

APPENDIX FOUR: RESULTS OF PBR AND CRM ANALYSIS

Table 1 Updated results of the PBR and CRM analysis for each species and SPA colony considered in the HRA. PBR thresholds are presented as individuals (ind.) and as a proportion (%) of the SPA population. Predicted collisions (98% avoidance rate) during the defined breeding season at Project Alpha, Project Bravo (Alpha + Bravo gives total collisions from The Seagreen Project), Neart na Gaoithe and Inch Cape are presented as a proportion (%) of the SPA population.

Species	SPA	Population (ind.)	PBR analysis			Predicted collisions (%)			
			f value	PBR (ind.)	PBR (%)	Alpha	Bravo	Neart na Gaoithe	Inch Cape
Fulmar	Buchan Ness to Collieston Coast	2,778	0.3	13	0.46	0.001	0.001	0	0
	Fowlsheugh	238	0.3	1	0.46	0.004	0.005	0	0.001
	Forth Islands	1,138	0.5	9	0.77	0.001	0.002	0.002	0.001
Gannet	Forth Islands	110,964	0.5	2511	2.26	0.40	0.40	0.21	0.92
	Buchan Ness to Collieston Coast	25,084	0.4	730	2.91	0	0	0	0
Kittiwake	Fowlsheugh	18,674	0.3	408	2.18	0.09	0.07	0	0.05
	Forth Islands	7,552	0.3	165	2.18	0.14	0.12	0.09	0.56
	St Abb's Head to Fast Castle	32,444	0.3	7082	2.18	0	0.01	0	0
Lesser Black-backed Gull	Forth Islands	4,026	0.5	101	2.50	0.03	0.1	0.04	0
	Buchan Ness to Collieston Coast	6,158	0.5	154	2.50	0.01	0.01	0	0
Herring Gull	Fowlsheugh	518	0.3	8	1.50	0.07	0.04	0	0.03
	Forth Islands	10,054	0.4	201	2.00	0.03	0.02	0.05	0.04
	St Abb's Head to Fast Castle	1,294	0.3	19	1.50	0.01	0.01	0.01	0.01
Guillemot	Buchan Ness to Collieston Coast	19,296	0.4	338	1.75	-	-	-	-
	Fowlsheugh	44,920	0.4	785	1.75	-	-	-	-
	Forth Islands	21,768	0.4	380	1.75	-	-	-	-
Razorbill	St Abb's Head to Fast Castle	43,744	0.4	765	1.75	-	-	-	-
	Fowlsheugh	5,260	0.4	100	1.90	-	-	-	-
	Forth Islands	4,719	0.5	112	2.38	-	-	-	-
Puffin	St Abb's Head to Fast Castle	3,157	0.5	75	2.38	-	-	-	-
	Forth Islands	100,564	0.5	1633	1.62	-	-	-	-

Results of PBR analysis for a range of *f* values (0.1 – 0.5) and CV values (0.1 – 0.5) for breeding seabird species at the SPAs considered in the HRA

Fulmar

Table 2 PBR expressed as a % of the population, for a range of *f* values (0.1 - 0.5) and CV values (0.5 - 0.1) for breeding Fulmar at the Buchan Ness to Collieston Coast SPA. Results of PBR according to selected *f* and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Buchan Ness to Collieston Coast SPA		<i>F</i>				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.15	0.31	0.46	0.62	0.77
	0.2	0.14	0.28	0.43	0.57	0.71
	0.3	0.13	0.26	0.39	0.52	0.65
	0.4	0.12	0.24	0.36	0.48	0.60
	0.5	0.11	0.22	0.33	0.44	0.55

Table 3 PBR expressed as a % of the population, for a range of *f* values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Fulmar at the Forth Islands SPA. Results of PBR according to selected *f* and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Forth Islands SPA		<i>F</i>				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.15	0.31	0.46	0.62	0.77
	0.2	0.14	0.28	0.43	0.57	0.71
	0.3	0.13	0.26	0.39	0.52	0.65
	0.4	0.12	0.24	0.36	0.48	0.60
	0.5	0.11	0.22	0.33	0.44	0.55

Table 4 PBR expressed as a % of the population, for a range of *f* values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Fulmar at the Fowlsheugh SPA. Results of PBR according to selected *f* and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Fowlsheugh SPA		<i>F</i>				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.15	0.31	0.46	0.62	0.77
	0.2	0.14	0.28	0.43	0.57	0.71
	0.3	0.13	0.26	0.39	0.52	0.65
	0.4	0.12	0.24	0.36	0.48	0.60
	0.5	0.11	0.22	0.33	0.44	0.55

Gannet

Table 5 PBR expressed as a % of the population, for a range of *f* values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Gannet at the Forth Islands SPA. Results of PBR according to selected *f* and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Forth Islands SPA		<i>F</i>				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.45	0.91	1.36	1.81	2.26
	0.2	0.42	0.83	1.25	1.66	2.08
	0.3	0.38	0.77	1.15	1.53	1.91
	0.4	0.35	0.7	1.05	1.41	1.76
	0.5	0.32	0.65	0.97	1.29	1.62

Kittiwake

Table 6 PBR expressed as a % of the population, for a range of *f* values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Kittiwake at the Buchan Ness to Collieston Coast SPA. Results of PBR according to selected *f* and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Buchan Ness to Collieston Coast SPA		<i>F</i>				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.73	1.46	2.18	2.91	3.64
	0.2	0.67	1.34	2.01	2.68	3.34
	0.3	0.61	1.23	1.84	2.46	3.07
	0.4	0.57	1.13	1.7	2.26	2.83
	0.5	0.52	1.04	1.56	2.08	2.60

Table 7 PBR expressed as a % of the population, for a range of *f* values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Kittiwake at Fowlsheugh SPA. Results of PBR according to selected *f* and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Fowlsheugh SPA		<i>F</i>				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.73	1.46	2.18	2.91	3.64
	0.2	0.67	1.34	2.01	2.68	3.34
	0.3	0.61	1.23	1.84	2.46	3.07
	0.4	0.57	1.13	1.7	2.26	2.83
	0.5	0.52	1.04	1.56	2.08	2.60

Table 8 PBR expressed as a % of the population, for a range of f values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Kittiwake the Forth Islands SPA. Results of PBR according to selected f and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Forth Islands SPA		F				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.73	1.46	2.18	2.91	3.64
	0.2	0.67	1.34	2.01	2.68	3.34
	0.3	0.61	1.23	1.84	2.46	3.07
	0.4	0.57	1.13	1.70	2.26	2.83
	0.5	0.52	1.04	1.56	2.08	2.60

Table 9 PBR expressed as a % of the population, for a range of f values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Kittiwake the St Abb's Head to Fast Castle SPA. Results of PBR according to selected f and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

St Abb's Head to Fast Castle SPA		F				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.73	1.46	2.18	2.91	3.64
	0.2	0.67	1.34	2.01	2.68	3.34
	0.3	0.61	1.23	1.84	2.46	3.07
	0.4	0.57	1.13	1.7	2.26	2.83
	0.5	0.52	1.04	1.56	2.08	2.60

Lesser Black-backed Gull

Table 10 PBR expressed as a % of the population, for a range of f values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Lesser Black-backed Gull at the Forth Islands SPA. Results of PBR according to selected f and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Forth Islands SPA		F				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.50	1.00	1.50	2.00	2.50
	0.2	0.46	0.92	1.38	1.84	2.29
	0.3	0.42	0.84	1.27	1.69	2.11
	0.4	0.39	0.78	1.16	1.55	1.94
	0.5	0.36	0.71	1.07	1.43	1.78

Herring Gull

Table 11 PBR expressed as a % of the population, for a range of f values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Herring Gull at the Buchan Ness to Collieston Coast SPA. Results of PBR according to selected f and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Buchan Ness to Collieston Coast SPA		F				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.50	1.00	1.50	2.00	2.50
	0.2	0.46	0.92	1.38	1.84	2.29
	0.3	0.42	0.84	1.27	1.69	2.11
	0.4	0.39	0.78	1.16	1.55	1.94
	0.5	0.36	0.71	1.07	1.43	1.78

Table 12 PBR expressed as a % of the population, for a range of f values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Herring Gull at the Fowlsheugh SPA. Results of PBR according to selected f and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Fowlsheugh SPA		F				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.50	1.00	1.50	2.00	2.50
	0.2	0.46	0.92	1.38	1.84	2.29
	0.3	0.42	0.84	1.27	1.69	2.11
	0.4	0.39	0.78	1.16	1.55	1.94
	0.5	0.36	0.71	1.07	1.43	1.78

Table 13 PBR expressed as a % of the population, for a range of f values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Herring Gull at the Forth Islands SPA. Results of PBR according to selected f and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Forth Islands SPA		F				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.50	1.00	1.50	2.00	2.50
	0.2	0.46	0.92	1.38	1.84	2.29
	0.3	0.42	0.84	1.27	1.69	2.11
	0.4	0.39	0.78	1.16	1.55	1.94
	0.5	0.36	0.71	1.07	1.43	1.78

Table 14 PBR expressed as a % of the population, for a range of f values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Herring Gull at the St Abb’s Head to Fast Castle SPA. Results of PBR according to selected f and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

St Abb’s Head to Fast Castle SPA		F				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.50	1.00	1.50	2.00	2.50
	0.2	0.46	0.92	1.38	1.84	2.29
	0.3	0.42	0.84	1.27	1.69	2.11
	0.4	0.39	0.78	1.16	1.55	1.94
	0.5	0.36	0.71	1.07	1.43	1.78

Guillemot

Table 15 PBR expressed as a % of the population, for a range of f values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Guillemot at the Buchan Ness to Collieston Coast SPA. Results of PBR according to selected f and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Buchan Ness to Collieston Coast SPA		F				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.52	1.03	1.55	2.07	2.59
	0.2	0.48	0.95	1.43	1.90	2.38
	0.3	0.44	0.87	1.31	1.75	2.18
	0.4	0.40	0.80	1.2	1.61	2.01
	0.5	0.37	0.74	1.11	1.48	1.85

Table 16 PBR expressed as a % of the population, for a range of f values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Guillemot at the Fowlsheugh SPA. Results of PBR according to selected f and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Fowlsheugh SPA		F				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.52	1.03	1.55	2.07	2.59
	0.2	0.48	0.95	1.43	1.90	2.38
	0.3	0.44	0.87	1.31	1.75	2.18
	0.4	0.40	0.80	1.2	1.61	2.01
	0.5	0.37	0.74	1.11	1.48	1.85

Table 17 PBR expressed as a % of the population, for a range of *f* values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Guillemot at the Forth Islands SPA. Results of PBR according to selected *f* and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Forth Islands SPA		<i>F</i>				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.52	1.03	1.55	2.07	2.59
	0.2	0.48	0.95	1.43	1.90	2.38
	0.3	0.44	0.87	1.31	1.75	2.18
	0.4	0.40	0.80	1.2	1.61	2.01
	0.5	0.37	0.74	1.11	1.48	1.85

Table 18 PBR expressed as a % of the population, for a range of *f* values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Guillemot at the St Abb's Head to Fast Castle SPA. Results of PBR according to selected *f* and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

St Abb's Head to Fast Castle SPA		<i>F</i>				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.52	1.03	1.55	2.07	2.59
	0.2	0.48	0.95	1.43	1.90	2.38
	0.3	0.44	0.87	1.31	1.75	2.18
	0.4	0.40	0.80	1.2	1.61	2.01
	0.5	0.37	0.74	1.11	1.48	1.85

Razorbill

Table 19 PBR expressed as a % of the population, for a range of *f* values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Razorbill at the Fowlsheugh SPA. Results of PBR according to selected *f* and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Fowlsheugh SPA		<i>F</i>				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.56	1.13	1.69	2.25	2.82
	0.2	0.52	1.04	1.55	2.07	2.59
	0.3	0.48	0.95	1.43	1.90	2.38
	0.4	0.44	0.88	1.31	1.75	2.19
	0.5	0.40	0.80	1.21	1.61	2.01

Table 20 PBR expressed as a % of the population, for a range of f values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Razorbill at the Forth Islands SPA. Results of PBR according to selected f and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Forth Islands SPA		F				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.56	1.13	1.69	2.25	2.82
	0.2	0.52	1.04	1.55	2.07	2.59
	0.3	0.48	0.95	1.43	1.90	2.38
	0.4	0.44	0.88	1.31	1.75	2.19
	0.5	0.40	0.80	1.21	1.61	2.01

Table 21 PBR expressed as a % of the population, for a range of f values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Razorbill at the St Abb's Head to Fast Castle SPA. Results of PBR according to selected f and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

St Abb's Head to Fast Castle SPA		F				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.56	1.13	1.69	2.25	2.82
	0.2	0.52	1.04	1.55	2.07	2.59
	0.3	0.48	0.95	1.43	1.90	2.38
	0.4	0.44	0.88	1.31	1.75	2.19
	0.5	0.40	0.80	1.21	1.61	2.01

Puffin

Table 22 PBR expressed as a % of the population, for a range of f values (0.1 - 0.5) and CV values (0.5 – 0.1) for breeding Puffin at the Forth Islands SPA. Results of PBR according to selected f and CV values are highlighted in light grey, with the value in dark grey showing the value compared to the predicted loss from collision (see Table 1.1).

Forth Islands SPA		F				
		0.1	0.2	0.3	0.4	0.5
CV	0.1	0.42	0.84	1.25	1.67	2.09
	0.2	0.38	0.77	1.15	1.54	1.92
	0.3	0.35	0.71	1.06	1.41	1.77
	0.4	0.32	0.65	0.97	1.30	1.62
	0.5	0.30	0.60	0.90	1.19	1.49