FIVE ESTUARIES
OFFSHORE WIND FARM

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ENVIRONMENTAL STATEMENT

VOLUME 6, PART 5, ANNEX 4.8: COLLISION RISK MODELLING INPUTS AND OUTPUTS

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Five Estuaries Offshore Windfarm

Ornithology Technical Annex 4.8a Deterministic Collision Risk Modelling inputs and outputs

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Contents

1 INTRODUCTION

This annex provides tables of the deterministic collision risk modelling (CRM) input parameters for the Five Estuaries Offshore Windfarm (VE) and the collision mortality results obtained.

A key to the tables which provide input densities and predicted collision mortalities is provided in Table 1, and in summary these tables comprise:

- Tables 2 to 19: densities of birds in flight in the VE Array Areas (North and South) in each month, presented as the mean, standard deviation and upper and lower 95% confidence range derived from 1,000 nonparametric bootstrap simulations (the monthly values were derived as the average of the densities estimated from surveys conducted during two consecutive years).
- Table 20: the Array Area and turbine data;
- Table 21: biometrics of each species modelled (e.g. wingspan, body length, etc.);
- Tables 22 to 38: monthly collisions using Turbine parameter set 1;
- Tables 39 to 55: seasonal[1] collisions using Turbine parameter set 1;
- Tables 56 to 72: monthly collisions using Turbine parameter set 2, and
- Tables 73 to 89: seasonal collisions using Turbine parameter set 2.

Table 1. Key to table numbers for seabird densities and collision outputs (note that 'NA' indicates species not recorded). For some species alternative input parameters have been used, hence multiple tables are presented.

Species	Input densities – Table no.		Output collisions – Table nos. (turbine 1 / 2)	
	North Array	South Array	Annual collisions	Seasonal collisions
Black-headed gull	NA	11	22 / 56	39 / 73
Common gull	2	12	23 / 57	40 / 74
Common tern	3	NA	24 / 58	41 / 75
Fulmar	4	13	25 / 59	42 / 76
Gannet	5	14	26 + 27 / 60 + 61	43 + 44 / 77 + 78
Great black-backed gull	6	NA	28 + 29 / 62 + 63	45 + 46 / 79 + 80
Great skua	NA	15	30 / 64	47 / 81
Herring gull	7	16	31 + 32 / 65 + 66	48 + 49 / 82 + 83
Kittiwake	8	17	33 + 34 / 67 + 68	50 + 51 / 84 + 85
Lesser black-backed gull	9	18	35 + 36 / 69 + 70	52 + 53 / 86 + 87
Little gull	10	NA	37 / 71	54 / 88
Sandwich tern	NA	19	38 / 72	55 / 89

[1] Taken from: Furness, R.W. 2015. Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Reports, Number 164.

2 FLIGHT DENSITIES

Table 2. Five Estuaries North. Monthly density of Common gull recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0 (0)	0-0	
Feb	0 (0)	0-0	
Mar	0 (0)	0-0	
Apr	0.05 (0.04)	0-0.15	0.79
May	0 (0)	0-0	
Jun	0 (0)	0-0	
Jul	0 (0)	0-0	
Aug	0 (0)	0-0	
Sep	0 (0)	0-0	
Oct	0 (0)	0-0	
Nov	0 (0)	0-0	
Dec	0.05 (0.04)	0-0.15	0.81

Table 3. Five Estuaries North. Monthly density of Common tern recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0 (0)	0-0	
Feb	0 (0)	0-0	
Mar	0 (0)	0-0	
Apr	0 (0)	0-0	
May	0 (0)	0-0	
Jun	0 (0)	0-0	
Jul	0 (0)	0-0	
Aug	0 (0)	0-0	
Sep	0.05 (0.04)	0-0.16	0.82
Oct	0 (0)	0-0	
Nov	0 (0)	0-0	
Dec	0 (0)	0-0	

Table 4. Five Estuaries North. Monthly density of Fulmar recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0.05 (0.04)	0-0.16	0.83
Feb	0 (0)	0-0	
Mar	0 (0)	0-0	
Apr	0.05 (0.04)	0-0.16	0.84
May	0 (0)	0-0	
Jun	0.05 (0.04)	0-0.15	0.83
Jul	0.26 (0.19)	0-0.68	0.73
Aug	0 (0)	0-0	
Sep	0 (0)	0-0	
Oct	0 (0)	0-0	
Nov	0 (0)	0-0	
Dec	0 (0)	0-0	

Table 5. Five Estuaries North. Monthly density of Gannet recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0 (0)	0-0	
Feb	0 (0)	0-0	
Mar	0.05 (0.04)	0-0.16	0.83
Apr	0.05 (0.04)	0-0.16	0.83
May	0 (0)	0-0	
Jun	0.16 (0.08)	0-0.32	0.47
Jul	0.15 (0.07)	0-0.3	0.48
Aug	0.1 (0.08)	0-0.26	0.79
Sep	0 (0)	0-0	
Oct	0.26 (0.19)	0-0.68	0.72
Nov	1.09 (0.55)	0.11-2.22	0.51
Dec	0.05 (0.04)	0-0.15	0.81

Table 6. Five Estuaries North. Monthly density of Great black-backed gull recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0.05 (0.04)	0-0.15	0.82
Feb	0 (0)	0-0	
Mar	0.05 (0.04)	0-0.16	0.8
Apr	0 (0)	0-0	
May	0 (0)	0-0	
Jun	0 (0)	0-0	
Jul	0 (0)	0-0	
Aug	0 (0)	0-0	
Sep	0 (0)	0-0	
Oct	0 (0)	0-0	
Nov	0 (0)	0-0	
Dec	0.05 (0.04)	0-0.15	0.81

Table 7. Five Estuaries North. Monthly density of Herring gull recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0 (0)	0-0	
Feb	0 (0)	0-0	
Mar	0 (0)	0-0	
Apr	0 (0)	0-0	
May	0 (0)	0-0	
Jun	0 (0)	0-0	
Jul	0.05 (0.04)	0-0.11	0.8
Aug	0 (0)	0-0	
Sep	0 (0)	0-0	
Oct	0 (0)	0-0	
Nov	0 (0)	0-0	
Dec	0.05 (0.04)	0-0.15	0.81

Table 8. Five Estuaries North. Monthly density of Kittiwake recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0.15 (0.1)	0-0.36	0.64
Feb	0.4 (0.23)	0-0.9	0.57
Mar	0.37 (0.19)	0.05-0.74	0.51
Apr	0.26 (0.16)	0-0.63	0.63
May	0 (0)	0-0	
Jun	0.27 (0.11)	0.05-0.48	0.4
Jul	0.1 (0.07)	0-0.25	0.71
Aug	0 (0)	0-0	
Sep	0.11 (0.09)	0-0.32	0.81
Oct	0.05 (0.04)	0-0.16	0.81
Nov	0.31 (0.17)	0.05-0.68	0.56
Dec	0.15 (0.11)	0-0.4	0.74

Table 9. Five Estuaries North. Monthly density of Lesser black-backed gull recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0.05 (0.04)	0-0.15	0.83
Feb	0 (0)	0-0	
Mar	0 (0)	0-0	
Apr	0 (0)	0-0	
May	0 (0)	0-0	
Jun	0.36 (0.23)	0-0.88	0.65
Jul	1.89 (1.42)	0-4.93	0.75
Aug	0 (0)	0-0	
Sep	0.05 (0.04)	0-0.15	0.83
Oct	0 (0)	0-0	
Nov	0 (0)	0-0	
Dec	0 (0)	0-0	

Table 10. Five Estuaries North. Monthly density of Little gull recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0 (0)	0-0	
Feb	0 (0)	0-0	
Mar	0 (0)	0-0	
Apr	0.05 (0.04)	0-0.16	0.81
May	0 (0)	0-0	
Jun	0 (0)	0-0	
Jul	0 (0)	0-0	
Aug	0 (0)	0-0	
Sep	0 (0)	0-0	
Oct	0 (0)	0-0	
Nov	0 (0)	0-0	
Dec	0 (0)	0-0	

Table 11. Five Estuaries South. Monthly density of Black-headed gull recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0 (0)	0-0	
Feb	0 (0)	0-0	
Mar	0 (0)	0-0	
Apr	0 (0)	0-0	
May	0 (0)	0-0	
Jun	0 (0)	0-0	
Jul	0.11 (0.06)	0-0.22	0.56
Aug	0 (0)	0-0	
Sep	0 (0)	0-0	
Oct	0.06 (0.05)	0-0.17	0.82
Nov	0.06 (0.05)	0-0.17	0.79
Dec	0 (0)	0-0	

Table 12. Five Estuaries South. Monthly density of Common gull recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0 (0)	0-0	
Feb	0.06 (0.04)	0-0.11	0.79
Mar	0.16 (0.09)	0-0.33	0.55
Apr	0 (0)	0-0	
May	0 (0)	0-0	
Jun	0 (0)	0-0	
Jul	0 (0)	0-0	
Aug	0 (0)	0-0	
Sep	0 (0)	0-0	
Oct	0 (0)	0-0	
Nov	0 (0)	0-0	
Dec	0 (0)	0-0	

Table 13. Five Estuaries South. Monthly density of Fulmar recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0 (0)	0-0	
Feb	0 (0)	0-0	
Mar	0.23 (0.11)	0.06-0.45	0.48
Apr	0.06 (0.05)	0-0.17	0.8
May	0.11 (0.07)	0-0.23	0.58
Jun	0 (0)	0-0	
Jul	0 (0)	0-0	
Aug	0 (0)	0-0	
Sep	0 (0)	0-0	
Oct	0 (0)	0-0	
Nov	0 (0)	0-0	
Dec	0 (0)	0-0	

Table 14. Five Estuaries South. Monthly density of Gannet recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0 (0)	0-0	
Feb	0.16 (0.13)	0-0.44	0.78
Mar	0.06 (0.04)	0-0.17	0.79
Apr	0.17 (0.11)	0-0.39	0.65
May	0.06 (0.04)	0-0.11	0.76
Jun	0.06 (0.05)	0-0.12	0.79
Jul	0 (0)	0-0	
Aug	0.06 (0.05)	0-0.17	0.83
Sep	0.4 (0.21)	0.06-0.85	0.52
Oct	0.22 (0.14)	0-0.5	0.62
Nov	0.69 (0.3)	0.17-1.26	0.43
Dec	0 (0)	0-0	

Table 15. Five Estuaries South. Monthly density of Great skua recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0 (0)	0-0	
Feb	0 (0)	0-0	
Mar	0 (0)	0-0	
Apr	0 (0)	0-0	
May	0 (0)	0-0	
Jun	0 (0)	0-0	
Jul	0 (0)	0-0	
Aug	0.06 (0.05)	0-0.17	0.81
Sep	0 (0)	0-0	
Oct	0 (0)	0-0	
Nov	0 (0)	0-0	
Dec	0 (0)	0-0	

Table 16. Five Estuaries South. Monthly density of Herring gull recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0 (0)	0-0	
Feb	0 (0)	0-0	
Mar	0 (0)	0-0	
Apr	0 (0)	0-0	
May	0 (0)	0-0	
Jun	0 (0)	0-0	
Jul	0 (0)	0-0	
Aug	0 (0)	0-0	
Sep	0 (0)	0-0	
Oct	0.06 (0.05)	0-0.17	0.82
Nov	0 (0)	0-0	
Dec	0 (0)	0-0	

Table 17. Five Estuaries South. Monthly density of Kittiwake recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0.17 (0.08)	0.05-0.34	0.46
Feb	0.6 (0.25)	0.11-1.1	0.42
Mar	0.79 (0.42)	0.11-1.69	0.53
Apr	0.06 (0.05)	0-0.17	0.82
May	0.22 (0.13)	0-0.5	0.56
Jun	0.17 (0.11)	0-0.4	0.65
Jul	0.06 (0.05)	0-0.17	0.83
Aug	0 (0)	0-0	
Sep	0 (0)	0-0	
Oct	0 (0)	0-0	
Nov	0.51 (0.22)	0.12-0.9	0.44
Dec	0.66 (0.29)	0.17-1.27	0.44

Table 18. Five Estuaries South. Monthly density of Lesser black-backed gull recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0 (0)	0-0	
Feb	0 (0)	0-0	
Mar	0.05 (0.04)	0-0.16	0.81
Apr	0.06 (0.05)	0-0.17	0.82
May	0 (0)	0-0	
Jun	0.46 (0.33)	0-1.27	0.72
Jul	0 (0)	0-0	
Aug	0.17 (0.13)	0-0.45	0.75
Sep	0.12 (0.1)	0-0.35	0.83
Oct	0 (0)	0-0	
Nov	0.06 (0.04)	0-0.17	0.78
Dec	0.11 (0.09)	0-0.33	0.82

Table 19. Five Estuaries South. Monthly density of Sandwich tern recorded in flight, S.D. and 95% confidence intervals, in the wind farm only.

Month	**Density**		
	Wind farm		
	Estimate (S.D.)	**95% c.i.**	**CV**
Jan	0 (0)	0-0	
Feb	0 (0)	0-0	
Mar	0 (0)	0-0	
Apr	0 (0)	0-0	
May	0 (0)	0-0	
Jun	0 (0)	0-0	
Jul	0 (0)	0-0	
Aug	0 (0)	0-0	
Sep	0 (0)	0-0	
Oct	0.06 (0.05)	0-0.17	0.82
Nov	0 (0)	0-0	
Dec	0 (0)	0-0	

3 CRM INPUT PARAMETERS

Table 20. VE Array Area and turbine data used in the CRM.

Parameter	Turbine parameter set 1		Turbine parameter set 2	
	North	South	North	South
No. turbines	31	48	16	25
Rotor radius (m)	129.6	129.6	180.0	180.0
Hub height (m; HAT)	157.6	157.6	208.0	208.0
Tidal offset (m; MSL to HAT)	1.2	1.2	1.2	1.2
Max. blade width (m)	9.4	9.4	13.2	13.2
Mean RPM	7.3	7.3	5.3	5.3
Mean blade angle (°)	15	15	15	15
Array Area width (km)	14.5	9.7	14.5	9.7
Array Area latitude (centre; °)	51.97	51.81	51.97	51.81
Percentage operational	95	95	95	95

Table 21: Biometrics of each species modelled. Species with two sets of parameters (gannet, kittiwake, large gulls) have been modelled with each set (i.e. row of this table) in order of presentation in this report (the second set is identified in each case in the output table heading).

Species	Body length (m)	Wingspan (m)	Flight speed (ms-1)	Nocturnal activity factor (1 to 5 / %)	Flight type	Avoidance rate (%)
Black-headed gull	0.37	1.10	11.9	3 / 50%	Flapping	99.5
Common gull	0.42	1.30	13.4	3 / 50%	Flapping	99.5
Common tern	0.33	0.87	10.5	5 / 100%	Flapping	99.0
Fulmar	0.48	1.07	13.0	4 / 75%	Flapping	99.0
Gannet	0.94	1.72	14.9	1.32 / 8%	Flapping	99.72
						99.88
Great black-backed gull	0.71	1.58	13.7	3 / 50%	Flapping	99.4
				2 / 25%		
Great skua	0.56	1.36	14.9	1 / 0%	Flapping	99.0
Herring gull	0.60	1.44	12.8	3 / 50%	Flapping	99.4
				2 / 25%		
Kittiwake	0.39	1.08	13.1	3 / 50%	Flapping	99.2
				2 / 25%		
Lesser black-backed gull	0.58	1.42	13.1	3 / 50%	Flapping	99.4
				2 / 25%		
Little gull	0.26	0.78	12.2	2 / 25%	Flapping	99.5
Sandwich tern	0.39	1.0	10.5	5 / 100%	Flapping	99.0

4 MONTHLY COLLISIONS USING TURBINE PARAMETER SET 1

Table 22. Black-headed Gull monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0	0	0	0.00	0.00	0	0.00	0.00
Feb	0	0	0	0	0.00	0.00	0	0.00	0.00
Mar	0	0	0	0	0.00	0.00	0	0.00	0.00
Apr	0	0	0	0	0.00	0.00	0	0.00	0.00
May	0	0	0	0	0.00	0.00	0	0.00	0.00
Jun	0	0	0	0	0.00	0.00	0	0.00	0.00
Jul	0	0	0	0	0.49	0.98	0	0.49	0.98
Aug	0	0	0	0	0.00	0.00	0	0.00	0.00
Sep	0	0	0	0	0.00	0.00	0	0.00	0.00
Oct	0	0	0	0	0.22	0.66	0	0.22	0.66
Nov	0	0	0	0	0.20	0.61	0	0.20	0.61
Dec	0	0	0	0	0.00	0.00	0	0.00	0.00
Annual	0	0	0	0	0.91	2.25	0	0.91	2.25

Table 23. Common Gull monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Feb	0	0.00	0.00	0	0.39	0.78	0	0.39	0.78
Mar	0	0.00	0.00	0	1.36	2.73	0	1.36	2.73
Apr	0	0.27	0.82	0	0.00	0.00	0	0.27	0.82
May	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Jun	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Jul	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Aug	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Sep	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Oct	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Nov	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Dec	0	0.24	0.72	0	0.00	0.00	0	0.24	0.72
Annual	0	0.51	1.54	0	1.75	3.51	0	2.27	5.05

Table 24. Common Tern monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.00	0.00	0	0	0	0	0.00	0.00
Feb	0	0.00	0.00	0	0	0	0	0.00	0.00
Mar	0	0.00	0.00	0	0	0	0	0.00	0.00
Apr	0	0.00	0.00	0	0	0	0	0.00	0.00
May	0	0.00	0.00	0	0	0	0	0.00	0.00
Jun	0	0.00	0.00	0	0	0	0	0.00	0.00
Jul	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug	0	0.00	0.00	0	0	0	0	0.00	0.00
Sep	0	0.13	0.38	0	0	0	0	0.13	0.38
Oct	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov	0	0.00	0.00	0	0	0	0	0.00	0.00
Dec	0	0.00	0.00	0	0	0	0	0.00	0.00
Annual	0	0.13	0.38	0	0	0	0	0.13	0.38

Table 25. Fulmar monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.01	0.02	0.00	0.00	0.00	0.00	0.01	0.02
Feb	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mar	0	0.00	0.00	0.01	0.05	0.11	0.01	0.05	0.11
Apr	0	0.01	0.02	0.00	0.01	0.04	0.00	0.02	0.06
May	0	0.00	0.00	0.00	0.03	0.06	0.00	0.03	0.06
Jun	0	0.01	0.02	0.00	0.00	0.00	0.00	0.01	0.02
Jul	0	0.04	0.11	0.00	0.00	0.00	0.00	0.04	0.11
Aug	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sep	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oct	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dec	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	0	0.07	0.18	0.01	0.10	0.20	0.01	0.16	0.39

Table 26. Gannet monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb	0.0	0.00	0.00	0.00	0.24	0.64	0.00	0.24	0.64
Mar	0.0	0.06	0.19	0.00	0.11	0.32	0.00	0.17	0.51
Apr	0.0	0.07	0.21	0.00	0.35	0.82	0.00	0.42	1.03
May	0.0	0.00	0.00	0.00	0.13	0.26	0.00	0.13	0.26
Jun	0.0	0.25	0.50	0.00	0.14	0.28	0.00	0.39	0.79
Jul	0.0	0.24	0.48	0.00	0.00	0.00	0.00	0.24	0.48
Aug	0.0	0.15	0.38	0.00	0.13	0.39	0.00	0.28	0.77
Sep	0.0	0.00	0.00	0.11	0.77	1.64	0.11	0.77	1.64
Oct	0.0	0.29	0.75	0.00	0.38	0.87	0.00	0.68	1.62
Nov	0.1	1.01	2.06	0.25	0.99	1.81	0.35	2.00	3.87
Dec	0.0	0.04	0.13	0.00	0.00	0.00	0.00	0.04	0.13
Annual	0.1	2.12	4.71	0.36	3.24	7.04	0.46	5.36	11.75

Table 27. Gannet2 monthly mean collision estimates and 95% confidence intervals (calculated using higher value of macro-avoidance rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb	0.00	0.00	0.00	0.00	0.10	0.28	0.00	0.10	0.28
Mar	0.00	0.03	0.08	0.00	0.05	0.14	0.00	0.07	0.22
Apr	0.00	0.03	0.09	0.00	0.15	0.35	0.00	0.18	0.44
May	0.00	0.00	0.00	0.00	0.06	0.11	0.00	0.06	0.11
Jun	0.00	0.11	0.22	0.00	0.06	0.12	0.00	0.17	0.34
Jul	0.00	0.10	0.21	0.00	0.00	0.00	0.00	0.10	0.21
Aug	0.00	0.06	0.16	0.00	0.06	0.17	0.00	0.12	0.33
Sep	0.00	0.00	0.00	0.05	0.33	0.70	0.05	0.33	0.70
Oct	0.00	0.12	0.32	0.00	0.16	0.37	0.00	0.29	0.70
Nov	0.04	0.43	0.88	0.11	0.42	0.78	0.15	0.86	1.66
Dec	0.00	0.02	0.06	0.00	0.00	0.00	0.00	0.02	0.06
Annual	0.04	0.91	2.02	0.15	1.39	3.02	0.20	2.30	5.04

Table 28. Great Black-backed Gull monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.59	1.78	0	0	0	0	0.59	1.78
Feb	0	0.00	0.00	0	0	0	0	0.00	0.00
Mar	0	0.68	2.05	0	0	0	0	0.68	2.05
Apr	0	0.00	0.00	0	0	0	0	0.00	0.00
May	0	0.00	0.00	0	0	0	0	0.00	0.00
Jun	0	0.00	0.00	0	0	0	0	0.00	0.00
Jul	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug	0	0.00	0.00	0	0	0	0	0.00	0.00
Sep	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov	0	0.00	0.00	0	0	0	0	0.00	0.00
Dec	0	0.58	1.75	0	0	0	0	0.58	1.75
Annual	0	1.86	5.57	0	0	0	0	1.86	5.57

Table 29. Great Black-backed Gull2 monthly mean collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.45	1.35	0	0	0	0	0.45	1.35
Feb	0	0.00	0.00	0	0	0	0	0.00	0.00
Mar	0	0.57	1.70	0	0	0	0	0.57	1.70
Apr	0	0.00	0.00	0	0	0	0	0.00	0.00
May	0	0.00	0.00	0	0	0	0	0.00	0.00
Jun	0	0.00	0.00	0	0	0	0	0.00	0.00
Jul	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug	0	0.00	0.00	0	0	0	0	0.00	0.00
Sep	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov	0	0.00	0.00	0	0	0	0	0.00	0.00
Dec	0	0.43	1.30	0	0	0	0	0.43	1.30
Annual	0	1.45	4.35	0	0	0	0	1.45	4.35

Table 30. Great Skua monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0	0	0	0.00	0.00	0	0.00	0.00
Feb	0	0	0	0	0.00	0.00	0	0.00	0.00
Mar	0	0	0	0	0.00	0.00	0	0.00	0.00
Apr	0	0	0	0	0.00	0.00	0	0.00	0.00
May	0	0	0	0	0.00	0.00	0	0.00	0.00
Jun	0	0	0	0	0.00	0.00	0	0.00	0.00
Jul	0	0	0	0	0.00	0.00	0	0.00	0.00
Aug	0	0	0	0	0.13	0.38	0	0.13	0.38
Sep	0	0	0	0	0.00	0.00	0	0.00	0.00
Oct	0	0	0	0	0.00	0.00	0	0.00	0.00
Nov	0	0	0	0	0.00	0.00	0	0.00	0.00
Dec	0	0	0	0	0.00	0.00	0	0.00	0.00
Annual	0	0	0	0	0.13	0.38	0	0.13	0.38

Table 31. Herring Gull monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.00	0.00	0	0	0.00	0	0.00	0.00
Feb	0	0.00	0.00	0	0	0.00	0	0.00	0.00
Mar	0	0.00	0.00	0	0	0.00	0	0.00	0.00
Apr	0	0.00	0.00	0	0	0.00	0	0.00	0.00
May	0	0.00	0.00	0	0	0.00	0	0.00	0.00
Jun	0	0.00	0.00	0	0	0.00	0	0.00	0.00
Jul	0	0.69	1.39	0	0	0.00	0	0.69	1.39
Aug	0	0.00	0.00	0	0	0.00	0	0.00	0.00
Sep	0	0.00	0.00	0	0	0.00	0	0.00	0.00
Oct	0	0.00	0.00	0	1	3.01	0	1.00	3.01
Nov	0	0.00	0.00	0	0	0.00	0	0.00	0.00
Dec	0	0.52	1.57	0	0	0.00	0	0.52	1.57
Annual	0	1.21	2.96	0	1	3.01	0	2.21	5.97

Table 32. Herring Gull2 monthly mean collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Feb	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Mar	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Apr	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
May	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Jun	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Jul	0	0.62	1.26	0	0.00	0.00	0	0.62	1.26
Aug	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Sep	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Oct	0	0.00	0.00	0	0.81	2.43	0	0.81	2.43
Nov	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Dec	0	0.39	1.17	0	0.00	0.00	0	0.39	1.17
Annual	0	1.01	2.43	0	0.81	2.43	0	1.82	4.86

Table 33. Kittiwake monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0.00	0.66	1.53	0.36	1.12	2.23	0.36	1.77	3.76
Feb	0.00	1.62	3.65	0.69	3.77	6.85	0.69	5.39	10.50
Mar	0.25	1.74	3.47	0.83	5.77	12.33	1.08	7.51	15.80
Apr	0.00	1.27	3.04	0.00	0.43	1.29	0.00	1.70	4.33
May	0.00	0.00	0.00	0.00	1.81	4.08	0.00	1.81	4.08
Jun	0.28	1.38	2.48	0.00	1.37	3.18	0.28	2.75	5.66
Jul	0.00	0.54	1.34	0.00	0.45	1.36	0.00	0.99	2.69
Aug	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sep	0.00	0.49	1.48	0.00	0.00	0.00	0.00	0.49	1.48
Oct	0.00	0.24	0.72	0.00	0.00	0.00	0.00	0.24	0.72
Nov	0.22	1.31	2.84	0.75	3.31	5.88	0.97	4.63	8.72
Dec	0.00	0.64	1.70	1.08	4.31	8.27	1.08	4.95	9.96
Annual	0.74	9.88	22.26	3.71	22.34	45.46	4.45	32.22	67.72

Table 34. Kittiwake2 monthly mean collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0.00	0.50	1.16	0.27	0.85	1.69	0.27	1.34	2.85
Feb	0.00	1.28	2.89	0.54	2.99	5.43	0.54	4.27	8.32
Mar	0.21	1.44	2.88	0.69	4.79	10.24	0.89	6.23	13.12
Apr	0.00	1.10	2.63	0.00	0.37	1.11	0.00	1.47	3.75
May	0.00	0.00	0.00	0.00	1.62	3.65	0.00	1.62	3.65
Jun	0.25	1.25	2.26	0.00	1.25	2.89	0.25	2.50	5.15
Jul	0.00	0.48	1.21	0.00	0.41	1.22	0.00	0.89	2.43
Aug	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sep	0.00	0.42	1.25	0.00	0.00	0.00	0.00	0.42	1.25
Oct	0.00	0.19	0.58	0.00	0.00	0.00	0.00	0.19	0.58
Nov	0.17	1.01	2.19	0.58	2.55	4.53	0.74	3.56	6.72
Dec	0.00	0.48	1.27	0.81	3.22	6.18	0.81	3.70	7.44
Annual	0.62	8.16	18.32	2.89	18.04	36.94	3.51	26.19	55.26

Table 35. Lesser Black-backed Gull monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.44	1.33	0	0.00	0.00	0	0.44	1.33
Feb	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Mar	0	0.00	0.00	0	0.83	2.48	0	0.83	2.48
Apr	0	0.00	0.00	0	0.88	2.65	0	0.88	2.65
May	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Jun	0	3.86	9.40	0	7.61	20.92	0	11.47	30.32
Jul	0	20.65	53.91	0	0.00	0.00	0	20.65	53.91
Aug	0	0.00	0.00	0	2.76	7.34	0	2.76	7.34
Sep	0	0.49	1.46	0	1.73	5.20	0	2.22	6.65
Oct	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Nov	0	0.00	0.00	0	0.74	2.22	0	0.74	2.22
Dec	0	0.00	0.00	0	1.48	4.44	0	1.48	4.44
Annual	0	25.44	66.10	0	16.03	45.24	0	41.47	111.35

Table 36. Lesser Black-backed Gull2 monthly mean collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.34	1.01	0	0.00	0.00	0	0.34	1.01
Feb	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Mar	0	0.00	0.00	0	0.69	2.06	0	0.69	2.06
Apr	0	0.00	0.00	0	0.77	2.30	0	0.77	2.30
May	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Jun	0	3.51	8.55	0	6.92	19.01	0	10.43	27.56
Jul	0	18.65	48.69	0	0.00	0.00	0	18.65	48.69
Aug	0	0.00	0.00	0	2.42	6.45	0	2.42	6.45
Sep	0	0.41	1.23	0	1.47	4.40	0	1.88	5.63
Oct	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Nov	0	0.00	0.00	0	0.57	1.71	0	0.57	1.71
Dec	0	0.00	0.00	0	1.11	3.32	0	1.11	3.32
Annual	0	22.91	59.48	0	13.93	39.24	0	36.84	98.72

Table 37. Little Gull monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.00	0.00	0	0	0	0	0.00	0.00
Feb	0	0.00	0.00	0	0	0	0	0.00	0.00
Mar	0	0.00	0.00	0	0	0	0	0.00	0.00
Apr	0	0.12	0.37	0	0	0	0	0.12	0.37
May	0	0.00	0.00	0	0	0	0	0.00	0.00
Jun	0	0.00	0.00	0	0	0	0	0.00	0.00
Jul	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug	0	0.00	0.00	0	0	0	0	0.00	0.00
Sep	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov	0	0.00	0.00	0	0	0	0	0.00	0.00
Dec	0	0.00	0.00	0	0	0	0	0.00	0.00
Annual	0	0.12	0.37	0	0	0	0	0.12	0.37

Table 38. Sandwich Tern monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0	0	0	0.00	0.00	0	0.00	0.00
Feb	0	0	0	0	0.00	0.00	0	0.00	0.00
Mar	0	0	0	0	0.00	0.00	0	0.00	0.00
Apr	0	0	0	0	0.00	0.00	0	0.00	0.00
May	0	0	0	0	0.00	0.00	0	0.00	0.00
Jun	0	0	0	0	0.00	0.00	0	0.00	0.00
Jul	0	0	0	0	0.00	0.00	0	0.00	0.00
Aug	0	0	0	0	0.00	0.00	0	0.00	0.00
Sep	0	0	0	0	0.00	0.00	0	0.00	0.00
Oct	0	0	0	0	0.21	0.64	0	0.21	0.64
Nov	0	0	0	0	0.00	0.00	0	0.00	0.00
Dec	0	0	0	0	0.00	0.00	0	0.00	0.00
Annual	0	0	0	0	0.21	0.64	0	0.21	0.64

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Table 39. Black-headed Gull seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0	0	0	0.00	0.00	0	0.00	0.00
Breeding (full)	0	0	0	0	0.49	0.98	0	0.49	0.98
Autumn migration	0	0	0	0	0.00	0.00	0	0.00	0.00
Winter	0	0	0	0	0.00	0.00	0	0.00	0.00
Non-breeding	0	0	0	0	0.42	1.27	0	0.42	1.27

Table 40. Common Gull seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Breeding (full)	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Autumn migration	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Winter	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Non-breeding	0	0.51	1.54	0	1.75	3.51	0	2.26	5.05

Table 41. Common Tern seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0	0	0	0	0.00	0.00
Breeding (full)	0	0.00	0.00	0	0	0	0	0.00	0.00
Autumn migration	0	0.13	0.38	0	0	0	0	0.13	0.38
Winter	0	0.00	0.00	0	0	0	0	0.00	0.00
Non-breeding	0	0.00	0.00	0	0	0	0	0.00	0.00

Table 42. Fulmar seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Breeding (full)	0	0.07	0.17	0.01	0.09	0.21	0.01	0.16	0.38
Autumn migration	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-breeding	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 43. Gannet seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0.0	0.04	0.13	0.00	0.24	0.64	0.00	0.28	0.77
Breeding (full)	0.0	0.77	1.76	0.11	1.63	3.71	0.11	2.40	5.48
Autumn migration	0.1	1.30	2.81	0.25	1.37	2.68	0.35	2.68	5.49
Winter	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-breeding	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 44. Gannet2 seasonal summed collision estimates and 95% confidence intervals (calculated using higher value of macro-avoidance rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0.00	0.02	0.06	0.00	0.10	0.28	0.00	0.12	0.34
Breeding (full)	0.00	0.33	0.76	0.05	0.71	1.59	0.05	1.03	2.35
Autumn migration	0.04	0.55	1.20	0.11	0.58	1.15	0.15	1.15	2.36
Winter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-breeding	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 45. Great Black-backed Gull seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.59	1.78	0	0	0	0	0.59	1.78
Breeding (full)	0	0.68	2.05	0	0	0	0	0.68	2.05
Autumn migration	0	0.00	0.00	0	0	0	0	0.00	0.00
Winter	0	0.58	1.75	0	0	0	0	0.58	1.75
Non-breeding	0	1.17	3.53	0	0	0	0	1.17	3.53

Table 46. Great Black-backed Gull2 seasonal summed collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.45	1.35	0	0	0	0	0.45	1.35
Breeding (full)	0	0.57	1.70	0	0	0	0	0.57	1.70
Autumn migration	0	0.00	0.00	0	0	0	0	0.00	0.00
Winter	0	0.43	1.30	0	0	0	0	0.43	1.30
Non-breeding	0	0.88	2.65	0	0	0	0	0.88	2.65

Table 47. Great Skua seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0	0	0	0.00	0.00	0	0.00	0.00
Breeding (full)	0	0	0	0	0.13	0.38	0	0.13	0.38
Autumn migration	0	0	0	0	0.00	0.00	0	0.00	0.00
Winter	0	0	0	0	0.00	0.00	0	0.00	0.00
Non-breeding	0	0	0	0	0.00	0.00	0	0.00	0.00

Table 48. Herring Gull seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0	0	0.00	0	0.00	0.00
Breeding (full)	0	0.69	1.39	0	0	0.00	0	0.69	1.39
Autumn migration	0	0.00	0.00	0	1	3.01	0	1.00	3.01
Winter	0	0.52	1.57	0	0	0.00	0	0.52	1.57
Non-breeding	0	0.52	1.57	0	1	3.01	0	1.52	4.58

Table 49. Herring Gull2 seasonal summed collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Breeding (full)	0	0.62	1.26	0	0.00	0.00	0	0.62	1.26
Autumn migration	0	0.00	0.00	0	0.81	2.43	0	0.81	2.43
Winter	0	0.39	1.17	0	0.00	0.00	0	0.39	1.17
Non-breeding	0	0.39	1.17	0	0.81	2.43	0	1.20	3.60

Table 50. Kittiwake seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0.00	2.28	5.18	1.05	4.89	9.08	1.05	7.16	14.26
Breeding (full)	0.53	4.93	10.33	0.83	9.83	22.24	1.36	14.76	32.56
Autumn migration	0.22	2.68	6.74	1.83	7.62	14.15	2.05	10.31	20.88
Winter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-breeding	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 51. Kittiwake2 seasonal summed collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0.00	1.78	4.05	0.81	3.84	7.12	0.81	5.61	11.17
Breeding (full)	0.46	4.27	8.98	0.69	8.44	19.11	1.14	12.71	28.10
Autumn migration	0.17	2.10	5.29	1.39	5.77	10.71	1.55	7.87	15.99
Winter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-breeding	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 52. Lesser Black-backed Gull seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0	0.83	2.48	0	0.83	2.48
Breeding (full)	0	24.51	63.31	0	11.25	30.91	0	35.76	94.22
Autumn migration	0	0.49	1.46	0	1.73	5.20	0	2.22	6.65
Winter	0	0.44	1.33	0	2.22	6.66	0	2.66	7.99
Non-breeding	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00

Table 53. Lesser Black-backed Gull2 seasonal summed collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0	0.69	2.06	0	0.69	2.06
Breeding (full)	0	22.16	57.24	0	10.11	27.76	0	32.27	85.00
Autumn migration	0	0.41	1.23	0	1.47	4.40	0	1.88	5.63
Winter	0	0.34	1.01	0	1.68	5.03	0	2.02	6.04
Non-breeding	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00

Table 54. Little Gull seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0	0	0	0	0.00	0.00
Breeding (full)	0	0.12	0.37	0	0	0	0	0.12	0.37
Autumn migration	0	0.00	0.00	0	0	0	0	0.00	0.00
Winter	0	0.00	0.00	0	0	0	0	0.00	0.00
Non-breeding	0	0.00	0.00	0	0	0	0	0.00	0.00

Table 55. Sandwich Tern seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 1.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0	0	0	0.00	0.00	0	0.00	0.00
Breeding (full)	0	0	0	0	0.00	0.00	0	0.00	0.00
Autumn migration	0	0	0	0	0.00	0.00	0	0.00	0.00
Winter	0	0	0	0	0.21	0.64	0	0.21	0.64
Non-breeding	0	0	0	0	0.21	0.64	0	0.21	0.64

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Table 56. Black-headed Gull monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0	0	0	0.00	0.00	0	0.00	0.00
Feb	0	0	0	0	0.00	0.00	0	0.00	0.00
Mar	0	0	0	0	0.00	0.00	0	0.00	0.00
Apr	0	0	0	0	0.00	0.00	0	0.00	0.00
May	0	0	0	0	0.00	0.00	0	0.00	0.00
Jun	0	0	0	0	0.00	0.00	0	0.00	0.00
Jul	0	0	0	0	0.35	0.70	0	0.35	0.70
Aug	0	0	0	0	0.00	0.00	0	0.00	0.00
Sep	0	0	0	0	0.00	0.00	0	0.00	0.00
Oct	0	0	0	0	0.16	0.47	0	0.16	0.47
Nov	0	0	0	0	0.15	0.44	0	0.15	0.44
Dec	0	0	0	0	0.00	0.00	0	0.00	0.00
Annual	0	0	0	0	0.65	1.61	0	0.65	1.61

Table 57. Common Gull monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Feb	0	0.00	0.00	0	0.27	0.55	0	0.27	0.55
Mar	0	0.00	0.00	0	0.96	1.92	0	0.96	1.92
Apr	0	0.19	0.57	0	0.00	0.00	0	0.19	0.57
May	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Jun	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Jul	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Aug	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Sep	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Oct	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Nov	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Dec	0	0.17	0.50	0	0.00	0.00	0	0.17	0.50
Annual	0	0.36	1.07	0	1.23	2.46	0	1.59	3.54

Table 58. Common Tern monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.00	0.00	0	0	0	0	0.00	0.00
Feb	0	0.00	0.00	0	0	0	0	0.00	0.00
Mar	0	0.00	0.00	0	0	0	0	0.00	0.00
Apr	0	0.00	0.00	0	0	0	0	0.00	0.00
May	0	0.00	0.00	0	0	0	0	0.00	0.00
Jun	0	0.00	0.00	0	0	0	0	0.00	0.00
Jul	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug	0	0.00	0.00	0	0	0	0	0.00	0.00
Sep	0	0.09	0.28	0	0	0	0	0.09	0.28
Oct	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov	0	0.00	0.00	0	0	0	0	0.00	0.00
Dec	0	0.00	0.00	0	0	0	0	0.00	0.00
Annual	0	0.09	0.28	0	0	0	0	0.09	0.28

Table 59. Fulmar monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.01	0.02	0.00	0.00	0.00	0.00	0.01	0.02
Feb	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mar	0	0.00	0.00	0.01	0.04	0.08	0.01	0.04	0.08
Apr	0	0.01	0.02	0.00	0.01	0.03	0.00	0.02	0.05
May	0	0.00	0.00	0.00	0.02	0.04	0.00	0.02	0.04
Jun	0	0.01	0.02	0.00	0.00	0.00	0.00	0.01	0.02
Jul	0	0.03	0.08	0.00	0.00	0.00	0.00	0.03	0.08
Aug	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sep	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oct	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dec	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	0	0.05	0.14	0.01	0.07	0.16	0.01	0.12	0.30

Table 60. Gannet monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb	0.00	0.00	0.00	0.00	0.16	0.44	0.00	0.16	0.44
Mar	0.00	0.04	0.13	0.00	0.07	0.22	0.00	0.12	0.35
Apr	0.00	0.05	0.14	0.00	0.24	0.56	0.00	0.29	0.70
May	0.00	0.00	0.00	0.00	0.09	0.18	0.00	0.09	0.18
Jun	0.00	0.17	0.34	0.00	0.10	0.19	0.00	0.27	0.53
Jul	0.00	0.16	0.33	0.00	0.00	0.00	0.00	0.16	0.33
Aug	0.00	0.10	0.26	0.00	0.09	0.27	0.00	0.19	0.52
Sep	0.00	0.00	0.00	0.08	0.52	1.12	0.08	0.52	1.12
Oct	0.00	0.20	0.51	0.00	0.26	0.59	0.00	0.46	1.11
Nov	0.07	0.68	1.39	0.17	0.68	1.24	0.24	1.36	2.63
Dec	0.00	0.03	0.09	0.00	0.00	0.00	0.00	0.03	0.09
Annual	0.07	1.44	3.19	0.25	2.22	4.81	0.31	3.65	8.01

Table 61. Gannet2 monthly mean collision estimates and 95% confidence intervals (calculated using higher value of macro-avoidance rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb	0.00	0.00	0.00	0.00	0.07	0.19	0.00	0.07	0.19
Mar	0.00	0.02	0.06	0.00	0.03	0.09	0.00	0.05	0.15
Apr	0.00	0.02	0.06	0.00	0.10	0.24	0.00	0.12	0.30
May	0.00	0.00	0.00	0.00	0.04	0.08	0.00	0.04	0.08
Jun	0.00	0.07	0.15	0.00	0.04	0.08	0.00	0.11	0.23
Jul	0.00	0.07	0.14	0.00	0.00	0.00	0.00	0.07	0.14
Aug	0.00	0.04	0.11	0.00	0.04	0.11	0.00	0.08	0.22
Sep	0.00	0.00	0.00	0.03	0.22	0.48	0.03	0.22	0.48
Oct	0.00	0.08	0.22	0.00	0.11	0.25	0.00	0.20	0.47
Nov	0.03	0.29	0.60	0.07	0.29	0.53	0.10	0.58	1.13
Dec	0.00	0.01	0.04	0.00	0.00	0.00	0.00	0.01	0.04
Annual	0.03	0.62	1.37	0.11	0.95	2.06	0.13	1.57	3.43

Table 62. Great Black-backed Gull monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.40	1.19	0	0	0	0	0.40	1.19
Feb	0	0.00	0.00	0	0	0	0	0.00	0.00
Mar	0	0.46	1.38	0	0	0	0	0.46	1.38
Apr	0	0.00	0.00	0	0	0	0	0.00	0.00
May	0	0.00	0.00	0	0	0	0	0.00	0.00
Jun	0	0.00	0.00	0	0	0	0	0.00	0.00
Jul	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug	0	0.00	0.00	0	0	0	0	0.00	0.00
Sep	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov	0	0.00	0.00	0	0	0	0	0.00	0.00
Dec	0	0.39	1.17	0	0	0	0	0.39	1.17
Annual	0	1.25	3.74	0	0	0	0	1.25	3.74

Table 63. Great Black-backed Gull2 monthly mean collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.30	0.90	0	0	0	0	0.30	0.90
Feb	0	0.00	0.00	0	0	0	0	0.00	0.00
Mar	0	0.38	1.14	0	0	0	0	0.38	1.14
Apr	0	0.00	0.00	0	0	0	0	0.00	0.00
May	0	0.00	0.00	0	0	0	0	0.00	0.00
Jun	0	0.00	0.00	0	0	0	0	0.00	0.00
Jul	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug	0	0.00	0.00	0	0	0	0	0.00	0.00
Sep	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov	0	0.00	0.00	0	0	0	0	0.00	0.00
Dec	0	0.29	0.88	0	0	0	0	0.29	0.88
Annual	0	0.97	2.92	0	0	0	0	0.97	2.92

Table 64. Great Skua monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0	0	0	0.00	0.00	0	0.00	0.00
Feb	0	0	0	0	0.00	0.00	0	0.00	0.00
Mar	0	0	0	0	0.00	0.00	0	0.00	0.00
Apr	0	0	0	0	0.00	0.00	0	0.00	0.00
May	0	0	0	0	0.00	0.00	0	0.00	0.00
Jun	0	0	0	0	0.00	0.00	0	0.00	0.00
Jul	0	0	0	0	0.00	0.00	0	0.00	0.00
Aug	0	0	0	0	0.09	0.28	0	0.09	0.28
Sep	0	0	0	0	0.00	0.00	0	0.00	0.00
Oct	0	0	0	0	0.00	0.00	0	0.00	0.00
Nov	0	0	0	0	0.00	0.00	0	0.00	0.00
Dec	0	0	0	0	0.00	0.00	0	0.00	0.00
Annual	0	0	0	0	0.09	0.28	0	0.09	0.28

Table 65. Herring Gull monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Feb	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Mar	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Apr	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
May	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Jun	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Jul	0	0.47	0.94	0	0.00	0.00	0	0.47	0.94
Aug	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Sep	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Oct	0	0.00	0.00	0	0.69	2.06	0	0.69	2.06
Nov	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Dec	0	0.35	1.06	0	0.00	0.00	0	0.35	1.06
Annual	0	0.82	2.01	0	0.69	2.06	0	1.51	4.07

Table 66. Herring Gull2 monthly mean collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Feb	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Mar	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Apr	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
May	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Jun	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Jul	0	0.42	0.85	0	0.00	0.00	0	0.42	0.85
Aug	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Sep	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Oct	0	0.00	0.00	0	0.56	1.67	0	0.56	1.67
Nov	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Dec	0	0.26	0.79	0	0.00	0.00	0	0.26	0.79
Annual	0	0.69	1.65	0	0.56	1.67	0	1.24	3.31

Table 67. Kittiwake monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0.00	0.46	1.08	0.26	0.79	1.59	0.26	1.26	2.67
Feb	0.00	1.14	2.58	0.49	2.68	4.88	0.49	3.83	7.46
Mar	0.18	1.23	2.45	0.59	4.11	8.78	0.77	5.34	11.23
Apr	0.00	0.89	2.15	0.00	0.31	0.92	0.00	1.20	3.06
May	0.00	0.00	0.00	0.00	1.29	2.90	0.00	1.29	2.90
Jun	0.19	0.97	1.75	0.00	0.98	2.27	0.19	1.95	4.02
Jul	0.00	0.38	0.95	0.00	0.32	0.97	0.00	0.70	1.91
Aug	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sep	0.00	0.35	1.04	0.00	0.00	0.00	0.00	0.35	1.04
Oct	0.00	0.17	0.51	0.00	0.00	0.00	0.00	0.17	0.51
Nov	0.15	0.93	2.01	0.53	2.36	4.19	0.69	3.29	6.19
Dec	0.00	0.45	1.20	0.77	3.07	5.89	0.77	3.52	7.09
Annual	0.52	6.98	15.71	2.64	15.91	32.38	3.16	22.89	48.09

Table 68. Kittiwake2 monthly mean collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0.00	0.35	0.82	0.20	0.60	1.21	0.20	0.95	2.02
Feb	0.00	0.91	2.04	0.39	2.13	3.87	0.39	3.03	5.91
Mar	0.15	1.02	2.04	0.49	3.41	7.29	0.64	4.43	9.33
Apr	0.00	0.77	1.86	0.00	0.26	0.79	0.00	1.04	2.65
May	0.00	0.00	0.00	0.00	1.15	2.60	0.00	1.15	2.60
Jun	0.18	0.88	1.59	0.00	0.89	2.06	0.18	1.77	3.65
Jul	0.00	0.34	0.85	0.00	0.29	0.87	0.00	0.63	1.73
Aug	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sep	0.00	0.29	0.88	0.00	0.00	0.00	0.00	0.29	0.88
Oct	0.00	0.14	0.41	0.00	0.00	0.00	0.00	0.14	0.41
Nov	0.12	0.71	1.54	0.41	1.82	3.23	0.53	2.53	4.77
Dec	0.00	0.34	0.89	0.57	2.30	4.40	0.57	2.63	5.29
Annual	0.44	5.76	12.93	2.06	12.85	26.31	2.50	18.61	39.24

Table 69. Lesser Black-backed Gull monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.30	0.91	0	0.00	0.00	0	0.30	0.91
Feb	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Mar	0	0.00	0.00	0	0.57	1.71	0	0.57	1.71
Apr	0	0.00	0.00	0	0.61	1.82	0	0.61	1.82
May	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Jun	0	2.63	6.41	0	5.23	14.39	0	7.87	20.79
Jul	0	14.07	36.74	0	0.00	0.00	0	14.07	36.74
Aug	0	0.00	0.00	0	1.90	5.05	0	1.90	5.05
Sep	0	0.33	0.99	0	1.19	3.57	0	1.52	4.57
Oct	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Nov	0	0.00	0.00	0	0.51	1.52	0	0.51	1.52
Dec	0	0.00	0.00	0	1.02	3.05	0	1.02	3.05
Annual	0	17.34	45.05	0	11.03	31.12	0	28.36	76.17

Table 70. Lesser Black-backed Gull2 monthly mean collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.23	0.69	0	0.00	0.00	0	0.23	0.69
Feb	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Mar	0	0.00	0.00	0	0.47	1.42	0	0.47	1.42
Apr	0	0.00	0.00	0	0.53	1.58	0	0.53	1.58
May	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Jun	0	2.39	5.83	0	4.76	13.08	0	7.15	18.90
Jul	0	12.71	33.19	0	0.00	0.00	0	12.71	33.19
Aug	0	0.00	0.00	0	1.67	4.44	0	1.67	4.44
Sep	0	0.28	0.84	0	1.01	3.02	0	1.29	3.87
Oct	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Nov	0	0.00	0.00	0	0.39	1.17	0	0.39	1.17
Dec	0	0.00	0.00	0	0.76	2.28	0	0.76	2.28
Annual	0	15.61	40.54	0	9.58	26.99	0	25.20	67.53

Table 71. Little Gull monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0.00	0.00	0	0	0	0	0.00	0.00
Feb	0	0.00	0.00	0	0	0	0	0.00	0.00
Mar	0	0.00	0.00	0	0	0	0	0.00	0.00
Apr	0	0.09	0.27	0	0	0	0	0.09	0.27
May	0	0.00	0.00	0	0	0	0	0.00	0.00
Jun	0	0.00	0.00	0	0	0	0	0.00	0.00
Jul	0	0.00	0.00	0	0	0	0	0.00	0.00
Aug	0	0.00	0.00	0	0	0	0	0.00	0.00
Sep	0	0.00	0.00	0	0	0	0	0.00	0.00
Oct	0	0.00	0.00	0	0	0	0	0.00	0.00
Nov	0	0.00	0.00	0	0	0	0	0.00	0.00
Dec	0	0.00	0.00	0	0	0	0	0.00	0.00
Annual	0	0.09	0.27	0	0	0	0	0.09	0.27

Table 72. Sandwich Tern monthly mean collision estimates and 95% confidence intervals, for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Month	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Jan	0	0	0	0	0.00	0.00	0	0.00	0.00
Feb	0	0	0	0	0.00	0.00	0	0.00	0.00
Mar	0	0	0	0	0.00	0.00	0	0.00	0.00
Apr	0	0	0	0	0.00	0.00	0	0.00	0.00
May	0	0	0	0	0.00	0.00	0	0.00	0.00
Jun	0	0	0	0	0.00	0.00	0	0.00	0.00
Jul	0	0	0	0	0.00	0.00	0	0.00	0.00
Aug	0	0	0	0	0.00	0.00	0	0.00	0.00
Sep	0	0	0	0	0.00	0.00	0	0.00	0.00
Oct	0	0	0	0	0.16	0.47	0	0.16	0.47
Nov	0	0	0	0	0.00	0.00	0	0.00	0.00
Dec	0	0	0	0	0.00	0.00	0	0.00	0.00
Annual	0	0	0	0	0.16	0.47	0	0.16	0.47

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Table 73. Black-headed Gull seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0	0	0	0.00	0.00	0	0.00	0.00
Breeding (full)	0	0	0	0	0.35	0.70	0	0.35	0.70
Autumn migration	0	0	0	0	0.00	0.00	0	0.00	0.00
Winter	0	0	0	0	0.00	0.00	0	0.00	0.00
Non-breeding	0	0	0	0	0.31	0.91	0	0.31	0.91

Table 74. Common Gull seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Breeding (full)	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Autumn migration	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Winter	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Non-breeding	0	0.36	1.07	0	1.23	2.47	0	1.59	3.54

Table 75. Common Tern seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0	0	0	0	0.00	0.00
Breeding (full)	0	0.00	0.00	0	0	0	0	0.00	0.00
Autumn migration	0	0.09	0.28	0	0	0	0	0.09	0.28
Winter	0	0.00	0.00	0	0	0	0	0.00	0.00
Non-breeding	0	0.00	0.00	0	0	0	0	0.00	0.00

Table 76. Fulmar seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Breeding (full)	0	0.06	0.14	0.01	0.07	0.15	0.01	0.13	0.29
Autumn migration	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Winter	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-breeding	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 77. Gannet seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0.00	0.03	0.09	0.00	0.16	0.44	0.00	0.19	0.53
Breeding (full)	0.00	0.52	1.20	0.08	1.11	2.54	0.08	1.64	3.73
Autumn migration	0.07	0.88	1.90	0.17	0.94	1.83	0.24	1.82	3.74
Winter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-breeding	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 78. Gannet2 seasonal summed collision estimates and 95% confidence intervals (calculated using higher value of macro-avoidance rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0.00	0.01	0.04	0.00	0.07	0.19	0.00	0.08	0.23
Breeding (full)	0.00	0.22	0.52	0.03	0.47	1.08	0.03	0.69	1.60
Autumn migration	0.03	0.37	0.82	0.07	0.40	0.78	0.10	0.78	1.60
Winter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-breeding	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 79. Great Black-backed Gull seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.40	1.19	0	0	0	0	0.40	1.19
Breeding (full)	0	0.46	1.38	0	0	0	0	0.46	1.38
Autumn migration	0	0.00	0.00	0	0	0	0	0.00	0.00
Winter	0	0.39	1.17	0	0	0	0	0.39	1.17
Non-breeding	0	0.79	2.36	0	0	0	0	0.79	2.36

Table 80. Great Black-backed Gull2 seasonal summed collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.30	0.90	0	0	0	0	0.30	0.90
Breeding (full)	0	0.38	1.14	0	0	0	0	0.38	1.14
Autumn migration	0	0.00	0.00	0	0	0	0	0.00	0.00
Winter	0	0.29	0.88	0	0	0	0	0.29	0.88
Non-breeding	0	0.59	1.78	0	0	0	0	0.59	1.78

Table 81. Great Skua seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0	0	0	0.00	0.00	0	0.00	0.00
Breeding (full)	0	0	0	0	0.09	0.28	0	0.09	0.28
Autumn migration	0	0	0	0	0.00	0.00	0	0.00	0.00
Winter	0	0	0	0	0.00	0.00	0	0.00	0.00
Non-breeding	0	0	0	0	0.00	0.00	0	0.00	0.00

Table 82. Herring Gull seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Breeding (full)	0	0.47	0.94	0	0.00	0.00	0	0.47	0.94
Autumn migration	0	0.00	0.00	0	0.69	2.06	0	0.69	2.06
Winter	0	0.35	1.06	0	0.00	0.00	0	0.35	1.06
Non-breeding	0	0.35	1.06	0	0.69	2.06	0	1.04	3.12

Table 83. Herring Gull2 seasonal summed collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
Breeding (full)	0	0.42	0.85	0	0.00	0.00	0	0.42	0.85
Autumn migration	0	0.00	0.00	0	0.56	1.67	0	0.56	1.67
Winter	0	0.26	0.79	0	0.00	0.00	0	0.26	0.79
Non-breeding	0	0.26	0.79	0	0.56	1.67	0	0.82	2.46

Table 84. Kittiwake seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0.00	1.60	3.66	0.75	3.47	6.47	0.75	5.09	10.13
Breeding (full)	0.37	3.47	7.30	0.59	7.01	15.84	0.96	10.48	23.12
Autumn migration	0.15	1.90	4.76	1.30	5.43	10.08	1.46	7.33	14.83
Winter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-breeding	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 85. Kittiwake2 seasonal summed collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0.00	1.26	2.86	0.59	2.73	5.08	0.59	3.98	7.93
Breeding (full)	0.33	3.01	6.34	0.49	6.00	13.61	0.82	9.02	19.96
Autumn migration	0.12	1.48	3.72	0.98	4.12	7.63	1.10	5.59	11.35
Winter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-breeding	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 86. Lesser Black-backed Gull seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0	0.57	1.71	0	0.57	1.71
Breeding (full)	0	16.70	43.15	0	7.74	21.26	0	24.45	64.40
Autumn migration	0	0.33	0.99	0	1.19	3.57	0	1.52	4.57
Winter	0	0.30	0.91	0	1.53	4.57	0	1.83	5.48
Non-breeding	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00

Table 87. Lesser Black-backed Gull2 seasonal summed collision estimates and 95% confidence intervals (calculated using lower end of nocturnal activity rate range), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0	0.47	1.42	0	0.47	1.42
Breeding (full)	0	15.10	39.02	0	6.96	19.10	0	22.06	58.11
Autumn migration	0	0.28	0.84	0	1.01	3.02	0	1.29	3.87
Winter	0	0.23	0.69	0	1.15	3.45	0	1.38	4.14
Non-breeding	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00

Table 88. Little Gull seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0.00	0.00	0	0	0	0	0.00	0.00
Breeding (full)	0	0.09	0.27	0	0	0	0	0.09	0.27
Autumn migration	0	0.00	0.00	0	0	0	0	0.00	0.00
Winter	0	0.00	0.00	0	0	0	0	0.00	0.00
Non-breeding	0	0.00	0.00	0	0	0	0	0.00	0.00

Table 89. Sandwich Tern seasonal summed collision estimates (mean and 95% confidence intervals), for the VE North and South Array Areas and combined. Collisions estimated using turbine parameter set 2.

Season	North			South			Total		
	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.	Lwr 95% c.i.	Mean	Upr 95% c.i.
Spring migration	0	0	0	0	0.00	0.00	0	0.00	0.00
Breeding (full)	0	0	0	0	0.00	0.00	0	0.00	0.00
Autumn migration	0	0	0	0	0.00	0.00	0	0.00	0.00
Winter	0	0	0	0	0.16	0.47	0	0.16	0.47
Non-breeding	0	0	0	0	0.16	0.47	0	0.16	0.47

Five Estuaries Offshore Windfarm

Ornithology Technical Annex 4.8b Stochastic Collision Risk Modelling inputs and outputs

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1 INTRODUCTION

This annex provides stochastic collision mortality results obtained for the Five Estuaries Offshore Windfarm (VE).

This annex supplements the deterministic collision risk model (CRM) outputs provided in Technical Annex 4.8a. The stochastic collision estimates were obtained using the stochLAB R Package (https://github.com/HiDef-Aerial-Surveying/stochLAB). The outputs from this package have been compared with those obtained using the online sCRM (https://dmpstats.shinyapps.io/avian_stochcrm/) and found to be identical (albeit with small variations as would be expected due to the use of random numbers). This comparison of stochLAB and sCRM is provided in Technical Annex 4.10.

Note that stochastic collisions have only been estimated for gannet, kittiwake, herring gull, lesser black-backed gull and great black-backed gull, as these are the species typically considered to be of greater concern for collisions (due to their flight heights) and also because the other species recorded had very low deterministic collision estimates (for which the mean values would be very similar) (see Technical Annex 4.8a) and it was therefore considered there was little added benefit in providing additional stochastic collision modelling estimates in these cases. The turbine parameters are the same as those presented in Technical Annex 4.8a.

2 METHODS

The species-specific biometric parameters are provided in Table 1.

Table 1: Biometrics of each species modelled (mean and SD).

Species	Body length (m)	Wingspan (m)	Flight speed (ms-1)	Nocturnal activity factor (%)	Flight type	Avoidance rate (%)
Gannet	0.94 (0.0325)	1.72 (0.0375)	14.9 (0)	8 (10)	Flapping	99.3 (0.03; + macro avoidance at 70%)
Great black-backed gull	0.71 (0.035)	1.58 (0.0375)	13.7 (1.2)	37.5 (6.37)	Flapping	99.4 (0.04)
Herring gull	0.60 (0.0225)	1.44 (0.03)	12.8 (1.8)	37.5 (6.37)	Flapping	99.4 (0.04)
Kittiwake	0.39 (0.005)	1.08 (0.0625)	13.1 (0.4)	37.5 (6.37)	Flapping	99.3 (0.03)
Lesser black-backed gull	0.58 (0.03)	1.42 (0.0375)	13.1 (1.9)	37.5 (6.37)	Flapping	99.4 (0.04)

Monthly seabird densities can be inputted to stochLAB (and sCRM) in one of three formats, as:

- The mean and standard deviation (SD) which are used to generate random values from a truncated normal distribution;
- A set of bootstrap sample values (e.g. 1,000 values per month) from which a value for each iteration of the CRM is drawn at random; or

- A set of *n* quantile values (where the quantile probability is provided alongside each of the *n* quantile values) which define the distribution of densities from which random draws are taken.

For the first option, the truncated normal distribution is used instead of the standard (non-truncated) normal distribution as it permits user-defined boundaries to be set for the outputs, thereby preventing non-sensical random values. For example, in stochLAB when generating seabird densities the function is parameterised so that values cannot be less than zero. While this constraint is clearly required, if the input mean value is close to a boundary (in this case zero) and the SD is relatively large (e.g. with a coefficient of variation >=50%) the output distribution will be shifted to the right compared with the input distribution.

Figure 1 illustrates this effect by plotting bootstrap values alongside the truncated random numbers obtained using the mean SD of the bootstrapped numbers. The data are gannet densities recorded in the VE northern array area in November. On the right is the bootstrapped sample and on the left are the truncated normal values. The mean of the truncated outputs is 9% higher (1.199 cf 1.101) while the SD is 12% smaller (0.897 cf 0.691).

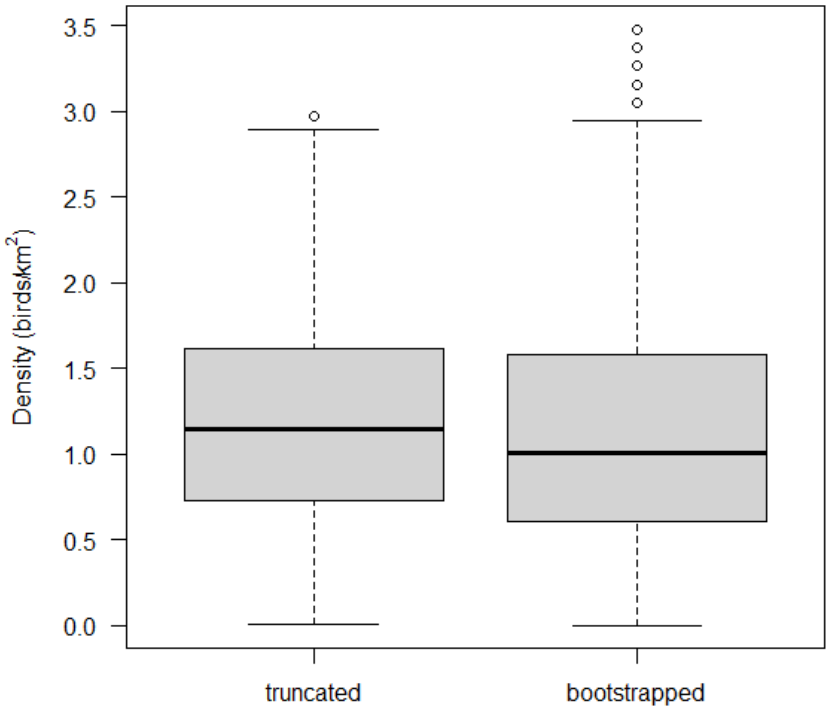

Figure 1. Comparison of bootstrap resampled survey data and truncated normal random numbers obtained using the mean and SD of the bootstrap.

It is important to note that the difference in the input and output means illustrated here decreases as the difference between the mean and the boundary increases and as the CV decreases (i.e. at higher densities the truncated normal values are no longer biased). However, since one of the primary motivations for using the truncated normal distribution is to prevent low mean values generating negative densities (as would occur with the unbounded standard normal distribution)

it is unfortunate that it also has the effect of biasing these values upwards (which in turn inflates collision estimates). Thus, when densities are higher the truncated normal is not required and when densities are lower it introduces bias to the resampling process. While this was identified in a review of stochastic CRM methods conducted for Natural England (Trinder 2017[1]) the guidance documents do not make it clear to end users that they should check for this effect.

To avoid this bias, the stochastic CRM results presented here were calculated using seabird densities supplied as bootstrap samples from the original survey data. This approach preserves the original distribution of values present in the survey data in the CRM input values.

The mean and SD density values in Table 2, calculated from the bootstrap data, are therefore provided for information only; if these are used as inputs to the truncated normal option for stochastic CRM then some of the collision risk values will differ from the results presented here.

Boxplots of the bootstrap data are provided in Figures 2 to 6 and the data files can be provided to Natural England on request. The boxplots clearly illustrate the skewed distributions of the seabird density data with small mean values and long tails.

[1] Trinder, M., (2017) Offshore wind farms and birds. Incorporating uncertainty in collision risk models: a test of Masden (2015) Natural England Commissioned Reports, Number 237. York.

Table 2. Monthly mean and SD of seabird densities. Note that these values were calculated from the bootstrap resampled data, however if used with the truncated normal random number option in the sCRM (or stochLAB) some outputs will be biased upwards compared with those presented below which used bootstrap resampled data.

Species	Array	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gannet	North	0 (0)	0 (0)	0.054 (0.082)	0.054 (0.082)	0 (0)	0.162 (0.194)	0.151 (0.183)	0.104 (0.082)	0 (0)	0.263 (0.269)	1.101 (0.691)	0.05 (0.076)
	South	0 (0)	0.165 (0.148)	0.053 (0.083)	0.168 (0.127)	0.054 (0.08)	0.055 (0.085)	0 (0)	0.055 (0.087)	0.392 (0.213)	0.223 (0.182)	0.689 (0.579)	0 (0)
Kittiwake	North	0.152 (0.114)	0.393 (0.4)	0.377 (0.46)	0.265 (0.353)	0 (0)	0.267 (0.306)	0.097 (0.14)	0 (0)	0.109 (0.162)	0.054 (0.081)	0.318 (0.293)	0.148 (0.128)
	South	0.167 (0.201)	0.606 (0.258)	0.787 (0.627)	0.057 (0.087)	0.224 (0.17)	0.167 (0.13)	0.056 (0.086)	0 (0)	0 (0)	0 (0)	0.503 (0.234)	0.65 (0.643)
Great black-backed gull	North	0.05 (0.077)	0 (0)	0.053 (0.079)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.076)
	South	-	-	-	-	-	-	-	-	-	-	-	-
Herring gull	North	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.051 (0.078)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.076)
	South	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.056 (0.087)	0 (0)	0 (0)
Lesser black-backed gull	North	0.049 (0.077)	0 (0)	0 (0)	0 (0)	0 (0)	0.348 (0.238)	1.807 (2.701)	0 (0)	0.048 (0.076)	0 (0)	0 (0)	0 (0)
	South	0 (0)	0 (0)	0.055 (0.084)	0.058 (0.089)	0 (0)	0.451 (0.535)	0 (0)	0.165 (0.145)	0.114 (0.177)	0 (0)	0.054 (0.082)	0.112 (0.091)

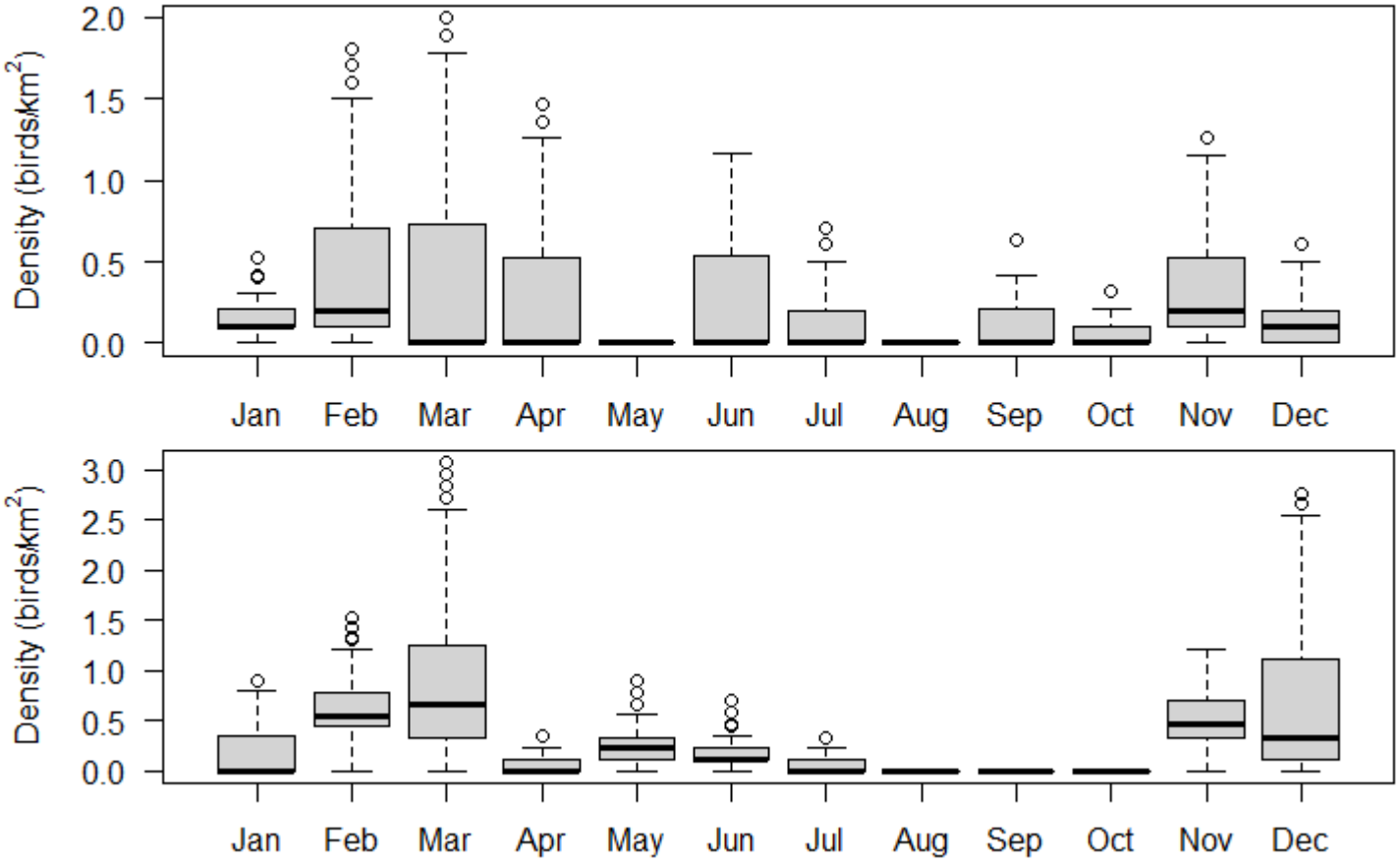

Figure 2. Gannet densities in the Northern array (top) and Southern array (bottom). Note different scales on the y-axes.

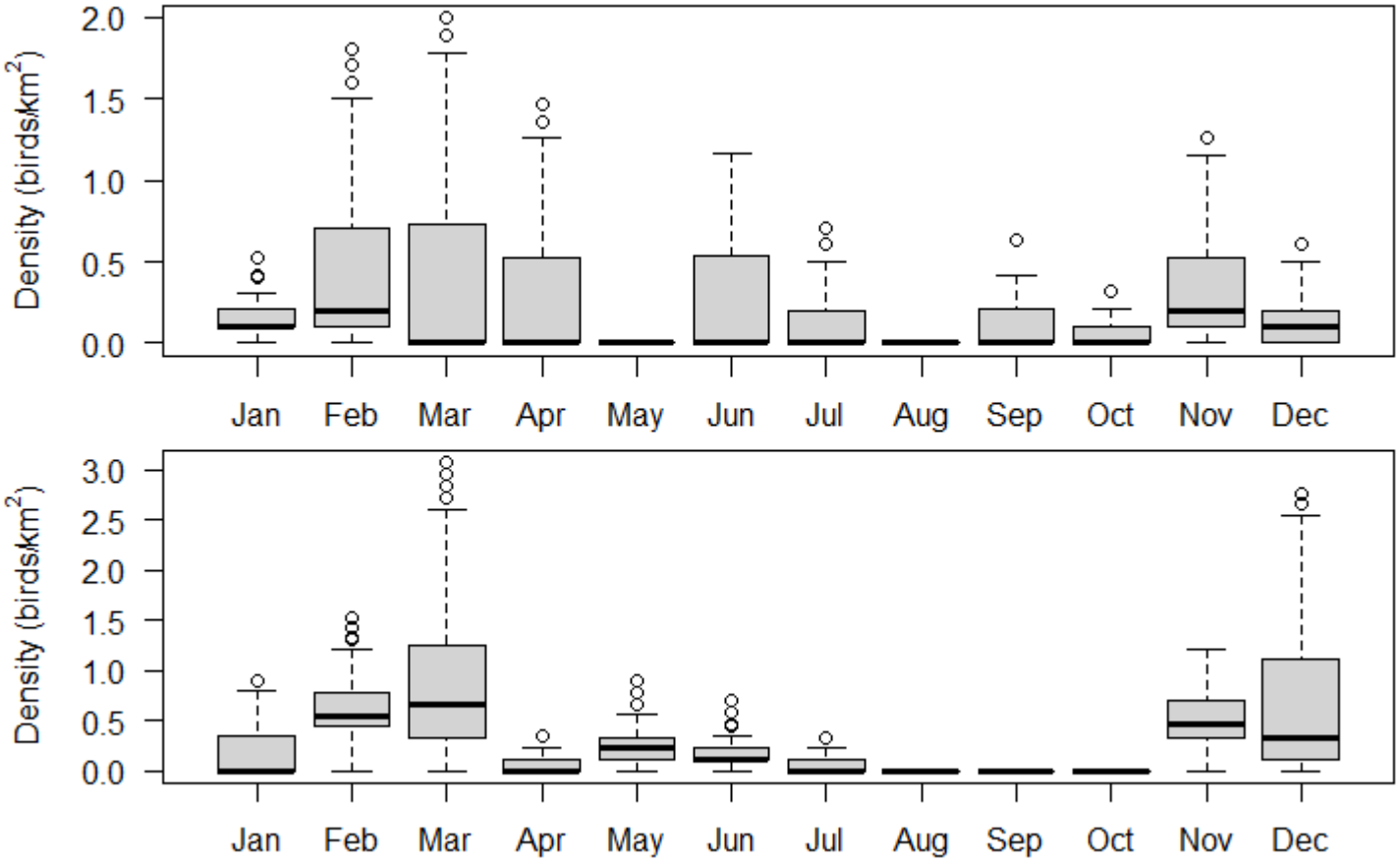

Figure 3. Kittiwake densities in the Northern array (top) and Southern array (bottom). Note different scales on the y- axes.

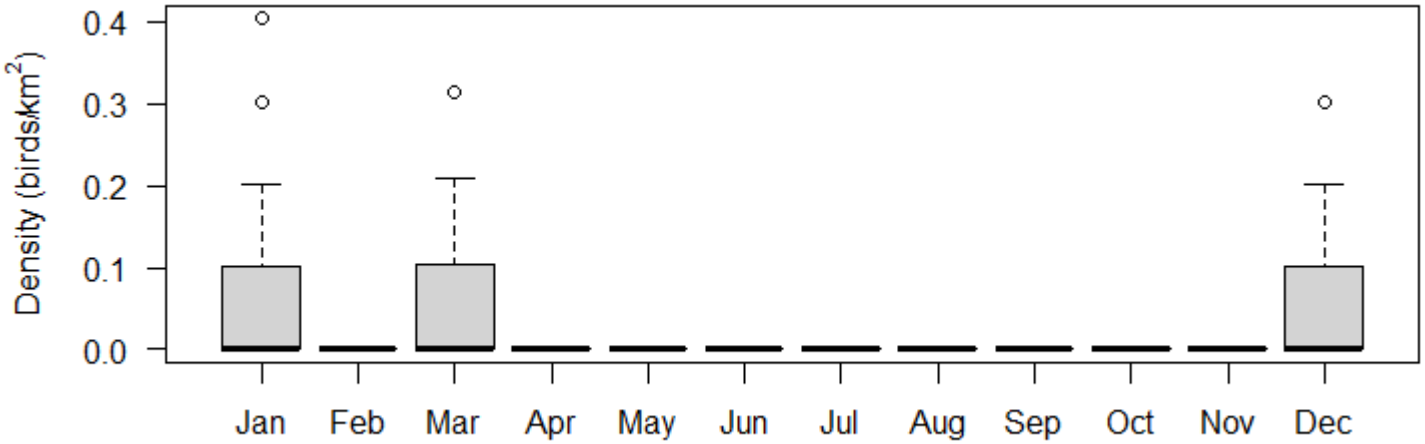

Figure 4. Great black-backed gull densities in the Northern array (none were recorded in the southern array).

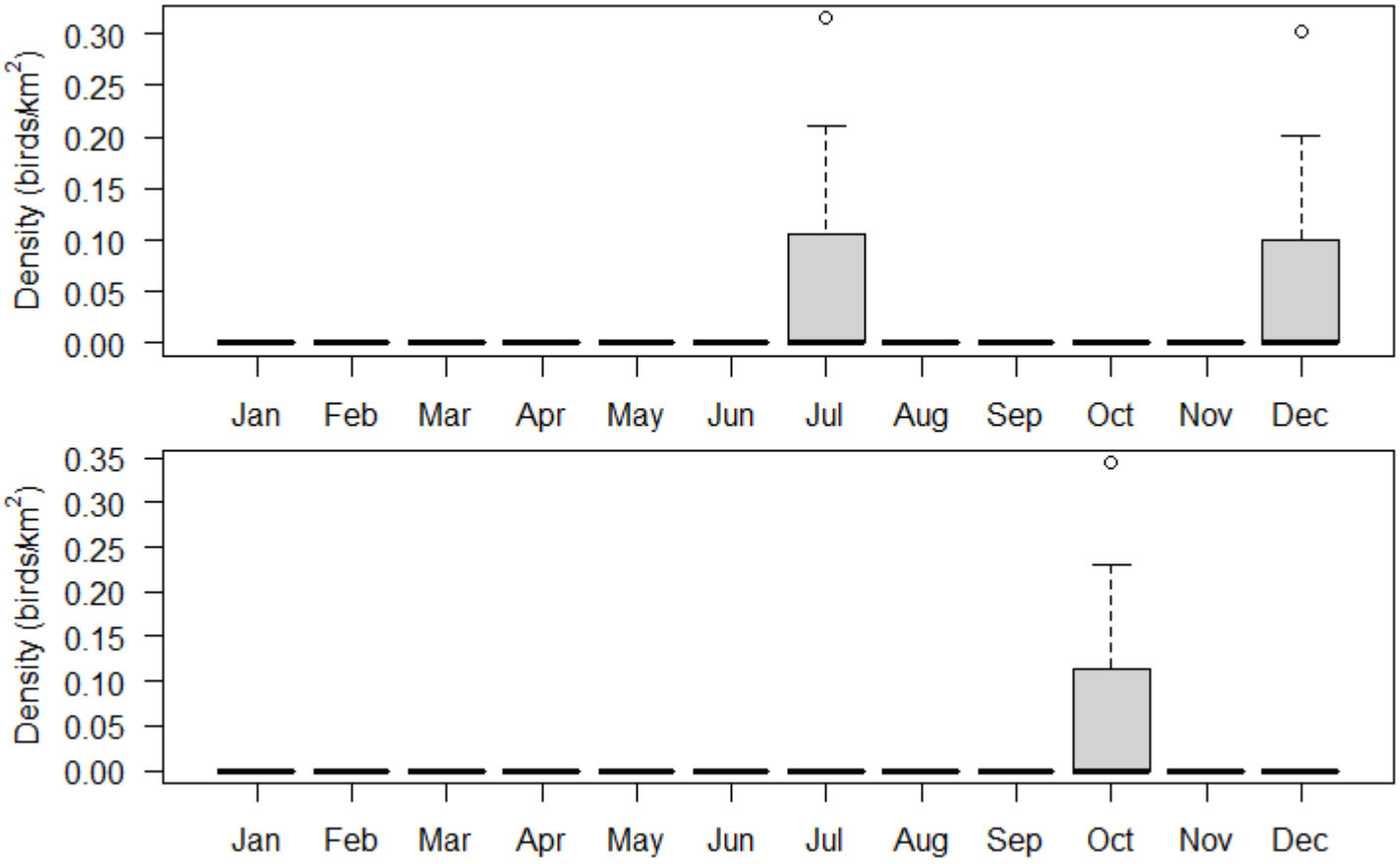

Figure 5. Herring gull densities in the Northern array (top) and Southern array (bottom). Note different scales on the y- axes.

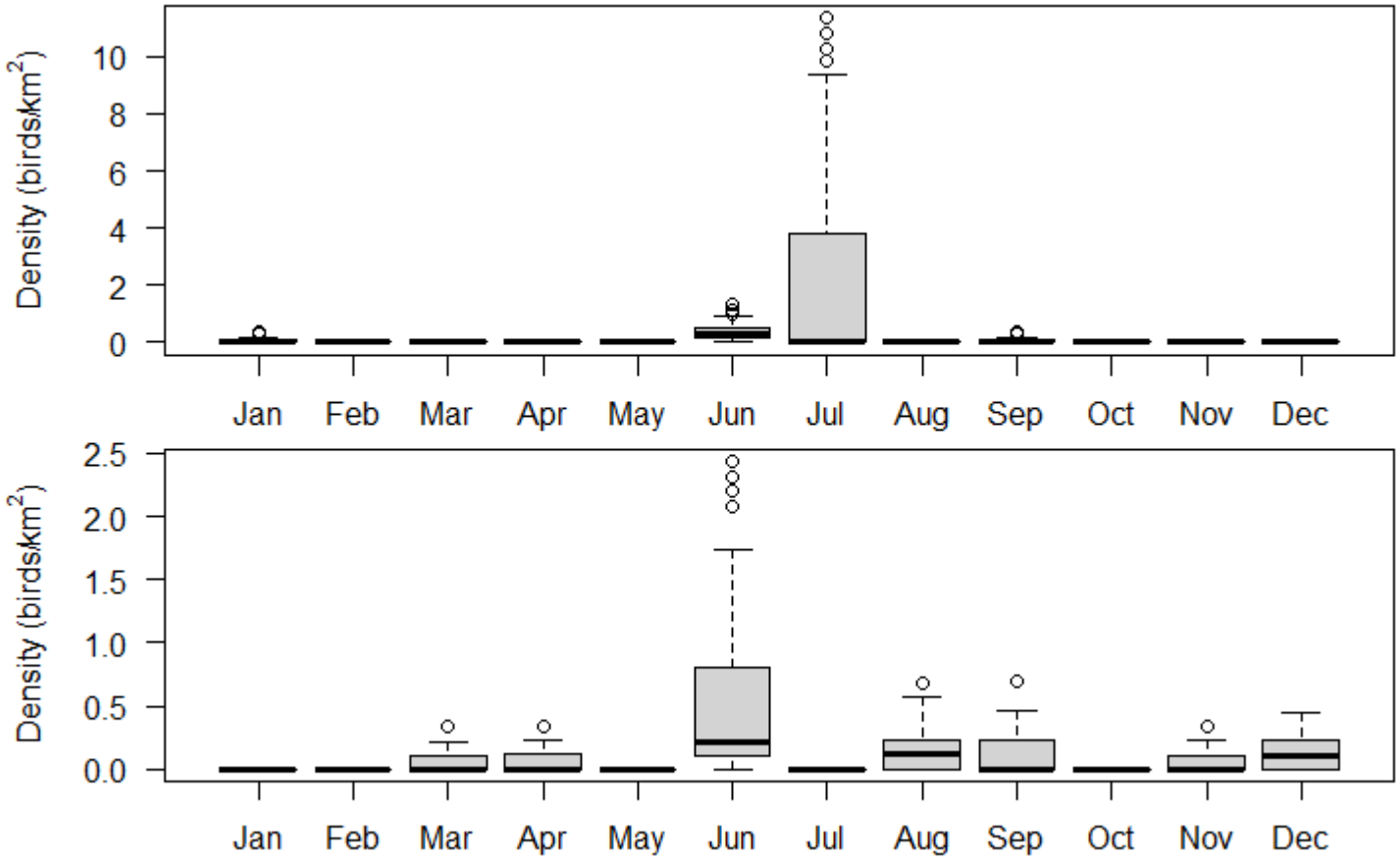

Figure 6. Lesser black-backed gull densities in the Northern array (top) and Southern array (bottom). Note different scales on the y-axes.

3 STOCHASTIC COLLISION RESULTS

Table 3. Gannet monthly collisions estimated using stochLAB.

Turbine model	Array	Values	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	North	Mean (SD)	0 (0)	0 (0)	0.06 (0.1)	0.06 (0.11)	0 (0)	0.23 (0.31)	0.2 (0.29)	0.13 (0.13)	0 (0)	0.25 (0.31)	0.87 (0.76)	0.04 (0.06)	1.82 (2.07)
		95% c.i.	0 - 0	0 - 0	0 - 0.34	0 - 0.38	0 - 0	0 - 1.06	0 - 0.98	0 - 0.45	0 - 0	0 - 1.1	0 - 2.87	0 - 0.23	0 - 7.41
	South	Mean (SD)	0 (0)	0.2 (0.23)	0.08 (0.15)	0.3 (0.29)	0.11 (0.18)	0.11 (0.2)	0 (0)	0.1 (0.19)	0.63 (0.5)	0.32 (0.34)	0.82 (0.88)	0 (0)	2.67 (2.97)
		95% c.i.	0 - 0	0 - 0.81	0 - 0.52	0 - 1.05	0 - 0.63	0 - 0.71	0 - 0	0 - 0.68	0 - 1.93	0 - 1.21	0 - 3.2	0 - 0	0 - 10.73
	Total	**Mean (SD)**	**0 (0)**	**0.2 (0.23)**	**0.14 (0.25)**	**0.36 (0.4)**	**0.11 (0.18)**	**0.34 (0.52)**	**0.2 (0.29)**	**0.23 (0.32)**	**0.63 (0.5)**	**0.57 (0.65)**	**1.69 (1.65)**	**0.04 (0.06)**	**4.5 (5.04)**
		95% c.i.	0 - 0	0 - 0.81	0 - 0.85	0 - 1.43	0 - 0.63	0 - 1.78	0 - 0.98	0 - 1.13	0 - 1.93	0 - 2.31	0 - 6.07	0 - 0.23	0 - 18.14
2	North	Mean (SD)	0 (0)	0 (0)	0.04 (0.06)	0.04 (0.07)	0 (0)	0.15 (0.2)	0.13 (0.19)	0.08 (0.08)	0 (0)	0.16 (0.2)	0.57 (0.5)	0.02 (0.04)	1.2 (1.35)
		95% c.i.	0 - 0	0 - 0	0 - 0.22	0 - 0.25	0 - 0	0 - 0.67	0 - 0.65	0 - 0.29	0 - 0	0 - 0.73	0 - 1.87	0 - 0.14	0 - 4.83
	South	Mean (SD)	0 (0)	0.14 (0.16)	0.05 (0.1)	0.2 (0.19)	0.07 (0.13)	0.07 (0.13)	0 (0)	0.07 (0.13)	0.43 (0.34)	0.23 (0.24)	0.55 (0.6)	0 (0)	1.82 (2)
		95% c.i.	0 - 0	0 - 0.58	0 - 0.34	0 - 0.73	0 - 0.44	0 - 0.46	0 - 0	0 - 0.44	0 - 1.28	0 - 0.87	0 - 2.23	0 - 0	0 - 7.36
	Total	**Mean (SD)**	**0 (0)**	**0.14 (0.16)**	**0.09 (0.16)**	**0.24 (0.26)**	**0.07 (0.13)**	**0.22 (0.33)**	**0.13 (0.19)**	**0.15 (0.21)**	**0.43 (0.34)**	**0.39 (0.44)**	**1.13 (1.1)**	**0.02 (0.04)**	**3.02 (3.35)**
		95% c.i.	0 - 0	0 - 0.58	0 - 0.56	0 - 0.98	0 - 0.44	0 - 1.13	0 - 0.65	0 - 0.73	0 - 1.28	0 - 1.6	0 - 4.1	0 - 0.14	0 - 12.19

Table 4. Gannet seasonal collisions estimated using stochLAB.

Turbine model	Array	Values	Spring	Breeding season	Autumn	Non-breeding/winter	Annual
1	North	Mean (SD)	0.04 (0.06)	0.68 (0.94)	1.12 (1.07)	-	1.82 (2.07)
		95% c.i.	0 - 0.23	0 - 3.21	0 - 3.97	-	0 - 7.41
	South	Mean (SD)	0.2 (0.23)	1.33 (1.51)	1.14 (1.22)	-	2.67 (2.97)
		95% c.i.	0 - 0.81	0 - 5.52	0 - 4.41	-	0 - 10.73
	Total	**Mean (SD)**	**0.24 (0.29)**	**2.01 (2.46)**	**2.26 (2.3)**	**-**	**4.5 (5.04)**
		95% c.i.	0 - 1.04	0 - 8.73	0 - 8.38	-	0 - 18.14
2	North	Mean (SD)	0.02 (0.04)	0.44 (0.6)	0.73 (0.7)	-	1.2 (1.35)
		95% c.i.	0 - 0.14	0 - 2.08	0 - 2.6	-	0 - 4.83
	South	Mean (SD)	0.14 (0.16)	0.89 (1.02)	0.78 (0.84)	-	1.82 (2)
		95% c.i.	0 - 0.58	0 - 3.69	0 - 3.1	-	0 - 7.36
	Total	**Mean (SD)**	**0.16 (0.2)**	**1.33 (1.62)**	**1.52 (1.54)**	**-**	**3.02 (3.35)**
		95% c.i.	0 - 0.72	0 - 5.77	0 - 5.7	-	0 - 12.19

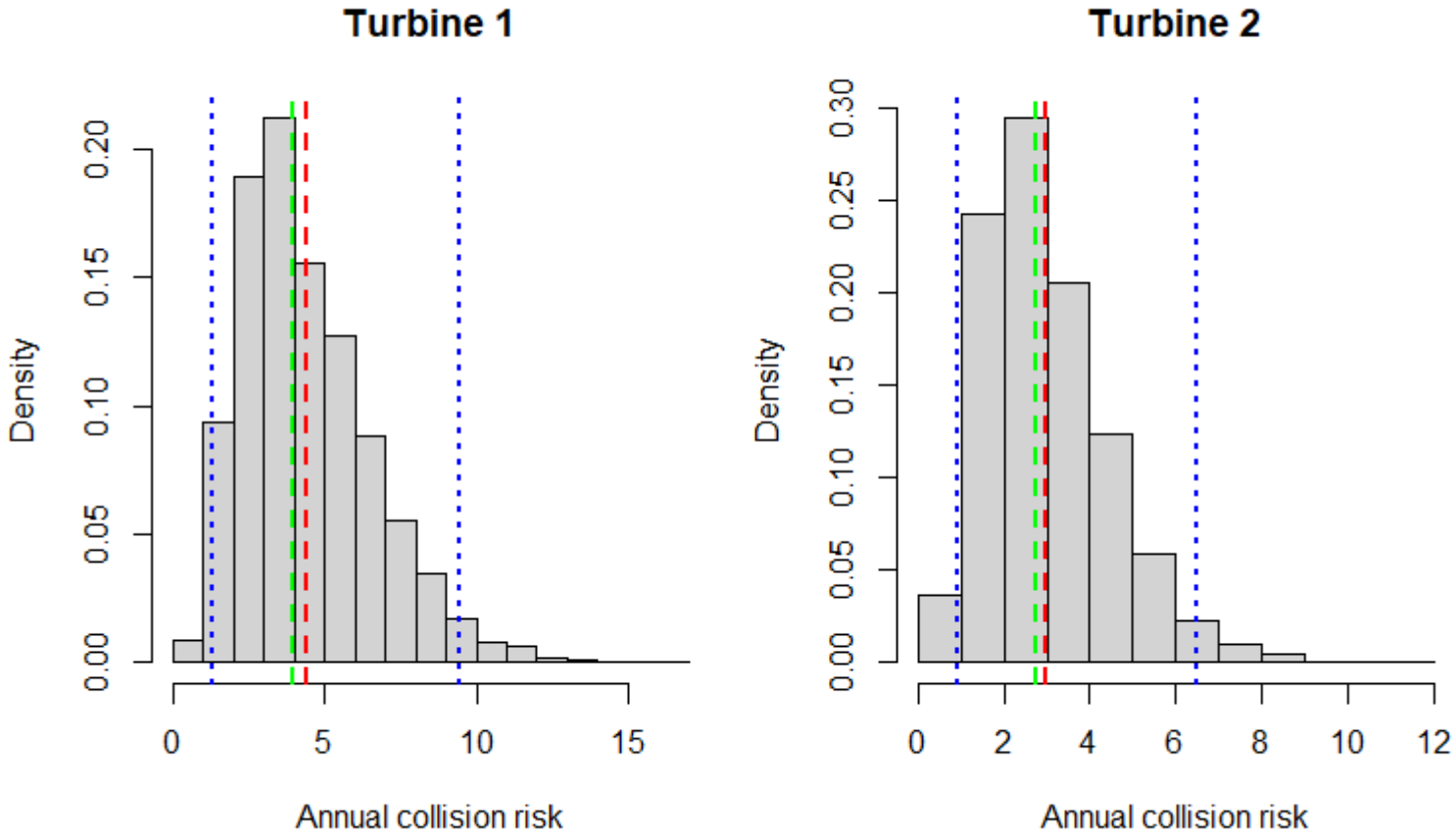

Figure 7. Histogram of gannet annual collisions for the North and South arrays combined. Lines indicate mean collisions (red dashed lines), median collisions (green dashed lines) and 95% percentiles (blue dotted lines).

Table 5. Kittiwake collisions estimated using stochLAB.

Turbine model	Array	Values	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	North	Mean (SD)	0.5 (0.39)	1.24 (1.3)	1.45 (1.75)	1.07 (1.42)	0 (0)	1.17 (1.37)	0.42 (0.62)	0 (0)	0.41 (0.62)	0.2 (0.3)	1.05 (0.99)	0.48 (0.42)	7.99 (9.16)
		95% c.i.	0 - 1.41	0 - 4.35	0 - 5.39	0 - 4.45	0 - 0	0 - 4.19	0 - 2	0 - 0	0 - 1.93	0 - 0.93	0 - 3.43	0 - 1.52	0 - 29.59
	South	Mean (SD)	0.84 (1.03)	2.93 (1.36)	4.48 (3.73)	0.34 (0.54)	1.49 (1.16)	1.12 (0.88)	0.37 (0.58)	0 (0)	0 (0)	0 (0)	2.52 (1.24)	3.22 (3.27)	17.31 (13.8)
		95% c.i.	0 - 3.2	0.56 - 5.93	0 - 13.47	0 - 1.69	0 - 4.12	0 - 3.11	0 - 1.84	0 - 0	0 - 0	0 - 0	0.42 - 5.14	0 - 10.55	0.97 - 49.05
	Total	**Mean (SD)**	**1.34 (1.42)**	**4.18 (2.65)**	**5.93 (5.49)**	**1.41 (1.96)**	**1.49 (1.16)**	**2.29 (2.24)**	**0.79 (1.2)**	**0 (0)**	**0.41 (0.62)**	**0.2 (0.3)**	**3.57 (2.23)**	**3.7 (3.69)**	**25.3 (22.96)**
		95% c.i.	0 - 4.61	0.56 - 10.29	0 - 18.86	0 - 6.14	0 - 4.12	0 - 7.3	0 - 3.84	0 - 0	0 - 1.93	0 - 0.93	0.42 - 8.57	0 - 12.07	0.97 - 78.65
2	North	Mean (SD)	0.34 (0.27)	0.87 (0.9)	1.01 (1.26)	0.73 (0.99)	0 (0)	0.8 (0.94)	0.3 (0.44)	0 (0)	0.3 (0.45)	0.13 (0.21)	0.72 (0.68)	0.33 (0.3)	5.54 (6.43)
		95% c.i.	0 - 1	0 - 3.03	0 - 3.93	0 - 3.16	0 - 0	0 - 2.88	0 - 1.42	0 - 0	0 - 1.36	0 - 0.64	0 - 2.32	0 - 1.04	0 - 20.78
	South	Mean (SD)	0.61 (0.75)	2.1 (0.99)	3.25 (2.67)	0.25 (0.39)	1.07 (0.83)	0.8 (0.63)	0.27 (0.42)	0 (0)	0 (0)	0 (0)	1.78 (0.89)	2.31 (2.34)	12.44 (9.9)
		95% c.i.	0 - 2.31	0.37 - 4.3	0 - 9.42	0 - 1.2	0 - 2.97	0 - 2.28	0 - 1.31	0 - 0	0 - 0	0 - 0	0.29 - 3.62	0 - 7.57	0.66 - 34.98
	Total	**Mean (SD)**	**0.96 (1.02)**	**2.97 (1.89)**	**4.26 (3.93)**	**0.98 (1.38)**	**1.07 (0.83)**	**1.6 (1.57)**	**0.57 (0.86)**	**0 (0)**	**0.3 (0.45)**	**0.13 (0.21)**	**2.5 (1.57)**	**2.64 (2.63)**	**17.98 (16.33)**
		95% c.i.	0 - 3.31	0.37 - 7.32	0 - 13.36	0 - 4.36	0 - 2.97	0 - 5.16	0 - 2.73	0 - 0	0 - 1.36	0 - 0.64	0.29 - 5.94	0 - 8.61	0.66 - 55.76

Table 6. Kittiwake seasonal collisions estimated using stochLAB.

Turbine model	Array	Values	Spring	Breeding season	Autumn	Non-breeding/winter	Annual
1	North	Mean (SD)	1.74 (1.69)	4.11 (5.16)	2.14 (2.33)	-	7.99 (9.16)
		95% c.i.	0 - 5.76	0 - 16.03	0 - 7.81	-	0 - 29.59
	South	Mean (SD)	3.77 (2.39)	7.8 (6.89)	5.74 (4.51)	-	17.31 (13.8)
		95% c.i.	0.56 - 9.13	0 - 24.23	0.42 - 15.69	-	0.97 - 49.05
	Total	**Mean (SD)**	**5.52 (4.07)**	**11.91 (12.05)**	**7.88 (6.84)**	**-**	**25.3 (22.96)**
		95% c.i.	0.56 - 14.9	0 - 40.26	0.42 - 23.5	-	0.97 - 78.65
2	North	Mean (SD)	1.21 (1.17)	2.84 (3.63)	1.48 (1.64)	-	5.54 (6.43)
		95% c.i.	0 - 4.03	0 - 11.39	0 - 5.36	-	0 - 20.78
	South	Mean (SD)	2.71 (1.74)	5.64 (4.94)	4.09 (3.23)	-	12.44 (9.9)
		95% c.i.	0.37 - 6.61	0 - 17.18	0.29 - 11.19	-	0.66 - 34.98
	Total	**Mean (SD)**	**3.93 (2.91)**	**8.48 (8.57)**	**5.57 (4.86)**	**-**	**17.98 (16.33)**
		95% c.i.	0.37 - 10.63	0 - 28.58	0.29 - 16.55	-	0.66 - 55.76

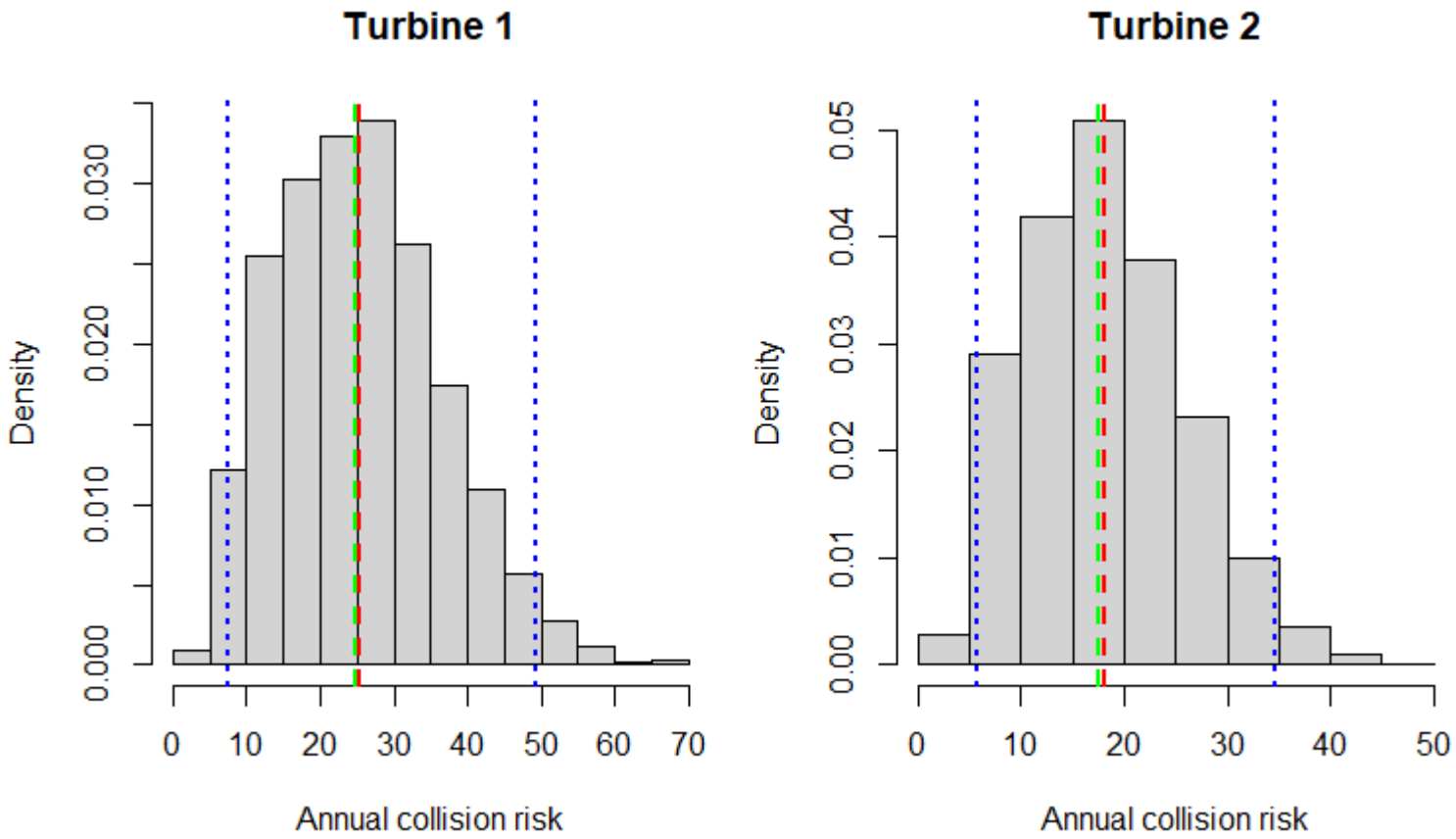

Figure 8. Histogram of kittiwake annual collisions for the North and South arrays combined. Lines indicate mean collisions (red dashed lines), median collisions (green dashed lines) and 95% percentiles (blue dotted lines).

Table 7. Great black-backed gull collisions estimated using stochLAB. Note this species was only recorded in flight in the Northern array.

Turbine model	Array	Values	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	North	Mean (SD)	0.59 (0.9)	0 (0)	0.68 (1.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.57 (0.89)	1.84 (2.85)
		95% c.i.	0 - 2.93	0 - 0	0 - 3.38	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 2.91	0 - 9.22
2	North	Mean (SD)	0.37 (0.6)	0 (0)	0.5 (0.74)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.37 (0.59)	1.24 (1.93)
		95% c.i.	0 - 1.9	0 - 0	0 - 2.4	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 1.91	0 - 6.22

Table 8. Great black-backed gull seasonal collisions estimated using stochLAB.

Turbine model	Array	Values	Spring	Breeding season	Autumn	Non-breeding/winter	Annual
1	North	Mean (SD)	0.59 (0.9)	0.68 (1.06)	0 (0)	0.57 (0.89)	1.84 (2.85)
		95% c.i.	0 - 2.93	0 - 3.38	0 - 0	0 - 2.91	0 - 9.22
2	North	Mean (SD)	0.37 (0.6)	0.5 (0.74)	0 (0)	0.37 (0.59)	1.24 (1.93)
		95% c.i.	0 - 1.9	0 - 2.4	0 - 0	0 - 1.91	0 - 6.22

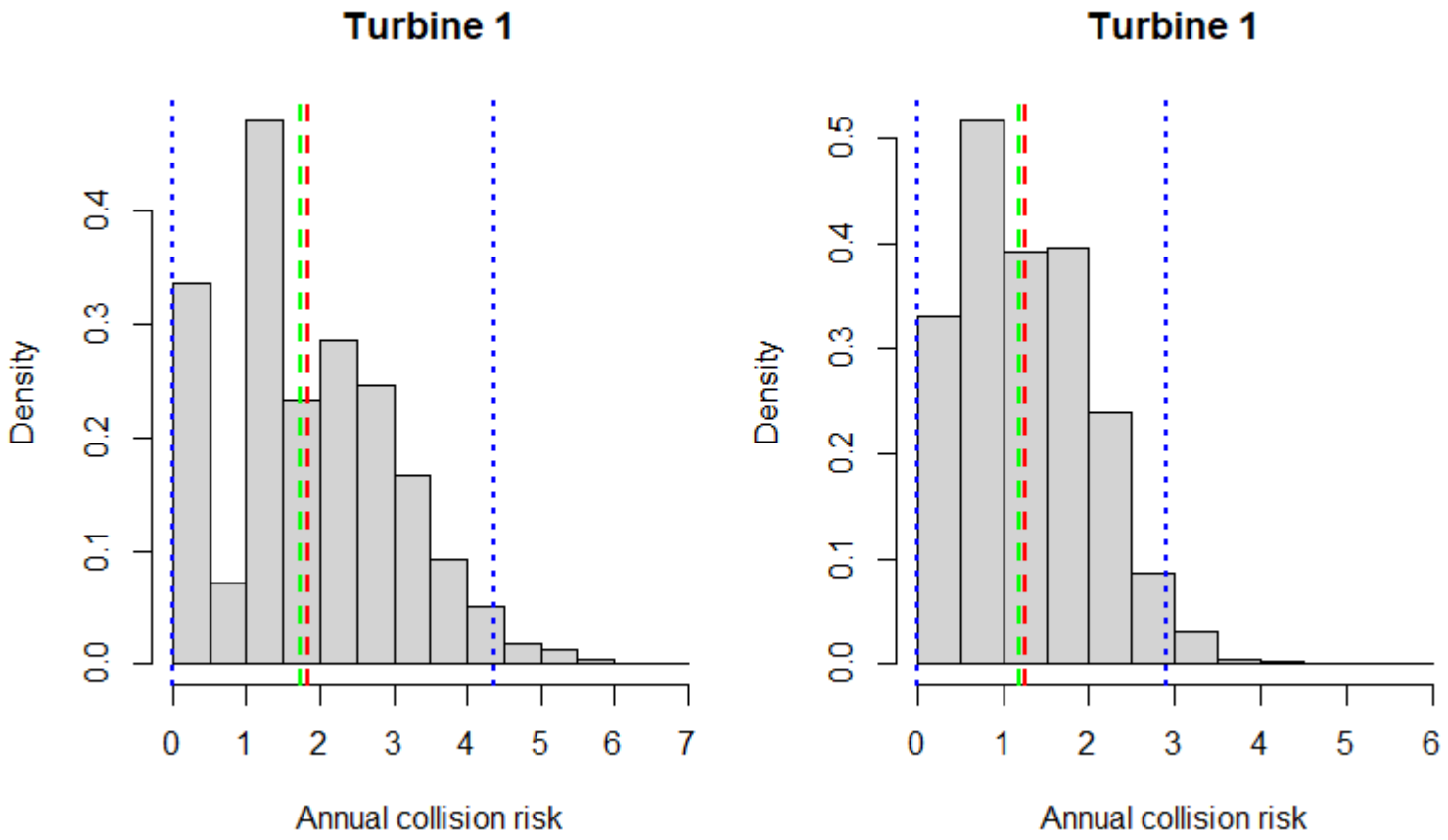

Figure 9. Histogram of great black-backed gull annual collisions for the North array. Lines indicate mean collisions (red dashed lines), median collisions (green dashed lines) and 95% percentiles (blue dotted lines).

Table 9. Herring gull collisions estimated using stochLAB.

Turbine model	Array	Values	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	North	Mean (SD)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.65 (1.03)	0 (0)	0 (0)	0 (0)	0 (0)	0.47 (0.74)	1.11 (1.77)
		95% c.i.	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 3.3	0 - 0	0 - 0	0 - 0	0 - 0	0 - 2.39	0 - 5.69
	South	Mean (SD)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.94 (1.48)	0 (0)	0 (0)	0.94 (1.48)
		95% c.i.	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 4.84	0 - 0	0 - 0	0 - 4.84
	Total	**Mean (SD)**	**0 (0)**	**0 (0)**	**0 (0)**	**0 (0)**	**0 (0)**	**0 (0)**	**0.65 (1.03)**	**0 (0)**	**0 (0)**	**0.94 (1.48)**	**0 (0)**	**0.47 (0.74)**	**2.05 (3.24)**
		95% c.i.	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 3.3	0 - 0	0 - 0	0 - 4.84	0 - 0	0 - 2.39	0 - 10.52
2	North	Mean (SD)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.44 (0.7)	0 (0)	0 (0)	0 (0)	0 (0)	0.32 (0.49)	0.76 (1.19)
		95% c.i.	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 2.27	0 - 0	0 - 0	0 - 0	0 - 0	0 - 1.6	0 - 3.87
	South	Mean (SD)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.64 (1.02)	0 (0)	0 (0)	0.64 (1.02)
		95% c.i.	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 3.37	0 - 0	0 - 0	0 - 3.37
	Total	**Mean (SD)**	**0 (0)**	**0 (0)**	**0 (0)**	**0 (0)**	**0 (0)**	**0 (0)**	**0.44 (0.7)**	**0 (0)**	**0 (0)**	**0.64 (1.02)**	**0 (0)**	**0.32 (0.49)**	**1.4 (2.21)**
		95% c.i.	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 2.27	0 - 0	0 - 0	0 - 3.37	0 - 0	0 - 1.6	0 - 7.24

Table 10. Herring gull seasonal collisions estimated using stochLAB.

Turbine model	Array	Values	Spring	Breeding season	Autumn	Non-breeding/winter	Annual
1	North	Mean (SD)	0 (0)	0.65 (1.03)	0 (0)	0.47 (0.74)	1.11 (1.77)
		95% c.i.	0 - 0	0 - 3.3	0 - 0	0 - 2.39	0 - 5.69
	South	Mean (SD)	0 (0)	0 (0)	0.94 (1.48)	0 (0)	0.94 (1.48)
		95% c.i.	0 - 0	0 - 0	0 - 4.84	0 - 0	0 - 4.84
	Total	**Mean (SD)**	**0 (0)**	**0.65 (1.03)**	**0.94 (1.48)**	**0.47 (0.74)**	**2.05 (3.24)**
		95% c.i.	0 - 0	0 - 3.3	0 - 4.84	0 - 2.39	0 - 10.52
2	North	Mean (SD)	0 (0)	0.44 (0.7)	0 (0)	0.32 (0.49)	0.76 (1.19)
		95% c.i.	0 - 0	0 - 2.27	0 - 0	0 - 1.6	0 - 3.87
	South	Mean (SD)	0 (0)	0 (0)	0.64 (1.02)	0 (0)	0.64 (1.02)
		95% c.i.	0 - 0	0 - 0	0 - 3.37	0 - 0	0 - 3.37
	Total	**Mean (SD)**	**0 (0)**	**0.44 (0.7)**	**0.64 (1.02)**	**0.32 (0.49)**	**1.4 (2.21)**
		95% c.i.	0 - 0	0 - 2.27	0 - 3.37	0 - 1.6	0 - 7.24

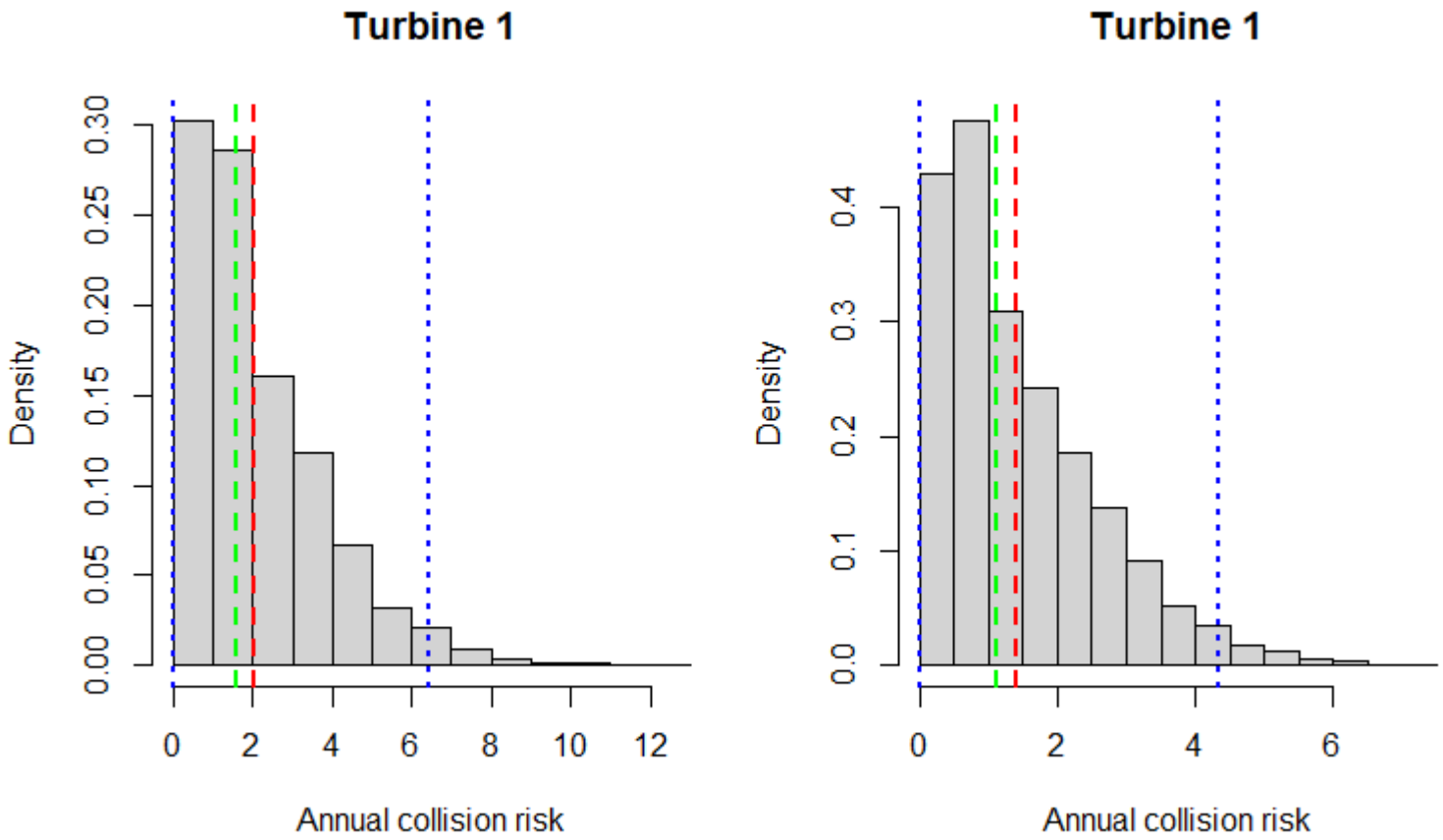

Figure 10. Histogram of herring gull annual collisions for the North and South arrays combined. Lines indicate mean collisions (red dashed lines), median collisions (green dashed lines) and 95% percentiles (blue dotted lines).

Table 11. Lesser black-backed gull collisions estimated using stochLAB.

Turbine model	Array	Values	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	North	Mean (SD)	0.41 (0.69)	0 (0)	0 (0)	0 (0)	0 (0)	3.82 (2.95)	19.86 (32.3)	0 (0)	0.45 (0.78)	0 (0)	0 (0)	0 (0)	24.54 (36.71)
		95% c.i.	0 - 2.29	0 - 0	0 - 0	0 - 0	0 - 0	0 - 10.59	0 - 105.81	0 - 0	0 - 2.55	0 - 0	0 - 0	0 - 0	0 - 121.25
	South	Mean (SD)	0 (0)	0 (0)	0.82 (1.35)	0.89 (1.45)	0 (0)	7.82 (9.92)	0 (0)	2.71 (2.69)	1.71 (2.89)	0 (0)	0.68 (1.13)	1.4 (1.3)	16.05 (20.72)
		95% c.i.	0 - 0	0 - 0	0 - 4.47	0 - 4.72	0 - 0	0 - 33.65	0 - 0	0 - 9.8	0 - 9.3	0 - 0	0 - 3.69	0 - 4.56	0 - 70.2
	Total	**Mean (SD)**	**0.41 (0.69)**	**0 (0)**	**0.82 (1.35)**	**0.89 (1.45)**	**0 (0)**	**11.63 (12.86)**	**19.86 (32.3)**	**2.71 (2.69)**	**2.16 (3.67)**	**0 (0)**	**0.68 (1.13)**	**1.4 (1.3)**	**40.58 (57.44)**
		95% c.i.	0 - 2.29	0 - 0	0 - 4.47	0 - 4.72	0 - 0	0 - 44.24	0 - 105.81	0 - 9.8	0 - 11.85	0 - 0	0 - 3.69	0 - 4.56	0 - 191.44
2	North	Mean (SD)	0.28 (0.46)	0 (0)	0 (0)	0 (0)	0 (0)	2.62 (2.08)	13.76 (21.97)	0 (0)	0.31 (0.53)	0 (0)	0 (0)	0 (0)	16.96 (25.05)
		95% c.i.	0 - 1.54	0 - 0	0 - 0	0 - 0	0 - 0	0 - 7.52	0 - 73.55	0 - 0	0 - 1.76	0 - 0	0 - 0	0 - 0	0 - 84.37
	South	Mean (SD)	0 (0)	0 (0)	0.55 (0.91)	0.62 (1.01)	0 (0)	5.19 (6.67)	0 (0)	1.84 (1.79)	1.15 (1.91)	0 (0)	0.48 (0.77)	0.95 (0.87)	10.78 (13.93)
		95% c.i.	0 - 0	0 - 0	0 - 2.94	0 - 3.36	0 - 0	0 - 22.73	0 - 0	0 - 6.44	0 - 6.33	0 - 0	0 - 2.58	0 - 2.99	0 - 47.37
	Total	**Mean (SD)**	**0.28 (0.46)**	**0 (0)**	**0.55 (0.91)**	**0.62 (1.01)**	**0 (0)**	**7.81 (8.76)**	**13.76 (21.97)**	**1.84 (1.79)**	**1.45 (2.44)**	**0 (0)**	**0.48 (0.77)**	**0.95 (0.87)**	**27.75 (38.98)**
		95% c.i.	0 - 1.54	0 - 0	0 - 2.94	0 - 3.36	0 - 0	0 - 30.25	0 - 73.55	0 - 6.44	0 - 8.09	0 - 0	0 - 2.58	0 - 2.99	0 - 131.74

Table 12. Lesser black-backed gull seasonal collisions estimated using stochLAB.

Turbine model	Array	Values	Spring	Breeding season	Autumn	Non-breeding/winter	Annual
1	North	Mean (SD)	0 (0)	23.68 (35.25)	0.45 (0.78)	0.41 (0.69)	24.54 (36.71)
		95% c.i.	0 - 0	0 - 116.4	0 - 2.55	0 - 2.29	0 - 121.25
	South	Mean (SD)	0.82 (1.35)	11.42 (14.06)	1.71 (2.89)	2.08 (2.43)	16.05 (20.72)
		95% c.i.	0 - 4.47	0 - 48.17	0 - 9.3	0 - 8.25	0 - 70.2
	Total	**Mean (SD)**	**0.82 (1.35)**	**35.09 (49.3)**	**2.16 (3.67)**	**2.49 (3.12)**	**40.58 (57.44)**
		95% c.i.	0 - 4.47	0 - 164.57	0 - 11.85	0 - 10.54	0 - 191.44
2	North	Mean (SD)	0 (0)	16.38 (24.05)	0.31 (0.53)	0.28 (0.46)	16.96 (25.05)
		95% c.i.	0 - 0	0 - 81.07	0 - 1.76	0 - 1.54	0 - 84.37
	South	Mean (SD)	0.55 (0.91)	7.65 (9.47)	1.15 (1.91)	1.43 (1.64)	10.78 (13.93)
		95% c.i.	0 - 2.94	0 - 32.53	0 - 6.33	0 - 5.57	0 - 47.37
	Total	**Mean (SD)**	**0.55 (0.91)**	**24.03 (33.53)**	**1.45 (2.44)**	**1.71 (2.1)**	**27.75 (38.98)**
		95% c.i.	0 - 2.94	0 - 113.6	0 - 8.09	0 - 7.11	0 - 131.74

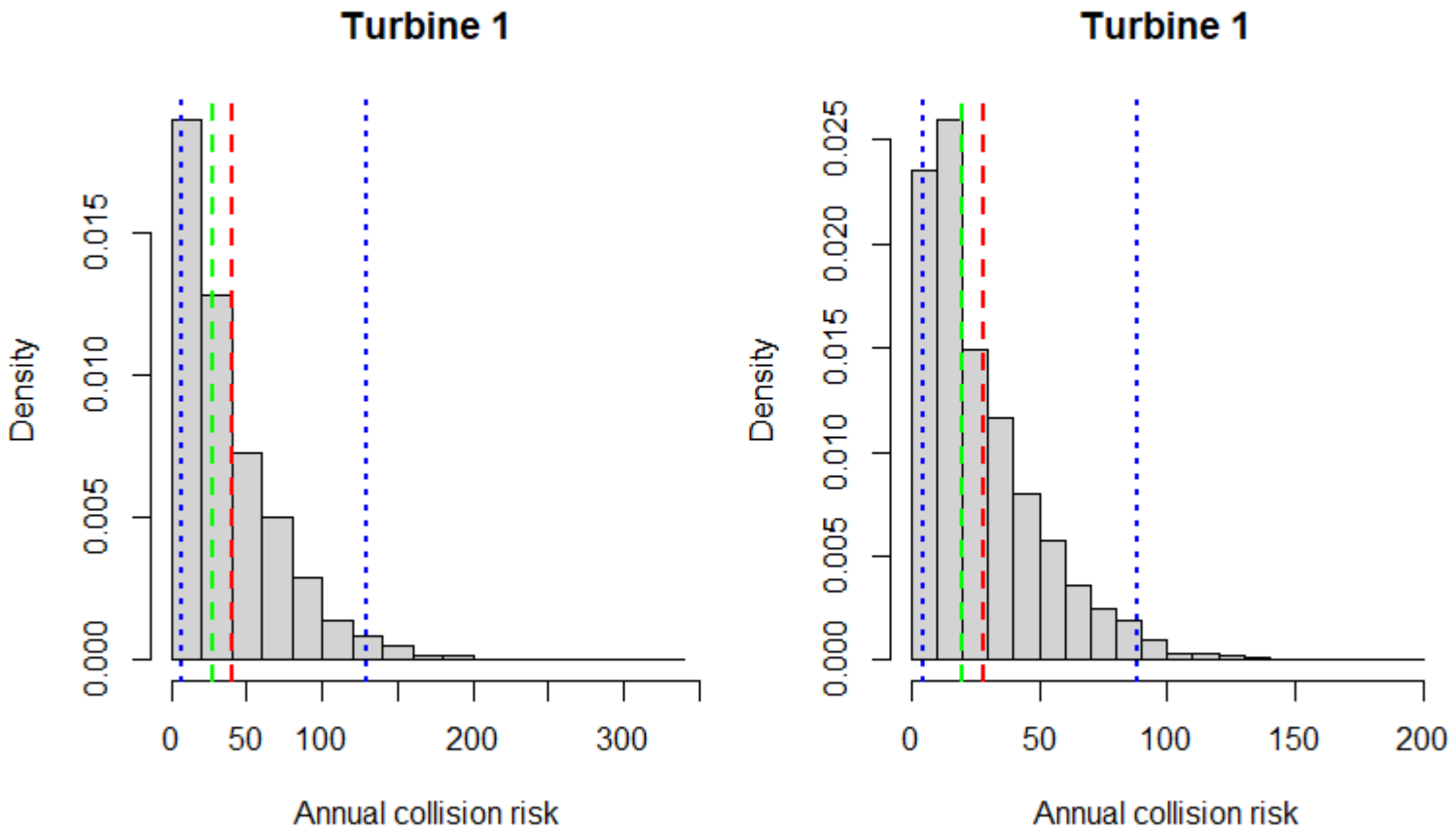

Figure 11. Histogram of lesser black-backed gull annual collisions for the North and South arrays combined. Lines indicate mean collisions (red dashed lines), median collisions (green dashed lines) and 95% percentiles (blue dotted lines).

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