

BERWICK BANK WIND FARM OFFSHORE ENVIRONMENTAL IMPACT ASSESSMENT

**APPENDIX 11.1, ANNEX F:
DESIGN-BASED ANALYSIS –
ADJUSTED MONTHLY
POPULATION ESTIMATES
(BERWICK BANK
DEVELOPMENT PLUS 16KM
BUFFER) FOR AUKS**

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NOTE

This annex provides unapportioned (detections assigned to species only) density and population estimates for three auk species (guillemot, razorbill and puffin) within the Offshore Ornithology Study Area, adjusted for availability bias. Further EIA/HRA assessments should rely on estimates that have this correction applied: for the most appropriate estimates available please see the adjusted apportioned estimates within the Technical Baseline Report.

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Table 1: Unapportioned absolute density and population estimates of guillemots in the Offshore Ornithology Study Area, calculated using design-based analysis and adjusted for availability bias

Guillemot	Adjusted Density Estimate (birds/km ²)	Adjusted Lower 95% CI (birds/km ²)	Adjusted Upper 95% CI (birds/km ²)	Adjusted Population Estimate (number)	Adjusted Lower 95% CI (number)	Adjusted Upper 95% CI (number)	Adjusted SD	Adjusted CV
Survey								
Mar-19	7.19	5.37	9.09	28557	21400	36156	3813	13.35%
May-19	25.19	20.76	30.35	100161	82530	120732	9599	9.58%
Jun-19	5.38	4.06	6.88	21396	16129	27387	2855	13.34%
Jul-19	22.86	17.25	28.84	90939	68589	114671	12446	13.69%
Aug-19	38.31	25.36	52.38	152352	100864	208340	28180	18.5%
Sep-19	4.77	4.05	5.71	19001	16103	22667	1626	8.56%
Oct-19	5.73	2.91	9.39	22800	11579	37313	7170	31.45%
Nov-19	1.82	1.22	2.69	7234	4819	10688	1513	20.92%
Dec-19	3.46	1.99	5.22	13762	7901	20768	3529	25.64%
Jan-20	11.28	8.25	14.55	44894	32798	57887	6622	14.75%
Feb-20	6.38	5	7.77	25360	19904	30946	3007	11.86%
Mar-20	21.07	15.51	26.51	83771	61653	105464	10686	12.76%
May S01 20	29.39	23.83	34.73	116874	94788	138131	11478	9.82%
May S02 20	23.06	18.85	27.7	91761	74978	110158	9863	10.75%
Jun-20	27.51	23.32	31.46	109439	92742	125157	8458	7.73%
Jul-20	9.47	7.71	11.43	37716	30687	45475	3883	10.3%
Aug-20	31.25	26.6	35.93	124285	105758	142861	10858	8.74%
Sep-20	45.33	34.25	57.88	180278	136188	230195	24496	13.59%
Oct-20	10.26	5.81	14.73	40797	23119	58564	9490	23.26%
Nov-20	7.52	4.58	10.53	29877	18223	41899	6220	20.82%
Dec-20	18.2	13.85	23.48	72364	55108	93357	10294	14.23%
Jan-21	8.89	7.76	10.11	35375	30883	40197	2482	7.02%
Feb-21	4.21	3.29	5.29	16758	13071	21030	2177	12.99%
Apr S01 20	24.23	19.61	29.32	96390	78028	116602	10532	10.93%
Apr S02 20	59.57	46.17	74.43	236954	183623	296011	29803	12.58%

Table 2: Unapportioned absolute density and population estimates of sitting guillemots in the Offshore Ornithology Study Area, calculated using design-based analysis and adjusted for availability bias

Guillemot	Adjusted Density Estimate (birds/km ²)	Adjusted Lower 95% CI (birds/km ²)	Adjusted Upper 95% CI (birds/km ²)	Adjusted Population Estimate (number)	Adjusted Lower 95% CI (number)	Adjusted Upper 95% CI (number)	Adjusted SD	Adjusted CV
Survey								
Mar-19	6.48	4.88	8.14	25741	19436	32388	3012	11.70%
May-19	24.37	20.24	29.19	96911	80471	116121	7851	8.10%
Jun-19	5.00	3.81	6.36	19901	15138	25301	2310	11.61%
Jul-19	22.80	17.21	28.76	90702	68442	114346	9885	10.90%
Aug-19	38.30	25.36	52.36	152328	100864	208278	23659	15.53%
Sep-19	4.74	4.04	5.64	18862	16071	22388	1362	7.22%

Guillemot	Adjusted Density Estimate (birds/km ²)	Adjusted Lower 95% CI (birds/km ²)	Adjusted Upper 95% CI (birds/km ²)	Adjusted Population Estimate (number)	Adjusted Lower 95% CI (number)	Adjusted Upper 95% CI (number)	Adjusted SD	Adjusted CV
Survey								
Oct-19	5.50	2.79	9.01	21891	11120	35804	5743	26.23%
Nov-19	1.71	1.16	2.51	6795	4585	9983	1227	18.05%
Dec-19	3.45	1.99	5.20	13724	7897	20691	2830	20.62%
Jan-20	11.10	8.14	14.29	44169	32342	56844	5517	12.49%
Feb-20	6.32	4.96	7.69	25119	19754	30608	2484	9.89%
Mar-20	19.95	14.80	24.94	79317	58839	99203	8671	10.93%
May S01 20	28.55	23.25	33.59	113517	92473	133587	9176	8.08%
May S02 20	22.30	18.30	26.68	88722	72781	106100	7528	8.49%
Jun-20	26.98	22.96	30.74	107319	91327	122300	6685	6.23%
Jul-20	9.28	7.62	11.11	36944	30330	44195	3006	8.14%
Aug-20	31.24	26.60	35.91	124253	105758	142789	8768	7.06%
Sep-20	45.32	34.25	57.85	180228	136188	230076	20560	11.41%
Oct-20	10.06	5.67	14.46	40000	22575	57489	7877	19.69%
Nov-20	7.36	4.49	10.28	29255	17863	40895	4931	16.85%
Dec-20	17.79	13.61	22.88	70743	54145	90989	8278	11.70%
Jan-21	8.77	7.68	9.93	34893	30556	39490	2072	5.94%
Feb-21	4.15	3.25	5.20	16503	12916	20664	1793	10.87%
Apr S01 20	23.17	18.85	27.93	92158	74999	111082	8293	9.00%
Apr S02 20	58.83	45.73	73.34	234000	181862	291688	24647	10.53%

Table 3: Unapportioned absolute density and population estimates of razorbills in the Offshore Ornithology Study Area, calculated using design-based analysis and adjusted for availability bias

Razorbill	Adjusted Density Estimate (birds/km ²)	Adjusted Lower 95% CI (birds/km ²)	Adjusted Upper 95% CI (birds/km ²)	Adjusted Population Estimate (number)	Adjusted Lower 95% CI (number)	Adjusted Upper 95% CI (number)	Adjusted SD	Adjusted CV
Survey								
Mar-19	1.1	0.76	1.52	4371	2979	6050	752	17.2%
May-19	1.26	1.01	1.51	4979	4023	5983	579	11.63%
Jun-19	0.31	0.18	0.49	1248	697	1896	309	24.76%
Jul-19	1.96	1.01	3.01	7795	4033	11954	2252	28.89%
Aug-19	2.26	1.55	3.1	9004	6167	12349	1848	20.52%
Sep-19	1.26	1	1.54	5013	4008	6104	588	11.73%
Oct-19	2.62	1.25	4.4	10378	4986	17509	3789	36.51%
Nov-19	0.39	0.09	0.79	1534	330	3087	858	55.93%
Dec-19	0.68	0.38	1.08	2716	1494	4324	861	31.7%
Jan-20	1.15	0.76	1.68	4605	3041	6661	972	21.11%
Feb-20	0.71	0.49	0.91	2801	1937	3664	488	17.42%
Mar-20	3.75	2.66	4.96	14884	10576	19701	2539	17.06%
May S01 20	1.13	0.79	1.48	4477	3153	5892	748	16.71%
May S02 20	0.8	0.52	1.16	3200	2064	4582	687	21.47%
Jun-20	0.7	0.54	0.89	2785	2112	3525	378	13.57%
Jul-20	1.72	1.19	2.31	6856	4710	9159	1291	18.83%
Aug-20	2.96	2.21	3.78	11783	8779	15022	1869	15.86%
Sep-20	13.2	8.91	17.73	52475	35458	70534	10315	19.66%

Razorbill	Adjusted Density Estimate (birds/km ²)	Adjusted Lower 95% CI (birds/km ²)	Adjusted Upper 95% CI (birds/km ²)	Adjusted Population Estimate (number)	Adjusted Lower 95% CI (number)	Adjusted Upper 95% CI (number)	Adjusted SD	Adjusted CV
Survey								
Oct-20	1.08	0.55	1.74	4303	2193	6917	1172	27.24%
Nov-20	0.36	0.21	0.5	1444	840	2034	315	21.81%
Dec-20	1.17	0.71	1.7	4675	2858	6765	1057	22.61%
Jan-21	2.32	1.72	3	9219	6828	11946	1470	15.95%
Feb-21	0.79	0.54	1.06	3132	2152	4212	592	18.9%
Apr S01 20	3.14	2.23	4.15	12464	8873	16541	2045	16.41%
Apr S02 20	1.44	1.18	1.73	5731	4668	6886	569	9.93%

Table 4: Unapportioned absolute density and population estimates of sitting razorbills in the Offshore Ornithology Study Area, calculated using design-based analysis and adjusted for availability bias

Razorbill	Adjusted Density Estimate (birds/km ²)	Adjusted Lower 95% CI (birds/km ²)	Adjusted Upper 95% CI (birds/km ²)	Adjusted Population Estimate (number)	Adjusted Lower 95% CI (number)	Adjusted Upper 95% CI (number)	Adjusted SD	Adjusted CV
Survey								
Mar-19	0.89	0.64	1.21	3544	2504	4803	527	14.88%
May-19	1.25	1.01	1.49	4955	4023	5920	464	9.37%
Jun-19	0.28	0.17	0.42	1124	673	1633	231	20.55%
Jul-19	1.96	1.01	3.01	7795	4033	11954	1817	23.32%
Aug-19	2.26	1.55	3.09	8988	6167	12310	1453	16.16%
Sep-19	1.26	1.00	1.54	5013	4008	6104	473	9.44%
Oct-19	2.47	1.19	4.14	9797	4732	16480	2787	28.45%
Nov-19	0.37	0.09	0.75	1470	330	2947	645	43.84%
Dec-19	0.67	0.38	1.06	2685	1494	4250	641	23.88%
Jan-20	1.11	0.75	1.60	4440	2981	6359	763	17.18%
Feb-20	0.70	0.49	0.89	2762	1937	3568	390	14.13%
Mar-20	3.45	2.46	4.55	13689	9781	18063	2043	14.92%
May S01 20	1.10	0.78	1.43	4372	3118	5702	594	13.58%
May S02 20	0.77	0.51	1.09	3068	2040	4320	534	17.41%
Jun-20	0.67	0.53	0.84	2674	2072	3333	300	11.20%
Jul-20	1.71	1.19	2.29	6808	4694	9072	1026	15.07%
Aug-20	2.96	2.21	3.78	11783	8779	15022	1431	12.14%
Sep-20	13.19	8.91	17.71	52444	35458	70451	8065	15.38%
Oct-20	0.92	0.46	1.48	3654	1844	5870	903	24.72%
Nov-20	0.34	0.21	0.46	1357	824	1857	242	17.85%
Dec-20	1.10	0.68	1.58	4397	2740	6276	811	18.45%
Jan-21	2.27	1.69	2.92	9017	6722	11638	1125	12.48%
Feb-21	0.76	0.53	1.01	3027	2112	4026	453	14.97%
Apr S01 20	2.85	2.08	3.70	11320	8260	14749	1562	13.80%
Apr S02 20	1.38	1.15	1.64	5510	4559	6527	444	8.07%

Table 5: Unapportioned absolute density and population estimates of puffins in the Offshore Ornithology Study Area, calculated using design-based analysis and adjusted for availability bias

Puffin	Adjusted Density Estimate (birds/km ²)	Adjusted Lower 95% CI (birds/km ²)	Adjusted Upper 95% CI (birds/km ²)	Adjusted Population Estimate (number)	Adjusted Lower 95% CI (number)	Adjusted Upper 95% CI (number)	Adjusted SD	Adjusted CV
Survey								
Mar-19	1.17	0.87	1.48	4662	3479	5884	709	15.21%
May-19	1.65	1.43	1.9	6597	5678	7540	553	8.38%
Jun-19	1.27	0.61	2.12	5057	2445	8404	1785	35.3%
Jul-19	2.6	1.82	3.52	10383	7218	13998	2057	19.81%
Aug-19	2.05	1.48	2.65	8176	5876	10562	1475	18.04%
Sep-19	0.92	0.57	1.31	3633	2275	5226	876	24.11%
Oct-19	0.22	0.13	0.31	855	522	1278	231	27.02%
Nov-19	0.02	0	0.03	82	19	155	45	54.88%
Dec-19	0	0	0	0	0	0	0	0
Jan-20	0.02	0	0.03	70	20	129	35	50%
Feb-20	0.05	0.02	0.07	195	111	288	57	29.23%
Mar-20	0.44	0.25	0.63	1733	1019	2504	402	23.2%
May S01 20	0.88	0.59	1.22	3549	2366	4824	747	21.05%
May S02 20	0.31	0.24	0.41	1274	990	1602	185	14.52%
Jun-20	0.51	0.32	0.72	2032	1315	2865	365	17.96%
Jul-20	1.21	0.72	1.8	4823	2860	7187	1168	24.22%
Aug-20	1.47	1.15	1.76	5815	4611	6976	734	12.62%
Sep-20	7.7	6.44	8.99	30615	25603	35761	3105	10.14%
Oct-20	0.1	0.07	0.14	395	262	545	89	22.53%
Nov-20	0.13	0.07	0.19	484	269	756	134	27.69%
Dec-20	0.01	0.01	0.02	65	28	112	29	44.62%
Jan-21	0.02	0.01	0.03	73	28	140	35	47.95%
Feb-21	0.22	0.13	0.36	880	514	1399	271	30.8%
Apr S01 20	1.02	0.63	1.49	4061	2500	5928	1038	25.56%
Apr S02 20	2.98	2.33	3.68	11827	9221	14638	1667	14.09%

Table 6: Unapportioned absolute density and population estimates of sitting puffins in the Offshore Ornithology Study Area, calculated using design-based analysis and adjusted for availability bias

Puffin	Adjusted Density Estimate (birds/km ²)	Adjusted Lower 95% CI (birds/km ²)	Adjusted Upper 95% CI (birds/km ²)	Adjusted Population Estimate (number)	Adjusted Lower 95% CI (number)	Adjusted Upper 95% CI (number)	Adjusted SD	Adjusted CV
Survey								
Mar-19	1.15	0.86	1.44	4568	3437	5736	527	11.53%
May-19	1.62	1.41	1.84	6462	5614	7312	421	6.51%
Jun-19	1.20	0.58	1.99	4774	2318	7902	1297	27.18%
Jul-19	2.57	1.81	3.46	10255	7171	13753	1568	15.29%
Aug-19	2.00	1.46	2.57	7980	5783	10238	1098	13.76%
Sep-19	0.90	0.57	1.27	3561	2267	5059	657	18.46%

Puffin	Adjusted Density Estimate (birds/km ²)	Adjusted Lower 95% CI (birds/km ²)	Adjusted Upper 95% CI (birds/km ²)	Adjusted Population Estimate (number)	Adjusted Lower 95% CI (number)	Adjusted Upper 95% CI (number)	Adjusted SD	Adjusted CV
Survey								
Oct-19	0.21	0.13	0.30	833	522	1227	173	20.73%
Nov-19	0.02	0.00	0.03	82	19	155	35	42.35%
Dec-19	0.00	0.00	0.00	0	0	0	0	0.00%
Jan-20	0.02	0.00	0.03	70	20	129	27	38.60%
Feb-20	0.05	0.02	0.07	195	111	288	43	22.19%
Mar-20	0.33	0.19	0.47	1279	760	1850	266	20.76%
May S01 20	0.87	0.59	1.19	3491	2352	4711	566	16.20%
May S02 20	0.31	0.24	0.41	1274	990	1602	142	11.18%
Jun-20	0.43	0.30	0.57	1716	1228	2259	247	14.40%
Jul-20	1.12	0.68	1.65	4464	2709	6576	927	20.77%
Aug-20	1.46	1.15	1.74	5782	4611	6881	556	9.61%
Sep-20	7.70	6.44	8.99	30615	25603	35761	2315	7.56%
Oct-20	0.10	0.07	0.14	395	262	545	69	17.49%
Nov-20	0.12	0.07	0.17	459	269	693	99	21.63%
Dec-20	0.01	0.01	0.02	65	28	112	22	33.09%
Jan-21	0.02	0.01	0.03	73	28	140	27	36.77%
Feb-21	0.22	0.13	0.35	871	514	1375	212	24.28%
Apr S01 20	0.98	0.61	1.43	3912	2428	5694	799	20.42%
Apr S02 20	2.94	2.31	3.61	11664	9158	14360	1241	10.64%

