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Subject: Hornsea Project Three (UK) Ltd response to Deadline 6 (Part 8)

Dear Kay, K-J

Please find attached the 8th instalment of documents.

Best regards,
Dr Dominika Chalder PIEMA
Environment and Consent Manager

Environmental Management UK | Wind Power
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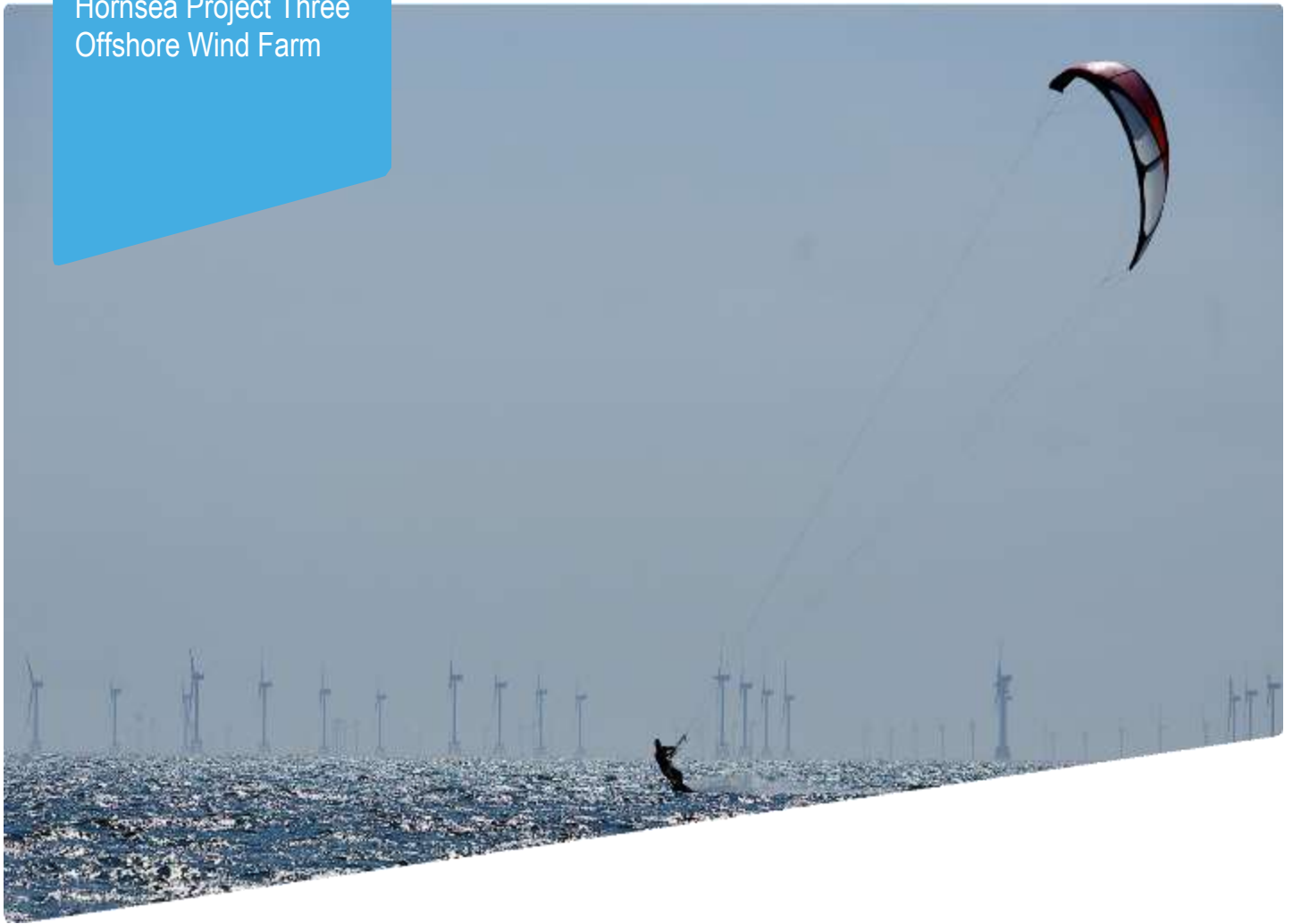
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Appendix 29 to Deadline 6 submission -Applicant's
interpretation of Natural England's position in relation to
collision risk modelling

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1. Introduction

- 1.1 At Issue Specific Hearing 5 (29th January 2018) for Hornsea Three in relation to ornithology, it was requested by the ExA that the Applicant provide collision risk estimates calculated using the parameters which appear to be advocated by Natural England to collision risk modelling, set out separately to all other values. These values have previously been provided in Appendix 28 to the Applicant's submission at Deadline 4 [REP4-049], though the Applicant sought in good faith to place these in context alongside other values that allow for the proper consideration of variability and uncertainty incorporating a range of parameters. This approach was taken not least because Natural England's position remains unclear in many respects.
- 1.2 It is not considered that it is the Applicant's role to set out Natural England's possible position. The information in this Appendix is therefore provided to assist the ExA in the continuing absence of advice from Natural England, in response to the direct request from the ExA. In the absence of clear advice from Natural England, the information set out should be seen as an attempt in good faith to identify parameters and values which may (or may not) reflect Natural England's position.
- 1.3 For reasons set out in the following paragraph it is expected the values below go beyond even Natural England's position in some respects. That being so, the Applicant requests that NE urgently identifies its position from this information and, in doing so, sets out the evidence base to support the use of any of the parameters and outputs represented in this Appendix or otherwise, to allow that to be considered against the Applicant's evidenced position. The use of the information in this Appendix, without further input and supporting evidence from Natural England, would be inappropriate and may not reflect Natural England's true position and/or may not be supported by evidence. For example, in the absence of clarity as to how NE would approach apportioning outside the core breeding season, we have presented an upper range whereas on any realistic worst case the actual value would be somewhere lower on the range.
- 1.4 The Applicant's position is separately summarised in Appendix 28 of the Applicant's Deadline 6 submission and that is supported by a comprehensive set of data and evidence and robust justification which is set out in detail across a range of documents including the RIAA [APP-051] and subsequent submissions, as drawn together in REP4-049. The Applicant does not consider the use of the parameters set out in Table 2.1 is supported by the best available evidence, even on a precautionary approach and accounting for uncertainty. Consequently, both individually and cumulatively (as each parameter adds precaution upon precaution), it is considered that the values set out in Table 2.2 below can only be regarded as extreme and to represent a gross over-estimate of impact going beyond any realistic worst-case assessment.

2. Assumptions

The position of Natural England as interpreted by the Applicant in Appendix 28 of the Applicant's submission at Deadline 4 (REP4-049) in relation to the parameters used in collision risk modelling and other aspects of analyses used for assessment purposes is presented in Table 2.1.

Table 2.1: Assumptions in relation to collision risk modelling parameters and analysis techniques for the position of Natural England

Parameter/Analysis	Possible Position of Natural England	Reference
Density data	Natural England confirmed during discussions at ISH5 that collision risk estimates should be presented using the mean estimate alongside collision risk estimates calculated using the upper and lower 95% confidence intervals	Discussions at ISH5
Flight speed data	Alerstam <i>et al.</i> (2007)/Pennycuik (1987)	Appendix 1 of Natural England's Written Submission for Deadline 3 (REP3-075)
Nocturnal activity factors	A range of nocturnal activity factors: Gannet = 1-2 Kittiwake and large gulls = 2-3	Paragraph 3.13 of Annex C of Natural England's Written Representation (REP1-211)
Band model	Option 2	Paragraph 3.8 of Annex C of Natural England's Written Representation (REP1-211)
Avoidance rates	JNCC <i>et al.</i> (2014)	Paragraph 3.26 of Annex C of Natural England's Written Representation (REP1-211)
Apportioning	<u>Breeding season</u> A range of apportioning values informed by site-specific age class data <u>Non-breeding seasons</u> Apportioning values calculated using population data presented in Furness (2015)	Section 7 of Annex C of Natural England's Written Representation (REP1-211)
Seasonality	Seasonal extents as described in Section 7 of Annex C of Natural England's Written Representation (REP1-211)	Section 7 of Annex C of Natural England's Written Representation (REP1-211)

3. Collision risk estimates

Gannet

EIA scale

Table 3.1: Monthly collision risk estimates for gannet calculated using Option 2 of Band (2012) using confidence intervals associated with density and nocturnal activity factor range of 1-2.

Avoidance rate (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Density = Mean estimate												
98.7	0.25 - 0.37	0	1.81 - 2.28	2.3 - 2.71	0.48 - 0.54	1.61 - 1.77	7.43 - 8.26	9.28 - 10.71	3.6 - 4.39	8.43 - 11.09	1.81 - 2.61	8.27 - 12.81
98.9	0.21 - 0.31	0	1.53 - 1.93	1.95 - 2.29	0.41 - 0.46	1.36 - 1.5	6.28 - 6.99	7.85 - 9.06	3.04 - 3.71	7.13 - 9.38	1.53 - 2.21	7.00 - 10.84
99.1	0.17 - 0.26	0	1.26 - 1.58	1.59 - 1.88	0.33 - 0.37	1.11 - 1.23	5.14 - 5.72	6.42 - 7.41	2.49 - 3.04	5.83 - 7.68	1.25 - 1.81	5.73 - 8.87
Density = Upper confidence limit												
98.7	0.64 - 0.96	0	3.15 - 3.96	3.28 - 3.86	0.88 - 0.99	2.61 - 2.88	9.96 - 11.09	13.16 - 15.19	4.93 - 6.01	10.64 - 13.99	2.53 - 3.66	12.06 - 18.68
98.9	0.54 - 0.81	0	2.66 - 3.35	2.77 - 3.27	0.74 - 0.84	2.21 - 2.44	8.43 - 9.38	11.14 - 12.85	4.17 - 5.09	9.00 - 11.84	2.14 - 3.09	10.21 - 15.8
99.1	0.45 - 0.67	0	2.18 - 2.74	2.27 - 2.67	0.61 - 0.69	1.81 - 1.99	6.9 - 7.68	9.11 - 10.51	3.41 - 4.16	7.36 - 9.69	1.75 - 2.53	8.35 - 12.93
Density = Lower confidence limit												
98.7	0	0	0.63 - 0.79	1.32 - 1.56	0.08 - 0.09	0.61 - 0.67	4.89 - 5.44	5.4 - 6.23	2.27 - 2.76	6.22 - 8.18	1.08 - 1.56	4.77 - 7.38
98.9	0	0	0.53 - 0.67	1.12 - 1.32	0.07 - 0.08	0.51 - 0.57	4.14 - 4.6	4.57 - 5.27	1.92 - 2.34	5.26 - 6.92	0.92 - 1.32	4.03 - 6.25
99.1	0	0	0.44 - 0.55	0.92 - 1.08	0.06 - 0.06	0.42 - 0.46	3.38 - 3.76	3.74 - 4.31	1.57 - 1.91	4.3 - 5.66	0.75 - 1.08	3.3 - 5.11

Table 3.2: Monthly collision risk estimates for gannet calculated using Option 2 of Band (2012) using the mean estimate of density and confidence intervals associated with flight height distribution and a nocturnal activity factor range of 1-2.

Avoidance rate (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flight height distribution = Maximum likelihood												
98.7	0.25 - 0.37	0	1.81 - 2.28	2.3 - 2.71	0.48 - 0.54	1.61 - 1.77	7.43 - 8.26	9.28 - 10.71	3.6 - 4.39	8.43 - 11.09	1.81 - 2.61	8.27 - 12.81
98.9	0.21 - 0.31	0	1.53 - 1.93	1.95 - 2.29	0.41 - 0.46	1.36 - 1.5	6.28 - 6.99	7.85 - 9.06	3.04 - 3.71	7.13 - 9.38	1.53 - 2.21	7.00 - 10.84
99.1	0.17 - 0.26	0	1.26 - 1.58	1.59 - 1.88	0.33 - 0.37	1.11 - 1.23	5.14 - 5.72	6.42 - 7.41	2.49 - 3.04	5.83 - 7.68	1.25 - 1.81	5.73 - 8.87
Flight height distribution = Upper confidence metric												
98.7	0.55 - 0.82	0	4.02 - 5.06	5.1 - 6.01	1.07 - 1.2	3.57 - 3.93	16.46 - 18.31	20.56 - 23.73	7.97 - 9.73	18.68 - 24.57	4.01 - 5.79	18.34 - 28.4
98.9	0.46 - 0.69	0	3.4 - 4.28	4.31 - 5.09	0.9 - 1.02	3.02 - 3.33	13.93 - 15.49	17.4 - 20.08	6.75 - 8.23	15.8 - 20.79	3.39 - 4.9	15.52 - 24.03
99.1	0.38 - 0.57	0	2.78 - 3.5	3.53 - 4.16	0.74 - 0.83	2.47 - 2.72	11.39 - 12.68	14.24 - 16.43	5.52 - 6.73	12.93 - 17.01	2.77 - 4.01	12.7 - 19.66
Flight height distribution = Lower confidence limit												
98.7	0.08 - 0.11	0	0.56 - 0.7	0.7 - 0.83	0.15 - 0.17	0.49 - 0.54	2.27 - 2.53	2.84 - 3.28	1.1 - 1.34	2.58 - 3.39	0.55 - 0.8	2.53 - 3.92
98.9	0.06 - 0.1	0	0.47 - 0.59	0.6 - 0.7	0.12 - 0.14	0.42 - 0.46	1.92 - 2.14	2.4 - 2.77	0.93 - 1.14	2.18 - 2.87	0.47 - 0.68	2.14 - 3.32
99.1	0.05 - 0.08	0	0.38 - 0.48	0.49 - 0.57	0.1 - 0.11	0.34 - 0.38	1.57 - 1.75	1.97 - 2.27	0.76 - 0.93	1.79 - 2.35	0.38 - 0.55	1.75 - 2.72

HRA scale

Table 3.3: Apportioned collision risk estimates for gannet when using the alternative analysis and confidence metrics associated with density using a nocturnal activity factor of 1

Band model Option	Density scenario	Avoidance rate (%)	Collision risk estimates				Total
			Post-breeding (4.8% apportioning value)	Pre-breeding (6.2 % apportioning value)	Breeding season apportioning (%)		
					46.5	63.3	
Option 2	LCL	98.7	0	0	7	10	8 - 10
		98.9	0	0	6	8	7 - 9
		99.1	0	0	5	7	5 - 7
	Mean	98.7	0	1	12	17	13 - 18
		98.9	0	0	10	14	11 - 15
		99.1	0	0	9	12	9 - 12
	UCL	98.7	1	1	18	24	19 - 25
		98.9	1	1	15	20	16 - 22
		99.1	0	1	12	17	13 - 18

Table 3.4: Apportioned collision risk estimates for gannet when using the alternative analysis and confidence metrics associated with density using a nocturnal activity factor of 2

Band model Option	Density scenario	Avoidance rate (%)	Collision risk estimates							Total
			Post-breeding (4.8% apportioning value)	Pre-breeding (6.2% apportioning value)	Breeding season apportioning (%)					
					10	20	30	46.5	63.3	
Option 2	LCL	98.7	0	0	2	4	5	8	11	9 - 12
		98.9	0	0	1	3	4	7	9	8 - 10
		99.1	0	0	1	2	4	6	8	6 - 8
	Mean	98.7	1	1	3	6	9	14	19	16 - 21
		98.9	1	1	3	5	8	12	16	13 - 18
		99.1	0	1	2	4	6	10	13	11 - 14
	UCL	98.7	1	1	4	9	13	20	28	23 - 30
		98.9	1	1	4	7	11	17	24	19 - 25
		99.1	1	1	3	6	9	14	19	16 - 21

Table 3.5: Apportioned collision risk estimates for gannet when using the alternative analysis and confidence metrics associated with flight height data and the mean estimate density scenario using a nocturnal activity factor of 1

Band model Option	Flight height data	Avoidance rate (%)	Collision risk estimates				Total
			Post-breeding (4.8% apportioning value)	Pre-breeding (6.2% apportioning value)	Breeding season apportioning (%)		
					46.5	63.3	
Option 2	LCL	98.7	0	0	4	5	4 - 5
		98.9	0	0	3	4	3 - 5
		99.1	0	0	3	4	3 - 4
	Maximum likelihood	98.7	0	1	12	17	13 - 18
		98.9	0	0	10	14	11 - 15
		99.1	0	0	9	12	9 - 12
	UCL	98.7	1	1	27	37	30 - 39
		98.9	1	1	23	31	25 - 33
		99.1	1	1	19	26	20 - 27

Table 3.6: Apportioned collision risk estimates for gannet when using the alternative analysis and confidence metrics associated with flight height data and the mean estimate density scenario using a nocturnal activity factor of 2

Band model Option	Flight height data	Avoidance rate (%)	Collision risk estimates				Total
			Post-breeding (4.8% apportioning value)	Pre-breeding (6.2% apportioning value)	Breeding season apportioning (%)		
					46.5	63.3	
Option 2	LCL	98.7	0	0	4	6	5 - 6
		98.9	0	0	4	5	4 - 5
		99.1	0	0	3	4	3 - 4
	Maximum likelihood	98.7	1	1	14	19	16 - 21
		98.9	1	1	12	16	13 - 18
		99.1	0	1	10	13	11 - 14
	UCL	98.7	1	2	32	43	35 - 46
		98.9	1	2	27	36	30 - 39
		99.1	1	1	22	30	24 - 32

Kittiwake

EIA scale

Table 3.7: Monthly collision risk estimates for kittiwake calculated using Option 2 of Band (2012) using confidence intervals associated with density and nocturnal activity factor range of 2-3.

Avoidance rate (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Density = Mean estimate												
98.7	9.69 - 12.9	3.81 - 4.84	34.4 - 41.45	39.98 - 46.05	35.02 - 38.96	10.23 - 11.19	58.47 - 64.38	17.27 - 19.57	30.04 - 35.45	7.48 - 9.27	10.62 - 13.89	39.31 - 53.24
98.9	8.2 - 10.92	3.23 - 4.09	29.1 - 35.07	33.83 - 38.97	29.63 - 32.97	8.66 - 9.47	49.47 - 54.48	14.61 - 16.56	25.42 - 30	6.33 - 7.84	8.99 - 11.76	33.26 - 45.05
99.1	6.71 - 8.93	2.64 - 3.35	23.81 - 28.69	27.68 - 31.88	24.25 - 26.97	7.09 - 7.75	40.48 - 44.57	11.96 - 13.55	20.79 - 24.54	5.18 - 6.42	7.35 - 9.62	27.22 - 36.86
Density = Upper confidence limit												
98.7	14.28 - 19.02	7.65 - 9.71	58.76 - 70.81	54.15 - 62.37	46.84 - 52.11	13.69 - 14.97	81.67 - 89.93	21.62 - 24.5	42.45 - 50.1	9.44 - 11.71	12.63 - 16.52	59.98 - 81.23
98.9	12.08 - 16.09	6.48 - 8.21	49.72 - 59.92	45.82 - 52.77	39.64 - 44.09	11.59 - 12.66	69.1 - 76.1	18.29 - 20.73	35.92 - 42.39	7.99 - 9.91	10.69 - 13.98	50.75 - 68.73
99.1	9.89 - 13.17	5.3 - 6.72	40.68 - 49.02	37.49 - 43.18	32.43 - 36.08	9.48 - 10.36	56.54 - 62.26	14.97 - 16.96	29.39 - 34.69	6.54 - 8.11	8.74 - 11.44	41.52 - 56.23
Density = Lower confidence limit												
98.7	5.65 - 7.53	1.19 - 1.51	17.6 - 21.21	25.82 - 29.74	23.2 - 25.81	6.78 - 7.41	35.27 - 38.84	12.92 - 14.65	17.63 - 20.81	5.51 - 6.83	8.62 - 11.27	23.15 - 31.35
98.9	4.78 - 6.37	1.01 - 1.28	14.89 - 17.95	21.85 - 25.16	19.63 - 21.84	5.74 - 6.27	29.84 - 32.86	10.93 - 12.39	14.91 - 17.6	4.66 - 5.78	7.29 - 9.53	19.59 - 26.52
99.1	3.91 - 5.21	0.83 - 1.05	12.19 - 14.68	17.88 - 20.59	16.06 - 17.87	4.69 - 5.13	24.42 - 26.89	8.95 - 10.14	12.2 - 14.4	3.81 - 4.73	5.96 - 7.8	16.02 - 21.7

Table 3.8: Monthly collision risk estimates for kittiwake calculated using Option 2 of Band (2012) using the mean estimate of density and confidence intervals associated with flight height distribution and a nocturnal activity factor range of 2-3.

Avoidance rate (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flight height distribution = Maximum likelihood												
98.7	9.69 - 12.9	3.81 - 4.84	34.4 - 41.45	39.98 - 46.05	35.02 - 38.96	10.23 - 11.19	58.47 - 64.38	17.27 - 19.57	30.04 - 35.45	7.48 - 9.27	10.62 - 13.89	39.31 - 53.24
98.9	8.2 - 10.92	3.23 - 4.09	29.1 - 35.07	33.83 - 38.97	29.63 - 32.97	8.66 - 9.47	49.47 - 54.48	14.61 - 16.56	25.42 - 30	6.33 - 7.84	8.99 - 11.76	33.26 - 45.05
99.1	6.71 - 8.93	2.64 - 3.35	23.81 - 28.69	27.68 - 31.88	24.25 - 26.97	7.09 - 7.75	40.48 - 44.57	11.96 - 13.55	20.79 - 24.54	5.18 - 6.42	7.35 - 9.62	27.22 - 36.86
Flight height distribution = Upper confidence metric												
98.7	12.68 - 16.89	4.99 - 6.33	45.03 - 54.26	52.34 - 60.29	45.85 - 51.01	13.4 - 14.65	76.54 - 84.29	22.61 - 25.62	39.32 - 46.41	9.79 - 12.14	13.91 - 18.19	51.46 - 69.7
98.9	10.73 - 14.29	4.22 - 5.36	38.1 - 45.91	44.29 - 51.01	38.8 - 43.16	11.34 - 12.39	64.76 - 71.32	19.13 - 21.68	33.27 - 39.27	8.28 - 10.27	11.77 - 15.39	43.55 - 58.97
99.1	8.78 - 11.69	3.46 - 4.38	31.17 - 37.56	36.24 - 41.74	31.74 - 35.31	9.28 - 10.14	52.99 - 58.35	15.65 - 17.74	27.22 - 32.13	6.78 - 8.4	9.63 - 12.59	35.63 - 48.25
Flight height distribution = Lower confidence limit												
98.7	6.34 - 8.44	2.5 - 3.17	22.51 - 27.13	26.17 - 30.14	22.92 - 25.5	6.7 - 7.32	38.27 - 42.14	11.3 - 12.81	19.66 - 23.21	4.89 - 6.07	6.95 - 9.09	25.73 - 34.85
98.9	5.37 - 7.15	2.11 - 2.68	19.05 - 22.96	22.15 - 25.51	19.4 - 21.58	5.67 - 6.2	32.38 - 35.66	9.56 - 10.84	16.64 - 19.64	4.14 - 5.13	5.88 - 7.69	21.77 - 29.49
99.1	4.39 - 5.85	1.73 - 2.19	15.59 - 18.78	18.12 - 20.87	15.87 - 17.66	4.64 - 5.07	26.49 - 29.18	7.83 - 8.87	13.61 - 16.07	3.39 - 4.2	4.81 - 6.3	17.81 - 24.13

HRA scale

Table 3.9: Apportioned collision risk estimates for kittiwake when using the alternative analysis and confidence metrics associated with density using a nocturnal activity factor of 2

Band model Option	Density scenario	Avoidance rate (%)	Collision risk estimates						Total
			Post-breeding (5.4% apportioning value)	Pre-breeding (7.2% apportioning value)	Breeding season apportioning (%)				
					37.4	75.8	82.2	93.1	
Option 2	LCL	98.7	3	0	45	92	100	113	49 - 117
		98.9	3	0	38	78	85	96	41 - 99
		99.1	2	0	31	64	69	78	34 - 81
	Mean	98.7	5	1	73	148	161	182	79 - 188
		98.9	4	1	62	125	136	154	67 - 159
		99.1	4	1	56	114	124	140	61 - 144
	UCL	98.7	7	2	103	210	227	258	112 - 266
		98.9	6	1	88	177	192	218	95 - 225
		99.1	5	1	72	145	157	178	77 - 184

Table 3.10: Apportioned collision risk estimates for kittiwake when using the alternative analysis and confidence metrics associated with density using a nocturnal activity factor of 3

Band model Option	Density scenario	Avoidance rate (%)	Collision risk estimates						Total
			Post-breeding (5.4% apportioning value)	Pre-breeding (7.2% apportioning value)	Breeding season apportioning (%)				
			5.4	7.2	37.4	75.8	82.2	93.1	
Option 2	LCL	98.7	4	1	51	104	113	128	56 - 133
		98.9	3	1	44	88	96	108	47 - 112
		99.1	3	0	36	72	78	89	39 - 92
	Mean	98.7	6	1	83	168	182	206	90 - 214
		98.9	5	1	70	142	154	175	76 - 181
		99.1	5	1	64	129	140	159	69 - 164
	UCL	98.7	9	2	118	239	259	293	128 - 304
		98.9	7	2	100	202	219	248	109 - 257
		99.1	6	1	81	165	179	203	89 - 210

Table 3.11: Apportioned collision risk estimates for kittiwake when using the alternative analysis and confidence metrics associated with flight height data and the mean estimate density scenario using a nocturnal activity factor of 2

Band model Option	Density scenario	Avoidance rate (%)	Collision risk estimates						Total
			Post-breeding (5.4% apportioning value)	Pre-breeding (7.2% apportioning value)	Breeding season apportioning (%)				
			5.4	7.2	37.4	75.8	82.2	93.1	
Option 2	LCL	98.7	3	1	48	97	105	119	52 - 123
		98.9	3	1	40	82	89	101	44 - 104
		99.1	2	0	33	67	73	82	36 - 85
	Mean	98.7	5	1	73	148	161	182	79 - 188
		98.9	4	1	62	125	136	154	67 - 159
		99.1	4	1	56	114	124	140	61 - 144
	UCL	98.7	6	1	96	194	210	238	103 - 246
		98.9	5	1	81	164	178	201	87 - 208
		99.1	4	1	66	134	146	165	71 - 170

Table 3.12: Apportioned collision risk estimates for kittiwake when using the alternative analysis and confidence metrics associated with flight height data and the mean estimate density scenario using a nocturnal activity factor of 3

Band model Option	Density scenario	Avoidance rate (%)	Collision risk estimates						Total
			Post-breeding (5.4% apportioning value)	Pre-breeding (7.2% apportioning value)	Breeding season apportioning				
			5.4	7.2	37.4	75.8	82.2	93.1	
Option 2	LCL	98.7	4	1	54	110	119	135	59 - 140
		98.9	3	1	46	93	101	114	50 - 118
		99.1	3	1	38	76	83	93	41 - 97
	Mean	98.7	6	1	83	168	182	206	90 - 214
		98.9	5	1	70	142	154	175	76 - 181
		99.1	5	1	64	129	140	159	69 - 164
	UCL	98.7	8	2	109	220	238	270	118 - 280
		98.9	7	1	92	186	202	229	100 - 237
		99.1	6	1	75	152	165	187	82 - 194

Lesser black-backed gull

EIA scale

Table 3.13: Monthly collision risk estimates for lesser black-backed gull calculated using Option 2 of Band (2012) using confidence intervals associated with density with a nocturnal activity factor range of 2-3.

Avoidance rate (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Density = Mean estimate												
99.4	0	0	0	0.83 - 0.96	0.37 - 0.41	9.66 - 10.56	6.22 - 6.85	1.76 - 1.99	0	0	0	0
99.5	0	0	0	0.69 - 0.8	0.31 - 0.34	8.05 - 8.8	5.19 - 5.71	1.47 - 1.66	0	0	0	0
99.6	0	0	0	0.56 - 0.64	0.25 - 0.27	6.44 - 7.04	4.15 - 4.57	1.17 - 1.33	0	0	0	0
Density = Upper confidence limit												
99.4	0	0	0	1.58 - 1.82	0.83 - 0.93	15.29 - 16.72	10.94 - 12.04	3.55 - 4.03	0	0	0	0
99.5	0	0	0	1.31 - 1.51	0.69 - 0.77	12.74 - 13.93	9.11 - 10.04	2.96 - 3.36	0	0	0	0
99.6	0	0	0	1.05 - 1.21	0.56 - 0.62	10.19 - 11.14	7.29 - 8.03	2.37 - 2.68	0	0	0	0
Density = Lower confidence limit												
99.4	0	0	0	0.09 - 0.1	0	4.02 - 4.39	1.51 - 1.66	0	0	0	0	0
99.5	0	0	0	0.07 - 0.08	0	3.35 - 3.66	1.26 - 1.39	0	0	0	0	0
99.6	0	0	0	0.06 - 0.07	0	2.68 - 2.93	1.01 - 1.11	0	0	0	0	0

Table 3.14: Monthly collision risk estimates for lesser black-backed gull calculated using Option 2 of Band (2012) using the mean estimate of density and confidence intervals associated with flight height distribution with a nocturnal activity factor range of 2-3.

Avoidance rate (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flight height distribution = Maximum likelihood												
99.4	0	0	0	0.83 - 0.96	0.37 - 0.41	9.66 - 10.56	6.22 - 6.85	1.76 - 1.99	0	0	0	0
99.5	0	0	0	0.69 - 0.8	0.31 - 0.34	8.05 - 8.8	5.19 - 5.71	1.47 - 1.66	0	0	0	0
99.6	0	0	0	0.56 - 0.64	0.25 - 0.27	6.44 - 7.04	4.15 - 4.57	1.17 - 1.33	0	0	0	0
Flight height distribution = Upper confidence limit												
99.4	0	0	0	1.76 - 2.03	0.78 - 0.87	20.43 - 22.34	13.17 - 14.5	3.72 - 4.22	0	0	0	0
99.5	0	0	0	1.47 - 1.69	0.65 - 0.72	17.03 - 18.61	10.98 - 12.09	3.1 - 3.51	0	0	0	0
99.6	0	0	0	1.17 - 1.35	0.52 - 0.58	13.62 - 14.89	8.78 - 9.67	2.48 - 2.81	0	0	0	0
Flight height distribution = Lower confidence limit												
99.4	0	0	0	0.47 - 0.55	0	5.49 - 6.01	3.54 - 3.9	0	0	0	0	0
99.5	0	0	0	0.39 - 0.45	0	4.58 - 5	2.95 - 3.25	0	0	0	0	0
99.6	0	0	0	0.32 - 0.36	0	3.66 - 4	2.36 - 2.6	0	0	0	0	0

Herring gull

EIA scale

Table 3.15: Monthly collision risk estimates for herring gull calculated using Option 2 of Band (2012) using confidence intervals associated with density with a nocturnal activity factor range of 2-3.

Avoidance rate (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Density = Mean estimate												
99.4	0	1.52 - 1.92	0	0	0	0.55 - 0.6	0.56 - 0.62	0	2.58 - 3.05	0	0	3.67 - 4.97
99.5	0	1.26 - 1.6	0	0	0	0.46 - 0.5	0.47 - 0.51	0	2.15 - 2.54	0	0	3.06 - 4.15
99.6	0	1.01 - 1.28	0	0	0	0.37 - 0.4	0.37 - 0.41	0	1.72 - 2.03	0	0	2.45 - 3.32
Density = Upper confidence limit												
99.4	0	3.03 - 3.85	0	0	0	1.94 - 2.12	1.68 - 1.85	0	5.63 - 6.64	0	0	0 - 8.95
99.5	0	2.53 - 3.21	0	0	0	1.61 - 1.76	1.4 - 1.54	0	4.69 - 5.54	0	0	0 - 7.46
99.6	0	2.02 - 2.57	0	0	0	1.29 - 1.41	1.12 - 1.23	0	3.75 - 4.43	0	0	0 - 5.97
Density = Lower confidence limit												
99.4	0	0	0	0	0	0	0	0	0	0	0	1.1 - 1.49
99.5	0	0	0	0	0	0	0	0	0	0	0	0.92 - 1.24
99.6	0	0	0	0	0	0	0	0	0	0	0	0.73 - 0.99

Table 3.16: Monthly collision risk estimates for herring gull calculated using Option 2 of Band (2012) using the mean estimate of density and confidence intervals associated with flight height distribution with a nocturnal activity factor range of 2-3.

Avoidance rate (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flight height distribution = Maximum likelihood												
99.4	0	1.52 - 1.92	0	0	0	0.55 - 0.6	0.56 - 0.62	0	2.58 - 3.05	0	0	3.67 - 4.97
99.5	0	1.26 - 1.6	0	0	0	0.46 - 0.5	0.47 - 0.51	0	2.15 - 2.54	0	0	3.06 - 4.15
99.6	0	1.01 - 1.28	0	0	0	0.37 - 0.4	0.37 - 0.41	0	1.72 - 2.03	0	0	2.45 - 3.32
Flight height distribution = Upper confidence limit												
99.4	0	2.55 - 3.23	0	0	0	0.93 - 1.02	0.94 - 1.04	0	4.33 - 5.11	0	0	6.17 - 8.35
99.5	0	2.12 - 2.69	0	0	0	0.77 - 0.85	0.78 - 0.86	0	3.61 - 4.26	0	0	5.14 - 6.96
99.6	0	1.7 - 2.15	0	0	0	0.62 - 0.68	0.63 - 0.69	0	2.89 - 3.41	0	0	4.11 - 5.57
Flight height distribution = Lower confidence limit												
99.4	0	1.02 - 1.29	0	0	0	0.37 - 0.41	0.38 - 0.41	0	1.73 - 2.04	0	0	2.46 - 3.34
99.5	0	0.85 - 1.08	0	0	0	0.31 - 0.34	0.31 - 0.34	0	1.44 - 1.7	0	0	2.05 - 2.78
99.6	0	0.68 - 0.86	0	0	0	0.25 - 0.27	0.25 - 0.28	0	1.15 - 1.36	0	0	1.64 - 2.22

Great black-backed gull

EIA scale

Table 3.17: Monthly collision risk estimates for great black-backed gull calculated using Option 2 of Band (2012) using confidence intervals associated with density with a nocturnal activity factor range of 2-3.

Avoidance rate (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Density = Mean estimate												
99.4	5.81 - 7.74	1.61 - 2.04	1.83 - 2.21	0.47 - 0.54	0	1.3 - 1.42	15.86 - 17.47	1.5 - 1.7	5.11 - 6.04	4.11 - 5.09	6.62 - 8.66	19.42 - 26.3
99.5	4.84 - 6.45	1.34 - 1.7	1.53 - 1.84	0.39 - 0.45	0	1.08 - 1.18	13.22 - 14.55	1.25 - 1.42	4.26 - 5.03	3.42 - 4.25	5.52 - 7.22	16.18 - 21.91
99.6	3.87 - 5.16	1.07 - 1.36	1.22 - 1.47	0.31 - 0.36	0	0.86 - 0.95	10.57 - 11.64	1 - 1.14	3.41 - 4.02	2.74 - 3.4	4.41 - 5.77	12.94 - 17.53
Density = Upper confidence limit												
99.4	11.3 - 15.05	3.51 - 4.45	4.03 - 4.85	1.05 - 1.21	0	2.31 - 2.52	31.63 - 34.83	2.51 - 2.84	9.73 - 11.48	6.26 - 7.77	8.61 - 11.26	29.16 - 39.49
99.5	9.42 - 12.54	2.93 - 3.71	3.35 - 4.04	0.87 - 1.01	0	1.92 - 2.1	26.36 - 29.03	2.09 - 2.37	8.11 - 9.57	5.22 - 6.47	7.18 - 9.38	24.3 - 32.91
99.6	7.53 - 10.03	2.34 - 2.97	2.68 - 3.23	0.7 - 0.81	0	1.54 - 1.68	21.09 - 23.22	1.67 - 1.89	6.49 - 7.66	4.18 - 5.18	5.74 - 7.51	19.44 - 26.33
Density = Lower confidence limit												
99.4	1.26 - 1.67	0	0	0	0	0.28 - 0.31	0.09 - 0.1	0.5 - 0.57	0	0	4.63 - 6.06	11.57 - 15.67
99.5	1.05 - 1.39	0	0	0	0	0.24 - 0.26	0.07 - 0.08	0.42 - 0.47	0	0	3.86 - 5.05	9.64 - 13.06
99.6	0.84 - 1.11	0	0	0	0	0.19 - 0.21	0.06 - 0.06	0.33 - 0.38	0	0	3.09 - 4.04	7.71 - 10.44

Table 3.18: Monthly collision risk estimates for great black-backed gull calculated using Option 2 of Band (2012) using the mean estimate of density and confidence intervals associated with flight height distribution with a nocturnal activity factor range of 2-3.

Avoidance rate (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flight height distribution = Maximum likelihood												
99.4	5.81 - 7.74	1.61 - 2.04	1.83 - 2.21	0.47 - 0.54	0	1.3 - 1.42	15.86 - 17.47	1.5 - 1.7	5.11 - 6.04	4.11 - 5.09	6.62 - 8.66	19.42 - 26.3
99.5	4.84 - 6.45	1.34 - 1.7	1.53 - 1.84	0.39 - 0.45	0	1.08 - 1.18	13.22 - 14.55	1.25 - 1.42	4.26 - 5.03	3.42 - 4.25	5.52 - 7.22	16.18 - 21.91
99.6	3.87 - 5.16	1.07 - 1.36	1.22 - 1.47	0.31 - 0.36	0	0.86 - 0.95	10.57 - 11.64	1 - 1.14	3.41 - 4.02	2.74 - 3.4	4.41 - 5.77	12.94 - 17.53
Flight height distribution = Upper confidence limit												
99.4	10.03 - 13.36	2.78 - 3.53	3.16 - 3.81	0.8 - 0.93	0	2.24 - 2.45	27.39 - 30.16	2.6 - 2.94	8.83 - 10.42	7.1 - 8.8	11.43 - 14.95	33.53 - 45.41
99.5	8.36 - 11.14	2.32 - 2.94	2.64 - 3.18	0.67 - 0.77	0	1.87 - 2.04	22.82 - 25.13	2.16 - 2.45	7.36 - 8.69	5.91 - 7.33	9.53 - 12.46	27.94 - 37.84
99.6	6.69 - 8.91	1.86 - 2.35	2.11 - 2.54	0.54 - 0.62	0	1.49 - 1.63	18.26 - 20.11	1.73 - 1.96	5.89 - 6.95	4.73 - 5.86	7.62 - 9.97	22.35 - 30.27
Flight height distribution = Lower confidence limit												
99.4	4.57 - 6.09	1.27 - 1.61	1.44 - 1.74	0.37 - 0.42	0	1.02 - 1.12	12.48 - 13.75	1.18 - 1.34	4.03 - 4.75	3.23 - 4.01	5.21 - 6.82	15.28 - 20.7
99.5	3.81 - 5.08	1.06 - 1.34	1.2 - 1.45	0.31 - 0.35	0	0.85 - 0.93	10.4 - 11.46	0.99 - 1.12	3.36 - 3.96	2.7 - 3.34	4.34 - 5.68	12.74 - 17.25
99.6	3.05 - 4.06	0.85 - 1.07	0.96 - 1.16	0.24 - 0.28	0	0.68 - 0.74	8.32 - 9.17	0.79 - 0.89	2.68 - 3.17	2.16 - 2.67	3.48 - 4.54	10.19 - 13.8