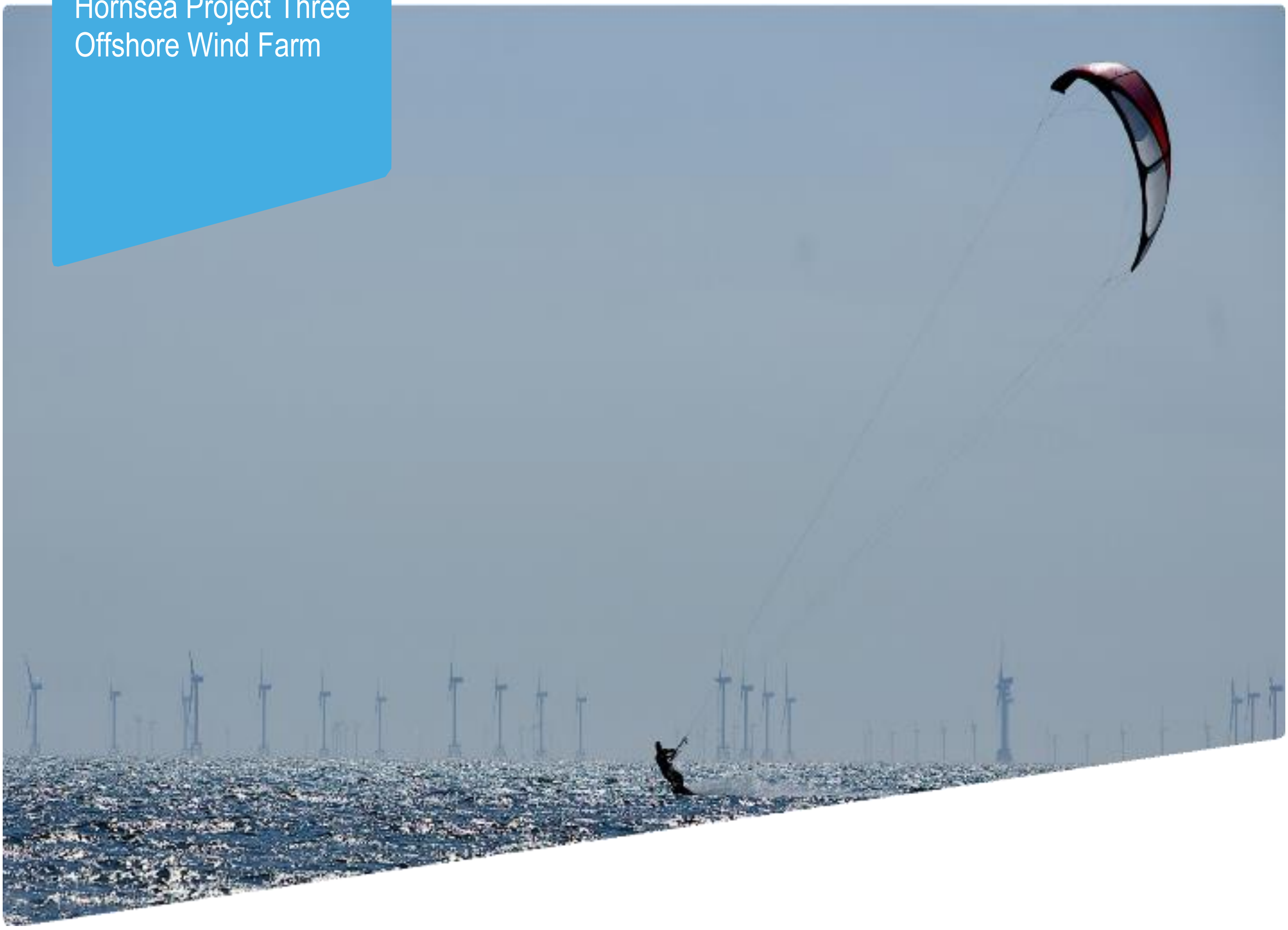
Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Appendix 10 to Deadline I submission –Collision risk modelling
Updates to species-specific parameters – Clarification Note

Date: 7th November 2018

Hornsea 3
Offshore Wind Farm

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1. Refinement of collision risk estimates in light of emerging evidence

Introduction

1.1 There is some uncertainty surrounding the estimates provided by collision risk models, including that from the Band model (Band, 2012; Masden, 2015; Skov *et al*., 2018). Any model is only as good as its assumptions and the parameter values used. As more data become available, for example, through radar or tracking studies, refinement of the models should be sought in order to more accurately account for bird movement and behaviour.

1.2 Following the submission of the Hornsea Three application, a number of publications have become available that provide updated information in relation to parameters and assumptions used in collision risk modelling (CRM). This report provides an overview of these information sources and the implications for CRM. Collision risk estimates incorporating relevant updated parameters are made and the potential implications for the assessment conclusions included in Volume 2, Chapter 5 Offshore Ornithology (Document 6.2.5) and the RIAA (Document 5.2) are discussed.

Information sources considered

1.3 Updated information exists for the following species-specific parameters used in collision risk modelling:

- Bird flight speed;
- Nocturnal activity factors; and
- Avoidance rate.

1.4 The recent publication of the ORJIP Bird Collision Avoidance (BCA) study (Skov *et al*., 2018) provides important updates to the best available species-specific data on flight speeds, empirical evidence on nocturnal activity and empirical information to account for avoidance behaviour in seabirds which can be readily applied in CRM. This section considers these existing opportunities to refine the CRM in order to more accurately account for bird movement and behaviour.

1.5 In addition to Skov *et al.* (2018), information in relation to nocturnal activity factors for gannet and kittiwake has been sourced from Furness *et al.* (2018) and MacArthur Green (2018). Furness *et al.* (2018) reviews the evidence available in relation to the nocturnal activity of gannet and defines nocturnal activity factors to be used in collision risk modelling. MacArthur Green (2018) presents the results for a similar process for kittiwake however, the supporting paper detailing the evidence for the nocturnal activity factors presented is not published.

Bird flight speed

1.6 The ORJIP BCA study has generated the most extensive dataset of observations of seabird behaviour in and around an operational offshore wind farm(Thanet offshore wind farm) that is currently available. This includes species-specific data on flight speed which can inform the estimation of more realistic flux of birds through rotor swept areas. The Band model makes use of bird speed at two separate points: firstly in order to estimate the flux rate of birds through the wind farm and; secondly to estimate the probability of a bird colliding with a turbine rotor (Skov *et al*., 2018). The Band CRM assumes flight speeds occur through the wind farm as linear flight patterns. However, the empirical flight speeds obtained by Skov *et al*., (2018) and other studies clearly indicate that seabirds typically perform non-linear movements within a wind farm. Moreover bird flight speeds are highly variable (Thaxter *et al*., 2011) depending on environmental factors, notably wind direction. The duration of a long convoluted track is also different than the duration of a straight track.

1.7 At present, flight speed data for use in CRM relies on published data (Pennycuick 1997; Alerstam *et al*., 2007) based on very small sample sizes ranging from 32 individuals (gannet) down to as few as 2 (kittiwake). On the other hand, the laser rangefinder track data recorded by Skov *et al*. (2018) at Thanet Offshore Wind Farm off the Kent coast, offers species-specific empirical data on flight speeds from large numbers of individuals. As such, those data are a valuable source of information on more realistic mean flight speeds and associated variability in offshore wind farms necessary for improving estimates of the flux of birds for the species in question.

1.8 Table 1.1 provides a comparison between the species-specific mean flight speeds used in the CRM presented in Volume 5, Annex 5.3: Collision Risk Modelling (Document 6.5.5.3) and those recorded by Skov *et al*., (2018). For the former, the total track time for the two radar recordings of kittiwake was 660 seconds. Furthermore, the flight speed data for all three gull species considered for collision risk modelling at Hornsea Three (kittiwake, lesser black-backed gull and great black-backed gull) was restricted to radar recordings from migration flight which are expected to be birds flying at an airspeed close to that associated with maximum lift-drag ratio (Alerstam *et al*., 2007). This would imply that the very small sample sizes of flight speed data used at present in CRM are not necessarily behaviourally representative of bird flight at sea. Indeed the flight speeds recorded by Skov *et al*. (2018) were markedly lower than the generic speeds typically used (Alerstam *et al*., 2007).

Table 1.1: Species-specific mean flight speeds (m/s) often used in CRM, and those measured from single rangefinder segments recorded at Thanet

<table>
<tr><th>Species</th><th>Flight speed commonly used (m/s) (no. of tracks)</th><th>Flight speed estimated by the study (m/s) (SD)</th></tr>
<tr><td>Gannet</td><td>14.9[a] (n=32)</td><td>13.33 (4.24) [n=683]</td></tr>
<tr><td>Kittiwake</td><td>13.1[b] (n=2)</td><td>8.71 (3.16) [n= 287]</td></tr>
<tr><td>Lesser black-backed gull</td><td>13.1[b] (n=11)</td><td rowspan="2">9.80 (3.63)[c] [n=790]</td></tr>
<tr><td>Great black-backed gull</td><td>13.7[b] (n=4)</td></tr>
</table>

Species	Flight speed commonly used (m/s) (no. of tracks)	Flight speed estimated by the study (m/s) (SD)
a Pennycuick (1987)		
b Alerstam *et al.* (2007)		
c Estimated with data for all large gulls combined		

1.9 There is no reason to consider the Thanet data to be any less representative for birds at HOW03 than those of Pennycuick (1987) or Alerstam *et al*., (2007). In relation to this it should be noted that:

- The flight speed for gannet calculated in Pennycuick (1987) is based on a small sample size with these data having been collected from birds flying at a breeding colony (Foula, Shetland). It is therefore possible that the flight speeds recorded are not representative of the flight speeds of birds that may occur at Hornsea Three due to the proximity of birds to the breeding colony.
- The birds observed by Alerstam *et al*. (2007) were located either in southern Sweden or within the Arctic circle and no determination is given between migratory or foraging birds from colonies. Indeed, the large range of species included in Alerstam *et al.* (2007) suggests that non-breeding and/or migratory flights comprised a significant component of the data set.

1.10 The limitations with the flight speed data from Pennycuick (1987) and Alerstam *et al.* (2007) highlighted above were previously accepted as an inherent source of uncertainty as the values presented in those studies represented the best available evidence. However, against this background, the data in Skov *et al*. (2018) are considered to now represent the best available evidence on flight speeds for collision risk modelling.

Nocturnal activity factors

1.11 Bird flight activity at night is inherently more difficult to quantify than during daylight hours, when surveys are typically undertaken. Consequently, nocturnal activity factors used in collision risk modelling are typically based on Garthe and Hüppop (2004) who subjectively classify species on the basis of assumed levels of activity. They rank each species likely to be at risk from 1 (hardly any flight activity at night) to 5 (much flight activity at night). As part of the Band (2012) CRM guidance it was suggested that these classifications be converted into percentage activity (0, 25, 50, 75 and 100% activity at night), although this conversion is not based on any specific evidence. The use of percentage rates was also not the intention of Garthe and Hüppop (2004) with these scores not intended to represent quantifiable rates of nocturnal activity rather they were intended to indicate that those bird species that scored higher were more likely to show more nocturnal flight activity than those that scored lower (Furness *et al.* 2018). With the information now available, and summarised in Appendix D of Volume 5, Annex 5.3: Collision Risk Modelling (Document 6.5.5.3), the quantification by Band (2012) is considered highly likely to represent a considerable over-estimation of nocturnal activity, with Band (2012) accepting that the approach taken could be precautionary.

1.12 The use of evidence based appropriate nocturnal activity factors has been considered at a number of recent offshore wind farm projects, including East Anglia Three, Norfolk Vanguard and as part of the application for Hornsea Three (see Appendix D of Volume 5, Annex 5.3: Collision Risk Modelling (Document 6.5.5.3)). These reviews concluded that the use of nocturnal activity factors from Garthe and Hüppop (2004) almost certainly over-estimate the level of nocturnal activity exhibited by gannet and kittiwake and potentially also for lesser black-backed gull and great black-backed gull, although there was less evidence for the latter two species.

1.13 Furness *et al.* (2018) derives evidence-based correction factors for nocturnal activity, to be used in the Band (2012) CRM for gannet incorporating much of the information presented in Appendix D of Volume 5, Annex 5.3: Collision Risk Modelling (Document 6.5.5.3), in addition to further analysis and additional information. Furness *et al.* (2018) concludes that the nocturnal activity factors to be used in collision risk modelling for gannet are 8% in the breeding season and 3% in the non-breeding season with use of these factors considered to improve the accuracy and reduce the uncertainty associated with collision risk modelling. This is slightly higher than the equivalent percentage (0%) incorporated into the collision risk modelling for kittiwake used in Volume 2, Chapter 5 Offshore Ornithology (Document 6.2.5) and the RIAA (Document 5.2). Furness *et al.* (2018) also suggests that a lower flight height distribution may also be appropriate to use for birds flying during twilight, when compared to flights occurring in the day. It is important to note that some of the evidence used by Furness *et al.* (2018) was originally used by Garthe and Hüppop (2004) to assign a nocturnal activity factor of 2 to gannet. The conversion of a nocturnal flight activity score of 2 to a nocturnal activity rate of 25%, as suggested by Band (2012) therefore represents a considerable over-estimate.

1.14 Furness *et al.* (2018) suggests that the derivation of evidence-based nocturnal activity factors should also be considered for kittiwake, great black-backed gull and lesser black-backed gull in order to reduce uncertainty in collision risk modelling undertaken for these species. The derivation of evidence-based nocturnal activity factors for kittiwake is currently in preparation with the results having been reported in MacArthur Green (2018). MacArthur Green (2018) suggests that nocturnal activity factors of 20% and 17% in the breeding and non-breeding season respectively should be used for kittiwake. These factors are lower than the equivalent percentage (25%) incorporated into the collision risk modelling for kittiwake used in Volume 2, Chapter 5 Offshore Ornithology (Document 6.2.5) and the RIAA (Document 5.2).

1.15 Many studies on nocturnal activity had only managed to capture very small sample sizes (Desholm, 2005; Furness *et al.,* 2018) prior to the study of Skov *et al*. (2018). The thermal video data collected by Skov *et al*. (2018) at Thanet Offshore Wind Farm provide an unprecedented body of evidence on nocturnal flight activity by seabirds in an offshore wind farm, indicating very low activity during dark hours throughout the annual cycle. Based on the thermal videos processed, there is an indication that nocturnal flight activity may only constitute a negligible proportion (i.e. < 5%) of total flight activity of the species included in the study (kittiwake, lesser black-backed gull, great black-backed gull and herring gull). These data, although not species-specific support the nocturnal activity rates derived by Furness *et al.* (2018) and reported in MacArthur Green (2018).

1.16 The information presented in Furness *et al.* (2018) and in Skov *et al.* (2018) clearly indicates that assuming nocturnal activity based on the scores presented in Garthe and Hüppop (2004) (as suggested by Band, 2012) is no longer a reasonable assumption. Using these rates uncritically will significantly over-estimate the magnitude of the collision risk. The use of the nocturnal activity factors derived by Furness *et al.* (2018) is considered to be sufficiently precautionary particularly in light of the very low nocturnal activity recorded by Skov *et al.* (2018) and is considered to represent the best available evidence.

Avoidance rates

1.17 Species specific generic avoidance rates currently used are often based on mortality rates observed at onshore wind farms with no consideration of actual avoidance behaviour. The ORJIP BCA study, 2014 – 2017 (Skov *et al*., 2018), was designed to improve the evidence base for seabird avoidance behaviour and collisions around offshore wind farms. This study generated the most extensive dataset of observations of seabird behaviour in and around an operational offshore wind farm (Thanet Offshore Wind Farm) that is currently available. A bird monitoring system was developed for the study, that allowed detecting and tracking bird movements at the species level in and around an operational offshore wind farm. Bird behaviour was monitored by the study at Thanet Offshore Wind Farm, deploying a multiple sensor monitoring system partly operated by experienced seabird observers (laser rangefinders and radar equipment), and partly automated through the collection of video evidence, with a focus on five target species: gannet, kittiwake and three species of large gulls (lesser black-backed gull, herring gull, great black-backed gull).

1.18 The study by Skov *et al*. (2018) concluded that bird avoidance behaviour is likely to lead to a greater reduction in estimated collision rates than current correction factors (avoidance rates) applied to CRM assume. The differences between avoidance rates and Empirical Avoidance Rates (EARs) as quantified by Skov *et al*. (2018), are mainly driven by the fact that the former have been developed from land-based studies using the Band CRM to fit the observed number of collisions from carcass surveys while assuming flight speeds through the wind farm as linear flight patterns. The Skov *et al*. (2018) empirical avoidance rates are considered to represent the best available empirical information to account for avoidance behaviour. This provides a compelling basis for using higher avoidance rates, for these species, than are currently advised for use in collision risk assessment in the UK. Those rates should be closer to those indicated by the EARs derived in this study.

1.19 The empirical avoidance rates derived by Skov *et al*. (2018) are considered applicable in the basic and extended version of the Band model (Band 2012). Thus, provided that empirically derived input parameters on flight speed in offshore wind farms and flight height outside offshore wind farms are applied, Skov *et al*. (2018) advise that the empirical avoidance rates can be readily used in the Band model. The empirical avoidance rates are provided below with standard deviation below calculated so as to reflect both variability and uncertainty.

- Gannet: 0.999 ± 0.003 SD
- Kittiwake: 0.998 ± 0.006 SD
- Lesser black-backed gull: 0.998 ± 0.006 SD
- Great black-backed gull: 0.996 ± 0.011 SD
- All large gulls: 0.998 ± 0.007 SD

1.20 The SNCBs are however currently assessing how the empirically estimated avoidance rates estimated by Skov *et al*. (2018) should (or should not) be fed into the basic, and/or extended versions of the Band (2012) model. The EARs presented by Skov *et al*. (2018) are therefore applied in this report alongside those calculated by Cook *et al*. (2014) and those advised by JNCC *et al*. (2014) (see Table 1.2).

Summary

1.21 Table 1.2 presents the species-specific parameters used for collision risk modelling taking into account the information presented in the preceding sections. For those species-specific parameters required for collision risk modelling but not included Table 1.2, the values presented in Volume 5, Annex 5.3: Collision Risk Modelling (Document 6.5.5.3) are used. Similarly, the wind farm and turbine parameters used are consistent with those presented in Volume 5, Annex 5.3: Collision Risk Modelling (Document 6.5.5.3).

Table 1.2: Seabird parameters used for collision risk modelling.

Parameter	Source	Gannet	Kittiwake	Lesser black-backed gull	Great black-backed gull
Flight speed (m/s)	Skov *et al*. (2018)	13.33	8.71	9.80	9.80
Nocturnal activity factor	Garthe and Hüppop (2004) / Furness *et al*. (2018) / MacArthur Green (2018)	Breeding = 8% Non-breeding = 3%	Breeding = 20% Non-breeding = 17%	3	3
Avoidance rate (Basic model) (%)	Skov *et al*. (2018) Cook *et al*. (2014) JNCC *et al*. (2014)	99.9 (± 0.3) 98.9 (± 0.2) 98.9 (± 0.2)	99.8 (± 0.6) 99.2 (± 0.2) 98.9 (± 0.2)	99.8 (± 0.6) 99.5 (± 0.1) 99.5 (± 0.1)	99.6 (± 1.1) 99.5 (± 0.1) 99.5 (± 0.1)
Avoidance rate (Extended model) (%)	Skov *et al*. (2018) Cook *et al*. (2014) JNCC *et al*. (2014)	99.9 (± 0.3) 98.0[a]	99.8 (± 0.6) 98.0[a]	99.8 (± 0.6) 98.9 (± 0.2) 98.9 (± 0.2)	99.6 (± 0.6) 98.9 (± 0.2) 98.9 (± 0.2)

a Default value used for gannet and kittiwake, Cook *et al*. (2014) was unable to recommend an avoidance rate for these species for use with the Extended model

Results

Gannet

1.22 The annual collision risk estimates (Options 1, 2 and 3) calculated for gannet using the updated species-specific parameters are shown in Table 1.3 alongside the original collision risk estimates incorporated into the assessments for gannet presented in Volume 2, Chapter 5 Offshore Ornithology (Document 6.2.5).

Table 1.3: Annual collision risk estimates for gannet calculated using Options 1, 2 and 3 of the Band (2012) collision risk model using updated species-specific parameters.

Avoidance rate (%)	**Collision risk estimates (no. of collisions/annum)**			
	Original estimates	Updated estimates taking account of:		
		Flight speed	Nocturnal activity factors	Flight speeds and nocturnal activity factors combined
Option 1				
98.7	20	19	21	20
98.9	17	16	18	17
99.1	14	13	15	14
99.6		6	6	6
99.9		1	2	2
Option 2				
98.7	44	41	46	43
98.9	37	35	39	36
99.1	31	28	32	30
99.6		13	14	13
99.9		3	4	3
Option 3				
98	15	15	16	16
99.6		3	3	3
99.9		1	1	1

Kittiwake

1.23 The annual collision risk estimates (Options 1, 2 and 3) calculated for kittiwake using the updated species-specific parameters are shown in Table 1.4 alongside the original collision risk estimates incorporated into the assessments for kittiwake presented in Volume 2, Chapter 5 Offshore Ornithology (Document 6.2.5).

Table 1.4: Annual collision risk estimates for kittiwake calculated using Options 1, 2 and 3 of the Band (2012) collision risk model using updated species-specific parameters.

Avoidance rate (%)	Collision risk estimates (no. of collisions/annum)			
	Original collision risk estimate	Updated flight speed	Updated nocturnal activity factors	Updated flight speeds and nocturnal activity factors combined
Option 1				
98.7	54	39	51	37
98.9	45	33	43	32
99.1	37	27	35	26
99.2	33	24	31	23
99.5	21	15	20	14
99.8		6	8	6
Option 2				
98.7	281	206	267	196
98.9	238	174	226	166
99.1	195	143	185	136
99.2	173	127	165	121
99.5	108	79	103	75
99.8		32	41	30
Option 3				
98	83	70	79	67
99.2		28	32	17
99.8		7	8	7

Lesser black-backed gull

1.24 The annual collision risk estimates (Options 1, 2 and 3) calculated for lesser black-backed gull using the updated species-specific parameters are shown in Table 1.5 alongside the original collision risk estimates incorporated into the assessments for lesser black-backed gull presented in Volume 2, Chapter 5 Offshore Ornithology (Document 6.2.5).

Table 1.5: Annual collision risk estimates for lesser black-backed gull calculated using Options 1, 2 and 3 of the Band (2012) collision risk model using updated species-specific parameters.

Avoidance rate (%)	**Collision risk estimates (no. of collisions/annum)**	
	Original collision risk estimate	Updated flight speed
Option 1		
99.2		19
99.4	17	14
99.5	14	12
99.6	11	9
99.8		5
Option 2		
99.2		23
99.4	21	17
99.5	17	14
99.6	14	11
99.8		6
Option 3		
98.7	14	12
98.9	12	10
99.1	9	8
99.2		8
99.8		2

Great black-backed gull

1.25 The annual collision risk estimates (Options 1, 2 and 3) calculated for great black-backed gull using the updated species-specific parameters are shown in Table 1.6 alongside the original collision risk estimates incorporated into the assessments for great black-backed gull presented in Volume 2, Chapter 5 Offshore Ornithology (Document 6.2.5).

Table 1.6: Annual collision risk estimates for great black-backed gull calculated using Options 1, 2 and 3 of the Band (2012) collision risk model using updated species-specific parameters.

Avoidance rate (%)	**Collision risk estimates (no. of collisions/annum)**	
	Original collision risk estimate	Updated flight speed
Option 1		
98.5		77
99.4	38	31
99.5	32	26
99.6	25	20
Option 2		
98.5		159
99.4	79	64
99.5	66	53
99.6	53	42
Option 3		
98.5		63
98.7	62	54
98.9	52	46
99.1	43	38
99.6		17

Implications for assessment conclusions

Hornsea Three

1.26 The differences between collision risk estimates calculated for the four species incorporated into collision risk modelling when using the updated parameters are presented in Table 1.7. These differences have been calculated using identical avoidance rates. The differences shown apply to annual collision risk estimates calculated using any avoidance rate. The changes for flight speeds also apply on a seasonal basis for each species, however due to the use of seasonal nocturnal activity factors the differences shown do not apply on a seasonal basis for collision risk estimates associated with nocturnal activity factors or to those calculated when combining flight speed and nocturnal activity factor.

Table 1.7: Differences between collision risk estimates calculated when using flight speeds from Alerstam *et al.* (2007) / Pennycuick (1987) and Skov *et al.* (2018)

Species	**Model version**	**% change**		
		Flight speed	Nocturnal activity factors	Flight speed and nocturnal activity factors
Gannet	Basic	-6.9	+4.4	-2.8
	Extended	-2.8	+4.4	+1.4
Kittiwake	Basic	-26.7	-4.9	-30.3
	Extended	-15.1	-4.9	-19.3
Lesser black-backed gull	Basic	-18.3		
	Extended	-10.8		
Great black-backed gull	Basic	-19.7		
	Extended	-12.2		

1.27 There are significant reductions in the collision risk estimates calculated using the updated parameters for the three gull species. The parameter driving the majority of these reductions for kittiwake is flight speed with the reductions for kittiwake highly significant in assessment terms. The differences for gannet are less significant with the changes in parameters almost cancelling each other out.

1.28 The differences calculated in Table 1.7 have been calculated using collision risk estimates calculated using the same avoidance rates. The results of Skov *et al.* (2018) suggest that the avoidance rates applied in the original collision risk modelling conducted for Hornsea Three under-estimate avoidance behaviour. The potential reductions to collision risk estimates when applying the avoidance rates derived by Skov *et al.* (2018) are shown in Table 1.8.

Table 1.8: Changes to collision risk estimates when applying avoidance rates derived by Skov *et al.* (2018)

Species	Original avoidance rate as used in assessments for Hornsea Three (%)		Empirical avoidance rate (Skov *et al.*, 2018) (%)	Change in collision risk estimates (%)	
	Basic	Extended		Basic	Extended
Gannet	98.9	98	99.9	-90.9	-95
Kittiwake	98.9/99.2	98	99.8	-75-81.8	-90
Lesser black-backed gull	99.5	98.9	99.8	-60	-81.8
Great black-backed gull	99.5	98.9	99.6	-20	-63.6

1.29 The reductions in collision risk estimates that result from applying the empirical avoidance rates derived by Skov *et al.* (2018) are highly significant, resulting in collision risk estimates that are significantly lower than those incorporated into the assessments for Hornsea Three. However, the avoidance rates derived by Skov *et al.* (2018) have not yet been assessed for use in the Band (2012) CRM. The collision risk estimates calculated when applying the empirical avoidance rates should therefore be considered alongside those defined by other authors (Cook *et al.,* 2014 and *JNCC et al.,* 2004) to provide an indication as to the likely range of the collision impact at Hornsea Three.

Cumulative and in-combination assessments

1.30 Flight speed data from Skov *et al.* (2018) is considered to represent the best available evidence to inform collision risk modelling. This therefore has implications for cumulative and in-combination assessments with collision risk modelling undertaken for projects considered in such assessments likely to represent, in some cases, a considerable over-estimate. It is difficult to accurately quantify any such reductions that may occur at projects considered cumulatively/in-combination without conducting collision risk modelling as differences in turbine parameters will influence the magnitude of any change. However, the potential reductions for kittiwake, lesser black-backed gull and great black-backed gull are likely to be considerable and this over-estimation should be taken into account when conclusions are drawn.

1.31 A change in nocturnal activity factors for any species has considerable implications for the cumulative and in-combination assessments. Collision risk modelling conducted for gannet and kittiwake for almost all of the projects incorporated into the cumulative and in-combination assessments for Hornsea Three utilised nocturnal activity factors from Garthe and Hüppop (2004). Evidence now suggests that the use of the nocturnal activity factors from Garthe and Hüppop will, in some cases considerably over-estimate the collision risk estimates for these species. An attempt was made in Volume 2, Chapter 5 Offshore Ornithology (Document 6.2.5) (see Tables 5.47 and 5.50 in the chapter) and RIAA (Document 5.2) (see Tables 7.35 and 7.38 in the RIAA) to account for this over-estimation with potential reductions of nearly 10%.

Conclusion

1.32 This report has highlighted considerable elements of over-precaution that exist in species-specific parameters incorporated into collision risk modelling both for Hornsea Three and for projects considered cumulatively and in-combination. The parameters used previously were, in some cases, not evidence-based, based on small sample sizes or not representative of bird behaviour in an offshore environment. It is now considered appropriate to update these parameters to ensure the use of best available evidence which will lead to reduced uncertainty and improved accuracy of collision risk estimates used to inform assessments for Hornsea Three.

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