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Volume 7B Proposed Development (Offshore) Appendices

Appendix 6-1 Offshore Ornithology Baseline Characterisation Report Annex 11 Offshore Ornithology MRSea-based and Design-based Abundance Estimates

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Volume 7B Appendix 6-1 Annex 11 MRSea-based and Design-based Abundance Estimates

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Acronyms and Abbreviations

CV	Coefficient of Variation
DAS	Digital Aerial Survey
OWF	Offshore Wind Farm

1 Introduction

1.1.1.1 The data used to identify species requiring assessment for the Proposed Development (Offshore) was collected over a 24-month Digital Aerial Survey (DAS) programme within the Caledonia Offshore Wind Farm (i.e., Array Area) and a 4km buffer (May 2021 to April 2023). The analysis of the survey data was undertaken for the Caledonia OWF, Caledonia North Site and Caledonia South Site separately. Five seabird species have been identified as requiring consideration of potential distributional responses risk, as follows:

- Kittiwake (*Rissa tridactyla*);
- Common guillemot (*Uria aalge*), hereafter 'guillemot';
- Razorbill (*Alca torda*);
- Puffin (*Fratercula arctica*); and
- Northern gannet (*Morus bassanus*), hereafter 'gannet'.

1.1.1.2 The distributional responses assessment has been run using the design-based and/or the model-based density estimates (see Volume 7B, Appendix 6-2: Offshore Ornithology Distributional Responses Technical Report). This annex presents comparisons of MRSea (model-based) and design-based estimates for the Caledonia OWF, and the approach presented to NatureScot (01 July 2024) and agreed with NatureScot within in an email dated 07 August 2024. As such, these agreed approaches have also been applied to assessment of Caledonia North and Caledonia South.

2 Kittiwake

2.1 Overview

2.1.1.1 For kittiwake, MRSea could be run for all surveys within the breeding season, as such, MRSea values have been used within assessments for distributional responses during the breeding season (shown in bold within Table 2-1, Table 2-2, and Table 2-3 below). Within the non-breeding season, there are a significant number of gaps within the MRSea data due to zero counts and low numbers, as such, design-based abundance estimates have been used within assessments for distributional responses during the non-breeding season (shown in bold within Table 2-1, Table 2-2, and Table 2-3 below). A summary of seasonal peaks used within assessments is presented within Section 2.5.

2.2 Caledonia OWF

2.2.1.1 Table 2-1 presents apportioned density and population estimate of all kittiwake in the Caledonia OWF (plus a 2km buffer), calculated using the model-based median abundance and design-based mean abundance.

Table 2-1: Density and population estimate of all kittiwake in the Caledonia OWF plus a 2km buffer, calculated using the model-based median abundance have been used during the breeding season (Mid-April to August) and design-based mean abundance during the non-breeding season (September to mid-April).

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision	
Breeding Season (Mid-April to August)									
May 2021	931	381	1,941	0.08	494	250	1,040	0.35	-0.89
June 2021	1,560	654	2,981	0.06	881	458	1,898	0.35	-0.77
July 2021	3,811	802	8,185	0.04	**1,868**	762	5,427	1.24	-1.04
August 2021	907	497	1,552	0.08	945	451	2,192	0.39	0.04
April 2022	488	204	1,015	0.11	248	131	512	0.36	-0.97
May 2022	3,472	1,636	5,681	0.04	1,002	427	2,491	0.49	-2.47
June 2022	4,142	1358	8,005	0.04	1,992	888	4,877	0.47	-1.08
July 2022	1,912	818	3,714	0.05	**2,210**	1,035	5,200	0.39	0.13
August 2022	623	386	909	0.1	572	302	1,132	0.34	-0.09
April 2023	691	131	1,786	0.09	400	100	1,795	0.73	-0.73

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision	
Non-breeding Season (September to Mid-April)									
September 2021	**741**	144	1,998	0.09	286	85	1056	0.68	-1.59
October 2021	345	231	479	0.13	301	167	574	0.32	-0.15
November 2021	578	265	876	0.10	617	385	1048	0.33	0.06
December 2021	121	64	183	0.22	104	55	207	0.36	-0.17
January 2022	40	17	74	0.38	-	-	-	-	-
February 2022	120	45	211	0.21	-	-	-	-	-
March 2022	106	45	180	0.22	141	69	305	0.39	0.25
September 2022	**225**	93	398	0.16	152	82	308	0.33	-0.48
October 2022	140	52	250	0.20	109	51	259	0.40	-0.28

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision	
November 2022	87	17	198	0.26	-	-	-	-	-
December 2022	27	4	74	0.50	-	-	-	-	-
January 2023	17	3	35	0.58	-	-	-	-	-
February 2023	109	28	217	0.23	-	-	-	-	-
March 2023	65	18	113	0.30	-	-	-	-	-

Note, seasonal peak abundance estimates used within assessments are shown in **bold**. Note, the model-based median abundance have been used during the breeding season (Mid-April to August) and design-based mean abundance during the non-breeding season (September to mid-April).

2.3 Caledonia North

2.3.1.1 Table 2-2 presents apportioned density and population estimate of all kittiwake in the Caledonia North Site (plus a 2km buffer), calculated using the model-based median abundance and design-based mean abundance.

Table 2-2: Density and population estimate of all kittiwake in the Caledonia North Site plus a 2km buffer, calculated using the model-based median abundance have been used during the breeding season (Mid-April to August) and design-based mean abundance during the non-breeding season (September to mid-April).

Survey	Predicted Abundance	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
Breeding Season (Mid-April to August) – Model-based Abundance Estimates				
May 2021	275	135	583	0.35
June 2021	397	211	811	0.32
July 2021	366	145	1,008	0.81
August 2021	**426**	217	918	0.35
April 2022	116	58	247	0.39
May 2022	450	189	1,165	0.51
June 2022	894	396	2,165	0.45
July 2022	**995**	497	2,175	0.36
August 2022	232	123	445	0.34
April 2023	103	35	316	0.57
Non-breeding Season (September to Mid-April) – Design-based Abundance Estimates				
September 2021	74	28	131	0.28
October 2021	200	90	326	0.17

Survey	Predicted Abundance	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
November 2021	**548**	308	850	0.10
December 2021	91	41	142	0.25
January 2022	28	6	51	0.45
February 2022	94	33	163	0.24
March 2022	75	23	149	0.27
September 2022	**93**	30	185	0.25
October 2022	18	3	47	0.58
November 2022	63	11	150	0.30
December 2022	14	2	41	0.71
January 2023	12	2	29	0.71
February 2023	57	10	143	0.32
March 2023	34	9	70	0.41

Note, seasonal peak abundance estimates used within assessments are shown in **bold**. Note, the model-based median abundance have been used during the breeding season (Mid-April to August) and design-based mean abundance during the non-breeding season (September to mid-April).

2.4 Caledonia South

2.4.1.1 Table 2-3 presents apportioned density and population estimate of all kittiwake in the Caledonia South Site (plus a 2km buffer), calculated using the model-based median abundance and design-based mean abundance.

Table 2-3: Density and population estimate of all kittiwake in the Caledonia South Site plus a 2km buffer, calculated using the model-based median abundance have been used during the breeding season (Mid-April to August) and design-based mean abundance during the non-breeding season (September to mid-April).

Survey	Predicted Abundance	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
Breeding Season (Mid-April to August) – Model-based Abundance Estimates				
May 2021	254	136	519	0.34
June 2021	549	287	1,195	0.35
July 2021	**1,650**	686	4,769	1.65
August 2021	603	280	1,436	0.41
April 2022	158	87	312	0.32
May 2022	639	274	1,542	0.47
June 2022	1,272	574	3,110	0.48
July 2022	**1,410**	644	3,404	0.41
August 2022	391	208	772	0.32
April 2023	336	75	1,617	0.89
Non-breeding Season (September to Mid-April) – Design-based Abundance Estimates				
September 2021	**705**	122	1,994	0.09
October 2021	162	90	272	0.19

Survey	Predicted Abundance	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
November 2021	177	77	304	0.18
December 2021	58	13	121	0.32
January 2022	11	2	29	0.71
February 2022	32	8	64	0.41
March 2022	42	17	79	0.35
September 2022	**149**	45	292	0.20
October 2022	138	50	254	0.20
November 2022	52	9	125	0.33
December 2022	25	6	68	0.50
January 2023	6	1	17	1.00
February 2023	57	20	97	0.32
March 2023	41	10	83	0.38

Note, seasonal peak abundance estimates used within assessments are shown in **bold**. Note, the model-based median abundance have been used during the breeding season (Mid-April to August) and design-based mean abundance during the non-breeding season (September to mid-April).

2.5 Seasonal Peaks

2.5.1.1 Table 2-4 presents the seasonal peaks of kittiwake within the Caledonia OWF (+2km buffer), Caldonia North Site (+2km buffer) and Caledonia South Site (+2km buffer), during the NatureScot defined seasons.

Table 2-4: Seasonal Peaks of kittiwake within the Caledonia OWF (+2km buffer), Caldonia North Site (+2km buffer) and Caledonia South Site (+2km buffer), during the NatureScot defined seasons.

Mean Peak	Design-based Abundance	MRSea Modelled Based Abundance	LCL (95% CI)	UCL (95% CI)
Caledonia OWF				
Breeding (April to mid-August)	-	2,039 (1,868 / 2,210)	899	5314
Non-Breeding (Mid-August to March)	483 (741 / 225)	-	119	1,198
Caledonia North Site				
Breeding (April to mid-August)	-	710 (426 / 995)	321	1,591
Non-Breeding (Mid-August to March)	321 (548 / 93)	-	29	158
Caledonia South Site				
Breeding (April to mid-August)	-	1,530 (1,650 / 1,410)	665	4087
Non-Breeding (Mid-August to March)	427 (705 / 149)	-	84	1,143
Note, the seasonal peaks from Year 1 and Year 2 of DAS data used to calculate the median seasonal peaks are provided within the brackets.				

3 Guillemot

3.1 Overview

3.1.1.1 For guillemot, MRSea could be run for all surveys, as such, MRSea values have been used within assessments for distributional responses (shown in bold within Table 3-1, Table 3-2 and Table 3-3 below). A summary of seasonal peaks used within assessments is presented within Section 3.5.

3.2 Caledonia OWF

3.2.1.1 Table 3-1 presents availability bias-corrected density and population estimate of all guillemot in the Caledonia OWF (plus a 2km buffer), calculated using the model-based median abundance and design-based mean abundance.

Table 3-1: Availability bias-corrected density and population estimate of all guillemot in the Caledonia OWF plus a 2km buffer, calculated using model-based abundance estimates and design-based abundance estimates.

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/ Precision	
May 2021	12,171	7,597	17,122	0.03	10,920	7,341	17,331	0.23	-0.11
June 2021	7,235	4,671	10,233	0.04	6,714	4,676	10,107	0.20	-0.08
July 2021	15,538	6,068	30,106	0.02	**15,457**	8,159	32,579	0.27	-0.01
August 2021	1,050	563	1,721	0.13	2,120	1,311	3,515	0.38	0.50
September 2021	4,536	2,408	7,499	0.04	**4,705**	2,804	8,129	0.26	0.04
October 2021	1,620	909	2,337	0.08	1,838	1,192	2,982	0.24	0.12
November 2021	2,270	1,758	2,891	0.06	2,193	1,489	3,416	0.20	-0.04
December 2021	800	642	1,018	0.27	1,055	697	1,669	0.22	0.24
January 2022	669	340	1,100	0.12	605	368	1,039	0.27	-0.11

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/ Precision	
February 2022	1,493	1,042	2,044	0.1	1,532	1,012	2,485	0.21	0.03
March 2022	745	370	1,176	0.11	888	543	1,507	0.25	0.16
April 2022	1,942	1,052	2,922	0.06	2,500	1,655	4,143	0.22	0.22
May 2022	19,546	12,599	26,440	0.02	**16,727**	11,905	25,771	0.18	-0.17
June 2022	13,314	7,816	19,161	0.02	11,814	7,574	19,672	0.23	-0.13
July 2022	11,529	6,775	17,386	0.03	12,053	8,367	17,909	0.20	0.04
August 2022	981	599	1,424	0.09	856	522	1,436	0.29	-0.15
September 2022	11,408	3,416	24,432	0.03	**8,715**	4,555	17,361	0.68	-0.31
October 2022	979	234	2,216	0.11	865	454	1,761	0.34	-0.13
November 2022	94	35	161	0.45	147	75	311	0.36	0.36
December 2022	529	350	714	0.13	520	372	797	0.19	-0.02

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/ Precision	
January 2023	813	470	1,212	0.1	738	471	1,252	0.26	-0.10
February 2023	2,419	1,384	3,622	0.05	2,435	1,629	3,819	0.22	0.01
March 2023	3,304	2,093	4,493	0.05	3,079	2,100	4,634	0.20	-0.07
April 2023	3,137	1,404	5,919	0.05	2,592	1,191	6,625	0.37	-0.21
Note, seasonal peak abundance estimates used within assessments are shown in **bold**.									

3.3 Caledonia North

3.3.1.1 Table 3-2 presents availability bias-corrected density and population estimate of all guillemot in the Caledonia North Site (plus a 2km buffer), calculated using the model-based median abundance.

Table 3-2: Availability bias-corrected density and population estimate of all guillemot in the Caledonia North Site plus a 2km buffer, calculated using model-based abundance estimates.

Survey	MRSea Modelled Abundance Estimates – Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
May 2021	3,814	2,571	6,475	0.24
June 2021	2,266	1,591	3,606	0.20
July 2021	**3,959**	2,614	6,766	0.22
August 2021	321	178	629	0.45
September 2021	**1,593**	972	2,800	0.26
October 2021	522	340	887	0.26
November 2021	964	659	1,573	0.20
December 2021	514	341	843	0.21
January 2022	227	131	431	0.29
February 2022	728	487	1,243	0.21
March 2022	407	252	719	0.25
April 2022	1,259	851	2,164	0.22
May 2022	**10,481**	7,578	16,515	0.17
June 2022	4,452	2,913	7,589	0.23

Survey	MRSea Modelled Abundance Estimates – Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
July 2022	2,909	2,004	4,653	0.20
August 2022	425	258	724	0.29
September 2022	790	328	2,485	0.85
October 2022	380	199	795	0.34
November 2022	66	34	145	0.36
December 2022	324	236	508	0.17
January 2023	298	180	578	0.29
February 2023	974	645	1,617	0.23
March 2023	**1,271**	877	1,964	0.21
April 2023	799	447	1,578	0.32
Note, seasonal peak abundance estimates used within assessments are shown in **bold**.				

3.4 Caledonia South

3.4.1.1 Table 3-3 presents availability bias-corrected density and population estimate of all guillemot in the Caledonia South Site (plus a 2km buffer), calculated using the model-based median abundance.

Table 3-3: Availability bias-corrected density and population estimate of all guillemot in the Caledonia South Site plus a 2km buffer, calculated using model-based abundance estimates.

Survey	MRSea Modelled Abundance Estimates – Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
May 2021	8,250	5,616	12,428	0.20
June 2021	4,907	3,416	7,145	0.19
July 2021	**12,725**	6,326	27,767	0.30
August 2021	1,950	1,225	3,132	0.29
September 2021	**3,487**	2,069	5,905	0.26
October 2021	1,494	976	2,352	0.22
November 2021	1,435	967	2,150	0.21
December 2021	668	442	1,005	0.21
January 2022	431	271	689	0.24
February 2022	945	625	1,442	0.21
March 2022	562	344	914	0.25
April 2022	1,513	1,001	2,373	0.21
May 2022	7,664	5,425	11,112	0.18
June 2022	8,594	5,499	13,914	0.23

Survey	MRSea Modelled Abundance Estimates – Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
July 2022	**9,921**	6,913	14,336	0.19
August 2022	514	318	841	0.28
September 2022	**8,088**	4,280	15,452	0.57
October 2022	564	297	1,111	0.34
November 2022	95	49	192	0.36
December 2022	270	192	387	0.19
January 2023	501	331	771	0.22
February 2023	1,754	1,186	2,631	0.21
March 2023	2,271	1,537	3,343	0.19
April 2023	1,980	857	5,364	0.39
Note, seasonal peak abundance estimates used within assessments are shown in **bold**.				

3.5 Seasonal Peaks

3.5.1.1 Table 3-4 presents the seasonal peaks of guillemot within the Caledonia OWF (+2km buffer), Caldonia North Site (+2km buffer) and Caledonia South Site (+2km buffer), during the NatureScot defined seasons.

Table 3-4: Seasonal Peaks of guillemot within the Caledonia OWF (+2km buffer), Caldonia North Site (+2km buffer) and Caledonia South Site (+2km buffer), during the NatureScot defined seasons.

Mean Peak	MRSea Modelled Based Abundance	LCL (95% CI)	UCL(95% CI)
Caledonia OWF			
Breeding (April to mid-August)	16,092 (15,457 / 16,727)	10,032	29,175
Non-Breeding (Mid-August to March)	6,710 (4,705 / 8,715)	3,679	12,745
Caledonia North Site			
Breeding (April to mid-August)	7,220 (3,959 / 10,481)	5,096	11,640
Non-Breeding (Mid-August to March)	1,432 (1,593 / 1,271)	650	2,643
Caledonia South Site			
Breeding (April to mid-August)	11,323 (12,725 / 9,921)	5,876	19,439
Non-Breeding (Mid-August to March)	5,788 (3,487 / 8,088)	3,174	10,679
Note, the seasonal peaks from Year 1 and Year 2 of DAS data used to calculate the seasonal peaks are provided within the brackets.			

4 Razorbill

4.1 Overview

4.1.1.1 For razorbill, MRSea could be run for all surveys within the breeding season, as such, MRSea values have been used within assessments for distributional responses during the breeding season (shown in bold within Table 4-1, Table 4-2 and Table 4-3 below). Within the non-breeding season, there are a significant number of gaps within the MRSea data due to zero counts and low numbers, as such, design-based abundance estimates have been used within assessments for distributional responses during the non-breeding season (shown in bold within Table 4-1, Table 4-2 and Table 4-3 below). A summary of seasonal peaks used within assessments is presented within Section 4.5.

4.2 Caledonia OWF

4.2.1.1 Table 4-1 presents availability bias-corrected density and population estimate of all razorbill in the Caledonia OWF (plus a 2km buffer), calculated using the model-based median abundance and design-based mean abundance.

Table 4-1: Availability bias-corrected density and population estimate of all razorbill in the Caledonia OWF plus a 2km buffer, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March).

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision	
Breeding Season (April to mid-August)									
May 2021	974	625	1,319	0.09	835	504	1,409	0.30	-0.17
June 2021	886	473	1,440	0.1	876	423	1,841	0.39	-0.01
July 2021	1,437	800	2,312	0.07	1,510	893	2,699	0.26	0.05
August 2021	921	435	1,590	0.14	550	334	900	0.26	-0.67
April 2022	774	340	1,349	0.1	699	408	1,226	0.33	-0.11
May 2022	2,205	1,213	3,555	0.06	2,014	1,209	3,427	0.27	-0.09
June 2022	172	113	229	0.2	158	97	259	0.26	-0.09
July 2022	1,094	687	1,521	0.08	953	542	1,717	0.31	-0.15
August 2022	444	268	667	0.13	294	155	567	0.37	-0.51
April 2023	600	156	1,233	0.11	466	159	1,537	0.69	-0.29

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision	
Non-breeding Season (Mid-August to March)									
September 2021	449	289	612	0.14	380	238	614	0.25	-0.18
October 2021	72	34	112	0.35	-	-	-	-	-
November 2021	-	-	-	-	-	-	-	-	-
December 2021	314	163	425	0.41	-	-	-	-	-
January 2022	63	17	112	0.38	-	-	-	-	-
February 2022	627	476	754	0.15	540	304	938	0.29	-0.16
March 2022	93	39	155	0.35	-	-	-	-	-
September 2022	3,232	2,065	4,636	0.05	2,913	1,912	4,521	0.23	-0.11
October 2022	54	9	155	0.38	135	23	727	0.98	0.60

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision	
November 2022	191	63	354	0.32	151	78	295	0.39	-0.26
December 2022	114	40	201	0.28	-	-	-	-	-
January 2023	126	56	213	0.24	-	-	-	-	-
February 2023	334	160	542	0.15	286	193	440	0.28	-0.17
March 2023	432	220	690	0.13	432	220	690	0.13	-0.23

Note, seasonal peak abundance estimates used within assessments are shown in **bold**. Note, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March).

4.3 Caledonia North

4.3.1.1 Table 4-2 presents availability bias-corrected density and population estimate of all razorbill in the Caledonia North Site (plus a 2km buffer), calculated using the model-based median abundance and design-based mean abundance.

Table 4-2: Availability bias-corrected density and population estimate of all razorbill in the Caledonia North Site plus a 2km buffer, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March).

Survey	Predicted Abundance	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
Breeding Season (April to mid-August) – Model-based Abundance Estimates				
May 2021	396	234	682	0.33
June 2021	**527**	263	1,077	0.37
July 2021	513	336	798	0.24
August 2021	336	206	548	0.26
April 2022	366	209	657	0.38
May 2022	**1,232**	735	2,110	0.28
June 2022	97	60	158	0.26
July 2022	584	338	1,026	0.30
August 2022	112	59	216	0.39
April 2023	124	48	397	0.79
Non-breeding Season (Mid-August to March) – Design-based Abundance Estimates				
September 2021	192	55	379	0.24
October 2021	10	2	29	1.00

Survey	Predicted Abundance	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
November 2021	-	-	-	-
December 2021	116	54	259	0.71
January 2022	10	1	30	1.00
February 2022	**454**	261	659	0.19
March 2022	57	9	108	0.45
September 2022	**2,438**	1,262	3,850	0.06
October 2022	70	12	195	0.38
November 2022	135	40	232	0.41
December 2022	56	17	114	0.41
January 2023	54	15	112	0.38
February 2023	92	20	190	0.28
March 2023	236	77	426	0.18

Note, seasonal peak abundance estimates used within assessments are shown in **bold**. Note, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March).

4.4 Caledonia South

4.4.1.1 Table 4-3 presents availability bias-corrected density and population estimate of all razorbill in the Caledonia South Site (plus a 2km buffer), calculated using the model-based median abundance and design-based mean abundance.

Table 4-3: Availability bias-corrected density and population estimate of all razorbill in the Caledonia South Site plus a 2km buffer, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March).

Survey	Predicted Abundance	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
Breeding Season (April to mid-August) – Model-based Abundance Estimates				
May 2021	529	326	871	0.26
June 2021	450	214	958	0.39
July 2021	**1,156**	669	2,132	0.25
August 2021	279	170	454	0.25
April 2022	428	258	725	0.27
May 2022	**1,022**	625	1,702	0.26
June 2022	80	49	130	0.25
July 2022	483	272	881	0.30
August 2022	216	115	412	0.33
April 2023	398	138	1,256	0.51
Non-breeding Season (Mid-August to March) – Design-based Abundance Estimates				
September 2021	**320**	210	461	0.16
October 2021	72	44	115	0.35

Survey	Predicted Abundance	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
November 2021	-	-	-	-
December 2021	233	213	302	0.45
January 2022	55	27	102	0.41
February 2022	241	190	322	0.23
March 2022	45	25	92	0.50
September 2022	**1,286**	970	1,659	0.08
October 2022	8	1	22	1.00
November 2022	95	59	203	0.41
December 2022	68	26	120	0.35
January 2023	78	15	160	0.30
February 2023	249	127	420	0.17
March 2023	261	122	435	0.17

Note, seasonal peak abundance estimates used within assessments are shown in **bold**. Note, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March).

4.5 Seasonal Peaks

4.5.1.1 Table 4-4 presents the seasonal peaks of razorbill within the Caledonia OWF (+2km buffer), Caldonia North Site (+2km buffer) and Caledonia South Site (+2km buffer), during the NatureScot defined seasons.

Table 4-4: Seasonal Peaks of razorbill within the Caledonia OWF (+2km buffer), Caldonia North Site (+2km buffer) and Caledonia South Site (+2km buffer), during the NatureScot defined seasons.

Mean Peak	Design-based Abundance	MRSea Modelled Based Abundance	LCL (95% CI)	UCL (95% CI)
Caledonia OWF				
Breeding (April to mid-August)	-	1,762 (1,510 / 2,014)	1,051	3,063
Non-Breeding (Mid-August to March)	1,930 (627 / 3,232)	-	1,271	2,695
Caledonia North Site				
Breeding (April to mid-August)	-	879 (527 / 1,232)	535	1,454
Non-Breeding (Mid-August to March)	1,446 (454 / 2,438)	-	762	2,255
Caledonia South Site				
Breeding (April to mid-August)	-	1,089 (1,156 / 1,022)	647	1,917
Non-Breeding (Mid-August to March)	803 (320 / 1,286)	-	580	991
Note, the seasonal peaks from Year 1 and Year 2 of DAS data used to calculate the seasonal peaks are provided within the brackets.				

5 Puffin

5.1 Overview

5.1.1.1 For puffin, MRSea could be run for all surveys within the breeding season, as such, MRSea values have been used within assessments for distributional responses during the breeding season (shown in bold within Table 5-1, Table 5-2 and Table 5-3 for the Applicant Approach and Table 5-5, Table 5-6 and Table 5-7 for the Guidance Approach). Within the non-breeding season, there are a significant number of gaps within the MRSea data due to zero counts and low numbers, as such, design-based abundance estimates have been used within assessments for distributional responses during the non-breeding season (shown in bold within Table 5-1, Table 5-2 and Table 5-3 for the Applicant Approach and Table 5-5, Table 5-6 and Table 5-7 for the Guidance Approach). A summary of seasonal peaks used within assessments is presented within Section 5.2.4 and 5.3.4 for the Applicant Approach and Guidance Approach, respectively.

5.2 Applicant Approach

5.2.1 Caledonia OWF

5.2.1.1 Table 5-1 presents availability bias-corrected density and population estimate of all puffin in the Caledonia OWF (plus a 2km buffer), calculated using the model-based median abundance and design-based mean abundance.

Table 5-1: Availability bias-corrected density and population estimate of all puffin in the Caledonia OWF plus a 2km buffer, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March), as per the Applicant Approach.

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision	
Breeding Season (Mid-April to August)									
May 2021	491	329	689	0.12	435	263	727	0.27	-0.13
June 2021	364	125	641	0.14	359	194	687	0.35	-0.01
July 2021	527	295	809	0.11	**500**	285	902	0.32	-0.05
April 2022	957	514	1,498	0.08	873	491	1,555	0.30	-0.10
May 2022	1,057	671	1,424	0.08	**896**	577	1,408	0.24	-0.18
June 2022	100	35	205	0.26	98	51	199	0.51	-0.02
July 2022	183	89	288	0.19	171	84	353	0.40	-0.07
August 2022	652	392	916	0.1	580	307	1,076	0.34	-0.12
April 2023	53	20	94	0.35	-	-	-	-	-
Non-breeding Season (Mid-August to March)									
August 2021	**3,583**	1,793	5,797	0.05	3,226	2,012	5,292	0.27	-0.11

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision	
September 2021	122	61	204	0.24	110	55	235	0.36	-0.11
October 2021	245	99	411	0.17	180	84	378	0.41	-0.36
November 2021	-	-	-	-	-	-	-	-	-
December 2021	-	-	-	-	-	-	-	-	-
January 2022	-	-	-	-	-	-	-	-	-
February 2022	-	-	-	-	-	-	-	-	-
March 2022	14	2	42	0.71	-	-	-	-	-
September 2022	**2,426**	1,475	3,477	0.05	2,281	1,393	3,760	0.26	-0.06
October 2022	-	-	-	-	-	-	-	-	-

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision	
November 2022	-	-	-	-	-	-	-	-	-
December 2022	-	-	-	-	-	-	-	-	-
January 2023	20	4	62	0.58	-	-	-	-	-
February 2023	47	13	81	0.38	-	-	-	-	-
March 2023	75	20	131	0.30	-	-	-	-	-

Note, seasonal peak abundance estimates used within assessments are in **bold**. Note, the Applicant has decided to include the Year 1 August count in the non-breeding season rather than during the breeding season. This is due to the Year 1 August abundance being considered to reflect migration rather than individuals present in the breeding season. The seasonal peaks for puffin have also been presented with the August count included in the breeding season as per the Guidance Approach. Note, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March).

5.2.2 Caledonia North

5.2.2.1 Table 5-2 presents availability bias-corrected density and population estimate of all puffin in the Caledonia North Site (plus a 2km buffer), calculated using the model-based median abundance and design-based mean abundance.

Table 5-2: Availability bias-corrected density and population estimate of all puffin in the Caledonia North Site plus a 2km buffer, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March), as per the Applicant Approach.

Survey	Predicted Abundance	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
Breeding Season (Mid-April to August) – Model-based Abundance Estimates				
May 2021	**255**	160	417	0.25
June 2021	145	77	287	0.36
July 2021	199	111	364	0.33
April 2022	**479**	276	833	0.29
May 2022	372	241	588	0.25
June 2022	38	19	85	0.58
July 2022	75	33	169	0.45
August 2022	184	97	351	0.35
April 2023	-	-	-	-
Non-breeding Season (Mid-August to March) – Design-based Abundance Estimates				
August 2021	**2,385**	997	3,942	0.05
September 2021	49	13	107	0.38
October 2021	105	18	213	0.28

Survey	Predicted Abundance	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
November 2021	-	-	-	-
December 2021	-	-	-	-
January 2022	-	-	-	-
February 2022	-	-	-	-
March 2022	-	-	-	-
September 2022	**1,372**	896	1,887	0.07
October 2022	-	-	-	-
November 2022	-	-	-	-
December 2022	-	-	-	-
January 2023	21	4	64	0.58
February 2023	27	7	56	0.50
March 2023	49	8	105	0.38

Note, seasonal peak abundance estimates used within assessments are shown in **bold**. Note, the Applicant has decided to include the Year 1 August count in the non-breeding season rather than during the breeding season. This is due to the Year 1 August abundance being considered to reflect migration rather than individuals present in the breeding season. The seasonal peaks for puffin have also been presented with the August count included in the breeding season as per the Guidance Approach. Note, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March).

5.2.3 Caledonia South

5.2.3.1 Table 5-3 presents availability bias-corrected density and population estimate of all puffin in the Caledonia South Site (plus a 2km buffer), calculated using the model-based median abundance and design-based mean abundance.

Table 5-3: Availability bias-corrected density and population estimate of all puffin in the Caledonia South Site plus a 2km buffer, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March), as per the Applicant Approach.

Survey	Predicted Abundance	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
Breeding Season (Mid-April to August) – Model-based Abundance Estimates				
May 2021	232	138	391	0.27
June 2021	261	143	490	0.33
July 2021	**384**	222	678	0.29
April 2022	488	269	884	0.30
May 2022	**644**	417	998	0.22
June 2022	72	39	136	0.39
July 2022	121	61	241	0.37
August 2022	455	244	831	0.32
April 2023	-	-	-	-
Non-breeding Season (Mid-August to March) – Design-based Abundance Estimates				
August 2021	**2,093**	1,418	3,420	0.06
September 2021	88	41	142	0.28
October 2021	179	92	293	0.20

Survey	Predicted Abundance	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
November 2021	-	-	-	-
December 2021	-	-	-	-
January 2022	-	-	-	-
February 2022	-	-	-	-
March 2022	14	3	42	0.71
September 2022	**1,358**	976	1,848	0.07
October 2022	-	-	-	-
November 2022	-	-	-	-
December 2022	-	-	-	-
January 2023	-	-	-	-
February 2023	27	5	59	0.50
March 2023	34	6	75	0.45

Note, seasonal peak abundance estimates used within assessments are shown in **bold**. Note, the Applicant has decided to include the Year 1 August count in the non-breeding season rather than during the breeding season. This is due to the Year 1 August abundance being considered to reflect migration rather than individuals present in the breeding season. The seasonal peaks for puffin have also been presented with the August count included in the breeding season as per the Guidance Approach. Note, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March).

5.2.4 Seasonal Peaks

5.2.4.1 Table 5-4 presents the seasonal peaks of puffin within the Caledonia OWF (+2km buffer), Caldonia North Site (+2km buffer) and Caledonia South Site (+2km buffer), during the NatureScot defined seasons, as per the Applicant Approach.

Table 5-4: Seasonal Peaks of puffin within the Caledonia OWF (+2km buffer), Caldonia North Site (+2km buffer) and Caledonia South Site (+2km buffer), during the NatureScot defined seasons, as per the Applicant Approach.

Mean Peak	Design-based Abundance	MRSea Modelled Based Abundance	LCL (95% CI)	UCL (95% CI)
Caledonia OWF				
Breeding (April to mid-August)	-	698 (500 / 896)	431	1,155
Non-Breeding (Mid-August to March)	3,005 (3,583 / 2,426)	-	1,634	4,637
Caledonia North Site				
Breeding (April to mid-August)	-	367 (255 / 479)	176	476
Non-Breeding (Mid-August to March)	1,879 (2,385 / 1,372)	-	947	2,915
Caledonia South Site				
Breeding (April to mid-August)	-	514 (384 / 644)	320	838
Non-Breeding (Mid-August to March)	1,726 (2,093 / 1,358)	-	1,197	2,634
Note, the seasonal peaks from Year 1 and Year 2 of DAS data used to calculate the seasonal peaks are provided within the brackets. Note, the Applicant has decided to include the Year 1 August count in the non-breeding season rather than during the breeding season. This is due to the Year 1 August abundance being considered to reflect migration rather than individuals present in the breeding season. The seasonal peaks for puffin have also been presented with the August count included in the breeding season as per the Guidance Approach.				

5.3 Guidance Approach

5.3.1 Caledonia OWF

5.3.1.1 Table 5-5 presents availability bias-corrected density and population estimate of all puffin in the Caledonia OWF (plus a 2km buffer), calculated using the model-based median abundance and design-based mean abundance.

Table 5-5: Availability bias-corrected density and population estimate of all puffin in the Caledonia OWF plus a 2km buffer, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March), as per the Guidance Approach.

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision	
Breeding Season (Mid-April to August)									
May 2021	491	329	689	0.12	435	263	727	0.27	-0.13
June 2021	364	125	641	0.14	359	194	687	0.35	-0.01
July 2021	527	295	809	0.11	500	285	902	0.32	-0.05
April 2022	957	514	1,498	0.08	873	491	1,555	0.30	-0.10
May 2022	1,057	671	1,424	0.08	**896**	577	1,408	0.24	-0.18
June 2022	100	35	205	0.26	98	51	199	0.51	-0.02
July 2022	183	89	288	0.19	171	84	353	0.40	-0.07
August 2022	652	392	916	0.1	580	307	1,076	0.34	-0.12

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision	
April 2023	53	20	94	0.35	-	-	-	-	-
August 2021	3,583	1,793	5,797	0.05	**3,226**	5,292	2,012	0.27	-0.11
Non-breeding Season (Mid-August to March)									
September 2021	122	61	204	0.24	110	55	235	0.36	-0.11
October 2021	**245**	99	411	0.17	180	84	378	0.41	-0.36
November 2021	-	-	-	-	-	-	-	-	-
December 2021	-	-	-	-	-	-	-	-	-
January 2022	-	-	-	-	-	-	-	-	-
February 2022	-	-	-	-	-	-	-	-	-
March 2022	14	2	42	0.71	-	-	-	-	-

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision	
September 2022	**2,426**	1,475	3,477	0.05	2,281	1,393	3,760	0.26	-0.06
October 2022	-	-	-	-	-	-	-	-	-
November 2022	-	-	-	-	-	-	-	-	-
December 2022	-	-	-	-	-	-	-	-	-
January 2023	20	4	62	0.58	-	-	-	-	-
February 2023	47	13	81	0.38	-	-	-	-	-
March 2023	75	20	131	0.30	-	-	-	-	-

Note, seasonal peak abundance estimates used within assessments are shown in **bold**. Note, the Applicant has decided to include the Year 1 August count in the non-breeding season rather than during the breeding season. This is due to the Year 1 August abundance being considered to reflect migration rather than individuals present in the breeding season. The seasonal peaks for puffin have also been presented with the August count included in the breeding season as per the Guidance Approach. Note, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March).

5.3.2 Caledonia North

5.3.2.1 Table 5-6 presents availability bias-corrected density and population estimate of all puffin in the Caledonia North Site (plus a 2km buffer), calculated using the model-based median abundance and design-based mean abundance.

Table 5-6: Availability bias-corrected density and population estimate of all puffin in the Caledonia North Site plus a 2km buffer, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March), as per the Guidance Approach.

Survey	Predicted Abundance	LCL (95% CI)	UCL(95% CI)	Average of Coefficient of Variation (CV)/Precision
Breeding Season (Mid-April to August) – Model-based Abundance Estimates				
May 2021	255	160	417	0.25
June 2021	145	77	287	0.36
July 2021	199	111	364	0.33
April 2022	**479**	276	833	0.29
May 2022	372	241	588	0.25
June 2022	38	19	85	0.58
July 2022	75	33	169	0.45
August 2022	184	97	351	0.35
April 2023	-	-	-	-
August 2021	**2,138**	1,342	3,489	0.25
Non-breeding Season (Mid-August to March) – Design-based Abundance Estimates				
September 2021	49	13	107	0.38
October 2021	**105**	18	213	0.28

Survey	Predicted Abundance	LCL (95% CI)	UCL(95% CI)	Average of Coefficient of Variation (CV)/Precision
November 2021	-	-	-	-
December 2021	-	-	-	-
January 2022	-	-	-	-
February 2022	-	-	-	-
March 2022	-	-	-	-
September 2022	**1,372**	896	1,887	0.07
October 2022	-	-	-	-
November 2022	-	-	-	-
December 2022	-	-	-	-
January 2023	21	4	64	0.58
February 2023	27	7	56	0.50
March 2023	49	8	105	0.38

Note, seasonal peak abundance estimates used within assessments are shown in **bold**. Note, the Applicant has decided to include the Year 1 August count in the non-breeding season rather than during the breeding season. This is due to the Year 1 August abundance being considered to reflect migration rather than individuals present in the breeding season. The seasonal peaks for puffin have also been presented with the August count included in the breeding season as per the Guidance Approach. Note, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March).

5.3.3 Caledonia South

5.3.3.1 Table 5-7 presents availability bias-corrected density and population estimate of all puffin in the Caledonia South Site (plus a 2km buffer), calculated using the model-based median abundance and design-based mean abundance.

Table 5-7: Availability bias-corrected density and population estimate of all puffin in the Caledonia South Site plus a 2km buffer, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March), as per the Guidance Approach.

Survey	Predicted Abundance	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
Breeding Season (Mid-April to August) – Model-based Abundance Estimates				
May 2021	232	138	391	0.27
June 2021	261	143	490	0.33
July 2021	384	222	678	0.29
April 2022	488	269	884	0.30
May 2022	**644**	417	998	0.22
June 2022	72	39	136	0.39
July 2022	121	61	241	0.37
August 2022	455	244	831	0.32
April 2023	-	-	-	-
August 2021	**1,773**	1,090	2,959	0.28
Non-breeding Season (Mid-August to March) – Design-based Abundance Estimates				
September 2021	88	41	142	0.28
October 2021	**179**	92	293	0.20

Survey	Predicted Abundance	LCL (95% CI)	UCL (95% CI)	Average of Coefficient of Variation (CV)/Precision
November 2021	-	-	-	-
December 2021	-	-	-	-
January 2022	-	-	-	-
February 2022	-	-	-	-
March 2022	14	3	42	0.71
September 2022	**1,358**	976	1,848	0.07
October 2022	-	-	-	-
November 2022	-	-	-	-
December 2022	-	-	-	-
January 2023	-	-	-	-
February 2023	27	5	59	0.50
March 2023	34	6	75	0.45

Note, seasonal peak abundance estimates used within assessments are shown in **bold**. Note, the Applicant has decided to include the Year 1 August count in the non-breeding season rather than during the breeding season. This is due to the Year 1 August abundance being considered to reflect migration rather than individuals present in the breeding season. The seasonal peaks for puffin have also been presented with the August count included in the breeding season as per the Guidance Approach. Note, the model-based median abundance have been used during the breeding season (April to mid-August) and design-based mean abundance during the non-breeding season (Mid-August to March).

5.3.4 Seasonal Peaks

5.3.4.1 Table 5-8 presents the seasonal peaks of puffin within the Caledonia OWF (+2km buffer), Caldonia North Site (+2km buffer) and Caledonia South Site (+2km buffer), during the NatureScot defined seasons, as per the Guidance Approach.

Table 5-8: Seasonal Peaks of puffin within the Caledonia OWF (+2km buffer), Caldonia North Site (+2km buffer) and Caledonia South Site (+2km buffer), during the NatureScot defined seasons, as per the Guidance Approach.

Mean Peak	Design-based Abundance	MRSea Modelled Based Abundance	LCL (95% CI)	UCL(95% CI)
Caledonia OWF				
Breeding (April to mid-August)	-	2,061 (896 / 3,226)	2,934	1,710
Non-Breeding (Mid-August to March)	1,336 (245 / 2,426)	-	787	1,944
Caledonia North Site				
Breeding (April to mid-August)	-	1,309 (479 / 2,138)	809	2,161
Non-Breeding (Mid-August to March)	739 (105 / 1,372)	-	457	1,050
Caledonia South Site				
Breeding (April to mid-August)	-	1,209 (644 / 1,773)	753	1,978
Non-Breeding (Mid-August to March)	769 (179 / 1,358)	-	534	1,071
Note, the seasonal peaks from Year 1 and Year 2 of DAS data used to calculate the seasonal peaks are provided within the brackets. Note, the Applicant has decided to include the Year 1 August count in the non-breeding season rather than during the breeding season. This is due to the Year 1 August abundance being considered to reflect migration rather than individuals present in the breeding season. The seasonal peaks for puffin have also been presented with the August count included in the breeding season as per the Guidance Approach.				

6 Gannet

6.1 Overview

6.1.1.1 For gannet, there are a significant number of gaps within the MRSea data due to zero counts and low numbers, as such, design-based abundance estimates have been used within assessments for distributional responses during both the breeding and non-breeding season (shown in bold within Table 6-1 below). A summary of seasonal peaks used within assessments is presented within Section 6.3.

6.2 Caledonia OWF

6.2.1.1 Table 6-1 presents density and population estimate of all gannet in the Caledonia OWF (plus a 2km buffer), calculated using the model-based median abundance and design-based mean abundance.

Table 6-1: Density and population estimate of all gannet in the Caledonia OWF plus a 2km buffer, the model-based median abundance have been used during the breeding season (Mid-March to September) and design-based mean abundance during the non-breeding season (October to early-March).

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of CV	
May 2021	63	34	98	0.3	-	-	-	-	-
June 2021	**528**	273	835	0.1	**473**	188	1,265	0.55	-0.12
July 2021	122	21	266	0.22	142	51	458	2.50	0.14
August 2021	280	171	394	0.14	275	121	669	0.56	-0.02
September 2021	379	230	545	0.12	368	161	908	0.49	-0.03
October 2021	**525**	375	692	0.1	**515**	247	1,190	0.43	-0.02
November 2021	74	34	114	0.28	-	-	-	-	-
December 2021	23	4	52	0.5	-	-	-	-	-
January 2022	11	2	29	0.71	-	-	-	-	-
February 2022	21	4	64	0.5	-	-	-	-	-

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of CV	
March 2022	5	1	16	1	-	-	-	-	-
April 2022	28	11	45	0.45	-	-	-	-	-
May 2022	97	23	212	0.24	85	24	413	1.22	-0.14
June 2022	**1,289**	487	2,212	0.07	**1,152**	475	3,065	0.48	-0.12
July 2022	253	127	403	0.15	458	222	989	0.48	0.45
August 2022	63	34	97	0.3	-	-	-	-	-
September 2022	491	317	646	0.11	444	205	1,034	0.48	-0.10
October 2022	**105**	29	210	0.24	**199**	55	753	0.74	0.47
November 2022	6	1	17	1	-	-	-	-	-
December 2022	18	3	35	0.58	-	-	-	-	-
January 2023	12	2	29	0.71	-	-	-	-	-

Survey	Design-based Abundance Estimates				MRSea Modelled Abundance Estimates				Difference Between Predicted Abundance (%)
	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)	Predicted Abundance (Median)	LCL (95% CI)	UCL (95% CI)	Average of CV	
February 2023	34	11	63	0.41	-	-	-	-	-
March 2023	6	1	17	1	-	-	-	-	-
April 2023	79	14	232	0.27	-	-	-	-	-

Note, seasonal peak abundance estimates used within assessments are shown in **bold**.

6.3 Caledonia North

6.3.1.1 Table 6-2 presents density and population estimate of all gannet in the Caledonia North Site (plus a 2km buffer), calculated using the design-based mean abundance.

Table 6-2. Density and population estimate of all gannet in the Caledonia North Site plus a 2km buffer, calculated using design-based abundance estimates.

Survey	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)
May 2021	40	11	74	0.38
June 2021	**272**	81	521	0.15
July 2021	29	6	63	0.45
August 2021	113	34	204	0.22
September 2021	233	97	398	0.16
October 2021	**349**	206	497	0.13
November 2021	29	6	57	0.45
December 2021	11	2	28	0.71
January 2022	0	0	0	-
February 2022	0	0	0	-
March 2022	0	0	0	-
April 2022	17	3	34	0.58
May 2022	23	4	46	0.50
June 2022	**208**	121	294	0.17
July 2022	74	34	120	0.28

Survey	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)
August 2022	34	6	69	0.41
September 2022	163	99	227	0.19
October 2022	**41**	7	100	0.38
November 2022	0	0	0	-
December 2022	6	1	18	1.00
January 2023	6	1	18	1.00
February 2023	29	6	51	0.45
March 2023	0	0	0	-
April 2023	0	0	0	-
Note, seasonal peak abundance estimates used within assessments are shown in **bold**.				

6.4 Caledonia South

6.4.1.1 Table 6-3 presents density and population estimate of all gannet in the Caledonia South Site (plus a 2km buffer), calculated using the design-based mean abundance.

Table 6-3. Density and population estimate of all gannet in the Caledonia South Site plus a 2km buffer, calculated using design-based abundance estimates.

Survey	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)
May 2021	29	6	52	0.45
June 2021	**302**	157	487	0.14
July 2021	93	16	233	0.25
August 2021	212	155	275	0.16
September 2021	150	87	231	0.20
October 2021	**267**	186	354	0.15
November 2021	52	17	92	0.33
December 2021	12	2	35	0.71
January 2022	11	2	29	0.71
February 2022	21	4	64	0.50
March 2022	5	1	16	1.00
April 2022	17	6	34	0.58
May 2022	75	13	189	0.28
June 2022	**1,113**	324	2066	0.07
July 2022	220	87	382	0.16

Survey	Predicted Abundance (Mean)	LCL (95% CI)	UCL (95% CI)	Precision (Unapportioned)
August 2022	51	29	74	0.33
September 2022	388	234	548	0.12
October 2022	**98**	23	225	0.24
November 2022	6	1	17	1.00
December 2022	12	2	29	0.71
January 2023	11	2	29	0.71
February 2023	11	2	29	0.71
March 2023	6	1	17	1.00
April 2023	78	14	230	0.27
Note, seasonal peak abundance estimates used within assessments are shown in **bold**.				

6.5 Seasonal Peaks

6.5.1.1 Table 6-4 presents the seasonal peaks of gannet within the Caledonia OWF (+2km buffer), Caldonia North Site (+2km buffer) and Caledonia South Site (+2km buffer), during the NatureScot defined seasons.

Table 6-4: Seasonal peaks of gannet within the Caledonia OWF (+2km buffer), Caledonia North Site (+2km buffer) and Caledonia South Site (+2km buffer) during the NatureScot defined seasons.

Mean Peak	Design-based Abundance	MRSea Modelled Based Abundance
Caledonia OWF		
Breeding (Mid-March to September)	908.5 (528 / 1,829)	813 (473 / 1,152)
Non-Breeding (October to early-March)	315 (525 / 105)	357 (515 / 199)
Caledonia North Site		
Breeding (Mid-March to September)	240 (272 / 208)	-
Non-Breeding (October to early-March)	195 (349 / 41)	-
Caledonia South Site		
Breeding (Mid-March to September)	702.5 (302 / 1,113)	-
Non-Breeding (October to early-March)	182.5 (267 / 98)	-
Note, the seasonal peaks from Year 1 and Year 2 of DAS data used to calculate the seasonal peaks are provided within the brackets.		

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