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Volume 7B Proposed Development (Offshore) Appendices

Appendix 6-5 Migratory Collision Risk Modelling Technical Report
Annex 3 Migratory Collision Risk Modelling Results (Caledonia South)

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Volume 7B Appendix 6-5 Annex 3 Migratory Collision Risk Modelling Results (Caledonia South)

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Table of Contents

1	Introduction	1
2	Scoping Results	2
3	Results	16
4	References	23

List of Tables

Table 1-1: OWF and WTG parameters used for mCRM for the Caledonia South Site....	1
Table 2-1: Caledonia South Site scenario WTG 1a initial scoping results.	3
Table 2-2: Caledonia South Site scenario WTG 1b scoping results.	7
Table 2-3: Caledonia South Site scenario WTG 2 scoping results.....	10
Table 2-4: Caledonia South Site scenario WTG 3 (combined fixed and floating) scoping results.	13
Table 3-1: Summary of estimated seasonal migratory collisions for the Caledonia South Site scenario WTG 1.....	17
Table 3-2: Summary of estimated seasonal migratory collisions for the Caledonia South Site scenario WTG 2.....	19
Table 3-3: Summary of estimated seasonal migratory collisions for the Caledonia South Site scenario WTG 3 (WCS).	21

Acronyms and Abbreviations

mCRM	Migratory Collision Risk Modelling
OWF	Offshore Wind Farm
SD	Standard Deviation
WCS	Worst-case Scenario
WTG	Wind Turbine Generator

1 Introduction

1.1.1.1 The results of the migratory Collision Risk Modelling (mCRM) for the Caledonia Offshore Wind Farm (OWF), specifically the Caledonia South Site, are presented within this annex. Three Wind Turbine Generator (WTG) options have been modelled using the Marine Scotland Avian Migration Collision Risk Model Shiny Application ("mCRM Application"; HiDef Aerial Surveying Ltd., 2024¹). The full mCRM methodology is outlined in Volume 7B, Appendix 6-5: Migratory Collision Risk Modelling Technical Report.

1.1.1.2 The WTG parameters used within the mCRM for the Caledonia South Site are presented in (Table 1-1). Scoping results are presented in Section 2, and estimated seasonal collisions are presented in Section 3.

Table 1-1: OWF and WTG parameters used for mCRM for the Caledonia South Site.

Parameter	WTG 1 (S)		WTG 2 (S)	WTG 3 (S)	
	Fixed	Floating	Fixed	Fixed	Floating
Number of WTGs	24	29	47	39	39
Latitude (degrees)	58.13	58.13	58.13	58.13	58.13
Width (km)	28.90	28.90	28.90	28.90	28.90
Number of blades	3	3	3	3	3
Rotor radius (m)	155	145	155	118	118
Blade width (m)	7.50	7.50	7.50	7.50	7.50
Average pitch (°)	2	2	2	2	2
Average pitch SD (°)	No data (assumed 0)	No data (assumed 0)	No data (assumed 0)	No data (assumed 0)	No data (assumed 0)
Rotation speed (rpm)	8.4	8.4	8.4	8.4	8.4
Rotation speed SD (rpm)	No data (assumed 0)	No data (assumed 0)	No data (assumed 0)	No data (assumed 0)	No data (assumed 0)

2 Scoping Results

- 2.1.1.1 The results from the scoping process (methodology described in Volume 7B, Appendix 6-5: Migratory Collision Risk Modelling Technical Report) are presented in Table 2-1 to Table 2-4. For each table, the species UK Population estimate (and corresponding Standard Deviation (SD)) predicted to intersect the Caledonia South Site on migration, based on the default UK population sizes within the model are presented. The population estimate predicted to intersect the Caledonia South Site is calculated based on the proportion of randomly generated migration lines which intersect the Caledonia South Site within the species defined migratory corridor. Further detail on population estimation can be found within the mCRM Application github repository (HiDef Aerial Surveying Ltd., 2024¹).
- 2.1.1.2 The percentage of the UK population predicted to intersect the Caledonia South Site (and thus at potential risk of collision) on migration is also provided within Table 2-1 to Table 2-4. In accordance with the Scoping methodology (described in Volume 7B, Appendix 6-5: Migratory Collision Risk Modelling Technical Report) where less than 1% of the UK population is predicted to intersect the Caledonia South Site, the species has been scoped out of further modelling. The species that have been scoped in have been carried through into Section 3.

Table 2-1: Caledonia South Site scenario WTG 1a initial scoping results.

Species	Population Estimate	SD	% at Collision Risk	Scoped In/Out
Bar-tailed godwit (<i>Limosa lapponica</i>)	7,688	1,547	1.1	In
Bean goose (<i>Anser fabalis</i>)	16	3	1.6	In
Bittern (<i>Botaurus stellaris</i>)	-	-	0.0	Out
Black-tailed godwit (<i>Limosa limosa</i>)	-	-	0.0	Out
Black-throated Diver (<i>Gavia arctica</i>)	15	3	1.2	In
Canadian Light-bellied brent goose (<i>Branta bernicla hrota</i>)	-	-	0.0	Out
Common scoter (<i>Melanitta nigra</i>)	1,261	252	0.9	Out
Corncrake (<i>Crex crex</i>)	170	36	1.0	In
Curlew (<i>Numenius arquata</i>)	1,665	334	1.2	In
Dotterel (<i>Charadrius morinellus</i>)	8	2	2.0	In
Dunlin (<i>Calidris alpina</i>)	20,229	4,111	1.0	In
Eider (<i>Somateria mollissima</i>)	1,214	211	1.1	In
Golden plover (<i>Pluvialis apricaria</i>)	31,515	6,795	1.0	In
Goldeneye (<i>Bucephala clangula</i>)	388	92	1.0	In
Goosander (<i>Mergus merganser</i>)	405	62	2.3	In
Great crested grebe (<i>Podiceps cristatus</i>)	-	-	0.0	Out
Great northern diver (<i>Gavia immer</i>)	102	23	0.9	Out

Species	Population Estimate	SD	% at Collision Risk	Scoped In/Out
Greenshank (<i>Tringa nebularia</i>)	76	15	1.1	In
Grey plover (<i>Pluvialis squatarola</i>)	1,278	296	1.0	In
Hen harrier (<i>Circus cyaneus</i>)	24	5	1.1	In
Icelandic greylag goose (<i>Anser anser</i>)	33	34	0.0	Out
Knot (<i>Calidris canutus</i>)	3,575	814	1.0	In
Lapwing (<i>Vanellus vanellus</i>)	37,356	8,751	0.9	Out
Long-tailed duck (<i>Clangula hyemalis</i>)	177	30	1.4	In
Mallard (<i>Anas platyrhynchos</i>)	10,251	2,104	1.2	In
Marsh harrier (<i>Circus aeruginosus</i>)	35	7	1.3	In
Merlin (<i>Falco columbarius</i>)	29	11	0.3	Out
Nightjar (<i>Caprimulgus europaeus</i>)	53	14	0.7	Out
Osprey (<i>Pandion haliaetus</i>)	11	2	1.6	In
Oystercatcher (<i>Haematopus ostralegus</i>)	3,997	825	1.1	In
Pink-footed goose (<i>Anser brachyrhynchus</i>)	180	220	0.0	Out
Pintail (<i>Anas acuta</i>)	231	49	1.1	In
Purple sandpiper (<i>Calidris maritima</i>)	301	56	1.2	In
Red-breasted merganser (<i>Mergus serrator</i>)	183	39	1.2	In

Species	Population Estimate	SD	% at Collision Risk	Scoped In/Out
Redshank (<i>Tringa totanus</i>)	3,592	798	0.9	Out
Red-throated diver (<i>Gavia stellata</i>)	470	84	1.4	In
Ringed plover (<i>Charadrius hiaticula</i>)	2,627	598	0.9	Out
Ruff (<i>Calidris pugnax</i>)	327	75	1.1	In
Sanderling (<i>Calidris alba</i>)	2,169	474	1.1	In
Scaup (<i>Aythya marila</i>)	55	14	0.8	Out
Shelduck (<i>Tadorna tadorna</i>)	640	154	1.0	In
Short-eared owl (<i>Asio flammeus</i>)	154	35	1.0	In
Shoveler (<i>Anas clypeata</i>)	158	45	0.7	Out
Slavonian grebe (<i>Podiceps auritus</i>)	12	3	1.2	In
Snipe (<i>Gallinago gallinago</i>)	55,587	12,502	0.9	Out
Spotted crake (<i>Porzana porzana</i>)	1	-	3.8	In
Svalbard barnacle goose (<i>Branta leucopsis</i>)	1,093	164	2.5	In
Svalbard light-bellied brent goose (<i>Branta bernicla hrota</i>)	223	33	2.2	In
Teal (<i>Anas crecca</i>)	698	369	0.2	Out
Tufted duck (<i>Aythya fuligula</i>)	1,394	321	0.9	Out
Turnstone (<i>Arenaria interpres</i>)	3,610	738	1.0	In

Species	Population Estimate	SD	% at Collision Risk	Scoped In/Out
Velvet scoter (<i>Melanitta fusca</i>)	40	9	1.2	In
Whimbrel (<i>Numenius phaeopus</i>)	50	11	1.1	In
White-tailed eagle (<i>Haliaeetus albicilla</i>)	2	1	0.7	Out
Whooper swan (<i>Cygnus cygnus</i>)	729	119	1.8	In
Wigeon (<i>Anas penelope</i>)	5,108	1,086	1.1	In
Wood sandpiper (<i>Tringa glareola</i>)	1	-	1.9	In

Table 2-2: Caledonia South Site scenario WTG 1b scoping results.

Species	Population Estimate	SD	% at Collision Risk	Scoped In/Out
Bar-tailed godwit	7,688	1,547	1.10	In
Bean goose	16	3	1.60	In
Bittern	-	-	0.00	Out
Black-tailed godwit	-	-	0.00	Out
Black-throated diver	15	3	1.20	In
Canadian light-bellied brent goose	-	-	0.00	Out
Common scoter	1,261	252	0.90	Out
Corncrake	170	36	1.00	In
Curlew	1,665	334	1.20	In
Dotterel	8	2	2.00	In
Dunlin	20,229	4,111	1.00	In
Eider	1,214	211	1.10	In
Golden plover	31,515	6,795	1.00	In
Goldeneye	388	92	1.00	In
Goosander	405	62	2.30	In
Great crested grebe	-	-	0.00	Out
Great northern diver	102	23	0.90	Out
Greenshank	76	15	1.10	In
Grey plover	1,278	296	1.00	In
Hen harrier	24	5	1.10	In
Icelandic greylag goose	33	34	0.00	Out
Knot	3,575	814	1.00	In
Lapwing	37,356	8,751	0.90	Out
Long-tailed duck	177	30	1.40	In

Species	Population Estimate	SD	% at Collision Risk	Scoped In/Out
Mallard	10,251	2,104	1.20	In
Marsh harrier	35	7	1.30	In
Merlin	29	11	0.30	Out
Nightjar	53	14	0.70	Out
Osprey	11	2	1.60	In
Oystercatcher	3,997	825	1.10	In
Pink-footed Goose	180	220	0.00	Out
Pintail	231	49	1.10	In
Purple sandpiper	301	56	1.20	In
Red-breasted merganser	183	39	1.20	In
Redshank	3,592	798	0.90	Out
Red-throated diver	470	84	1.40	In
Ringed plover	2,627	598	0.90	Out
Ruff	327	75	1.10	In
Sanderling	2,169	474	1.10	In
Scaup	55	14	0.80	Out
Shelduck	640	154	1.00	In
Short-eared owl	154	35	1.00	In
Shoveler	158	45	0.70	Out
Slavonian grebe	12	3	1.20	In
Snipe	55,587	12,502	0.90	Out
Spotted crake	1	-	3.80	In
Svalbard barnacle goose	1,093	164	2.50	In
Svalbard light-bellied brent goose	223	33	2.20	In

Species	Population Estimate	SD	% at Collision Risk	Scoped In/Out
Teal	698	369	0.20	Out
Tufted duck	1,394	321	0.90	Out
Turnstone	3,610	738	1.00	In
Velvet scoter	40	9	1.20	In
Whimbrel	50	11	1.10	In
White-tailed Eagle	2	1	0.70	Out
Whooper swan	729	119	1.80	In
Wigeon	5,108	1,086	1.10	In
Wood sandpiper	1	-	1.90	In

Table 2-3: Caledonia South Site scenario WTG 2 scoping results.

Species	Population Estimate	SD	% at Collision Risk	Scoped In/Out
Bar-tailed godwit	7,688	1,547	1.10	In
Bean goose	16	3	1.60	In
Bittern	-	-	0.00	Out
Black-tailed godwit	-	-	0.00	Out
Black-throated diver	15	3	1.20	In
Canadian light-bellied brent goose	-	-	0.00	Out
Common scoter	1,261	252	0.90	Out
Corncrake	170	36	1.00	In
Curlew	1,665	334	1.20	In
Dotterel	8	2	2.00	In
Dunlin	20,229	4,111	1.00	In
Eider	1,214	211	1.10	In
Golden plover	31,515	6,795	1.00	In
Goldeneye	388	92	1.00	In
Goosander	405	62	2.30	In
Great crested grebe	-	-	0.00	Out
Great northern diver	102	23	0.90	Out
Greenshank	76	15	1.10	In
Grey plover	1,278	296	1.00	Out
Hen harrier	24	5	1.10	In
Icelandic greylag goose	33	34	0.00	Out
Knot	3,575	814	1.00	In
Lapwing	37,356	8,751	0.90	Out
Long-tailed duck	177	30	1.40	In

Species	Population Estimate	SD	% at Collision Risk	Scoped In/Out
Mallard	10,251	2,104	1.20	In
Marsh harrier	35	7	1.30	In
Merlin	29	11	0.30	Out
Nightjar	53	14	0.70	Out
Osprey	11	2	1.60	In
Oystercatcher	3,997	825	1.10	In
Pink-footed Goose	180	220	0.00	Out
Pintail	231	49	1.10	In
Purple sandpiper	301	56	1.20	In
Red-breasted merganser	183	39	1.20	In
Redshank	3,592	798	0.90	Out
Red-throated diver	470	84	1.40	In
Ringed plover	2,627	598	0.90	Out
Ruff	327	75	1.10	In
Sanderling	2,169	474	1.10	In
Scaup	55	14	0.80	Out
Shelduck	640	154	1.00	In
Short-eared owl	154	35	1.00	In
Shoveler	158	45	0.70	Out
Slavonian grebe	12	3	1.20	In
Snipe	55,587	12,502	0.90	Out
Spotted crake	1	-	3.80	In
Svalbard barnacle goose	1,093	164	2.50	In
Svalbard light-bellied brent goose	223	33	2.20	In

Species	Population Estimate	SD	% at Collision Risk	Scoped In/Out
Teal	698	369	0.20	Out
Tufted duck	1,394	321	0.90	Out
Turnstone	3,610	738	1.00	In
Velvet scoter	40	9	1.20	In
Whimbrel	50	11	1.10	In
White-tailed Eagle	2	1	0.70	Out
Whooper swan	729	119	1.80	In
Wigeon	5,108	1,086	1.10	In
Wood sandpiper	1	-	1.90	In

Table 2-4: Caledonia South Site scenario WTG 3 (combined fixed and floating) scoping results.

Species	Population Estimate	SD	% at Collision Risk	Scoped In/Out
Bar-tailed godwit	7,739	1,488	1.10	In
Bean goose	16	3	1.60	In
Bittern	-	-	0.00	Out
Black-tailed godwit	-	-	0.00	Out
Black-throated diver	15	3	1.30	In
Canadian light-bellied brent goose	-	-	0.00	Out
Common scoter	1,226	309	0.90	Out
Corncrake	178	34	1.00	In
Curlew	1,621	367	1.10	In
Dotterel	8	2	2.00	In
Dunlin	19,825	4,396	1.00	In
Eider	1,206	250	1.10	In
Golden plover	30,098	6,813	0.90	Out
Goldeneye	399	90	1.10	In
Goosander	397	56	2.30	In
Great crested grebe	-	-	0.00	Out
Great northern diver	104	24	0.90	Out
Greenshank	74	16	1.00	In
Grey plover	1,285	267	1.00	In
Hen harrier	24	5	1.10	In
Icelandic greylag goose	31	32	0.00	Out
Knot	3,701	908	1.00	In
Lapwing	38,164	9,337	1.00	In
Long-tailed duck	176	31	1.40	In

Species	Population Estimate	SD	% at Collision Risk	Scoped In/Out
Mallard	10,728	1,956	1.30	In
Marsh harrier	34	7	1.30	In
Merlin	29	11	0.30	Out
Nightjar	53	15	0.70	Out
Osprey	11	2	1.50	In
Oystercatcher	3,988	854	1.10	In
Pink-footed Goose	200	247	0.00	Out
Pintail	224	52	1.10	In
Purple sandpiper	304	55	1.20	In
Red-breasted merganser	181	32	1.10	In
Redshank	3,310	777	0.80	Out
Red-throated diver	461	76	1.40	In
Ringed plover	2,573	590	0.90	Out
Ruff	336	73	1.10	In
Sanderling	2,110	422	1.10	In
Scaup	54	15	0.80	Out
Shelduck	622	137	1.00	In
Short-eared owl	158	38	1.10	In
Shoveler	165	39	0.70	Out
Slavonian grebe	13	3	1.20	In
Snipe	55,893	13,043	0.90	Out
Spotted crake	1	-	3.80	In
Svalbard barnacle goose	1,115	168	2.60	In
Svalbard light-bellied brent goose	216	33	2.20	In

Species	Population Estimate	SD	% at Collision Risk	Scoped In/Out
Teal	674	360	0.20	Out
Tufted duck	1,421	357	0.90	Out
Turnstone	3,714	777	1.10	In
Velvet scoter	39	8	1.10	In
Whimbrel	49	10	1.00	In
White-tailed Eagle	2	1	0.70	Out
Whooper swan	727	112	1.80	In
Wigeon	5,559	1,095	1.20	In
Wood sandpiper	1	-	1.90	In

3 Results

3.1.1.1 The mCRM results for Scenarios 1, 2 and 3 for the Caledonia South Site are presented below in Table 3-1 to Table 3-3.

3.1.1.2 Scenario 1 results are presented as a combination of WTG 1 (bottom-fixed) and WTG 1 (floating). The same species were scoped out (Section 2), therefore the predicted collisions have been combined to present one total for the WTG 1 scenario for the Caledonia South Site (Table 3-1). The worst-case scenario (WCS) for the Caledonia South Site, determined by comparing scenarios for the majority highest estimated annual collision rate, is WTG 3.

Table 3-1: Summary of estimated seasonal migratory collisions for the Caledonia South Site scenario WTG 1.

Species	Pre-breeding	Post-breeding	Other	Total
Bar-tailed godwit	0.124 ± 0.026	0.122 ± 0.026	0 ± 0	0.246 ± 0.037
Bean goose	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Black-throated diver	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Corncrake	0.014 ± 0.003	0.014 ± 0.003	0 ± 0	0.028 ± 0.004
Curlew	0.033 ± 0.007	0.033 ± 0.007	0 ± 0	0.066 ± 0.01
Dotterel	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Dunlin	0.303 ± 0.063	0.297 ± 0.062	0 ± 0	0.6 ± 0.088
Eider	0.088 ± 0.018	0.09 ± 0.018	0 ± 0	0.178 ± 0.026
Golden plover	0.510 ± 0.109	0.501 ± 0.108	0 ± 0	1.011 ± 0.153
Goldeneye	0.100 ± 0.024	0.101 ± 0.024	0 ± 0	0.201 ± 0.034
Goosander	0.111 ± 0.016	0.108 ± 0.016	0 ± 0	0.219 ± 0.022
Greenshank	0.002 ± 0	0.002 ± 0	0 ± 0	0.004 ± 0
Grey Plover	0.020 ± 0.005	0.020 ± 0.005	0 ± 0	0.040 ± 0.007
Hen Harrier	0.002 ± 0	0.002 ± 0	0 ± 0	0.004 ± 0
Knot	0.053 ± 0.012	0.053 ± 0.011	0 ± 0	0.106 ± 0.016
Long-tailed duck	0.045 ± 0.009	0.045 ± 0.009	0 ± 0	0.090 ± 0.013
Mallard	2.939 ± 0.588	2.994 ± 0.6	3.035 ± 0.608	8.968 ± 1.037
Marsh harrier	0.002 ± 0	0.002 ± 0	0 ± 0	0.004 ± 0
Osprey	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Oystercatcher	0.076 ± 0.016	0.074 ± 0.016	0 ± 0	0.150 ± 0.023
Pintail	0.059 ± 0.013	0.059 ± 0.013	0 ± 0	0.118 ± 0.018
Purple sandpiper	0.005 ± 0.001	0.005 ± 0.001	0 ± 0	0.010 ± 0.001
Red-breasted merganser	0.045 ± 0.01	0.046 ± 0.01	0 ± 0	0.091 ± 0.014

Species	Pre-breeding	Post-breeding	Other	Total
Red-throated diver	0.011 ± 0.002	0.011 ± 0.002	0 ± 0	0.022 ± 0.002
Ruff	0.005 ± 0.002	0.005 ± 0.002	0 ± 0	0.010 ± 0.002
Sanderling	0.031 ± 0.007	0.031 ± 0.007	0 ± 0	0.062 ± 0.01
Shelduck	0.094 ± 0.023	0.089 ± 0.022	0.093 ± 0.023	0.276 ± 0.039
Short-eared owl	0.015 ± 0.004	0.015 ± 0.004	0 ± 0	0.030 ± 0.006
Slavonian grebe	0.001 ± 0	0.001 ± 0	0 ± 0	0.002 ± 0
Spotted crake	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Svalbard barnacle goose	0.022 ± 0.004	0.022 ± 0.004	0 ± 0	0.044 ± 0.006
Svalbard light-bellied brent goose	0.002 ± 0	0.002 ± 0	0 ± 0	0.004 ± 0
Turnstone	0.064 ± 0.018	0.062 ± 0.018	0 ± 0	0.126 ± 0.025
Velvet scoter	0.011 ± 0.002	0.011 ± 0.002	0 ± 0	0.022 ± 0.002
Whimbrel	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Whooper swan	0.127 ± 0.029	0.128 ± 0.029	0 ± 0	0.255 ± 0.041
Wigeon	1.359 ± 0.294	1.355 ± 0.293	0 ± 0	2.714 ± 0.415
Wood sandpiper	0 ± 0	0 ± 0	0 ± 0	0 ± 0

Table 3-2: Summary of estimated seasonal migratory collisions for the Caledonia South Site scenario WTG 2.

Species	Pre-breeding	Post-breeding	Other	Total
Bar-tailed godwit	0.115 ± 0.023	0.113 ± 0.023	0 ± 0	0.228 ± 0.033
Bean goose	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Black-throated diver	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Curlew	0.029 ± 0.006	0.029 ± 0.006	0 ± 0	0.058 ± 0.008
Corncrake	0.013 ± 0.003	0.012 ± 0.003	0 ± 0	0.025 ± 0.004
Dotterel	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Dunlin	0.269 ± 0.055	0.265 ± 0.054	0 ± 0	0.534 ± 0.077
Eider	0.078 ± 0.014	0.079 ± 0.014	0 ± 0	0.157 ± 0.02
Golden plover	0.453 ± 0.097	0.445 ± 0.095	0 ± 0	0.898 ± 0.136
Goldeneye	0.089 ± 0.022	0.089 ± 0.022	0 ± 0	0.178 ± 0.031
Goosander	0.100 ± 0.016	0.098 ± 0.016	0 ± 0	0.198 ± 0.023
Greenshank	0.001 ± 0	0.001 ± 0	0 ± 0	0.002 ± 0
Hen harrier	0.002 ± 0	0.002 ± 0	0 ± 0	0.004 ± 0
Knot	0.047 ± 0.011	0.047 ± 0.011	0 ± 0	0.094 ± 0.016
Long-tailed duck	0.04 ± 0.007	0.04 ± 0.007	0 ± 0	0.08 ± 0.01
Mallard	2.602 ± 0.557	2.651 ± 0.567	2.687 ± 0.575	7.94 ± 0.981
Marsh harrier	0.002 ± 0	0.002 ± 0	0 ± 0	0.004 ± 0
Osprey	0.001 ± 0	0.001 ± 0	0 ± 0	0.002 ± 0
Oystercatcher	0.069 ± 0.015	0.067 ± 0.014	0 ± 0	0.136 ± 0.021
Pintail	0.054 ± 0.012	0.055 ± 0.012	0 ± 0	0.109 ± 0.017
Purple sandpiper	0.004 ± 0.001	0.004 ± 0.001	0 ± 0	0.008 ± 0.001
Red-breasted merganser	0.042 ± 0.009	0.043 ± 0.009	0 ± 0	0.085 ± 0.013
Red-throated diver	0.010 ± 0.002	0.010 ± 0.002	0 ± 0	0.020 ± 0.003

Species	Pre-breeding	Post-breeding	Other	Total
Ruff	0.005 ± 0.001	0.005 ± 0.001	0 ± 0	0.010 ± 0.001
Sanderling	0.028 ± 0.006	0.028 ± 0.006	0 ± 0	0.056 ± 0.008
Shelduck	0.084 ± 0.022	0.079 ± 0.021	0.083 ± 0.021	0.246 ± 0.037
Short-eared owl	0.014 ± 0.003	0.014 ± 0.003	0 ± 0	0.028 ± 0.004
Slavonian grebe	0.001 ± 0	0.001 ± 0	0 ± 0	0.002 ± 0
Spotted crake	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Svalbard barnacle goose	0.019 ± 0.003	0.019 ± 0.003	0 ± 0	0.038 ± 0.004
Svalbard light-bellied brent goose	0.002 ± 0.001	0.002 ± 0.001	0 ± 0	0.004 ± 0.001
Turnstone	0.057 ± 0.016	0.055 ± 0.015	0 ± 0	0.112 ± 0.022
Velvet scoter	0.01 ± 0.002	0.009 ± 0.002	0 ± 0	0.019 ± 0.003
Whimbrel	0.001 ± 0	0.001 ± 0	0 ± 0	0.002 ± 0
Whooper swan	0.116 ± 0.027	0.117 ± 0.028	0 ± 0	0.233 ± 0.039
Wigeon	1.207 ± 0.262	1.203 ± 0.261	0 ± 0	2.41 ± 0.37
Wood sandpiper	0 ± 0	0 ± 0	0 ± 0	0 ± 0

Table 3-3: Summary of estimated seasonal migratory collisions for the Caledonia South Site scenario WTG 3 (WCS).

Species	Pre-breeding	Post-breeding	Other	Total
Bar-tailed godwit	0.183 ± 0.035	0.179 ± 0.034	0 ± 0	0.362 ± 0.049
Bean goose	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Black-throated diver	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Corncrake	0.021 ± 0.004	0.020 ± 0.004	0 ± 0	0.041 ± 0.006
Curlew	0.043 ± 0.01	0.043 ± 0.01	0 ± 0	0.086 ± 0.014
Dotterel	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Dunlin	0.425 ± 0.094	0.418 ± 0.092	0 ± 0	0.843 ± 0.132
Eider	0.119 ± 0.025	0.121 ± 0.025	0 ± 0	0.24 ± 0.035
Goldeneye	0.143 ± 0.033	0.144 ± 0.034	0 ± 0	0.287 ± 0.047
Goosander	0.151 ± 0.023	0.148 ± 0.022	0 ± 0	0.299 ± 0.032
Greenshank	0.002 ± 0	0.002 ± 0	0 ± 0	0.004 ± 0
Grey Plover	0.029 ± 0.006	0.029 ± 0.006	0 ± 0	0.058 ± 0.008
Hen Harrier	0.003 ± 0.001	0.003 ± 0.001	0 ± 0	0.006 ± 0.001
Knot	0.080 ± 0.019	0.078 ± 0.019	0 ± 0	0.158 ± 0.027
Lapwing	0.929 ± 0.222	0.942 ± 0.225	0 ± 0	1.871 ± 0.316
Long-tailed duck	0.062 ± 0.011	0.063 ± 0.011	0 ± 0	0.125 ± 0.016
Mallard	4.169 ± 0.795	4.248 ± 0.81	4.306 ± 0.821	12.723 ± 1.401
Marsh Harrier	0.002 ± 0.001	0.002 ± 0.001	0 ± 0	0.004 ± 0.001
Osprey	0.001 ± 0	0.001 ± 0	0 ± 0	0.002 ± 0
Oystercatcher	0.105 ± 0.023	0.103 ± 0.022	0 ± 0	0.208 ± 0.032
Pintail	0.082 ± 0.019	0.083 ± 0.019	0 ± 0	0.165 ± 0.027
Purple Sandpiper	0.007 ± 0.001	0.007 ± 0.001	0 ± 0	0.014 ± 0.001
Red-breasted Merganser	0.064 ± 0.012	0.066 ± 0.012	0 ± 0	0.130 ± 0.017

Species	Pre-breeding	Post-breeding	Other	Total
Red-throated Diver	0.015 ± 0.003	0.015 ± 0.003	0 ± 0	0.030 ± 0.004
Ruff	0.007 ± 0.002	0.007 ± 0.002	0 ± 0	0.014 ± 0.003
Sanderling	0.044 ± 0.009	0.044 ± 0.009	0 ± 0	0.088 ± 0.013
Shelduck	0.125 ± 0.029	0.119 ± 0.028	0.124 ± 0.029	0.368 ± 0.050
Short-eared Owl	0.022 ± 0.005	0.021 ± 0.005	0 ± 0	0.043 ± 0.007
Slavonian Grebe	0.001 ± 0	0.001 ± 0	0 ± 0	0.002 ± 0
Spotted Crake	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Svalbard Barnacle Goose	0.03 ± 0.005	0.03 ± 0.005	0 ± 0	0.06 ± 0.007
Svalbard Light-Bellied Brent Goose	0.003 ± 0.001	0.003 ± 0.001	0 ± 0	0.006 ± 0.001
Turnstone	0.091 ± 0.023	0.088 ± 0.022	0 ± 0	0.179 ± 0.032
Velvet Scoter	0.015 ± 0.003	0.014 ± 0.003	0 ± 0	0.029 ± 0.004*
Whimbrel	0.001 ± 0	0.001 ± 0	0 ± 0	0.002 ± 0*
Whooper Swan	0.168 ± 0.036	0.169 ± 0.036	0 ± 0	0.337 ± 0.051*
Wigeon	2.049 ± 0.412	2.042 ± 0.411	0 ± 0	4.091 ± 0.582
Wood Sandpiper	0 ± 0	0 ± 0	0 ± 0	0 ± 0

4 References

¹ HiDef Aerial Surveying Ltd. (2024). 'mCRM: Avian Migration Collision Risk Model'. R package version f0.4.1. Available at: <https://hidefdevo.shinyapps.io/mCRM/> (Accessed 13/05/2024)

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