tier	OWF	CRM iteration	CRM Option	Avoidance Rate (%)	Estimated lesser black-backed gull collisions (using original avoidance rate (0.995 in most cases[1] (SEP and DEP: 0.994))			Estimated updated lesser black-backed gull collisions (avoidance rate 0.994 in most cases[2])		
					Breeding	Non-breeding	Annual			
1	East Anglia ONE	Band, 2012	1	99.5	5.9	33.8	39.7	7.1	40.6	47.6
1	EOWDC (Aberdeen OWF)	n/a	n/a	n/a	0.0	0.0	0.0	0.0	0.0	0.0
1	Galloper	Band et al., 2007	1	99.5	27.8	111.0	138.8	33.4	133.2	166.6
1	Greater Gabbard	Band, 2000	1	99.5	12.4	49.6	62.0	14.9	59.5	74.4
1	Gunfleet Sands	Unknown	Unknown	99.0	1.0	0.0	1.0	0.6	0.0	0.6
1	Hornsea Project One	Band, 2012	1	99.5	4.4	17.4	21.8	5.3	20.9	26.2
1	Humber Gateway	Unknown	1	99.5	0.3	1.1	1.4	0.4	1.3	1.7
1	Hywind	n/a	n/a	n/a	0.0	0.0	0.0	0.0	0.0	0.0
1	Kentish Flats	Band et al., 2007	1	99.5	0.3	1.3	1.6	-	-	-
1	Kentish Flats Extension	Unknown	Unknown	Unknown	0.3	1.3	1.6	0.3	1.3	1.6
1	Kincardine	n/a	n/a	n/a	0.0	0.0	0.0	0.0	0.0	0.0
1	Lincs	Band, 2000	1	99.5	1.7	6.8	8.5	2.0	8.2	10.2
1	London Array	Unknown	Unknown	Unknown	-	-	-	-	-	-
1	Lynn and Inner Dowsing	Unknown	Unknown	Unknown	-	-	-	-	-	-
1	Methil	Unknown	Unknown	Unknown	0.5	0.0	0.5	0.5	0.0	0.5
1	Moray East	n/a	n/a	n/a	0.0	0.0	0.0	0.0	0.0	0.0
1	Race Bank	Band, 2000	1	99.5	43.2	10.8	54.0	51.8	13.0	64.8
1	Rampion	Band, 2012	1	99.5	1.6	6.3	7.9	1.9	7.6	9.5
1	Scroby Sands	Unknown	Unknown	Unknown	-	-	-	-	-	-
1	Sheringham Shoal	Band, 2000	1	99.5	1.7	6.6	8.3	2.0	7.9	10.0
1	Teesside	n/a	n/a	n/a	0.0	0.0	0.0	0.0	0.0	0.0
1	Thanet	Band, 2000	1	99.5	3.2	12.8	16.0	3.8	15.4	19.2
1	Triton Knoll	Band, 2012	1	99.5	7.4	29.6	37.0	8.9	35.5	44.4
1	Westermost Rough	Band, 2000	1	99.5	0.1	0.3	0.4	0.1	0.4	0.5
2	Dogger Bank A and B	Band, 2012	1	99.5	2.6	10.4	13.0	3.1	12.5	15.6

Tier	OWF	CRM iteration	CRM Option	Avoidance Rate (%)	Estimated lesser black-backed gull collisions (using original avoidance rate (0.995 in most cases[1] (SEP and DEP: 0.994))			Estimated updated lesser black-backed gull collisions (avoidance rate 0.994 in most cases[2])		
					Breeding	Non-breeding	Annual			
2	Dogger Bank C and Sofia	Band, 2012	2	99.5	2.4	9.6	12.0	2.9	11.5	14.4
2	Forth (Seagreen) Alpha and Bravo	Band, 2012	1	99.5	2.1	8.4	10.5	2.5	10.1	12.6
2	Hornsea Project Two	Band, 2012	1	99.5	2.0	2.0	4.0	2.4	2.4	4.8
2	Moray West	Unknown	Unknown	Unknown	0.0	0.0	0.0	0.0	0.0	0.0
2	Neart na Gaoithe	Band, 2012	1	99.5	0.3	1.2	1.5	0.4	1.4	1.8
3	East Anglia ONE North	Band, 2012	2	99.5	0.9	0.6	1.5	1.1	0.7	1.8
3	East Anglia THREE	Band, 2012	1	99.5	1.8	8.2	10.0	2.2	9.8	12.0
3	East Anglia TWO	Band, 2012	2	99.5	4.2	0.5	4.7	5.0	0.6	5.6
3	Hornsea Project Three	Band, 2012	2	99.5	8.0	1.0	9.0	9.6	1.2	10.8
3	Inch Cape	n/a	n/a	n/a	0.0	0.0	0.0	0.0	0.0	0.0
3	Norfolk Boreas	Band, 2012	2	99.5	6.2	8.1	14.3	7.4	9.7	17.2
3	Norfolk Vanguard	Band, 2012	2	99.5	8.4	3.6	12.0	10.1	4.3	14.4
4	Hornsea Project Four	Band, 2012	2	99.5	0.8	0.0	0.8	1.0	0.0	1.0
4	SEP and DEP	Band, 2012	2	99.4	1.9	0.3	2.2	1.9	0.3	2.2
5	Rampion 2	Band, 2012	2	99.5	0.6	1.2	1.8	0.7	1.4	2.2
TOTAL					**161.4**	**374.4**	**535.7**	**192.5**	**447.4**	**640.0**
% increase to annual mortality of largest BDMPS population							2.0%			2.4%
% increase to annual mortality of biogeographic population							0.5%			0.6%

[1] The majority of existing OWFs have used an avoidance rate of 0.995. A value of 0.990 was used for Gunfleet Sands. Avoidance rate is unknown for Kentish Flats Extension and Methil.

[2] Collision estimates for 0.994 avoidance rate calculated by applying correction factor to original avoidance rate, e.g. for 0.995 avoidance values (x) corrected value = (x / (1-0.995)) * (1-0.994). Existing values have been retained for projects where avoidance rate is unknown, as per (1) above.

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