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Volume 8 Additional Information

Appendix 17: Ornithology Population Viability Assessment (PVA) Technical Report (Caledonia North)

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Table of Contents

List of Tables

Acronyms and Abbreviations

BDMPS	Biologically Defined Minimum Population Scale
BTO	British Trust for Ornithology
CPGR	Counterfactual Population Growth Rate
CPS	Counterfactual Population Size
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
HRA	Habitat Regulations Appraisal
JNCC	Joint Nature Conservation Committee
MD-LOT	Marine Directorate – Licensing Operations Team
OWF	Offshore Wind Farm
PVA	Population Viability Analysis
SMP	Seabird Monitoring Programme
SPA	Special Protection Area
WCS	Worst Case Scenario
WTG	Wind Turbine Generator

1 Introduction

1.1 Background

1.1.1.1 This appendix provides background information, sets out the methodology for, and presents the results of the updated Population Viability Analysis (PVA) for the proposed Caledonia Offshore Wind Farm (OWF), specifically Caledonia North, located in the Moray Firth, Scotland. This document forms part of the addendum package submitted in response to the Marine Directorate – Licensing Operations Team (MD-LOT) request for Additional Information.

1.1.1.2 Background to the Proposed Development (Offshore) and the consent applications for Caledonia North and Caledonia South are presented within the Environmental Impact Assessment Report (EIAR) of the original consent application (Volume 1, Chapter 5: Proposed Development Phasing) and summarised within the covering addendum document (Volume 8: Caledonia Offshore Wind Farm EIAR and HRA Addendum).

1.1.1.3 PVA has been modelled separately for Caledonia North, Caledonia South (Volume 8, Appendix 18: Ornithology Population Viability Assessment (PVA) Technical Report (Caledonia South)) and the Proposed Development (Offshore) (Volume 8, Appendix 16: Ornithology Population Viability Assessment (PVA) Technical Report (Caledonia OWF)) where necessary to estimate the effect that the OWF may have upon ornithological populations alone and in-combination with other plans and projects.

1.1.1.4 The predicted mortalities for Caledonia North, Caledonia South and the Proposed Development (Offshore) have been presented as a worst-case scenario (WCS) (i.e., with respect to collision risk, the largest number of Wind Turbine Generators (WTGs) considered within the design envelope for the Proposed Development (Offshore)). The Proposed Development (Offshore) WCS is based on the maximum number of WTGs (bottom-fixed and floating) that could be constructed, rather than an addition of Caledonia North and Caledonia South, as to base the design on this assumption would overestimate potential impacts. For more information on the project design scenarios, refer to Volume 1, Chapter 3: Proposed Development Description (Offshore) and Volume 1, Chapter 5: Proposed Development Phasing of the EIAR.

1.2 Population Viability Analysis (PVA)

1.2.1.1 Marine renewable energy developments potentially impact seabirds through impact pathways such as displacement and barrier effects as a result of the presence of wind turbines and collision with turbine blades. These processes impact seabirds at an individual level but also have the potential to affect the productivity of a population, and/or increase baseline mortality within a population.

1.2.1.2 For breeding seabirds, 'distributional responses' include both barrier effects and displacement (NatureScot, 2023[1]). The use of 'displacement' for this report therefore includes habitat displacement effects as well as barrier effects.

1.2.1.3 The effects of OWF developments on a population can be estimated through the use of PVA modelling at an individual project level or in-combination. PVA provides a robust framework using demographic parameters to predict population changes and project these changes over a set period using statistical models. Different scenarios can be modelled to compare unimpacted 'baseline' scenarios that are assumed to follow a "natural" growth rate, with 'impact' scenarios including development impacts by altering demographic parameters. Comparisons between the baseline and impacted models can indicate the level of impact that an OWF development will have on a population and how this may impact the conservation objectives of Special Protection Area (SPA) colonies within the affected area.

1.2.1.4 The greatest potential risks that seabird populations face from OWFs are mortalities caused by turbine blade collisions or displacement and barrier effects associated with wind turbine presence. Cumulative effects resulting from negative individual-level impacts have the potential to cause reductions in productivity or an increased baseline mortality within a population. The Habitat Regulations Appraisal (HRA) includes the assessment of these potential effects with respect to individual SPA colonies and the wider population.

1.2.1.5 The PVA was undertaken using the PVA tool developed by UKCEH and BioSS under contract to Natural England and JNCC (Searle *et al*., 2019[2]), which was accessed via the 'Shiny App' interface or online portal. PVA was modelled for bird species and populations that are qualifying features of the designated sites in line with the approach outlined below.

2 Method

2.1 Overview

2.1.1.1 This section sets out the PVA process conducted for the HRA for Caledonia North (in addition to the cumulative PVA undertaken for Caledonia South in Volume 8, Appendix 18: Ornithology Population Viability Assessment (PVA) Technical Report (Caledonia South)). The results from the Environmental Impact Assessment (EIA) assessing collision risk impact were apportioned for potential effects in accordance with NatureScot Guidance and the impacts were assessed Volume 8, Appendix 5: Ornithology Additional Information Report (Caledonia North). A detailed methodology can be found in the apportionment appendix; Volume 8, Appendix 11: Ornithology Apportioning Technical Report (Caledonia North).

2.1.1.2 As requested by NatureScot within representations (letter dated 27 March 2025), EIA cumulative level PVA has also now been carried out separately for Caledonia North (Section 3) and Caledonia South (Volume 8, Appendix 18: Ornithology Population Viability Assessment (PVA) Technical Report (Caledonia South)). PVAs were modelled for bird species and populations which have been predicted by the EIA cumulatively to potentially experience a change above the guidance threshold of 0.02% change in adult survival rate (NatureScot, 2023[1]).

2.1.1.3 The threshold recommended for use of Caledonia North alone-level PVA is when a predicted impact is sufficiently large to result in a change of 0.02% in the adult survival rate of a qualifying feature (NatureScot, 2023[1]). Further to this, as agreed in consultation with NatureScot (consultation meetings dated 04 June 2025 and 07 August 2025), PVA for SPA qualifying features is only required to be re-run as part of assessment updates where the difference in the impacted adults apportioned to an SPA annually between submission impacts and updated impacts are greater than 0.5 of a bird (including increases and decreases) (presented in Section 4).

2.1.1.4 Potential impacts from Caledonia North in-combination with other plans and projects has been assessed for featured of designated sites when the contribution from Caledonia North alone is an annual mortality greater than 0.2 (in line with NatureScot advice given to previous projects such as GreenVolt and Cenos OWFs) and where impacts exceeded the threshold for assessment (0.02 percentage point change in adult survival rate) (in line with NatureScot Guidance Note 11; NatureScot 2023[1]) (presented in Section 4).

2.1.1.5 The PVA was conducted using the Seabird PVA tool interfaced through the online 'Shiny App' which is a user-friendly online platform. The PVA tool developed by Natural England (Searle *et al.*, 2019[2]) uses functions within the nepva R package to carry out the modelling and analysis.

2.2 Modelling Approach

2.2.1.1 All PVA models were undertaken using the 'Simulation' run type. Simulation runs are used to simulate population trajectories based on the specified demographic parameters, initial population sizes and scenarios.

2.2.1.2 A deterministic model translates the demographic parameters provided into actual numbers and provides a simplistic model, which can be used to generate average trends. Due to the lack of stochasticity, a deterministic model will produce the same result every time the simulation is run. In situations where little is known about how the population size has varied, or how the scale of impact may vary, running a deterministic model may provide a more practical assessment of the population and how it may be impacted.

2.2.1.3 A stochastic model produces probabilistic outputs to account for the impact of environmental and demographic stochasticity. Environmental stochasticity describes the effects random variation in factors such as weather can have on a population and is modelled by the incorporation of randomly generated values for the probability of survival from one-time step to the next. Demographic stochasticity refers to the effect of random variation in population structure on demographic rates and is modelled by generating random numbers of surviving individuals for any given survival probability. Demographic stochasticity can usually be ignored for populations greater than 100 individuals, however including demographic stochasticity will not cause any penalty when simulating larger populations (WWT Consulting, 2012[3]).

2.2.1.4 All PVA modelling in this report was undertaken with the Beta/Gamma model for environmental and demographic stochasticity. The number of simulations runs were set to 5,000 and were ran for the expected lifespan of Caledonia North (35 years only) as agreed in consultation with NatureScot (consultation meetings dated 04 June 2025 and 07 August 2025).

2.2.1.5 Additional "burn-in" time of ten years were included in each model which were then removed from the outputs. These dropped modelled years are often more variable in their estimates of population numbers due to potential initial population structure instability (i.e., an in balance of immature-matures). After several years, the modelled structure becomes stable which is the most appropriate time to take outputs. This is informed by internal model parameterisation developed during the burn-in period.

2.2.1.6 Demographic processes such as growth, survival, productivity and recruitment are density-dependent, as their rates change in relation to the number of individuals in a population. Density dependence can be described as either compensatory or depensatory (Begon *et al.*, 2005[4]). Compensation is characterised by demographic changes that cause a stabilising effect on a populations long-term average. Depensation acts to

further decrease the rate of population growth in declining populations and can delay the rate of recovery. This is typically exhibited in populations that have been significantly depleted in size and is caused by a reduction in the benefits associated with conspecific presence.

2.2.1.7 Density dependence is self-evident in the natural environment, as without it, populations would grow exponentially. For seabird populations, the mechanisms as to how this operates are largely uncertain, or where known this is evidently highly variable. If density dependence is mis-specified in a PVA, the modelled prediction may be unreliable. Therefore, it is more typical to use density independent models for seabird assessments, despite the lack of biologically realistic density dependence. As such, density independent models lack any means by which a population can recover once it has been reduced beyond a certain point, they are therefore appropriate for impact assessment purposes on the grounds of precaution (i.e., another source of precaution in the assessment process) (Ridge *et al.*, 2019[5]). Conversely, this also means that population projections can trend in as exponential function with no effective carrying capacity. As the populations in this assessment show highly varying trends with some in decline or poor data status, it is deemed density dependent methods are not appropriate for this assessment. Density independent models have therefore been used.

2.3 PVA Demographic Parameters

2.3.1.1 The option to use pre-set demographic parameters or custom values is available in the PVA Tool Shiny App. National or regional demographic parameters for each species within the tool were obtained from Horswill and Robinson (2015[6]) (Table 2-1).

2.3.1.2 Where SPA-specific productivity rates were not available, the most relevant values from Horswill and Robinson (2015[6]) were used. For specific SPAs where breeding success and colony count data were available these were used to calculate average productivity rates (and associated standard deviations).

2.3.1.3 Survival rates vary between age classes, with 0-1 representing birds under the age of one year, class 1-2 representing birds under the age of two etc. Adults are grouped as survival rates tend to be consistent at maturity despite actual age.

2.3.1.4 The age at first breeding and maximum brood size per pair parameters were selected from the pre-formulated values within the PVA Tool (Searle *et al.*, 2019[2]).

2.3.1.5 Populations sizes based on the most recent count information were extracted from the Seabird Monitoring Programme (SMP) online data base to allow assessment of predicted impacts on the most recent population estimate (Table 2-1). Colony counts for East Caithness Cliffs SPA were derived from Burnell *et al*. (2023[7]) and Forth Islands SPA colony counts take into account the 2021 estimated Bass Rock drone count of 81,000 AOS (Harris *et al*., 2021[8]), as requested by NatureScot within consultation meetings regarding NatureScot representations following submission (04 June 2025 and 07 August 2025).

Table 2-1: Summary of SPA demographic parameters selected for PVA species (Source: Horswill and Robinson (2015[6]) and SMP colony counts).

Species	Colony	SMP Count of Colony Breeding Adults	Productivity Rate ± SD	Mean Adult Survival Rate + SD	Mean Immature Age Class					
					0 – 1 Survival Rate + SD	1 – 2 Survival Rate + SD	2 – 3 Survival Rate + SD	3 – 4 Survival Rate + SD	4 – 5 Survival Rate + SD	5 – 6 Survival Rate + SD
Kittiwake	East Caithness Cliffs SPA	48,958	0.690 ± 0.296	0.854 ± 0.051	0.790 ± <0.001	0.854 ± 0.051	0.854 ± 0.051	0.854 ± 0.051	0.854 ± 0.051	-
	Troup, Pennan and Lion's Heads SPA	27,344								
	Buchan Ness to Collieston Coast SPA	27,094								
Guillemot	East Caithness Cliffs SPA	199,992	0.629 ± 0.174	0.939 ± 0.015	0.560 ± 0.001	0.792 ± 0.001	0.917 ± 0.001	0.917 ± 0.001	0.939 ± 0.001	0.939 ± 0.570
	North Caithness Cliffs SPA	62,102								
	Troup, Pennan and Lion's Heads SPA	47,719								
	Copinsay SPA	1,312								
	Hoy SPA	16,345								

Species	Colony	SMP Count of Colony Breeding Adults	Productivity Rate ± SD	Mean Adult Survival Rate + SD	Mean Immature Age Class					
					0 – 1 Survival Rate + SD	1 – 2 Survival Rate + SD	2 – 3 Survival Rate + SD	3 – 4 Survival Rate + SD	4 – 5 Survival Rate + SD	5 – 6 Survival Rate + SD
	Marwick Head SPA	12,800								
	Calf of Eday SPA	7,402								
	West Westray SPA	43,035								
	Rousay SPA	7,921								
Razorbill	East Caithness Cliffs SPA	40,373	0.570 ± 0.247	0.895 ± 0.067	0.630 ± 0.209	0.630 ± 0.209	0.630 ± 0.209	0.895 ± 0.067	0.895 ± 0.067	-
	North Caithness Cliffs SPA	12,329								
	Troup, Pennan and Lion's Heads SPA	8,801								

Species	Colony	SMP Count of Colony Breeding Adults	Productivity Rate ± SD	Mean Adult Survival Rate + SD	Mean Immature Age Class					
					0 – 1 Survival Rate + SD	1 – 2 Survival Rate + SD	2 – 3 Survival Rate + SD	3 – 4 Survival Rate + SD	4 – 5 Survival Rate + SD	5 – 6 Survival Rate + SD
Gannet	Fair Isle SPA	11,184	0.710 ± 0.049	0.919 ± 0.042	0.424 ± 0.045	0.829 ± 0.026	0.891 ± 0.019	0.895 ± 0.019	0.895 ± 0.042	-
	Forth Islands SPA	162,000								
	Hermaness, Saxa Vord and Valla Field SPA	39,606								
Puffin	North Caithness Cliffs SPA	6,766	0.617 ± 0.151	0.906 ± 0.083	0.709 ± 0.001	0.709 ± 0.001	0.709 ± 0.001	0.760 ± 0.001	0.805 ± 0.001	-
	Hoy SPA	722								
	Sule Skerry and Sule Stack SPA	95,484								
	Fair Isle SPA	13,332								
	Foula SPA	12,702								
Great black-backed gull	Copinsay SPA	97	1.111 ± 0.637	0.885 ± 0.022	0.798 ± 0.092	0.834 ± 0.034	0.834 ± 0.034	0.834 ± 0.034	0.834 ± 0.034	-
	Hoy SPA	775								

2.4 Impacts Assessed

2.4.1.1 The impact predicted from Caledonia North were parameterised as 'relative harvest' (the increase in baseline mortality rate as a result of the impact rather than the overall impact in terms of numbers of birds annually), as per the PVA guidance.

2.4.1.2 Each PVA simulation run included a baseline scenario that was paired with an impact scenario. The baseline scenario estimated population changes based on the baseline mortality rate, and the impact scenario estimated population change with the additional predicted mortality due to distributional response effects. The additional mortality was calculated as a proportion of the initial population and applied to the adult age class only.

2.4.1.3 For the species and relevant seasons in scope for assessment, a range of impact levels have been modelled based on the Guidance approach and Applicant approach shown in Table 2-2.

2.4.1.4 Each impact scenario includes additional predicted population-level mortality due to distributional responses. This increased mortality affects the survival rate, thereby predicting the impact magnitude on the population under different scenarios. The model used relative harvest, calculated based on the predicted mortalities apportioned to the designated site and initial regional population size.

2.4.1.5 As discussed and agreed in consultation with NatureScot (email dated 21 August 2025), the impact predicted on seabird populations from cumulative and in-combination impacts from offshore wind developments are predominantly based the updated in-combination and cumulative totals for seabird species developed by North East and East Ornithology Group.

2.4.1.6 As agreed in consultation with NatureScot, a macro-avoidance rate of 70% has been applied to gannet densities during the non-breeding season (October – early-March). During the breeding season (mid-March – September), the monthly in-flight densities have not been adjusted for macro-avoidance. This has been presented as the Guidance Approach. As per the Applicant Approach a macro-avoidance rate of 70% has been applied to all months. For further details see Section 6.7.2 of Volume 2, Chapter 6: Offshore Ornithology of the EIAR.

Table 2-2: Displacement and mortality rates used in the Matrix-based Method for the NatureScot Guidance Approach and the Applicant Approach.

Species	Displacement Rate	Mortality Rate – Breeding Season	Mortality Rate – Non-breeding Season
Guidance Approach			
Guillemot, Razorbill and Puffin	60%	3% and 5%	1% and 3%
Kittiwake	30%	1% and 3%	1% and 3%
Gannet	70%	1% and 3%	1% and 3%
Applicant Approach			
Guillemot, Razorbill and Puffin	50%	1%	1%
Kittiwake	Not Assessed		
Gannet	70%	1%	1%

2.4.1.7 It should be noted that the Applicant has decided to include the Year 1 August count (2,093 individuals) in the non-breeding season rather than during the breeding season for puffin. This is due to the Year 1 August abundance being considered to reflect migration rather than individuals present in the breeding season. The mean seasonal peaks for puffin have also been presented with the August count included in the breeding season as per the Guidance Approach. Further details are provided in Volume 7B, Appendix 6-2: Offshore Ornithology Distributional Responses Technical Report.

2.5 PVA Outputs

2.5.1.1 The outputs from the PVA tool focus on the counterfactual of population growth rate (CGR) and counterfactual of population size (CPS) (Searle *et al.*, 2019[2]). These metrics compare impacted and unimpacted scenarios, enabling interpretation of the predicted impact on the population (Cook and Robinson, 2016[9]). CPS represents the median ratio of the final size of the impacted population to the baseline (unimpacted) population. Both metrics are expressed as proportions.

3 Cumulative EIA Results

3.1 Introduction

3.1.1.1 The outputs from the PVA Tool including the counterfactuals of population size and growth rate are presented for the species and relevant seasons for each colony requiring PVA. One set of outputs are presented for each species:

- Cumulative impacts including all projects where information is available (plus Caledonia North).

3.2 Guillemot

Table 3-1: Guillemot cumulative PVA results showing distributional responses when considering the relevant regional population estimates derived from the SMP.

Approach	Season	Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant	Breeding	(50%, 1%)	0.135202	0.998 (<0.001)	0.152	0.947 (0.002)	5.323
Guidance	Breeding	(60%, 3%; 60%, 1%)	0.486727	0.995 (<0.001)	0.547	0.821 (0.002)	17.903
Guidance	Breeding	(60%, 5%; 60%, 3%)	0.811211	0.991 (<0.001)	0.911	0.719 (0.002)	28.076
Applicant	Non-breeding	(50%, 1%)	0.118457	0.999 (<0.001)	0.133	0.953 (0.002)	4.676
Guidance	Non-breeding	(60%, 3%; 60%, 1%)	0.142148	0.998 (<0.001)	0.160	0.944 (0.002)	5.585
Guidance	Non-breeding	(60%, 5%; 60%, 3%)	0.426444	0.995 (<0.001)	0.479	0.841 (0.002)	15.877
Applicant	Annual	(50%, 1%)	0.253659	0.997 (<0.001)	0.285	0.902 (0.002)	9.767
Guidance	Annual	(60%, 3%; 60%, 1%)	0.628875	0.993 (<0.001)	0.706	0.775 (0.002)	22.527
Guidance	Annual	(60%, 5%; 60%, 3%)	1.237655	0.986 (<0.001)	1.390	0.604 (0.002)	39.593

3.3 Razorbill

Table 3-2: Razorbill cumulative PVA results showing distributional responses when considering the relevant regional population estimates derived from the SMP.

Approach	Season	Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant	Breeding	(50%, 1%)	0.181028	0.998 (<0.001)	0.218	0.925 (0.019)	7.534
Guidance	Breeding	(60%, 3%; 60%, 1%)	0.651700	0.992 (<0.001)	0.782	0.754 (0.017)	24.596
Guidance	Breeding	(60%, 5%; 60%, 3%)	1.086167	0.987 (<0.001)	1.301	0.624 (0.015)	37.595
Applicant	Non-breeding	(50%, 1%)	0.150071	0.998 (<0.001)	0.180	0.937 (0.010)	6.271
Guidance	Non-breeding	(60%, 3%; 60%, 1%)	0.180085	0.998 (<0.001)	0.216	0.925 (0.010)	7.497
Guidance	Non-breeding	(60%, 5%; 60%, 3%)	0.540256	0.994 (<0.001)	0.647	0.791 (0.009)	20.853
Applicant	Annual	(50%, 1%)	0.198107	0.998 (<0.001)	0.237	0.918 (0.010)	8.206
Guidance	Annual	(60%, 3%; 60%, 1%)	0.353014	0.996 (<0.001)	0.423	0.858 (0.009)	14.158
Guidance	Annual	(60%, 5%; 60%, 3%)	0.828470	0.990 (<0.001)	0.992	0.698 (0.009)	30.155

3.4 Puffin

Table 3-3: Puffin cumulative PVA results showing distributional responses when considering the relevant regional population estimates derived from the SMP.

Approach	Season	Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant	Breeding	(50%, 1%)	0.027064	1.000 (<0.001)	0.031	0.989 (0.007)	1.123
Guidance	Breeding	(60%, 3%; 60%, 1%)	0.099471	0.999 (<0.001)	0.118	0.959 (0.007)	4.144
Guidance	Breeding	(60%, 5%; 60%, 3%)	0.165786	0.998 (<0.001)	0.196	0.932 (0.006)	6.819
Applicant	Non-breeding	(50%, 1%)	0.088697	0.999 (<0.001)	0.104	0.963 (0.013)	3.684
Guidance	Non-breeding	(60%, 3%; 60%, 1%)	0.103489	0.999 (<0.001)	0.122	0.957 (0.012)	4.294
Guidance	Non-breeding	(60%, 5%; 60%, 3%)	0.310466	0.996 (<0.001)	0.366	0.876 (0.012)	12.363
Applicant	Annual	(50%, 1%)	0.051857	0.999 (<0.001)	0.061	0.978 (0.007)	2.183
Guidance	Annual	(60%, 3%; 60%, 1%)	0.128400	0.998 (<0.001)	0.151	0.947 (0.007)	5.324
Guidance	Annual	(60%, 5%; 60%, 3%)	0.252570	0.997 (<0.001)	0.298	0.898 (0.006)	10.209

3.5 Kittiwake

Table 3-4: Kittiwake cumulative PVA results showing distributional responses and collision combined when considering the relevant regional population estimates derived from the SMP.

Approach	Season	Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	Breeding	(30%, 1%)	0.452998	0.995 (<0.001)	0.535	0.824 (0.005)	17.583
Guidance	Breeding	(30%, 3%)	0.517196	0.994 (<0.001)	0.612	0.802 (0.005)	19.821
Guidance	Non-breeding	(30%, 1%)	0.246986	0.997 (<0.001)	0.292	0.900 (0.004)	10.004
Guidance	Non-breeding	(30%, 3%)	0.279740	0.997 (<0.001)	0.330	0.888 (0.004)	11.246
Guidance	Annual	(30%, 1%)	0.529565	0.994 (<0.001)	0.626	0.798 (0.004)	20.233
Guidance	Annual	(30%, 3%)	0.602367	0.993 (<0.001)	0.712	0.773 (0.004)	22.689

3.6 Gannet

Table 3-5: Gannet cumulative PVA results showing distributional responses and collision combined when considering the relevant regional population estimates derived from the SMP.

Approach	Season	Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant	Breeding	(70%,1%)	0.077615	0.999 (<0.001)	0.092	0.967 (0.004)	3.253
Applicant	Breeding	(70%, 3%)	0.134577	0.998 (<0.001)	0.160	0.944 (0.004)	5.578
Guidance	Breeding	(70%, 1%)	0.188018	0.998 (<0.001)	0.222	0.923 (0.004)	7.709
Guidance	Breeding	(70%, 3%)	0.244980	0.997 (<0.001)	0.290	0.901 (0.004)	9.922
Applicant	Non-breeding	(70%,1%)	0.099011	0.999 (<0.001)	0.117	0.959 (0.005)	4.150
Applicant	Non-breeding	(70%, 3%)	0.214830	0.997 (<0.001)	0.254	0.912 (0.005)	8.758
Guidance	Non-breeding	(70%, 1%)	0.099011	0.999 (<0.001)	0.116	0.959 (0.005)	4.112
Guidance	Non-breeding	(70%, 3%)	0.214830	0.997 (<0.001)	0.255	0.912 (0.005)	8.761
Applicant	Annual	(70%,1%)	0.132965	0.998 (<0.001)	0.158	0.945 (0.004)	5.518
Applicant	Annual	(70%, 3%)	0.254673	0.997 (<0.001)	0.302	0.897 (0.004)	10.308
Guidance	Annual	(70%, 1%)	0.243368	0.997 (<0.001)	0.288	0.901 (0.004)	9.870
Guidance	Annual	(70%, 3%)	0.365077	0.996 (<0.001)	0.432	0.856 (0.004)	14.431

3.7 Great Black-backed Gull

Table 3-6: Great black-backed gull cumulative PVA results showing collision when considering the relevant regional population estimates derived from the SMP.

Approach	Season	Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	Non-breeding	Collision	0.522610	0.994 (<0.001)	0.611200	0.802 (0.007)	19.799
Guidance	Annual	Collision	0.580532	0.993 (<0.001)	0.679	0.783 (0.007)	21.748

3.8 Herring Gull

Table 3-7: Herring gull cumulative PVA results showing collision when considering the relevant regional population estimates derived from the SMP.

Approach	Season	Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	Non-breeding	Collision	0.065181	0.999 (<0.001)	0.078	0.972 (0.007)	2.777
Guidance	Annual	Collision	0.111676	0.999 (<0.001)	0.134	0.953 (0.007)	4.737

4 HRA Results

4.1 Overview

4.1.1.1 The outputs from the PVA Tool including the counterfactuals of population size and growth rate are presented for the species and relevant seasons for each colony requiring PVA. Three sets of outputs are presented for each species:

- Caledonia North Alone Guidance and Applicant approach where relevant;
- In-combination impacts including all projects where information is available (plus Caledonia North); and
- In-combination impacts including all projects excluding consented projects that have made a commitment to compensation (plus Caledonia North) (in this instance commitment to compensation refers to projects which have been awarded consent on the basis that any and all adverse effects on seabirds at a HRA-level would be fully compensated).

4.2 East Caithness Cliffs SPA: Caledonia North Alone

4.2.1 Guillemot

Table 4-1: PVA results using Seabird PVA Tool for annual impacts to guillemot apportioned to the East Caithness Cliffs SPA from Caledonia North showing distributional responses Project alone outputs.

Approach	Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
			Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 3%; 60%, 1%)	0.000261	1.000 (<0.001)	0.030	0.989 (0.005)	1.057
Guidance	(60%, 5%; 60%, 3%)	0.000450	0.999 (<0.001)	0.051	0.982 (0.005)	1.817

4.2.2 Razorbill

Table 4-2: PVA results using Seabird PVA Tool for annual impacts to razorbill apportioned to the East Caithness Cliffs SPA from Caledonia North showing distributional responses Project alone outputs.

Approach	Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
			Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 1%; 60%, 3%)	0.000165	1.000 (0.001)	0.020	0.993 (0.041)	0.745
Guidance	(60%, 5%; 60%, 3%)	0.000286	1.000 (0.001)	0.036	0.986 (0.041)	1.355

4.3 East Caithness Cliffs SPA: In-combination

4.3.1 Guillemot

Table 4-3: PVA results using Seabird PVA Tool for annual impacts apportioned to the East Caithness Cliffs SPA guillemot population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant	(50%, 1%)	All Projects (plus Caledonia North)	0.001646	1.000 (<0.001)	0.016	0.994 (0.005)	0.561
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.004196	0.995 (<0.001)	0.472	0.843 (0.005)	15.657
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.008146	0.991 (<0.001)	0.916	0.718 (0.004)	28.199
Applicant	(50%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001467	1.000 (<0.001)	0.015	0.995 (0.005)	0.546

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 3%; 60%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.003905	0.996 (<0.001)	0.439	0.853 (0.005)	14.661
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.007424	0.992 (<0.001)	0.835	0.739 (0.004)	26.052

4.3.2 Razorbill

Table 4-4: PVA results using Seabird PVA Tool for annual impacts apportioned to the East Caithness Cliffs SPA razorbill population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant	(50%, 1%)	All Projects (plus Caledonia North)	0.001527	0.998 (0.001)	0.185	0.936 (0.039)	6.447
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.003366	0.996 (0.001)	0.404	0.864 (0.036)	13.593
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.000165	0.992 (0.001)	0.843	0.737 (0.032)	26.251
Applicant	(50%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001366	0.998 (0.001)	0.166	0.943 (0.039)	5.718
Guidance	(60%, 3%; 60%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000286	0.996 (0.001)	0.373	0.874 (0.037)	12.594
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.003366	0.992 (0.001)	0.767	0.758 (0.033)	24.170

4.3.3 Kittiwake

Table 4-5: PVA results using Seabird PVA Tool for annual impacts apportioned to the East Caithness Cliffs SPA kittiwake population showing distributional responses and collision combined in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(30%, 1%)	All Projects (plus Caledonia North)	0.005693	0.993 (<0.001)	0.674	0.784 (0.015)	21.646
Guidance	(30%, 3%)	All Projects (plus Caledonia North)	0.008522	0.990 (<0.001)	1.007	0.695 (0.014)	30.537
Guidance	(30%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000000	0.996 (<0.001)	0.409	0.862 (0.016)	13.787
Guidance	(30%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.005824	0.993 (<0.001)	0.689	0.779 (0.015)	22.067

4.4 North Caithness Cliffs SPA: Caledonia North Alone

4.4.1 Guillemot

Table 4-6: PVA results using Seabird PVA Tool for annual impacts to guillemot apportioned to the North Caithness Cliffs SPA from Caledonia North showing distributional responses Project alone outputs.

Approach	Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
			Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 5%; 60%, 3%)	0.000226	1.000 (<0.001)	0.025	0.991 (0.010)	0.890

4.5 North Caithness Cliffs SPA: In-combination

4.5.1 Guillemot

Table 4-7: PVA results using Seabird PVA Tool for annual impacts apportioned to the North Caithness Cliffs SPA guillemot population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant	(50%, 1%)	All Projects (plus Caledonia North)	0.000415	1.000 (<0.001)	0.047	0.983 (0.009)	1.656
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.000000	0.999 (<0.001)	0.114	0.943 (0.010)	5.679
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.002011	0.998 (<0.001)	0.227	0.891 (0.009)	10.943
Applicant	(50%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000326	1.000 (<0.001)	0.036	0.987 (0.010)	1.313
Guidance	(60%, 3%; 60%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000876	0.999 (<0.001)	0.099	0.950 (0.010)	4.951

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001659	0.998 (<0.001)	0.187	0.909 (0.009)	9.125

4.5.2 Razorbill

Table 4-8: PVA results using Seabird PVA Tool for annual impacts apportioned to the North Caithness Cliffs SPA razorbill population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant	(50%, 1%)	All Projects (plus Caledonia North)	0.000429	0.999 (0.001)	0.054	0.980 (0.050)	1.951
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.000632	0.999 (0.002)	0.074	0.973 (0.073)	2.675
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.001662	0.998 (0.002)	0.199	0.931 (0.071)	6.881
Applicant	(50%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000361	1.000 (0.001)	0.046	0.984 (0.049)	1.630
Guidance	(60%, 3%; 60%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000524	0.999 (0.002)	0.064	0.977 (0.072)	2.292

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001390	0.998 (0.002)	0.163	0.944 (0.072)	5.644

4.5.3 Puffin

Table 4-9: PVA results using Seabird PVA Tool for annual impacts apportioned to the North Caithness Cliffs SPA puffin population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.004548	0.995 (0.002)	0.538	0.824 (0.063)	17.614
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.007640	0.991 (0.002)	0.911	0.720 (0.056)	28.020
Guidance	(60%, 3%; 60%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.004491	0.995 (0.002)	0.537	0.824 (0.063)	17.639
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.007528	0.991 (0.002)	0.895	0.723 (0.057)	27.669
Note, this table presents the Guidance Approach for puffin, whereby the Year 1 August abundance has been incorporated as part of the breeding season (Further details are provided in Volume 7B, Appendix 6-2: Offshore Ornithology Distributional Responses Technical Report).							

4.5.4 Kittiwake

Table 4-10: PVA results using Seabird PVA Tool for annual impacts apportioned to the North Caithness Cliffs SPA kittiwake population showing distributional responses and collision combined in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(30%, 1%)	All Projects (plus Caledonia North)	0.003419	0.996 (<0.001)	0.405	0.864 (0.026)	13.622
Guidance	(30%, 3%)	All Projects (plus Caledonia North)	0.004541	0.995 (<0.001)	0.538	0.824 (0.025)	17.570
Guidance	(30%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001495	0.998 (<0.001)	0.177	0.938 (0.028)	6.202
Guidance	(30%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.002454	0.997 (<0.001)	0.292	0.901 (0.027)	9.912

4.6 Troup, Pennan and Lion's Head SPA: Caledonia North Alone

4.6.1 Guillemot

Table 4-11: PVA results using Seabird PVA Tool for annual impacts to guillemot apportioned to the Troup, Pennan and Lion's Head SPA from Caledonia North showing distributional responses Project alone outputs.

Approach	Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
			Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 1%, 60%, 3%)	0.000116	1.000 (<0.001)	0.014	0.995 (0.011)	0.481
Guidance	(60%, 5%; 60%, 3%)	0.000208	1.000 (<0.001)	0.024	0.992 (0.011)	0.846

4.7 Troup, Pennan and Lion's Heads SPA: In-combination

4.7.1 Guillemot

Table 4-12: PVA results using Seabird PVA Tool for annual impacts apportioned to the Troup, Pennan and Lion's Heads SPA guillemot population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant	(50%, 1%)	All Projects (plus Caledonia North)	0.001028	0.999 (<0.001)	0.116	0.943 (0.011)	5.725
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.001975	0.998 (<0.001)	0.223	0.923 (0.010)	7.724
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.000116	0.995 (<0.001)	0.500	0.835 (0.010)	16.490
Applicant	(50%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000493	0.999 (<0.001)	0.056	0.972 (0.011)	2.804
Guidance	(60%, 3%; 60%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000208	0.999 (<0.001)	0.112	0.960 (0.011)	3.959

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001975	0.998 (<0.001)	0.245	0.915 (0.010)	8.473

4.7.2 Razorbill

Table 4-13: PVA results using Seabird PVA Tool for annual impacts apportioned to the Troup, Pennan and Lion's Heads SPA razorbill population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant	(50%, 1%)	All Projects (plus Caledonia North)	0.000695	0.999 (0.002)	0.086	0.971 (0.081)	2.938
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.001140	0.999 (0.002)	0.134	0.952 (0.079)	4.806
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.000071	0.997 (0.002)	0.333	0.887 (0.076)	11.338
Applicant	(50%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000532	0.999 (0.002)	0.063	0.978 (0.082)	2.213
Guidance	(60%, 3%; 60%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000127	0.999 (0.002)	0.092	0.967 (0.081)	3.296
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001140	0.998 (0.002)	0.243	0.916 (0.078)	8.387

4.7.3 Kittiwake

Table 4-14: PVA results using Seabird PVA Tool for annual impacts apportioned to the Troup, Pennan and Lion's Heads SPA kittiwake population showing distributional responses and collision combined in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(30%, 1%)	All Projects (plus Caledonia North)	0.005746	0.993 (<0.001)	0.680	0.782 (0.020)	21.782
Guidance	(30%, 3%)	All Projects (plus Caledonia North)	0.007102	0.992 (<0.001)	0.839	0.738 (0.019)	26.166
Guidance	(30%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.003291	0.996 (<0.001)	0.390	0.869 (0.022)	13.125
Guidance	(30%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.005746	0.995 (<0.001)	0.523	0.828 (0.021)	17.248

4.8 Copinsay SPA: Caledonia North Alone

4.8.1 Great black-backed gull

Table 4-15: PVA results using Seabird PVA Tool for annual impacts to great black-backed gull apportioned to the Copinsay SPA from Caledonia North showing collision Project alone outputs.

Approach	Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
			Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	Collision	0.000475	1.000 (0.007)	0.017	0.989 (0.301)	1.112

4.9 Copinsay SPA: In-combination

4.9.1 Great black-backed gull

Table 4-16: PVA results using Seabird PVA Tool for annual impacts apportioned to the Copinsay SPA great black-backed gull population showing collision in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	Collision	All Projects (plus Caledonia North)	0.045320	0.946 (0.010)	5.397	0.135 (0.056)	86.459
Guidance	Collision	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.044599	0.947 (0.009)	5.294	0.141 (0.056)	85.913

4.10 Hoy SPA: In-combination

4.10.1 Great black-backed gull

Table 4-17: PVA results using Seabird PVA Tool for annual impacts apportioned to the Hoy SPA great black-backed gull population showing collision in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	Collision	All Projects (plus Caledonia North)	0.001900	0.998 (0.002)	0.237	0.918 (0.091)	8.172
Guidance	Collision	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.005901	0.998 (0.002)	0.216	0.924 (0.093)	7.631

4.10.2 Guillemot

Table 4-18: PVA results using Seabird PVA Tool for annual impacts apportioned to the Hoy SPA guillemot population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.000222	1.000 (<0.001)	0.025	0.991 (0.019)	0.873
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.000460	0.999 (<0.001)	0.052	0.981 (0.019)	1.881
Guidance	(60%, 3%; 60%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000200	1.000 (<0.001)	0.023	0.991 (0.019)	0.851
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000396	1.000 (<0.001)	0.046	0.984 (0.019)	1.634

4.10.3 Puffin

Table 4-19: PVA results using Seabird PVA Tool for annual impacts apportioned to the Hoy SPA puffin population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.001838	0.998 (0.006)	0.211	0.925 (0.220)	7.496
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.005100	0.994 (0.006)	0.585	0.808 (0.201)	19.201
Guidance	(60%, 3%; 60%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000345	0.998 (0.006)	0.163	0.943 (0.228)	5.664
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001838	0.996 (0.006)	0.429	0.855 (0.214)	14.496
Note, this table presents the Guidance Approach for puffin, whereby the Year 1 August abundance has been incorporated as part of the breeding season (Further details are provided in Volume 7B, Appendix 6-2: Offshore Ornithology Distributional Responses Technical Report).							

4.11 Buchan Ness to Collieston Coast SPA: In-combination

4.11.1 Guillemot

Table 4-20: PVA results using Seabird PVA Tool for annual impacts apportioned to the Buchan Ness to Collieston Coast SPA guillemot population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant	(50%, 1%)	All Projects (plus Caledonia North)	0.001852	0.998 (<0.001)	0.207	0.928 (0.011)	7.191
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.003535	0.996 (<0.001)	0.397	0.816 (0.010)	18.357
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.007981	0.991 (<0.001)	0.897	0.632 (0.008)	36.825
Applicant	(50%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000520	0.999 (<0.001)	0.058	0.980 (0.011)	2.050
Guidance	(60%, 3%; 60%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000769	0.999 (<0.001)	0.087	0.957 (0.012)	4.337

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.002017	0.998 (<0.001)	0.226	0.891 (0.011)	10.936

4.11.2 Kittiwake

Table 4-21: PVA results using Seabird PVA Tool for annual impacts apportioned to the Buchan Ness to Colliestone Coast SPA kittiwake population showing distributional responses and collision combined in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(30%, 1%)	All Projects (plus Caledonia North)	0.003984	0.995 (<0.001)	0.471	0.843 (0.020)	15.650
Guidance	(30%, 3%)	All Projects (plus Caledonia North)	0.005205	0.994 (<0.001)	0.614	0.801 (0.019)	19.862
Guidance	(30%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001949	0.998 (<0.001)	0.229	0.920 (0.022)	8.010
Guidance	(30%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.002743	0.997 (<0.001)	0.323	0.890 (0.021)	10.992

4.12 Marwick Head SPA: In-combination

4.12.1 Guillemot

Table 4-22: PVA results using Seabird PVA Tool for annual impacts apportioned to the Marwick Head SPA guillemot population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.000210	1.000 (<0.001)	0.023	0.992 (0.021)	0.829
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.000470	0.999 (<0.001)	0.055	0.980 (0.020)	1.975
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000362	1.000 (<0.001)	0.042	0.985 (0.020)	1.486

4.13 Calf of Eday SPA: In-combination

4.13.1 Guillemot

Table 4-23: PVA results using Seabird PVA Tool for annual impacts apportioned to the Calf of Eday SPA guillemot population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.000000	1.000 (<0.001)	0.030	0.989 (0.027)	1.059

4.14 Rousay SPA: In-Combination

4.14.1 Guillemot

Table 4-24: PVA results using Seabird PVA Tool for annual impacts apportioned to the Rousay SPA guillemot population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.000279	1.000 (<0.001)	0.030	0.989 (0.027)	1.135

4.15 West Westray SPA: In-combination

4.15.1 Guillemot

Table 4-25: PVA results using Seabird PVA Tool for annual impacts apportioned to the West Westray SPA guillemot population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.000310	1.000 (<0.001)	0.036	0.987 (0.011)	1.266
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000234	1.000 (<0.001)	0.027	0.990 (0.011)	0.956

4.15.2 Kittiwake

Table 4-26: PVA results using Seabird PVA Tool for annual impacts apportioned to the West Westray SPA kittiwake population showing distributional responses and collision combined in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(30%, 1%)	All Projects (plus Caledonia North)	0.007729	0.991 (0.001)	0.911	0.719 (0.033)	28.055
Guidance	(30%, 3%)	All Projects (plus Caledonia North)	0.010356	0.988 (0.001)	1.222	0.642 (0.030)	35.788
Guidance	(30%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.002906	0.997 (0.001)	0.342	0.884 (0.039)	11.599
Guidance	(30%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.005234	0.994 (0.001)	0.617	0.800 (0.036)	20.022

4.16 Sule Skerry and Sule Stack SPA: In-combination

4.16.1 Guillemot

Table 4-27: PVA results using Seabird PVA Tool for annual impacts apportioned to the Sule Skerry and Sule Stack SPA guillemot population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant	(50%, 1%)	All Projects (plus Caledonia North)	0.001534	0.998 (<0.001)	0.172	0.940 (0.018)	6.025
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.005442	0.994 (<0.001)	0.612	0.802 (0.016)	19.844
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.009125	0.990 (<0.001)	1.026	0.690 (0.014)	31.002

4.16.2 Puffin

Table 4-28: PVA results using Seabird PVA Tool for annual impacts apportioned to the Sule Skerry and Sule Stack SPA puffin population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.000293	1.000 (<0.001)	0.035	0.988 (0.019)	1.236
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000218	1.000 (<0.001)	0.024	0.991 (0.018)	0.871

Note, this table presents the Guidance Approach for puffin, whereby the Year 1 August abundance has been incorporated as part of the breeding season (Further details are provided in Volume 7B, Appendix 6-2: Offshore Ornithology Distributional Responses Technical Report).

4.16.3 Gannet

Table 4-29: PVA results using Seabird PVA Tool for annual impacts apportioned to the Sule Skerry and Sule Stack SPA gannet population showing distributional responses and collision combined in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance*	(70%, 1%)	All Projects (plus Caledonia North)	0.001553	0.998 (<0.001)	0.185	0.936 (0.028)	6.428
Guidance*	(70%, 3%)	All Projects (plus Caledonia North)	0.002164	0.997 (<0.001)	0.258	0.911 (0.027)	8.868
Guidance*	(70%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000353	1.000 (<0.001)	0.040	0.986 (0.029)	1.445

* As agreed in consultation a macro-avoidance rate of 70% has been applied to gannet densities during the non-breeding season. During the breeding season, the monthly in-flight densities have not been adjusted for macro-avoidance. This approach has been presented as the Guidance Approach.

4.17 Fowlsheugh SPA: In-combination

4.17.1 Kittiwake

Table 4-30: PVA results using Seabird PVA Tool for annual impacts apportioned to the Fowlsheugh SPA kittiwake population showing distributional responses and collision combined in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(30%, 1%)	All Projects (plus Caledonia North)	0.004995	0.994 (<0.001)	0.591	0.808 (0.017)	19.215
Guidance	(30%, 3%)	All Projects (plus Caledonia North)	0.006513	0.992 (<0.001)	0.769	0.757 (0.016)	24.293
Guidance	(30%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.002282	0.997 (<0.001)	0.270	0.908 (0.019)	9.222
Guidance	(30%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.003241	0.996 (<0.001)	0.382	0.871 (0.018)	12.898

4.18 Cape Wrath SPA: In-combination

4.18.1 Puffin

Table 4-31: PVA results using Seabird PVA Tool for annual impacts apportioned to the Cape Wrath SPA puffin population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.000512	0.999 (0.008)	0.055	0.979 (0.320)	2.128
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.000864	0.999 (0.008)	0.090	0.969 (0.310)	3.110
Guidance	(60%, 3%; 60%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000398	1.000 (0.008)	0.040	0.988 (0.310)	1.250
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000671	0.999 (0.008)	0.074	0.966 (0.310)	3.376
Note, this table presents the Guidance Approach for puffin, whereby the Year 1 August abundance has been incorporated as part of the breeding season (Further details are provided in Volume 7B, Appendix 6-2: Offshore Ornithology Distributional Responses Technical Report).							

4.19 Fair Isle SPA: In-combination

4.19.1 Guillemot

Table 4-32: PVA results using Seabird PVA Tool for annual impacts apportioned to the Fair Isle SPA guillemot population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.000337	1.000 (<0.001)	0.038	0.981 (0.015)	1.863

4.19.2 Puffin

Table 4-33: PVA results using Seabird PVA Tool for annual impacts apportioned to the Fair Isle SPA puffin population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.001337	0.998 (0.001)	0.159	0.944 (0.052)	5.573
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.002566	0.997 (0.001)	0.304	0.897 (0.049)	10.348
Guidance	(60%, 3%; 60%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000946	0.999 (0.001)	0.107	0.963 (0.053)	3.717
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001819	0.998 (0.001)	0.218	0.924 (0.051)	7.616
Note, this table presents the Guidance Approach for puffin, whereby the Year 1 August abundance has been incorporated as part of the breeding season (Further details are provided in Volume 7B, Appendix 6-2: Offshore Ornithology Distributional Responses Technical Report).							

4.19.3 Gannet

Table 4-34: PVA results using Seabird PVA Tool for annual impacts apportioned to the Fair Isle SPA gannet population showing distributional responses and collision combined in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance*	(70%, 1%)	All Projects (plus Caledonia North)	0.000221	0.999 (<0.001)	0.054	0.981 (0.031)	1.894
Guidance*	(70%, 3%)	All Projects (plus Caledonia North)	0.000457	0.999 (<0.001)	0.125	0.956 (0.030)	4.378
Guidance*	(70%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000472	1.000 (<0.001)	0.049	0.983 (0.031)	1.710
Guidance*	(70%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001052	0.999 (<0.001)	0.109	0.962 (0.030)	3.828

* As agreed in consultation a macro-avoidance rate of 70% has been applied to gannet densities during the non-breeding season. During the breeding season, the monthly in-flight densities have not been adjusted for macro-avoidance. This approach has been presented as the Guidance Approach.

4.20 Foula SPA: In-combination

4.20.1 Puffin

Table 4-35: PVA results using Seabird PVA Tool for annual impacts apportioned to the Foula SPA puffin population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant	(50%, 1%)	All Projects (plus Caledonia North)	0.000474	0.999 (0.001)	0.057	0.979 (0.052)	2.067
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.000584	0.999 (0.001)	0.067	0.976 (0.053)	2.427
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.001718	0.998 (0.001)	0.205	0.929 (0.050)	7.098
Applicant	(50%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000341	1.000 (0.001)	0.040	0.986 (0.052)	1.424
Guidance	(60%, 3%; 60%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000422	0.999 (0.001)	0.050	0.982 (0.053)	1.786

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001238	0.999 (0.001)	0.144	0.949 (0.052)	5.093
Note, this table presents the Guidance Approach for puffin, whereby the Year 1 August abundance has been incorporated as part of the breeding season (Further details are provided in Volume 7B, Appendix 6-2: Offshore Ornithology Distributional Responses Technical Report).							

4.21 North Rona and Sula Sgeir SPA: In-combination

4.21.1 Gannet

Table 4-36: PVA results using Seabird PVA Tool for annual impacts apportioned to the North Rona and Sula Sgeir SPA gannet population showing distributional responses and collision combined in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance*	(70%, 3%)	All Projects (plus Caledonia North)	0.000366	1.000 (<0.001)	0.043	0.984 (0.024)	1.560
Guidance*	(70%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000291	1.000 (<0.001)	0.035	0.987 (0.024)	1.275
* As agreed in consultation a macro-avoidance rate of 70% has been applied to gannet densities during the non-breeding season. During the breeding season, the monthly in-flight densities have not been adjusted for macro-avoidance. This approach has been presented as the Guidance Approach.							

4.22 Forth Islands SPA: In-combination

4.22.1 Puffin

Table 4-37: PVA results using Seabird PVA Tool for annual impacts apportioned to the Forth Islands SPA puffin population showing distributional responses in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant	(50%, 1%)	All Projects (plus Caledonia North)	0.000876	0.999 (<0.001)	0.103	0.963 (0.015)	3.685
Guidance	(60%, 3%; 60%, 1%)	All Projects (plus Caledonia North)	0.002048	0.998 (<0.001)	0.242	0.916 (0.017)	8.362
Guidance	(60%, 5%; 60%, 3%)	All Projects (plus Caledonia North)	0.004153	0.995 (<0.001)	0.490	0.838 (0.016)	16.241
Applicant	(50%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000692	0.999 (<0.001)	0.081	0.971 (0.015)	2.907
Guidance	(60%, 3%; 60%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001699	0.998 (<0.001)	0.201	0.930 (0.017)	6.998

Approach	Scenario	In-combination scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance	(60%, 5%; 60%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.003362	0.996 (<0.001)	0.398	0.866 (0.016)	13.366
Note, this table presents the Guidance Approach for puffin, whereby the Year 1 August abundance has been incorporated as part of the breeding season (Further details are provided in Volume 7B, Appendix 6-2: Offshore Ornithology Distributional Responses Technical Report).							

4.22.2 Gannet

Table 4-38: PVA results using Seabird PVA Tool for annual impacts apportioned to the Forth Islands SPA gannet population showing distributional responses and collision combined in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant*	(70%, 1%)	All Projects (plus Caledonia North)	0.001890	0.998 (<0.001)	0.224	0.923 (0.008)	7.743
Guidance**	(70%, 1%)	All Projects (plus Caledonia North)	0.003988	0.995 (<0.001)	0.472	0.843 (0.007)	15.662
Guidance**	(70%, 3%)	All Projects (plus Caledonia North)	0.005813	0.993 (<0.001)	0.688	0.780 (0.007)	22.010
Applicant*	(70%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001457	0.998 (<0.001)	0.173	0.940 (0.008)	6.021
Guidance**	(70%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.003071	0.996 (<0.001)	0.363	0.877 (0.008)	12.299
Guidance**	(70%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.004453	0.995 (<0.001)	0.528	0.827 (0.007)	17.341

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
* The Applicant Approach has been presented, with the macro-avoidance rate of 70% applied to the predicted mortalities in all months. ** It should also be noted that as agreed in consultation a macro-avoidance rate of 70% has been applied to gannet densities during the non-breeding season. During the breeding season, the monthly in-flight densities have not been adjusted for macro-avoidance. This approach has been presented as the Guidance Approach.							

4.23 Noss SPA: In-combination

4.23.1 Gannet

Table 4-39: PVA results using Seabird PVA Tool for annual impacts apportioned to the Noss SPA gannet population showing distributional responses and collision combined in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant*	(70%, 1%)	All Projects (plus Caledonia North)	0.000531	0.999 (<0.001)	0.063	0.978 (0.021)	2.213
Guidance**	(70%, 1%)	All Projects (plus Caledonia North)	0.000604	0.999 (<0.001)	0.072	0.974 (0.021)	2.571
Guidance**	(70%, 3%)	All Projects (plus Caledonia North)	0.001431	0.998 (<0.001)	0.170	0.940 (0.020)	5.958
Applicant*	(70%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000474	0.999 (<0.001)	0.056	0.979 (0.021)	2.055

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance**	(70%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000520	0.999 (<0.001)	0.063	0.978 (0.021)	2.204
Guidance**	(70%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001263	0.998 (<0.001)	0.150	0.948 (0.020)	5.247

* The Applicant Approach has been presented, with the macro-avoidance rate of 70% applied to the predicted mortalities in all months.

** It should also be noted that as agreed in consultation a macro-avoidance rate of 70% has been applied to gannet densities during the non-breeding season. During the breeding season, the monthly in-flight densities have not been adjusted for macro-avoidance. This approach has been presented as the Guidance Approach.

4.24 Hermaness, Saxa Vord and Valla Field SPA: In-combination

4.24.1 Gannet

Table 4-40: PVA results using Seabird PVA Tool for annual impacts apportioned to the Hermaness, Saxa Vord and Valla Field SPA gannet population showing distributional responses and collision combined in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Applicant*	(70%, 1%)	All Projects (plus Caledonia North)	0.000688	0.999 (<0.001)	0.081	0.972 (0.016)	2.848
Guidance**	(70%, 1%)	All Projects (plus Caledonia North)	0.000746	0.999 (<0.001)	0.088	0.969 (0.016)	3.087
Guidance**	(70%, 3%)	All Projects (plus Caledonia North)	0.001838	0.998 (<0.001)	0.217	0.925 (0.016)	7.512
Applicant*	(70%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000618	0.999 (<0.001)	0.072	0.974 (0.016)	2.571
Guidance**	(70%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.000653	0.999 (<0.001)	0.076	0.973 (0.016)	2.721

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance**	(70%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.001635	0.998 (<0.001)	0.193	0.933 (0.016)	6.722

* The Applicant Approach has been presented, with the macro-avoidance rate of 70% applied to the predicted mortalities in all months.

** It should also be noted that as agreed in consultation a macro-avoidance rate of 70% has been applied to gannet densities during the non-breeding season. During the breeding season, the monthly in-flight densities have not been adjusted for macro-avoidance. This approach has been presented as the Guidance Approach.

4.25 Flamborough and Filey Coast SPA: In-combination

4.25.1 Gannet

Table 4-41: PVA results using Seabird PVA Tool for annual impacts apportioned to the Flamborough and Filey Coast SPA gannet population showing distributional responses and collision combined in-combination outputs for the two in-combination scenarios outlined in Section 2.4.

Approach	Scenario	In-combination Scenario	Mortality Rate Relative to the Population	Density Independent Counterfactual Metric (35 Years)			
				Median Growth Rate (±SD)	Decrease in CGR (%)	Median Pop. Size (±SD)	Decrease in CPS (%)
Guidance*	(70%, 1%)	All Projects (plus Caledonia North)	0.008644	0.996 (<0.001)	0.409	0.863 (0.007)	13.721
Guidance*	(70%, 3%)	All Projects (plus Caledonia North)	0.013719	0.995 (<0.001)	0.500	0.835 (0.007)	16.502
Guidance*	(70%, 1%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.008558	0.997 (<0.001)	0.323	0.890 (0.008)	10.989
Guidance*	(70%, 3%)	All Projects excluding consented projects committed to compensation (plus Caledonia North)	0.013576	0.996 (<0.001)	0.404	0.864 (0.007)	13.551

* As agreed in consultation a macro-avoidance rate of 70% has been applied to gannet densities during the non-breeding season. During the breeding season, the monthly in-flight densities have not been adjusted for macro-avoidance. This approach has been presented as the Guidance Approach.

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