



# **Bellrock Offshore Wind Farm**

## **Wind Farm Development Area**

**Environmental Impact Assessment Report - Volume IV**

**Appendix 10.4: Offshore Ornithology Population Viability Technical Report**

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# Contents

<b>1</b>	<b>Introduction .....</b>	<b>1</b>
<b>2</b>	<b>Methods .....</b>	<b>3</b>
2.1	Special Protection Area Populations.....	3
2.1.1	Reference Population Sizes .....	3
2.1.2	Determining Mortalities on Special Protection Area Populations Due to Wind Farm Impacts .....	5
2.1.3	Population Viability Analysis for Special Protection Area Populations .....	29
2.2	Regional Populations .....	37
2.2.1	Reference Population Sizes .....	37
2.2.2	Determining Mortalities on Regional Populations Due to Wind Farm Infrastructure Impacts .....	39
2.2.3	Population Viability Analysis for Regional Populations.....	49
<b>3</b>	<b>Results .....</b>	<b>54</b>
3.1	Population Viability Analysis Outputs.....	54
3.2	Population Viability Analysis for Special Protection Area Populations .....	55
3.2.1	Project-alone.....	57
3.2.2	In-combination .....	58
3.3	Population Viability Analysis for Regional Populations .....	92
3.3.1	Project-alone.....	92
3.3.2	Cumulative .....	93
<b>4</b>	<b>References.....</b>	<b>101</b>

## List of Tables

Table 1.1:	Total Estimated Annual Mortality of Individuals from Collision and Displacement Effects for Five Species of Seabird .....	2
Table 2.1:	Reference Population Size Estimates Used for the Special Protection Area Colony Populations Considered for Population Viability Analysis .....	4
Table 2.2:	Bellrock Wind Farm Infrastructure-alone Displacement Mortality and Associated Percentage Point Change in Breeding Adult Mortality for Special Protection Area Populations .....	7
Table 2.3:	Bellrock Wind Farm Infrastructure-alone Collision Mortality and Associated Percentage Point Change in Breeding Adult Mortality for Special Protection Area Populations .....	10
Table 2.4:	Bellrock Wind Farm Infrastructure-alone Combined Displacement and Collision Mortality and Associated Percentage Point Change in Breeding Adult Mortality for Special Protection Area Populations .....	12
Table 2.5:	Displacement Mortality for the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects, with the Associated Percentage Point Change in Breeding Adult Mortality for Special Protection Area Populations .....	17
Table 2.6:	Collision Mortality for the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects, with Associated Percentage Point Change in Breeding Adult Mortality for Special Protection Area Populations .....	21
Table 2.7:	Combined Displacement and Collision Mortality for the Bellrock Wind Infrastructure In-combination with Other Plans and Projects, with the Associated Percentage Point Change in Breeding Adult Mortality for Special Protection Area Populations .....	25
Table 2.8:	Set up and Approach Used for All Population Viability Analysis Undertaken on Special Protection Area Populations .....	30
Table 2.9:	Demographic Rates Used in Population Viability Analysis for Kittiwake Special Protection Area Populations .....	31
Table 2.10:	Demographic Rates Used in Population Viability Areas for Razorbill Special Protection Area Populations .....	32
Table 2.11:	Demographic Rates Used in Population Viability Areas for Puffin Special Protection Area Populations .....	33
Table 2.12:	Demographic Rates Used in Population Viability Analysis for Gannet Special Protection Area Populations .....	34
Table 2.13:	Estimated Proportions of the Adult and the Subadult Components of Special Protection Area Populations of Four Seabird Species as Derived from the Stable Age Distributions of the Population Models.....	36
Table 2.14:	Estimated Number of Adults and Subadults in the Regional Breeding Populations of Five Seabird Species .....	39
Table 2.15:	Bellrock Wind Farm Infrastructure-alone Displacement Mortality and Associated Percentage Point Change in Breeding Adult Mortality for the Regional Population of Each of the Five Seabird Species .....	41
Table 2.16:	Bellrock Wind Farm Infrastructure-alone Collision Mortality and Associated Percentage Point Change in Breeding Adult Mortality for the Regional Kittiwake and Gannet Populations .....	42
Table 2.17:	Bellrock Wind Farm Infrastructure-alone Combined Displacement and Collision Mortality and Associated Percentage Point Change in Breeding Adult Mortality for the Regional Kittiwake and Gannet Populations.....	42
Table 2.18:	Cumulative Displacement Mortality for the Bellrock Wind Farm Infrastructure with Other Plans and Projects and the Associated Percentage Point Change in Breeding Adult Mortality for Regional Populations of Each Species .....	45

Table 2.19:	Cumulative Collision Mortality for the Bellrock Wind Farm Infrastructure with Other Plans and Projects and the Associated Percentage Point Change in Breeding Adult Mortality within for the Regional Kittiwake and Gannet Populations.....	46
Table 2.20:	Cumulative Combined Displacement and Collision Mortality for the Bellrock Wind Farm Infrastructure with Other Plans and Projects and the Associated Percentage Point Change in Breeding Adult Mortality for the Regional Kittiwake and Gannet Populations .....	47
Table 2.21:	Demographic Rates Used in Population Viability Analysis for the Guillemot Regional Population .....	51
Table 3.1:	Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure-alone on the Fowlsheugh Special Protection Area Razorbill .....	57
Table 3.2:	Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects on Kittiwake Special Protection Area Populations	58
Table 3.3:	Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects on Razorbill Special Protection Area Populations	75
Table 3.4:	Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects on Puffin Special Protection Area Populations .....	80
Table 3.5:	Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects on Gannet Special Protection Area Populations. ....	83
Table 3.6:	Population Viability Analysis Outputs for Effects of the Bellrock on the Razorbill Regional Population .....	92
Table 3.7:	Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure Acting Cumulatively with Other Plans and Projects on the Kittiwake Regional Population .....	93
Table 3.8:	Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure Acting Cumulatively with Other Plans and Projects on the Guillemot Regional Population .....	95
Table 3.9:	Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure Acting Cumulatively with Other Plans and Projects on the Razorbill Regional Population .....	96
Table 3.10:	Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure Acting Cumulatively with Other Plans and Projects on the Puffin Regional Population .....	97
Table 3.11:	Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure Acting Cumulatively with Other Plans and Projects on the Gannet Regional Population .....	97

**List of Annexes**

- Annex A: Project Alone Mortality Apportionment Calculations
- Annex B: The NEEOG Interim CEF With Derived In-Combination and Cumulative Mortalities
- Annex C: In-Combination Mortality Apportionment Calculations
- Annex D: PVA Input Files
- Annex E: PVA Impact Values Inputs
- Annex F: Regional Population Colony Counts
- Annex G: PVA Output Files

## Glossary of Terminology

Term	Definition
Applicant	Bellrock Offshore Wind Farm Limited, the legal entity submitting Section 36 Consent and Marine Licence applications for the Bellrock Wind Farm Development Area.
Bellrock Offshore Wind Farm (or the Bellrock Project)	<p>An offshore wind farm capable of exporting up to 1.8 gigawatt of renewable energy to the National Electricity Transmission System.</p> <p>The Wind Farm Development Area is located 120 kilometres east of Stonehaven, and will connect to the National Electricity Transmission System at the proposed SSEN Transmission Hurlie substation, west of Stonehaven in Aberdeenshire. The Bellrock Offshore Wind Farm comprises of the following Development Areas:</p> <ul style="list-style-type: none"> <li>▪ Wind Farm Development Area;</li> <li>▪ Offshore Transmission Development Area; and</li> <li>▪ Onshore Transmission Development Area.</li> </ul>
Development Area	<p>For consenting purposes, the area for which separate consents and/or Marine Licences will be sought by the Applicant, comprising:</p> <ul style="list-style-type: none"> <li>▪ Wind Farm Development Area;</li> <li>▪ Offshore Transmission Development Area; and</li> <li>▪ Onshore Transmission Development Area.</li> </ul>
National Electricity Transmission System	The high-voltage electricity power transmission network serving Great Britain which receives electricity from generators (such as offshore wind farms) and transmits that electricity to anywhere on the National Electricity Transmission System to satisfy demand.
Offshore Transmission Development Area	The boundary within which the Offshore Transmission Infrastructure will be constructed, operated and maintained, and decommissioned (and includes the whole of the Wind Farm Development Area).
Onshore Transmission Development Area	The boundary within which the Onshore Transmission Infrastructure will be constructed, operated and maintained, and decommissioned.
Operational life	The expected operational life of the Wind Farm Infrastructure from the Commercial Operation Date to the first floating offshore unit being decommissioned.
ScotWind	A Crown Estate Scotland leasing round for offshore wind projects in which the process enabled developers to apply for seabed rights to plan and build wind farms in Scottish waters.
SSEN Transmission Hurlie substation	The onshore substation to be developed by SSEN Transmission, which will receive renewable electricity from the Bellrock Project onshore substation and allow supply of renewable electricity from the wind farm to the National Electricity Transmission System.
Wind Farm Development Area	The boundary within which the Wind Farm Infrastructure will be constructed, operated and decommissioned.

<b>Term</b>	<b>Definition</b>
Wind farm infrastructure	Infrastructure located within the Wind Farm Development Area including wind turbine generators; floating substructures, station keeping systems and associated scour protection; inter-array cables and associated cable protection; subsea cable hubs; and ancillary infrastructure including buoys (including activities associated with the Wind Farm Infrastructure construction, operation and maintenance, and decommissioning).
Wind turbine generator	A wind turbine generator converts wind energy into electrical energy. The main components include rotor assembly (composed of three blades and a hub); nacelle (containing the generator, shaft and gearbox, power electronic converter and transformer); and a tower (containing lifting equipment and switchgear).

## Glossary of Abbreviations

<b>Term</b>	<b>Definition</b>
BDMPS	Biologically Defined Minimum Population Scales
CEF	Cumulative Effects Framework
CPGR	Counterfactual of population growth rate
CPS	Counterfactual for population size
EIA	Environmental Impact Assessment
HPAI	Highly Pathogenic Avian Influenza
HRA	Habitats Regulations Appraisal
NEEOG	Northeast and East Ornithology Group
PVA	Population Viability Analysis
SD	Standard deviation
SMP	Seabird Monitoring Programme
SPA	Special Protection Area
WFDA	Wind Farm Development Area

# 1 Introduction

1. This Offshore Ornithology Population Viability Analysis (PVA) Technical Report is an appendix to **Chapter 10: Offshore Ornithology (Volume II)** of the **Bellrock Wind Farm Development Area (WFDA) Environmental Impact Assessment (EIA) Report**.
2. This report details the level of potential impact of collision and displacement mortalities on populations of those breeding seabird species for which collision and/or displacement are relevant effect pathways (as identified in the **Bellrock WFDA Scoping Report (Appendix 1.1, Volume IV) and Bellrock WFDA Habitats Regulations Appraisal (HRA) Screening Report (Shadow Habitats Regulations Appraisal Part 1: Annex A, Volume VI)**, and for which collision risk and/or displacement assessments have demonstrated a level of predicted mortality that could have the potential to lead to population-level impacts (**Appendix 10.2: Collision Risk Modelling Technical Report (Volume IV)** and **Appendix 10.3: Displacement Assessment Technical Report (Volume IV)**).
3. These species are kittiwake, guillemot, razorbill, puffin and gannet<sup>1</sup>. The populations of these species that are considered within this PVA Technical Report are the breeding colony Special Protection Area (SPA) populations which have been screened in for assessment in Stage 2 of the HRA process and the regional breeding populations. As such, this analysis is integral to informing the offshore ornithology assessment of the Bellrock Wind Farm Infrastructure.
4. This report establishes:
  - Whether the predicted levels of mortality from collisions and/or displacement exceed the threshold for requiring investigation of the population-level impacts using PVA, with this threshold being a percentage point change of 0.02 in the baseline annual adult mortality of the adult age class (NatureScot, 2023a), and
  - Where the threshold is exceeded, the population-level impacts as determined by PVA.
5. This is undertaken in relation to the mortality resulting from both the Bellrock Wind Farm Infrastructure-alone and the Bellrock Wind Farm Infrastructure in-combination (for SPA populations) or cumulatively (for regional populations) with other offshore wind farm plans and projects.
6. The overall predicted annual mortalities from the collision and/or displacement effects for each of the five species are detailed below in **Table 1.1**. This presents both the lower and upper estimates for the potential displacement mortality on each species (as determined using the advised species-specific displacement and mortality rates – NatureScot, 2023b), whilst the collision estimates for kittiwake and gannet are those derived from the worst case turbine design (see Section 2.4.1 in

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<sup>1</sup> In addition to these five species, collision (but not displacement) was undertaken on great black-backed gull, Arctic tern and Arctic skua, but in each of these cases the predicted mortality was a single bird or less per annum, which does not have the potential to result in population-level impacts and therefore have not been considered further in this PVA Technical Report.

**Appendix 10.2: Collision Risk Modelling Technical Report (Volume IV)** using the stochastic collision risk model (see Table 4.1 in **Appendix 10.3: Displacement Assessment Technical Report (Volume IV)** and Table 3.1 and Table 3.5 in **Appendix 10.2: Collision Risk Modelling Technical Report (Volume IV)** respectively).

**Table 1.1: Total Estimated Annual Mortality of Individuals from Collision and Displacement Effects for Five Species of Seabird**

Species <sup>1</sup>	Effects <sup>2</sup>				
	Displacement Lower	Displacement Upper	Collision	Displacement Lower and Collision	Displacement Upper and Collision
Kittiwake	1.5	4.4	18.9	20.4	23.3
Guillemot	50.3	132.0	N/A	N/A	N/A
Razorbill	24.0	40.9	N/A	N/A	N/A
Puffin	8.5	17.0	N/A	N/A	N/A
Gannet	4.5	13.4	17.8	22.3	31.2

Notes:

<sup>1</sup> Kittiwake and gannet are considered to be subject to both collision and displacement effects whilst guillemot, razorbill and puffin are considered to be subject to displacement effects only (which accords with the NatureScot representation on the Bellrock WFDA Scoping Opinion **Appendix 1.2: Bellrock WFDA Scoping Opinion (Volume IV)**).

<sup>2</sup> The estimated mortalities are taken from **Appendix 10.2: Collision Risk Modelling Technical Report (Volume IV)** and **Appendix 10.3: Displacement Assessment Technical Report (Volume IV)**.

## 2 Methods

### 2.1 Special Protection Area Populations

#### 2.1.1 Reference Population Sizes

7. Of the five species identified in **Table 1.1**, connectivity with breeding seabird colony SPA populations was established for only four species (with no connectivity being identified for guillemot in the **Bellrock WFDA HRA Screening Report (Shadow Habitats Regulations Appraisal Part 1: Annex A, Volume VI)**)<sup>2</sup>. The SPA populations of these four species (i.e. kittiwake, razorbill, puffin and gannet) considered for PVA analysis are as identified in the **Bellrock WFDA HRA Screening Report (Shadow Habitats Regulations Appraisal Part 1: Annex A, Volume VI)**, and as set out below in **Table 2.1**.
8. The reference (or baseline) population sizes against which impacts are assessed were derived from the most up-to-date comprehensive data available for each SPA population on the Seabird Monitoring Programme (SMP) database (JNCC 2025) and (BTO 2025), or from other published sources in a small number of instances (see **Table 2.1**). This is in accordance with NatureScot guidance which states that “*the most up to date population data (i.e. most will be available within the [SMP database \(https://app.bto.org/seabirds/public/index.jsp\)](https://app.bto.org/seabirds/public/index.jsp) should be used to determine the baseline populations*”, and broadly with NatureScot’s representation on the Bellrock WFDA Scoping Report which refers solely to obtaining such data from the SMP (NatureScot 2023a; NatureScot, 2024). The small number of instances in which data are taken from sources other than the SMP represent estimates that (at the time of writing) are more recent than those available on the SMP, and are considered to provide reliable, contemporaneous, estimates for these SPA populations (Clarkson et al. 2022; Harris et al. 2023). Their inclusion is important in maximising the extent to which impacts are assessed against population sizes that are representative of conditions following the advent of Highly Pathogenic Avian Influenza (HPAI) in UK seabird populations in 2021 and 2022 (Atkinson and Baillie 2025; Tremlett et al. 2025).
9. Many of the estimates used to provide the reference population sizes are derived from the Seabirds Count census, which are held on the SMP (Burnell et al. 2023). The Seabirds Count data pre-dates the advent of HPAI at UK seabird colonies, with only a sample of UK breeding seabird SPA populations having been subject to more recent counts. Where available, these more recent count data are used, provided they represent comprehensive coverage of the SPA population (although a small number of exceptions are made in this regard – see **Table 2.1** for details). Some colony counts undertaken since the advent of HPAI provide partial coverage of the SPA population only and so have not been used. The reference population sizes, years from which the data are derived and sources for each of the relevant SPA populations are presented in **Table 2.1**.

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<sup>2</sup> As agreed by NatureScot in email from NatureScot to the Applicant on 8 October 2024. Please see Section 10.3 in **Chapter 10: Offshore Ornithology (Volume II)**.

**Table 2.1: Reference Population Size Estimates Used for the Special Protection Area Colony Populations Considered for Population Viability Analysis**

Species	Special Protection Area	Population Size (Number of Breeding Adults) <sup>1</sup>	Year(s) of Counts
Kittiwake	Fowlsheugh SPA	28,078	2015 - 2021
	Buchan Ness to Collieston Coast SPA <sup>2</sup>	27,094	2023
	Flamborough & Filey Coast SPA <sup>3</sup>	89,148	2022
	Troup, Pennan & Lion's Heads SPA	21,232	2015 - 2021
	East Caithness Cliffs SPA <sup>4</sup>	36,600	2018 and 2024
	St Abb's Head to Fast Castle SPA <sup>2</sup>	11,992	2024
	Farne Islands SPA <sup>2</sup>	5,790	2024
	Forth Islands SPA <sup>2</sup>	13,114	2024
	North Caithness Cliffs SPA <sup>2</sup>	18,058	2023 - 2024
	Copinsay SPA	1,910	2015 - 2021
	Fair Isle SPA	896	2015 - 2021
	Hoy SPA	532	2015 - 2021
	West Westray SPA <sup>5</sup>	5,510	2015 - 2021
Razorbill	Fowlsheugh SPA	18,844	2015 - 2021
	Forth Islands SPA <sup>2, 5</sup>	8,379	2017 and 2024
	Troup, Pennan & Lion's Heads SPA <sup>5</sup>	6,054	2015 - 2021
	East Caithness Cliffs SPA <sup>5</sup>	40,373	2015 - 2021
	North Caithness Cliffs SPA <sup>5</sup>	4,796	2015 - 2021
	Flamborough & Filey Coast SPA <sup>3, 5</sup>	61,345	2022
	Mingulay & Berneray SPA <sup>5</sup>	26,787	2015 - 2021
	Rathlin Island SPA <sup>5</sup>	29,803	2015 - 2021
Puffin	Farne Islands SPA <sup>2</sup>	100,206	2024
	Forth Islands SPA <sup>2</sup>	117,960	2024
	North Caithness Cliffs SPA	6,078	2015 - 2016
	Coquet Island SPA	50,058	2019

Species	Special Protection Area	Population Size (Number of Breeding Adults) <sup>1</sup>	Year(s) of Counts
Gannet	Forth Islands SPA <sup>6</sup>	103,688	2023
	Flamborough & Filey Coast SPA <sup>2</sup>	31,588	2024
	St Kilda SPA <sup>2</sup>	118,410	2023
	Hermaness, Saxa Vord & Valla Field SPA <sup>2</sup>	39,606	2024
	Noss SPA <sup>2</sup>	24,670	2023
	Sule Skerry & Sule Stack SPA <sup>2, 7</sup>	15,648	2013 and 2024
	North Rona & Sula Sgeir SPA <sup>2</sup>	18,990	2023
	Fair Isle SPA <sup>2</sup>	11,184	2024
<p>Notes:</p> <p><sup>1</sup> Population size estimates are from the Seabirds Count census data (as held on the SMP database unless otherwise denoted (see notes 2 – 6 below). The number of breeding adults is derived by doubling the number of Apparently Occupied Sites, Apparently Occupied Nests or Apparently Occupied Burrows for kittiwake, gannet and (in most cases) puffin. The number of individuals is used for puffin, where the count unit is post-laying individuals and not Apparently Occupied Burrows. For razorbill, estimates are derived by multiplying the count of individuals by 1.34. See Burnell et al. (2023) for details.</p> <p><sup>2</sup> From SMP database counts that are more recent than the Seabirds Count census data.</p> <p><sup>3</sup> From Clarkson et al. (2022).</p> <p><sup>4</sup> From SMP database counts that are more recent than the Seabirds Count census except for the count in single section (Wick Bay) which is from 2018 (and held 38 breeding adults).</p> <p><sup>5</sup> SPA populations with connectivity to the Bellrock WFDA in the non-breeding periods only.</p> <p><sup>6</sup> From Harris et al. (2023).</p> <p><sup>7</sup> Combines the most recent Sule Skerry (2024) and Sule Stack (2013) counts, as held on the SMP database.</p>			

## 2.1.2 Determining Mortalities on Special Protection Area Populations Due to Wind Farm Impacts

### 2.1.2.1 Project-alone Mortality

- To estimate the potential mortality due to the Bellrock Wind Farm Infrastructure-alone on each SPA population, it was necessary to apportion the predicted annual mortality from collisions and/or displacement (**Table 1.1**) to the adult and subadult components of each population. This was undertaken by first calculating the seasonal breakdown in mortality for each species (see Table 3.7 and Table 3.11 in **Appendix 10.2: Collision Risk Modelling Technical Report (Volume IV)** and Table 4.1 in **Appendix 10.3: Displacement Assessment Technical Report (Volume IV)**) before applying the seasonally-specific SPA and age-class apportioning rates, as detailed in Section 3.1 and Section 3.2 of **Appendix 10.5: Offshore Ornithology Apportioning Report (Volume IV)**. Finally for the breeding adult age class during the breeding season, species-specific

sabbatical rates were applied to these apportioned estimates, as detailed in Section 3.3 of **Appendix 10.5: Offshore Ornithology Apportioning Technical Report (Volume IV)**. As outlined in the relevant reports (identified above), this apportioning process was undertaken in accordance with the appropriate NatureScot guidance and advice.

11. Apportioning to age class and SPA population was undertaken for each of the lower and upper estimates of displacement mortality and, for kittiwake and gannet, also for collision mortality and for the combined displacement and collision mortality (again encompassing both the lower and upper estimates for displacement mortality). In each case, the seasonal mortality values were summed to give annual values. The annual mortality of the breeding adult, as well as the subadult, age class predicted to result from displacement at each SPA population is presented in **Table 2.2**, with the analogous predicted annual mortalities of kittiwake and gannet from collisions and collisions plus displacement at SPA populations of these two species presented in **Table 2.3** and **Table 2.4**, respectively.
12. NatureScot consider that investigation of potential population-level impacts using PVA is required when the percentage point increase in the baseline annual mortality rate of breeding adults due to the predicted wind farm effects exceeds 0.02 (NatureScot, 2023a). The percentage point increase can be expressed simply as the predicted additional mortality divided by the size of the breeding adult population, with this value also presented for each SPA population in **Table 2.2** to **Table 2.4**. The percentage point increase in the annual mortality rate exceeded 0.02 for the Fowlsheugh SPA razorbill population only.
13. For each of the four species, detailed breakdowns of the apportioning of the different mortalities resulting from the Bellrock Wind Farm Infrastructure-alone to each SPA population are presented in **Table A 1** to **Table A 4** in **Annex A** of this Appendix.

**Table 2.2: Bellrock Wind Farm Infrastructure-alone Displacement Mortality and Associated Percentage Point Change in Breeding Adult Mortality for Special Protection Area Populations**

Species	Special Protection Area	Number of Breeding Adults	Apportioned Annual Displacement Mortality				Percentage Point Increase in Breeding Adult Mortality <sup>1</sup>	
			Lower		Upper		Displacement Lower	Displacement Upper
			Adults	Subadults	Adults	Subadults		
Kittiwake	Fowlsheugh SPA	28,078	0.15	0.01	0.46	0.04	0.0005	0.0017
	Buchan Ness to Collieston Coast SPA	27,094	0.13	0.01	0.39	0.04	0.0005	0.0014
	Flamborough & Filey Coast SPA	89,148	0.15	0.03	0.44	0.07	0.0002	0.0005
	Troup, Pennan & Lion's Heads SPA	21,232	0.08	0.01	0.23	0.03	0.0004	0.0011
	East Caithness Cliffs SPA	36,600	0.10	0.02	0.30	0.07	0.0003	0.0008
	St Abb's Head to Fast Castle SPA	11,992	0.04	0.00	0.12	0.01	0.0003	0.0010
	Farne Islands SPA	5,790	0.03	0.00	0.10	0.01	0.0006	0.0018
	Forth Islands SPA	13,114	0.03	0.00	0.09	0.01	0.0002	0.0007
	North Caithness Cliffs SPA	18,058	0.02	0.01	0.06	0.02	0.0001	0.0003
	Copinsay SPA	1,910	0.00	0.00	0.01	0.00	0.0001	0.0003
	Fair Isle SPA	896	0.00	0.00	0.00	0.00	0.0002	0.0005
	Hoy SPA	532	0.00	0.00	0.00	0.00	0.0002	0.0006
	West Westray SPA	5,510	0.01	0.01	0.03	0.02	0.0002	0.0006

Species	Special Protection Area	Number of Breeding Adults	Apportioned Annual Displacement Mortality				Percentage Point Increase in Breeding Adult Mortality <sup>1</sup>	
			Lower		Upper		Displacement Lower	Displacement Upper
			Adults	Subadults	Adults	Subadults		
Razorbill	Fowlsheugh SPA	18,844	7.60	8.79	12.67	14.66	0.0403	0.0672
	Forth Islands SPA	8,379	0.01	0.00	0.02	0.01	0.0001	0.0002
	Troup, Pennan & Lion's Heads SPA	6,054	0.00	0.00	0.01	0.01	0.0001	0.0002
	East Caithness Cliffs SPA	40,373	0.03	0.02	0.08	0.05	0.0001	0.0002
	North Caithness Cliffs SPA	4,796	0.00	0.00	0.01	0.01	0.0001	0.0002
	Flamborough & Filey Coast SPA	61,345	0.02	0.01	0.06	0.04	<0.0001	0.0001
	Mingulay & Berneray SPA	26,787	0.00	0.00	0.00	0.00	<0.0001	<0.0001
	Rathlin Island SPA	29,803	0.00	0.00	0.00	0.00	<0.0001	<0.0001
Puffin	Farne Islands SPA	100,206	1.44	1.27	2.39	2.11	0.0014	0.0024
	Forth Islands SPA	117,960	0.98	1.27	1.63	2.10	0.0008	0.0014
	North Caithness Cliffs SPA	6,078	0.01	0.01	0.02	0.02	0.0002	0.0003
	Coquet Island SPA	50,058	0.64	0.57	1.06	0.94	0.0013	0.0021
Gannet	Forth Islands SPA	103,688	1.87	0.48	5.59	1.42	0.0018	0.0054
	Flamborough & Filey Coast SPA	31,588	0.24	0.09	0.73	0.27	0.0008	0.0023
	St Kilda SPA	118,410	0.11	0.07	0.33	0.21	0.0001	0.0003
	Hermaness, Saxa Vord & Valla Field SPA	39,606	0.35	0.18	1.03	0.54	0.0009	0.0026
	Noss SPA	24,670	0.16	0.07	0.48	0.22	0.0007	0.0019

Species	Special Protection Area	Number of Breeding Adults	Apportioned Annual Displacement Mortality				Percentage Point Increase in Breeding Adult Mortality <sup>1</sup>	
			Lower		Upper		Displacement Lower	Displacement Upper
			Adults	Subadults	Adults	Subadults		
	Sule Skerry & Sule Stack SPA	15,648	0.03	0.01	0.10	0.02	0.0002	0.0006
	North Rona & Sula Sgeir SPA	18,990	0.03	0.01	0.09	0.03	0.0002	0.0005
	Fair Isle SPA	11,184	0.07	0.03	0.21	0.09	0.0006	0.0019

Notes:

<sup>1</sup> Text in red indicates a percentage point change of at least 0.02.

**Table 2.3: Bellrock Wind Farm Infrastructure-alone Collision Mortality and Associated Percentage Point Change in Breeding Adult Mortality for Special Protection Area Populations**

Species	Special Protection Area	Number of Breeding Adults	Apportioned Annual Collision Mortality		Percentage Point Increase in Breeding Adult Mortality
			Adults	Subadults	
Kittiwake	Fowlsheugh SPA	28,078	1.95	0.18	0.0070
	Buchan Ness to Collieston Coast SPA	27,094	1.64	0.18	0.0061
	Flamborough & Filey Coast SPA	89,148	1.87	0.32	0.0021
	Troup, Pennan & Lion's Heads SPA	21,232	0.96	0.14	0.0045
	East Caithness Cliffs SPA	36,600	1.26	0.30	0.0034
	St Abb's Head to Fast Castle SPA	11,992	0.51	0.05	0.0042
	Farne Islands SPA	5,790	0.44	0.05	0.0076
	Forth Islands SPA	13,114	0.37	0.04	0.0029
	North Caithness Cliffs SPA	18,058	0.25	0.07	0.0014
	Copinsay SPA	1,910	0.03	0.01	0.0014
	Fair Isle SPA	896	0.02	0.01	0.0021
	Hoy SPA	532	0.01	0.00	0.0027
	West Westray SPA	5,510	0.14	0.07	0.0025

Species	Special Protection Area	Number of Breeding Adults	Apportioned Annual Collision Mortality		Percentage Point Increase in Breeding Adult Mortality
			Adults	Subadults	
Gannet	Forth Islands SPA	103,688	10.14	0.81	0.0098
	Flamborough & Filey Coast SPA	31,588	0.96	0.13	0.0030
	St Kilda SPA	118,410	0.62	0.12	0.0005
	Hermaness, Saxa Vord & Valla Field SPA	39,606	0.77	0.22	0.0019
	Noss SPA	24,670	0.49	0.10	0.0020
	Sule Skerry & Sule Stack SPA	15,648	0.25	0.02	0.0016
	North Rona & Sula Sgeir SPA	18,990	0.22	0.02	0.0011
	Fair Isle SPA	11,184	0.24	0.04	0.0022

Notes:

<sup>1</sup> Text in red indicates a percentage point change of at least 0.02.

**Table 2.4: Bellrock Wind Farm Infrastructure-alone Combined Displacement and Collision Mortality and Associated Percentage Point Change in Breeding Adult Mortality for Special Protection Area Populations**

Species	Special Protection Area	Number of Breeding Adults	Apportioned Annual Collision Plus Displacement Mortality				Percentage Point Increase in Breeding Adult Mortality	
			Lower		Upper		Displacement Lower and Collision	Displacement Upper and Collision
			Adults	Subadults	Adults	Subadults		
Kittiwake	Fowlsheugh SPA	28,078	2.10	0.19	2.42	0.22	0.0075	0.0086
	Buchan Ness to Collieston Coast SPA	27,094	1.77	0.19	2.03	0.22	0.0065	0.0075
	Flamborough & Filey Coast SPA	89,148	2.02	0.35	2.32	0.40	0.0023	0.0026
	Troup, Pennan & Lion's Heads SPA	21,232	1.04	0.15	1.19	0.18	0.0049	0.0056
	East Caithness Cliffs SPA	36,600	1.36	0.32	1.55	0.36	0.0037	0.0042
	St Abb's Head to Fast Castle SPA	11,992	0.55	0.06	0.63	0.06	0.0046	0.0052
	Farne Islands SPA	5,790	0.47	0.05	0.54	0.06	0.0082	0.0094
	Forth Islands SPA	13,114	0.40	0.04	0.46	0.05	0.0031	0.0035
	North Caithness Cliffs SPA	18,058	0.27	0.08	0.31	0.09	0.0015	0.0017
	Copinsay SPA	1,910	0.03	0.01	0.03	0.01	0.0016	0.0018
	Fair Isle SPA	896	0.02	0.01	0.02	0.01	0.0023	0.0026
	Hoy SPA	532	0.02	0.00	0.02	0.00	0.0030	0.0034
	West Westray SPA	5,510	0.15	0.08	0.17	0.09	0.0028	0.0031
Gannet	Forth Islands SPA	103,688	12.01	1.29	15.73	2.23	0.0116	0.0152
	Flamborough & Filey Coast SPA	31,588	1.20	0.22	1.69	0.40	0.0038	0.0053

Species	Special Protection Area	Number of Breeding Adults	Apportioned Annual Collision Plus Displacement Mortality				Percentage Point Increase in Breeding Adult Mortality	
			Lower		Upper		Displacement Lower and Collision	Displacement Upper and Collision
			Adults	Subadults	Adults	Subadults		
	St Kilda SPA	118,410	0.73	0.19	0.95	0.33	0.0006	0.0008
	Hermaness, Saxa Sord & Valla Field SPA	39,606	1.12	0.41	1.80	0.76	0.0028	0.0045
	Noss SPA	24,670	0.65	0.17	0.97	0.31	0.0026	0.0039
	Sule Skerry & Sule Stack SPA	15,648	0.28	0.02	0.35	0.03	0.0018	0.0022
	North Rona & Sula Sgeir SPA	18,990	0.25	0.03	0.31	0.06	0.0013	0.0016
	Fair Isle SPA	11,184	0.31	0.07	0.45	0.13	0.0028	0.0040

Notes:

<sup>1</sup> Text in red indicates a percentage point change of at least 0.02.

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### 2.1.2.2 In-combination Mortality

14. The potential mortality on each SPA population due to the Bellrock Wind Farm Infrastructure in-combination with other plans and projects was derived from the sum of:
  - The Bellrock Wind Farm Infrastructure apportioned mortality (as detailed in **Table 2.2** to **Table 2.4**); and,
  - The predicted mortality from the other plans and projects identified as having potential displacement and/or collision mortality effects on the SPA population.
15. This was undertaken for both the breeding adult and subadult age classes, and separately for displacement mortality, collision mortality and the combined collision and displacement mortality (with these scenarios including the lower and upper levels of displacement mortality as for the Bellrock Wind Farm Infrastructure -alone).
16. The in-combination mortalities for the other plans and projects were taken from the totals collated by the Northeast and East Ornithology Group's (NEEOG) Interim Cumulative Effects Framework (CEF) project, using the most recently available update to these totals (i.e. April 2025)<sup>3</sup>. The NEEOG Interim CEF project totals provide SPA-specific mortality estimates for both the breeding adult and subadult age classes in the source files for each species.
17. For displacement, the SPA-specific mortality estimates held in the NEEOG Interim CEF source files for most of the plans and projects were adjusted to align with the species- and seasonal-specific displacement mortality rates advised by NatureScot (2023b), with the small number of exceptions in this regard relating to SeabORD-derived estimates (for which such adjustment is not appropriate) (Searle et al. 2018). This gave lower and upper levels of displacement mortality that aligned with those calculated for the Bellrock Wind Farm Infrastructure (**Appendix 10.3: Displacement Assessment Technical Report (Volume IV)**).
18. For collision mortality, the NEEOG Interim CEF source files consider the totals both with and without incorporation of the corrections for 'as-built' designs from MacArthur Green (2017), and with and without updates according to changes in the recommended model avoidance rates (noting that updates were applied only where the avoidance rates on which the original estimates were based could be established). The collision mortality totals used excluded the 'as-built' corrections but included the revised avoidance rates.
19. For kittiwake and gannet, the displacement and collision mortality totals were summed to obtain the potential combined displacement and collision mortality for each SPA population due the other plans and projects.
20. Details of the NEEOG Interim CEF project are provided in **Annex B** of this appendix, including copies of the source files (as updated in April 2025), as well as the final displacement, collision and combined displacement and collision mortality totals for each SPA population, as used to determine the potential mortality due to the Bellrock Wind Farm Infrastructure in-combination with other plans and projects.

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<sup>3</sup> As agreed by NatureScot in email from NatureScot to the Applicant on 27 January 2025.

21. In accordance with NatureScot's advice<sup>4</sup>, the following modifications were made to the plans and projects included in the in-combination totals:
- The predicted mortalities from the other plans and projects were calculated with both the mortality from the Berwick Bank Wind Farm included and excluded.
  - The predicted mortalities from the Green Volt wind farm on SPA populations for which an Adverse Effect on Integrity could not be excluded as a result of Green Volt and for which compensation is required as a condition of the Green Volt Section 36 consent were omitted from all in-combination totals. Based on Marine Directorate (2024), this resulted in their omission from the in-combination totals for:
    - Kittiwake at the Fowlsheugh SPA, Buchan Ness to Collieston Coast SPA, Troup, Pennan and Lion's Heads SPA and the East Caithness Cliffs SPA;
    - Razorbill at the East Caithness Cliffs SPA;
    - Puffin at the Forth Islands SPA; and
    - Gannet at the Forth Islands SPA.
22. **Table 2.5 to Table 2.7** below detail the annual in-combination mortality for the breeding adult and the subadult age classes of each SPA population, together with the associated percentage point change to the annual adult mortality rate. This is presented for displacement (**Table 2.5**), collisions (**Table 2.6**) and displacement plus collisions (**Table 2.7**), with the mortality in each case calculated with and without inclusion of the Berwick Bank Wind Farm. For each of the four species, detailed breakdowns of the different mortalities resulting from the Bellrock Wind Farm Infrastructure in-combination with other plans and projects are presented in **Table C 1 to Table C 4** in **AnnexC** of this appendix.

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<sup>4</sup> Email from NatureScot to the Applicant on 27 January 2025.

**Table 2.5: Displacement Mortality for the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects, with the Associated Percentage Point Change in Breeding Adult Mortality for Special Protection Area Populations**

Species	Special Protection Area	Number of Breeding Adults	In-combination Scenario	Apportioned Annual Displacement Mortality				Percentage Point Increase in Breeding Adult Mortality <sup>2</sup>	
				Lower		Upper		Displacement Lower	Displacement Upper
				Adults	Subadults	Adults	Subadults		
Kittiwake	Fowlsheugh SPA <sup>1</sup>	28,078	Excluding Berwick Bank	20.00	5.13	60.00	15.39	0.0712	0.2137
			All projects	30.69	6.07	92.07	18.21	0.1093	0.3279
	Buchan Ness to Collieston Coast SPA <sup>1</sup>	27,094	Excluding Berwick Bank	19.66	6.82	48.58	20.46	0.0726	0.1793
			All projects	21.91	7.61	55.33	22.84	0.0809	0.2042
	Flamborough & Filey Coast SPA	89,148	Excluding Berwick Bank	28.47	14.18	85.41	42.55	0.0319	0.0958
			All projects	33.32	16.56	99.95	49.68	0.0374	0.1121
	Troup, Pennan & Lion's Heads SPA <sup>1</sup>	21,232	Excluding Berwick Bank	21.64	7.14	55.31	21.43	0.1019	0.2605
			All projects	23.78	8.08	61.76	24.25	0.1120	0.2909
	East Caithness Cliffs SPA <sup>1</sup>	36,600	Excluding Berwick Bank	68.82	20.15	198.86	60.45	0.1880	0.5433
			All projects	74.02	22.71	214.46	68.12	0.2023	0.5860
	St Abb's Head to Fast Castle SPA	11,992	Excluding Berwick Bank	6.66	1.65	19.97	4.94	0.0555	0.1665
			All projects	35.99	2.86	107.97	8.59	0.3001	0.9004
	Farne Islands SPA	5,790	Excluding Berwick Bank	3.63	1.47	10.89	4.40	0.0627	0.1881
			All projects	6.57	1.78	19.71	5.35	0.1134	0.3404
Forth Islands SPA	13,114	Excluding Berwick Bank	9.45	1.76	26.36	5.29	0.0721	0.2010	

Species	Special Protection Area	Number of Breeding Adults	In-combination Scenario	Apportioned Annual Displacement Mortality				Percentage Point Increase in Breeding Adult Mortality <sup>2</sup>		
				Lower		Upper		Displacement Lower	Displacement Upper	
				Adults	Subadults	Adults	Subadults			
			All projects	13.00	2.06	37.00	6.17	0.0991	0.2821	
			North Caithness Cliffs SPA	18,058	Excluding Berwick Bank	11.86	4.63	30.37	13.88	0.0657
				All projects	13.15	5.27	34.25	15.81	0.0728	0.1897
	Copinsay SPA	1,910	Excluding Berwick Bank	0.54	0.28	1.62	0.84	0.0283	0.0849	
			All projects	0.63	0.32	1.88	0.97	0.0327	0.0982	
	Fair Isle SPA	896	Excluding Berwick Bank	0.58	0.30	1.73	0.89	0.0642	0.1927	
			All projects	0.67	0.34	2.02	1.03	0.0752	0.2256	
	Hoy SPA	532	Excluding Berwick Bank	0.34	0.19	1.01	0.58	0.0632	0.1897	
			All projects	0.39	0.22	1.16	0.65	0.0727	0.2182	
	West Westray SPA	5,510	Excluding Berwick Bank	8.99	4.57	26.95	13.71	0.1631	0.4892	
			All projects	10.52	5.33	31.56	16.00	0.1910	0.5729	
	Razorbill	Fowlsheugh SPA	18,844	Excluding Berwick Bank	74.41	58.43	138.21	105.89	0.3949	0.7334
				All projects	87.16	68.24	161.12	123.31	0.4625	0.8550
		Forth Islands SPA	8,379	Excluding Berwick Bank	41.45	34.75	79.96	64.26	0.4947	0.9543
All projects				52.08	44.25	98.91	80.90	0.6216	1.1805	
Troup, Pennan & Lion's Heads SPA		6,054	Excluding Berwick Bank	10.74	6.23	24.58	14.60	0.1773	0.4060	
			All projects	12.15	7.23	27.76	16.80	0.2008	0.4586	

Species	Special Protection Area	Number of Breeding Adults	In-combination Scenario	Apportioned Annual Displacement Mortality				Percentage Point Increase in Breeding Adult Mortality <sup>2</sup>		
				Lower		Upper		Displacement Lower	Displacement Upper	
				Adults	Subadults	Adults	Subadults			
	East Caithness Cliffs SPA <sup>1</sup>	40,373	Excluding Berwick Bank	133.48	95.83	274.20	189.87	0.3306	0.6792	
			All projects	138.80	99.39	288.97	199.63	0.3438	0.7158	
	North Caithness Cliffs SPA	4,796	Excluding Berwick Bank	9.53	5.93	21.79	13.99	0.1988	0.4542	
			All projects	10.11	6.32	23.51	15.16	0.2107	0.4901	
	Flamborough & Filey Coast SPA	61,345	Excluding Berwick Bank	189.79	18.12	357.74	54.33	0.3094	0.5832	
			All projects	193.33	20.41	368.36	61.21	0.3152	0.6005	
	Mingulay & Berneray SPA	26,787	Excluding Berwick Bank	2.76	1.77	8.28	5.32	0.0103	0.0309	
			All projects	2.90	1.93	8.71	5.78	0.0108	0.0325	
	Rathlin Island SPA	29,803	Excluding Berwick Bank	2.47	1.40	7.43	4.21	0.0083	0.0249	
			All projects	2.64	1.59	7.91	4.78	0.0088	0.0265	
	Puffin	Farne Islands SPA	100,206	Excluding Berwick Bank	30.40	23.73	47.86	39.54	0.0303	0.0478
				All projects	43.24	41.07	69.26	68.44	0.0432	0.0691
		Forth Islands SPA <sup>1</sup>	117,960	Excluding Berwick Bank	162.54	170.48	264.10	284.12	0.1378	0.2239
				All projects	180.66	191.84	294.30	319.72	0.1532	0.2495
North Caithness Cliffs SPA		6,078	Excluding Berwick Bank	33.18	32.15	54.11	53.58	0.5460	0.8902	
			All projects	33.24	32.21	54.21	53.68	0.5470	0.8918	
Coquet Island SPA	50,058	Excluding Berwick Bank	12.66	3.30	19.90	5.49	0.0253	0.0398		

Species	Special Protection Area	Number of Breeding Adults	In-combination Scenario	Apportioned Annual Displacement Mortality				Percentage Point Increase in Breeding Adult Mortality <sup>2</sup>	
				Lower		Upper		Displacement Lower	Displacement Upper
				Adults	Subadults	Adults	Subadults		
			All projects	16.26	8.16	25.90	13.59	0.0325	0.0517
Gannet	Fair Isle SPA	11,184	Excluding Berwick Bank	3.27	2.51	9.80	7.52	0.0292	0.0876
			All projects	3.49	2.61	10.46	7.82	0.0312	0.0936
	Forth Islands SPA <sup>1</sup>	103,688	Excluding Berwick Bank	117.34	51.59	352.01	154.76	0.1132	0.3395
			All projects	150.04	54.58	450.08	163.74	0.1447	0.4341
	Hermaness, Saxa Vord & Valla Field SPA	39,606	Excluding Berwick Bank	21.06	16.88	63.19	50.63	0.0532	0.1595
			All projects	22.13	17.59	66.38	52.75	0.0559	0.1676
	North Rona & Sula Sgeir SPA	18,990	Excluding Berwick Bank	1.65	1.18	4.96	3.55	0.0087	0.0261
			All projects	1.82	1.24	5.45	3.71	0.0096	0.0287
	Noss SPA	24,670	Excluding Berwick Bank	10.00	7.88	30.00	23.63	0.0405	0.1216
			All projects	10.50	8.20	31.50	24.61	0.0426	0.1277
	St Kilda SPA	118,410	Excluding Berwick Bank	0.69	0.21	2.06	0.64	0.0006	0.0017
			All projects	0.69	0.21	2.06	0.64	0.0006	0.0017
	Sule Skerry & Sule Stack SPA	15,648	Excluding Berwick Bank	4.87	3.71	14.60	11.14	0.0311	0.0933
			All projects	5.00	3.74	15.00	11.23	0.0320	0.0959
	Flamborough & Filey Coast SPA	31,588	Excluding Berwick Bank	79.77	7.72	239.29	23.15	0.2525	0.7575
			All projects	80.39	7.90	241.15	23.69	0.2545	0.7634

Species	Special Protection Area	Number of Breeding Adults	In-combination Scenario	Apportioned Annual Displacement Mortality				Percentage Point Increase in Breeding Adult Mortality <sup>2</sup>	
				Lower		Upper		Displacement Lower	Displacement Upper
				Adults	Subadults	Adults	Subadults		
Notes:									
<sup>1</sup> In-combination totals exclude the predicted mortality due to the Green Volt wind farm, in accordance with NatureScot advice (email from NatureScot to the Applicant on 27 January 2025).									
<sup>2</sup> Text in red indicates a percentage point change of at least 0.02.									

**Table 2.6: Collision Mortality for the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects, with Associated Percentage Point Change in Breeding Adult Mortality for Special Protection Area Populations**

Species	Special Protection Area	Number of Breeding Adults	In-combination Scenarios	Apportioned Annual Collision Mortality		Percentage Point Increase in Breeding Adult Mortality <sup>2</sup>
				Adults	Subadults	
Kittiwake	Fowlsheugh SPA <sup>1</sup>	28,078	Excluding Berwick Bank	89.11	25.70	0.3174
			All projects	160.65	30.14	0.5721
	Buchan Ness to Collieston Coast SPA <sup>1</sup>	27,094	Excluding Berwick Bank	67.26	32.00	0.2482
			All projects	77.61	34.99	0.2864
	Flamborough & Filey Coast SPA	89,148	Excluding Berwick Bank	496.58	47.26	0.5570
			All projects	513.82	55.79	0.5764
	Troup, Pennan & Lion's Heads SPA <sup>1</sup>	21,232	Excluding Berwick Bank	58.82	31.21	0.2770
			All projects	67.46	34.66	0.3177
East Caithness Cliffs SPA <sup>1</sup>	36,600	Excluding Berwick Bank	188.49	75.38	0.5150	

Species	Special Protection Area	Number of Breeding Adults	In-combination Scenarios	Apportioned Annual Collision Mortality		Percentage Point Increase in Breeding Adult Mortality <sup>2</sup>
				Adults	Subadults	
			All projects	206.98	84.54	0.5655
			Excluding Berwick Bank	21.66	5.93	0.1807
	St Abb's Head to Fast Castle SPA	11,992	All projects	227.48	13.68	1.8969
			Excluding Berwick Bank	14.96	5.07	0.2583
	Farne Islands SPA	5,790	All projects	34.10	6.43	0.5890
			Excluding Berwick Bank	25.16	7.03	0.1919
	Forth Islands SPA	13,114	All projects	48.88	8.53	0.3727
			Excluding Berwick Bank	37.00	18.01	0.2049
	North Caithness Cliffs SPA	18,058	All projects	41.56	20.31	0.2301
			Excluding Berwick Bank	1.85	0.99	0.0967
	Copinsay SPA	1,910	All projects	2.15	1.14	0.1124
			Excluding Berwick Bank	2.01	1.02	0.2241
	Fair Isle SPA	896	All projects	2.35	1.20	0.2627
			Excluding Berwick Bank	1.24	0.74	0.2330
	Hoy SPA	532	All projects	1.42	0.83	0.2665
			Excluding Berwick Bank	31.06	15.72	0.5637
	West Westray SPA	5,510	Excluding Berwick Bank			

Species	Special Protection Area	Number of Breeding Adults	In-combination Scenarios	Apportioned Annual Collision Mortality		Percentage Point Increase in Breeding Adult Mortality <sup>2</sup>
				Adults	Subadults	
			All projects	36.47	18.46	0.6618
Gannet	Fair Isle SPA	11,184	Excluding Berwick Bank	3.36	1.79	0.0301
			All projects	3.63	1.82	0.0324
	Forth Islands SPA	103,688	Excluding Berwick Bank	416.70	43.44	0.4019
			All projects	524.68	45.59	0.5060
	Hermaness, Saxa Vord & Valla Field SPA	39,606	Excluding Berwick Bank	15.71	10.79	0.0397
			All projects	16.61	11.05	0.0419 <sup>2</sup>
	North Rona & Sula Sgeir SPA	18,990	Excluding Berwick Bank	1.86	0.91	0.0098
			All projects	1.89	0.93	0.0099
	Noss SPA	24,670	Excluding Berwick Bank	8.46	5.17	0.0343
			All projects	9.05	5.29	0.0367
	St Kilda SPA	118,410	Excluding Berwick Bank	2.41	0.41	0.0020
			All projects	2.41	0.41	0.0020
	Sule Skerry & Sule Stack SPA	15,648	Excluding Berwick Bank	20.03	16.97	0.1280
			All projects	20.41	16.98	0.1304
Flamborough & Filey Coast SPA	31,588	Excluding Berwick Bank	159.98	4.66	0.5064	

Species	Special Protection Area	Number of Breeding Adults	In-combination Scenarios	Apportioned Annual Collision Mortality		Percentage Point Increase in Breeding Adult Mortality <sup>2</sup>
				Adults	Subadults	
			All projects	161.51	4.73	0.5113

Notes:

<sup>1</sup> In-combination totals exclude the predicted mortality due to the Green Volt wind farm, in accordance with NatureScot advice (email from NatureScot to the Applicant on 27 January 2025).

<sup>2</sup> Text in red indicates a percentage point change of at least 0.02.

**Table 2.7: Combined Displacement and Collision Mortality for the Bellrock Wind Infrastructure In-combination with Other Plans and Projects, with the Associated Percentage Point Change in Breeding Adult Mortality for Special Protection Area Populations**

Species	Special Protection Area	Number of Breeding Adults	In-combination Scenario	Apportioned Annual Mortality				Percentage Point Increase in Breeding Adult Mortality <sup>1</sup>	
				Lower		Upper		Displacement Lower and Collision	Displacement Upper and Collision
				Adults	Subadults	Adults	Subadults		
Kittiwake	Fowlsheugh SPA	28,078	Excluding Berwick Bank	109.11	30.83	149.11	41.09	0.3886	0.5311
			All projects	191.33	36.21	252.72	48.35	0.6814	0.9001
	Buchan Ness to Collieston Coast SPA	27,094	Excluding Berwick Bank	86.91	38.82	115.83	52.46	0.3208	0.4275
			All projects	99.51	42.60	132.93	57.83	0.3673	0.4906
	Flamborough & Filey Coast SPA	89,148	Excluding Berwick Bank	525.05	61.45	581.99	89.81	0.5890	0.6528
			All projects	547.13	72.35	613.77	105.47	0.6137	0.6885
	Troup, Pennan & Lion's Heads SPA	21,232	Excluding Berwick Bank	80.45	38.36	114.13	52.64	0.3789	0.5375
			All projects	91.25	42.75	129.22	58.92	0.4298	0.6086
	East Caithness Cliffs SPA	36,600	Excluding Berwick Bank	257.31	95.53	387.35	135.83	0.7030	1.0583
			All projects	281.01	107.24	421.45	152.65	0.7678	1.1515
	St Abb's Head to Fast Castle SPA	11,992	Excluding Berwick Bank	28.32	7.58	41.64	10.87	0.2362	0.3472
			All projects	263.47	16.55	335.45	22.27	2.1971	2.7973
	Farne Islands SPA	5,790	Excluding Berwick Bank	18.59	6.54	25.85	9.47	0.3210	0.4464

Species	Special Protection Area	Number of Breeding Adults	In-combination Scenario	Apportioned Annual Mortality				Percentage Point Increase in Breeding Adult Mortality <sup>1</sup>		
				Lower		Upper		Displacement Lower and Collision	Displacement Upper and Collision	
				Adults	Subadults	Adults	Subadults			
	Forth Islands SPA	13,114	All projects	40.67	8.22	53.81	11.79	0.7024	0.9293	
			Excluding Berwick Bank	34.62	8.79	51.53	12.32	0.2640	0.3929	
	North Caithness Cliffs SPA	18,058	All projects	61.88	10.59	85.88	14.71	0.4719	0.6549	
			Excluding Berwick Bank	48.86	22.64	67.37	31.89	0.2706	0.3731	
	Copinsay SPA	1,910	All projects	54.71	25.58	75.80	36.12	0.3029	0.4198	
			Excluding Berwick Bank	2.39	1.27	3.47	1.84	0.1250	0.1816	
	Fair Isle SPA	896	All projects	2.77	1.47	4.02	2.11	0.1451	0.2106	
			Excluding Berwick Bank	2.58	1.32	3.73	1.91	0.2883	0.4167	
	Hoy SPA	532	All projects	3.03	1.54	4.37	2.23	0.3379	0.4882	
			Excluding Berwick Bank	1.58	0.93	2.25	1.31	0.2962	0.4227	
	West Westray SPA	5,510	All projects	1.80	1.04	2.58	1.48	0.3392	0.4847	
			Excluding Berwick Bank	40.04	20.29	58.01	29.44	0.7267	1.0529	
	Gannet	Fair Isle SPA	11,184	All projects	46.99	23.79	68.03	34.46	0.8528	1.2347
				Excluding Berwick Bank	6.63	4.29	13.16	9.31	0.0593	0.1177
	Forth Islands SPA	103,688	Excluding Berwick Bank	534.05	95.03	768.71	198.19	0.5151	0.7414	

Species	Special Protection Area	Number of Breeding Adults	In-combination Scenario	Apportioned Annual Mortality				Percentage Point Increase in Breeding Adult Mortality <sup>1</sup>	
				Lower		Upper		Displacement Lower and Collision	Displacement Upper and Collision
				Adults	Subadults	Adults	Subadults		
			All projects	674.72	100.18	974.76	209.33	0.6507	0.9401
	Hermaness, Saxa Vord & Valla Field SPA	39,606	Excluding Berwick Bank	36.77	27.67	78.89	61.42	0.0928	0.1992
			All projects	38.74	28.64	82.99	63.80	0.0978	0.2095
	North Rona & Sula Sgeir SPA	18,990	Excluding Berwick Bank	3.52	2.10	6.82	4.47	0.0185	0.0359
			All projects	3.70	2.17	7.34	4.64	0.0195	0.0386
	Noss SPA	24,670	Excluding Berwick Bank	18.46	13.05	38.46	28.81	0.0748	0.1559
			All projects	19.55	13.50	40.54	29.90	0.0792	0.1643
	St Kilda SPA	118,410	Excluding Berwick Bank	3.10	0.63	4.47	1.05	0.0026	0.0038
			All projects	3.10	0.63	4.47	1.05	0.0026	0.0038
	Sule Skerry & Sule Stack SPA	15,648	Excluding Berwick Bank	24.90	20.68	34.63	28.11	0.1591	0.2213
			All projects	25.41	20.72	35.41	28.21	0.1624	0.2263
	Flamborough & Filey Coast SPA	31,588	Excluding Berwick Bank	239.74	12.38	399.27	27.81	0.7590	1.2640
			All projects	241.90	12.62	402.66	28.42	0.7658	1.2747

Notes:  
<sup>1</sup> Text in red indicates a percentage point change of at least 0.02.

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## 2.1.3 Population Viability Analysis for Special Protection Area Populations

### 2.1.3.1 Modelling Approach

23. Investigation of potential population-level impacts using PVA was undertaken in cases where the percentage point increase in the baseline annual mortality rate of breeding adults due to the predicted wind farm effects exceeded 0.02 (NatureScot, 2023a). This was in relation to the effects resulting from the Bellrock Wind Farm Infrastructure-alone and the Bellrock Wind Farm Infrastructure in-combination with other plans and projects (and as determined in **Table 2.2** to **Table 2.7**).
24. In accordance with NatureScot guidance, PVAs were undertaken using the Natural England nepva R package, as accessed via the web based Shiny tool, version 2 (Searle et al. 2019, NatureScot, 2023a). The PVAs were based on stochastic, density independent, matrix population models using demographic rates derived from Horswill and Robinson (2015)<sup>5</sup>, details of which are provided in **Section 2.1.3.2** below. Starting population sizes for each SPA population were as identified in **Table 2.1**, with the population trends under baseline conditions (i.e. no wind farm effects) compared with those which incorporated the additional mortality from the wind farm effects, noting that a key (but nonetheless biologically implausible) assumption of density independent PVAs is that there is no mechanisms for population regulation (i.e. density dependence). Thus, all mortality from the wind farm effects is treated as additional to baseline mortality.
25. The PVAs were run over two projection periods, i.e.:
  - 35 years, incorporating the Wind Farm Infrastructure's effects for its operational life; and
  - 50 years, incorporating Wind Farm Infrastructure's effects for the first 35 years, followed by a 15-year recovery period without any Wind Farm Infrastructure effects.
26. This is on the basis that the operational life of the Bellrock Wind Farm Infrastructure will be 35 years, and follows the advice provided by NatureScot on the projection periods to model<sup>6</sup>. The PVAs also included a five-year 'burn-in' period to allow the age distributions to stabilise prior to the start of each projection period and the incorporation of the additional mortality from the wind farm effects.
27. The specifications used for all PVAs undertaken on SPA populations in relation to the set up and options within nepva Shiny tool are detailed in **Table 2.8**, whilst copies of the input files produced in the runs of the tool are provided in **Annex D** of this appendix.

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<sup>5</sup> Confirmation that the PVAs should use demographic rates from Horswill and Robinson (2015) was provided in email from NatureScot to the Applicant on 9 September 2024. Please see Section 10.3 in **Chapter 10: Offshore Ornithology (Volume II)**.

<sup>6</sup> Email from NatureScot to the Applicant on 23 May 2025. Please see Section 10.3 in **Chapter 10: Offshore Ornithology (Volume II)**.

**Table 2.8: Set up and Approach Used for All Population Viability Analysis Undertaken on Special Protection Area Populations**

Model Set Up and Options	Parameter Used
Type	Simulation
Model to use for environmental stochasticity	Beta/gamma
Model for density dependence	No density dependence
Include demographic stochasticity?	Yes
Number of simulations	5,000
Random seed	10
Years for burn-in	5
Case studies	None

### 2.1.3.2 Demographic Rates

28. The species-specific demographic rates used in the PVAs were extracted from Horswill and Robinson (2015)<sup>5</sup>. These were estimates of the age of first breeding, annual breeding productivity and age specific annual survival rates for each species. Within the nepva tool, the annual survival rates need to be entered as separate values for each year class amongst the subadult component of the population, with a single value then used to represent the annual survival rates amongst the adult age class. In addition, an upper constraint on breeding productivity (i.e. a maximum brood size) can be specified, for which the species' default values in the nepva tool were used.
29. For each species, a single estimate (taken to be representative of the national average) was available for age of first breeding and for the age-specific annual survival rates (although in some cases only composite survival rates across different year classes were available, whilst in others it the breeding adult survival rate provided a surrogate value for survival rates amongst older subadults – see **Table 2.9** to **Table 2.12** for details). However, for breeding productivity, estimates were available as regional-specific and national average values for kittiwake, razorbill and gannet, and as colony-specific and national average values for puffin. The PVAs generally used the breeding productivity estimates that were considered most appropriate for each SPA population according to the location of the SPA relative to the different regions (or colonies for puffin) for which the estimates were available. The demographic rates used for each species are presented in **Table 2.9** to **Table 2.12**.

**Table 2.9: Demographic Rates Used in Population Viability Analysis for Kittiwake Special Protection Area Populations**

SPA Population	Maximum Brood Size	Age of First Breeding (Years)	Survival Rates for Subadult Year Classes and Adults (SD <sup>1</sup> ) <sup>2</sup>					Number of Chicks Fledged per Pair	
			0 – 1	1 - 2	2 - 3	3 - 4	Adult	Source <sup>3</sup>	Estimate (SD <sup>1</sup> )
All except Fair Isle	2	4	0.790	0.854	0.854	0.854	0.854	East region	0.819 (0.332)
Fair Isle			(0.047)	(0.051)	(0.051)	(0.051)	(0.051)	National average	0.690 (0.296)

Notes:

<sup>1</sup> SD = standard deviation.

<sup>2</sup> The adult survival rate estimate was applied to the 1 - 2 year age class, in lieu of a value being provided by Horswill and Robinson (2015). Also, Horswill and Robinson (2015) give no SD for the 0 – 1 year survival rate, so a value of 0.047 is assumed (on the basis that this is equivalent to the SDs for the other annual survival rates when expressed as a proportion of the mean estimate).

<sup>3</sup> All SPAs occur within the East region (as defined in Horswill and Robinson, 2015), except Fair Isle. For Fair Isle, the national average estimate is used instead of the Shetland estimate because the population was predicted to decline to extinction during the 'burn-in' period when using the Shetland estimate.

**Table 2.10: Demographic Rates Used in Population Viability Areas for Razorbill Special Protection Area Populations**

SPA Population	Maximum Brood Size	Age of First Breeding (Years)	Survival Rates for Subadult Year Classes and Adults (SD <sup>1</sup> ) <sup>2</sup>						Number of Chicks Fledged per Pair	
			0 – 1	1 - 2	2 - 3	3 - 4	4 - 5	Adult	Source	Estimate (SD <sup>1</sup> )
All	1	5	0.794 (0.134)	0.794 (0.134)	0.895 (0.067)	0.895 (0.067)	0.895 (0.067)	0.895 (0.067)	Mid region	0.643 (0.057)

Notes:

<sup>1</sup> SD = standard deviation.

<sup>2</sup> Values for the 0 – 1 and 1 – 2 year classes are derived from a composite value of 0.630 across both age classes by taking the square root. The associated SD is the value calculated as an approximate SD for this derived survival rate by DMP Stats and HiDef (2022).

**Table 2.11: Demographic Rates Used in Population Viability Areas for Puffin Special Protection Area Populations**

SPA Population	Maximum Brood Size	Age of First Breeding (Years)	Survival Rates for Subadult Year Classes and Adults (SD <sup>1</sup> ) <sup>2</sup>						Number of Chicks Fledged per Pair	
			0 – 1	1 - 2	2 - 3	3 - 4	4 - 5	Adult	Source	Estimate (SD <sup>1</sup> )
Forth Islands	1	5	0.892 (0.046)	0.892 (0.046)	0.892 (0.046)	0.760 (0.093)	0.805 (0.083)	0.906 (0.083)	Isle of May	0.642 (0.135)
Farne Islands									Farne Islands	0.415 (0.219)
Coquet Island										
North Caithness Cliffs									National average	0.617 (0.151)

Notes:

<sup>1</sup> SD = standard deviation.

<sup>2</sup> Values for the 0 – 1, 1 – 2 and 2 – 3 year classes are derived from a composite value of 0.709 across both age classes by taking the cube root. The associated SD is the value calculated as an approximate SD for this derived survival rate by DMP Stats and HiDef (2022). For year classes 3 – 4 and 4 – 5, Horswill and Robinson (2015) only give the standard error associated with the mean survival rates, so the SD values derived by DMP Stats and HiDef (2022) are also used here.

**Table 2.12: Demographic Rates Used in Population Viability Analysis for Gannet Special Protection Area Populations**

SPA Population	Maximum Brood Size	Age of First Breeding (Years)	Survival Rates for Subadult Year Classes and Adults (SD <sup>1</sup> ) <sup>2</sup>						Number of Chicks Fledged per Pair	
			0 – 1	1 - 2	2 - 3	3 - 4	4 - 5	Adult	Source	Estimate (SD <sup>1</sup> )
All except North Rona and Sula Sgeir	1	5	0.424	0.829	0.891	0.895	0.919	0.919	East region	0.698 (0.071)
North Rona and Sula Sgeir			(0.014)	(0.008)	(0.006)	(0.006)	(0.042)	(0.042)		

Notes:

<sup>1</sup> SD = standard deviation.

<sup>2</sup> The adult survival rate estimate was applied to the 4 – 5 year age class, in lieu of a value being provided by Horswill and Robinson (2015). For year classes 0 – 1, 1 – 2, 2 – 3 and 3 - 4, Horswill and Robinson (2015) only give the standard error associated with the mean survival rates, so these have been doubled to approximate the SD values.

### 2.1.3.3 Impacts

30. The impacts specified in the PVAs equate to the potential mortality from the Wind Farm Infrastructure -related effects (i.e. the predicted mortality from either displacement, collisions or displacement plus collisions, with these including both the lower and upper levels of displacement mortality).
31. For the Bellrock Wind Farm Infrastructure -alone, the predicted mortality from the Wind Farm Infrastructure -related effects produced an increase of greater than 0.02 percentage points in the annual mortality rate of breeding adults only in the case of the Fowlsheugh SPA razorbill population (**Table 2.2 to Table 2.4**). For the Fowlsheugh SPA razorbill population, this threshold was exceeded for both the lower and upper levels of the predicted displacement mortality. Thus, in relation to the effects of the Bellrock Wind Farm Infrastructure -alone, PVAs were limited to this SPA population.
32. For the Bellrock Wind Farm Infrastructure in-combination with other plans and projects, the predicted mortality from the Wind Farm Infrastructure -related effects produced an increase of greater than 0.02 percentage points in the annual mortality rate of breeding adults for the vast majority of SPA populations, mortality sources and in-combination scenarios (i.e. with or without the Berwick Bank Wind Farm) (**Table 2.5 to Table 2.7**). The exceptions in this regard are:
  - Mingulay and Berneray SPA: razorbill – lower (but not upper) level of displacement mortality (both with and without the Berwick Bank Wind Farm);
  - Rathlin SPA: razorbill - lower (but not upper) level of displacement mortality (both with and without the Berwick Bank Wind Farm);
  - North Rona and Sula Sgeir SPA: gannet – lower (but not upper) level of displacement mortality, collisions and lower level of displacement mortality plus collisions (both with and without the Berwick Bank Wind Farm); and
  - St Kilda SPA: gannet – all mortality sources, irrespective of whether based on lower or upper levels of displacement mortality and irrespective of inclusion (or not) of the Berwick Bank Wind Farm.
33. Thus, in relation to the effects of the Bellrock Wind Farm Infrastructure in-combination with other plans and projects, PVAs were undertaken on a total of 32 SPA populations (comprising 13 kittiwake, eight razorbill, four puffin and seven gannet populations). For most of these SPA populations it was necessary to consider both the lower and upper levels of the predicted displacement mortality which, for kittiwake and gannet, was also the case for the predicted displacement plus collision mortality. In addition, in-combination scenarios were required to include and exclude the Berwick Bank Wind Farm. This resulted in a total of 238 different impact scenarios being considered for the Bellrock Wind Farm Infrastructure in-combination with other plans and projects, each of which were modelled over both the 35 and 50-year projection periods.
34. In accordance with NatureScot guidance (NatureScot, 2023a), impacts within the PVAs were applied to all age classes. Therefore, the additional mortality from the Wind Farm Infrastructure -related effects attributed to subadults as well as to the breeding adults was included within the PVAs. Impacts were also specified as being relative, meaning that their magnitude varied in proportion to the size of the modelled population throughout the projection period. This required

the additional mortality from the Wind Farm Infrastructure related effects to be expressed as a proportion of the population size. For the breeding adults, this was obtained by dividing the predicted mortality of breeding adults by the estimated size of the breeding adult population at the start of the projection (with these values given for each SPA population in **Table 2.2** to **Table 2.7**). The number of subadults in the SPA population was estimated using the stable age distribution from the associated population model (i.e. with no impacts specified), with the number of breeding adults being multiplied by the ratio of the adult to subadult proportions. The additional mortality of subadults (as given in **Table 2.2** to **Table 2.7**) was then expressed as a proportion of the subadult population size to provide the relative impact for this age class. The stable age distributions derived for each of the SPA populations are presented in **Table 2.13**, whilst the relative impact values for the breeding adult and the subadult age classes used in each PVA are given in **Table E 1 of Annex E** of this appendix.

**Table 2.13: Estimated Proportions of the Adult and the Subadult Components of Special Protection Area Populations of Four Seabird Species as Derived from the Stable Age Distributions of the Population Models**

Species	SPA Populations <sup>1</sup>	Age Class Proportions	
		Adults	Subadults
Kittiwake	All SPA populations except Fair Isle	0.4562	0.5438
	Fair Isle SPA	0.4930	0.5070
Razorbill	All SPA populations	0.4814	0.5186
Puffin	Forth Islands SPA	0.4541	0.5459
	Farne Islands SPA and Coquet Island SPA	0.5492	0.4508
	North Caithness Cliffs SPA	0.4626	0.5374
Gannet	All SPA populations except North Rona and Sula Sgeir	0.5496	0.4504
	North Rona and Sula Sgeir SPA	0.5457	0.4541
Notes: <sup>1</sup> Age distributions were determined for all 31 SPA populations on which PVAs undertaken (see Section <b>2.1.3.3</b> and <b>Table 2.2</b> to <b>Table 2.7</b> ). Variation in the age distributions of SPA populations of the same species results from the use of different breeding productivity estimates in some of the population models (see <b>Table 2.9</b> to <b>Table 2.12</b> ).			

## 2.2 Regional Populations

### 2.2.1 Reference Population Sizes

35. For the purposes of the EIA, reference populations against which the Wind Farm Infrastructure - related effects can be assessed must be defined. For the five seabird species identified in **Table 1.1**, this was undertaken following the approach used by the Salamander Offshore Wind Farm and West of Orkney Windfarm submissions, which is in accordance with NatureScot advice as presented in the West of Orkney Windfarm additional information (MacArthur Green, 2024). This approach involved the following steps to determine the size of the regional breeding population:
- Identify all breeding colonies within breeding season foraging range of the Bellrock WFDA;
  - Estimate the number of breeding adults in the regional breeding population on the basis of the most recently available counts at these colonies; and
  - Estimate the number of subadult birds in the regional breeding population using an analogous approach to that undertaken for SPA populations, as described in **Section 2.1.3.3**.
36. For kittiwake, razorbill, puffin and gannet, the breeding colonies considered to be within breeding season foraging range of the Bellrock WFDA are as identified in **Section 2.1** (for SPA colonies) and **Annex A** (for non-SPA colonies) of **Appendix 10.5: Offshore Ornithology Apportioning Technical Report (Volume IV)**, As stated in **Section 2.1.1**, no connectivity was identified between the Bellrock WFDA and breeding guillemot SPA populations, because all guillemot breeding colonies are beyond the mean maximum plus one SD breeding season foraging range of the Bellrock WFDA (**Bellrock WFDA HRA Screening Report (Shadow Habitats Regulations Appraisal, Part 1: Annex A, Volume VI**; Woodward et al. 2019; NatureScot, 2023c). However, for the purposes of defining the regional guillemot population to be addressed in the **Chapter 10: Offshore Ornithology (Volume II)**, NatureScot advised that the maximum breeding season foraging range of 338 km should be used (Woodward et al. 2019)<sup>7</sup>.
37. To derive the number of breeding adults in the regional populations of kittiwake, razorbill, puffin and gannet, the population size estimates in **Table 2.1** for those SPA populations within breeding season foraging range were used (noting that some of the SPA populations in **Table 2.1** are beyond breeding season foraging range, having connectivity to the Bellrock WFDA in the non-breeding periods only). These estimates were augmented with the population size estimates from the non-SPA colonies within breeding season foraging range, which were sourced from either the Seabirds Count data or, if available, more recent counts held on the SMP database (Burnell et al. 2023; JNCC 2025; BTO 2025).

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<sup>7</sup> Email from NatureScot to the Applicant on 8 October 2024. Please see Section 10.3 in **Chapter 10: Offshore Ornithology (Volume II)**.

38. For guillemot, the breeding colonies within the maximum breeding season foraging range of the Bellrock WFDA were identified (on the basis of the by-sea distances, as calculated using Geographical Information System). The number of adults estimated to be breeding at each of these colonies was obtained from either the Seabirds Count data or, if available, more recent counts held on the SMP database, with the estimated number of individuals in attendance at the colony multiplied by the 1.49 correction factor (Burnell et al. 2023).
39. The number of breeding adults estimated to be in the regional populations of each of these five species is presented in **Table 2.14** (with estimates for each of the contributory colonies provided in **Annex F** of this appendix).
40. As for SPA populations, the number of subadults in each regional population was estimated by multiplying the number of breeding adults by the ratio of the adult to subadult proportions as derived from the stable age distributions of population models. For kittiwake, razorbill, puffin and gannet, the stable age distributions were derived from population models which used the same demographic rates as for the SPA populations (see **Table 2.9** to **Table 2.12**). The kittiwake and gannet models relied on the breeding productivity estimates for the respective East regions, whilst the estimates used for razorbill and puffin were for the Mid region and national average, respectively (with these regions as defined for each species in Horswill and Robinson, 2015). For kittiwake, gannet and razorbill this was on the basis that the majority of the birds in the regional populations derived from colonies in these regions, whilst for puffin the national average value was considered most appropriate because it was intermediate between the Isle of May and Farne Islands colony-specific estimates. Consequently, the adult proportions in the regional populations were estimated as:
- Kittiwake – 0.4562 (equivalent to that for all SPA populations except Fair Isle in **Table 2.13**);
  - Razorbill – 0.4814 (equivalent to that for all SPA populations in **Table 2.13**);
  - Puffin – 0.4626 (equivalent to that for North Caithness Cliffs SPA in **Table 2.13**); and
  - Gannet – 0.5496 (equivalent to that for all SPA populations except North Rona and Sula Sgeir in **Table 2.13**).
41. The details of the demographic rates used in the PVA for the regional guillemot population are presented in **Table 2.14**. In relation to the different regional breeding productivity estimates given for guillemot in Horswill and Robinson (2015), the East region values were considered most appropriate because the majority of the birds in the regional population derived from colonies in this region. The resulting population model produced a stable age distribution in which the adult and subadult proportions were almost identical (i.e. 0.5057 adults to 0.4943 subadults).
42. Applying these stable age distributions to the respective breeding adult population sizes gave the estimated number of subadult birds in each of the regional populations of each species, as presented in **Table 2.14**.

**Table 2.14: Estimated Number of Adults and Subadults in the Regional Breeding Populations of Five Seabird Species**

Species	Total Individuals	
	Breeding Adults	Subadults
Kittiwake	313,061	373,175
Guillemot	1,003,449	980,436
Razorbill	26,583	28,637
Puffin	278,750	323,822
Gannet	379,768	311,222

## 2.2.2 Determining Mortalities on Regional Populations Due to Wind Farm Infrastructure Impacts

### 2.2.2.1 Project-alone Mortality

43. As for calculating the potential mortality due to the Bellrock Wind Farm Infrastructure-alone on SPA populations (see **Section 2.1.2.1**), the calculation for the regional breeding populations of each of the five species required apportioning to the different age classes. As for the SPA populations, this was undertaken on a seasonally-specific basis. In addition, a correction was applied to the mortality in the non-breeding periods in those cases where the size of the relevant Biologically Defined Minimum Population Scales (BDMPS) population (if used) exceeded that of the regional population, which is in accordance with NatureScot advice as presented in the West of Orkney Windfarm additional information (MacArthur Green, 2024). This was on the basis that the regional population would contribute only some of the birds subject to the Bellrock Wind Farm Infrastructure impacts in such cases, with a proportion of the mortality affecting birds which do not belong to this population. The different steps in calculating the potential mortality on the regional breeding populations are as follows:

- For each species, the seasonal breakdown in the total annual mortality (**Table 1.1**) was calculated (see Table 3.7 and Table 3.11 in **Appendix 10.2: Collision Risk Modelling Technical Report (Volume IV)** and Table 4.1 in **Appendix 10.3: Displacement Assessment Technical Report (Volume IV)**);
- The seasonally-specific mortalities were apportioned to the adult and subadult age classes, using the same broad approach as for SPA populations (see **Section 2.1**) but with some additional considerations. Thus, for:
  - The breeding season, mortality to kittiwake and gannet was apportioned to the adult age class according to the digital aerial survey -derived estimates, whilst for guillemot, razorbill and puffin it was apportioned to the adult age class according to the stable age distribution estimates (see Table 3.12 and Table 3.13 of **Appendix 10.5: Offshore Ornithology Apportioning Technical Report (Volume IV)**), noting that for puffin the stable age

distribution based on the national average breeding productivity estimate was used, as in **Section 2.2.1**); and

- The non-breeding periods, apportioning to age class was based upon the ratio of adults to subadults in the relevant BDMPS population for all species except guillemot (for which NatureScot advice is not to use the BDMPS approach (NatureScot, 2023d)). These ratios are as detailed for the BDMPS totals in Table 3.2 and Table 3.3 for kittiwake, Table 3.6 and Table 3.7 for razorbill, and Table 3.10 and Table 3.11 for gannet of **Appendix 10.5: Offshore Ornithology Apportioning Technical Report (Volume IV)** and are as given in Furness (2015). The proportion of adult puffins in the UK North Sea and Channel BDMPS during the single non-breeding period for this species is estimated as 0.862 (Furness 2015). For guillemot, the age class ratios in the non-breeding periods are assumed to be as for the breeding season, on the basis that the region used during the non-breeding periods is considered to be equivalent to that used during the breeding season (NatureScot, 2023d)<sup>8</sup>.
  - For the breeding adult age class during the breeding season, species-specific sabbatical rates were applied to the estimated adult mortality, as detailed in Section 3.3 of **Appendix 10.5: Offshore Ornithology Apportioning Technical Report (Volume IV)**; and
  - For kittiwake and razorbill, the estimated mortality for each non-breeding period was corrected according to the ratio of the regional population size to the BDMPS population size for the non-breeding period because the BDMPS populations of these species were larger than the regional populations. This was done separately for the adult and subadult age classes. No such correction was applied to puffin and gannet mortality in the non-breeding periods because the BDMPS populations were smaller than the regional populations, whilst it was not considered for guillemot because the BDMPS approach is not used for this species (NatureScot, 2023d).
44. The above process was undertaken for each species for both the lower and upper estimates of displacement mortality and, for kittiwake and gannet, also for collision mortality and for the combined displacement and collision mortality (again encompassing both the lower and upper estimates for displacement mortality). In each case, the seasonal mortality values were summed to give annual values. As for the SPA populations, the percentage point increase in the annual baseline mortality rate of breeding adults in the regional breeding populations due to the predicted additional mortality was calculated (**Table 2.15 to Table 2.17**). The percentage point increase in the annual mortality rate of breeding adults exceeded 0.02 for the regional razorbill population only.
45. The detailed breakdown of the calculations from the above steps are presented in **Table A 5** in **Annex A** of this appendix.

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<sup>8</sup> Email from NatureScot to the Applicant on 8 October 2024. Please see Section 10.3 in **Chapter 10: Offshore Ornithology (Volume II)**.

**Table 2.15: Bellrock Wind Farm Infrastructure-alone Displacement Mortality and Associated Percentage Point Change in Breeding Adult Mortality for the Regional Population of Each of the Five Seabird Species**

Species	Number of Breeding Adults	Annual Displacement Mortality				Percentage Point Increase in Breeding Adult Mortality <sup>1</sup>	
		Lower		Upper		Displacement Lower	Displacement Upper
		Adults	Subadults	Adults	Subadults		
Kittiwake	313,061	1.03	0.2979	3.08	0.82	0.0003	0.0010
Guillemot	1,003,449	24.94	24.86	65.93	65.23	0.0025	0.0066
Razorbill	26,583	10.50	12.16	17.55	20.33	0.0395	0.0660
Puffin	323,822	4.61	3.78	9.99	6.66	0.0017	0.0036
Gannet	379,768	3.15	1.17	9.40	3.47	0.0008	0.0025

Notes:  
<sup>1</sup> Text in red indicates a percentage point change of at least 0.02.

**Table 2.16: Bellrock Wind Farm Infrastructure-alone Collision Mortality and Associated Percentage Point Change in Breeding Adult Mortality for the Regional Kittiwake and Gannet Populations**

Species	Number of Breeding Adults	Annual Collision Mortality		Percentage Point Increase in Breeding Adult Mortality <sup>1</sup>
		Adults	Subadults	
Kittiwake	313,061	13.00	3.61	0.0042
Gannet	379,768	14.64	1.76	0.0039

Notes:  
<sup>1</sup> Text in red indicates a percentage point change of at least 0.02.

**Table 2.17: Bellrock Wind Farm Infrastructure-alone Combined Displacement and Collision Mortality and Associated Percentage Point Change in Breeding Adult Mortality for the Regional Kittiwake and Gannet Populations**

Species	Number of Breeding Adults	Annual Collision Plus Displacement Mortality				Percentage Point Increase in Breeding Adult Mortality <sup>1</sup>	
		Lower		Upper		Displacement Lower and Collision	Displacement Upper and Collision
		Adults	Subadults	Adults	Subadults		
Kittiwake	313,061	14.03	3.91	16.08	4.43	0.0045	0.0051
Gannet	379,768	17.79	2.93	24.04	5.23	0.0047	0.0063

Notes:  
<sup>1</sup> Text in red indicates a percentage point change of at least 0.02.

### 2.2.2.2 Cumulative Mortality

46. The potential mortality on each regional population due to the Bellrock Wind Farm Infrastructure acting cumulatively with other plans and projects is derived by summing the mortality due to the Bellrock Wind Farm Infrastructure-alone (as detailed in **Table 2.15** to **Table 2.17**) with that from the other plans and projects which are identified as having potential displacement and/or collision mortality effects on the regional population. This was undertaken for both the breeding adult and subadult age classes, and separately for displacement mortality, collision mortality and the combined collision and displacement mortality (with these scenarios including the lower and upper levels of displacement mortality as for the Bellrock Wind Farm Infrastructure-alone).
47. The cumulative mortalities for the other plans and projects were taken from the totals collated by the NEEOG Interim CEF project, using the most recently available update to these totals (i.e. April 2025)<sup>9</sup>. In this case, the seasonal-specific collision mortalities (for kittiwake and gannet) and mean peak abundances (for all five species) for the plans and projects provided in the NEEOG Interim CEF source files were used (**Annex B** of this appendix).
48. The mean peak abundances were converted to predicted lower and upper displacement mortalities by applying the species- and seasonal-specific displacement and displacement mortality rates advised by Nature Scot (2023b). As for the in-combination scenarios (**Section 2.1.2.2**), the NEEOG Interim CEF source files consider the cumulative collisions both with and without incorporation of the corrections for 'as-built' designs from MacArthur Green (2017), and with and without updates according to changes in the recommended model avoidance rates (noting that updates were applied only where the avoidance rates on which the original estimates were based could be established). The collision mortality totals used excluded the 'as-built' corrections but included the revised avoidance rates.
49. Using these totals, the cumulative mortality from the other plans and projects was derived as follows:
- Breeding season:
    - The subset of plans and projects (from the full suite included in the NEEOG Interim CEF totals) with potential breeding season effects on the regional population of each species was identified on the basis of those within the breeding season foraging range of the Bellrock WFDA. The foraging range for each species was as used to determine the reference population size for the regional population (detailed in **Section 2.2.1**); and
    - The cumulative mortality from these plans and projects was calculated and apportioned to age classes. For kittiwake and gannet, age class apportioning was based on the overall ratio of adults to subadults as determined from the respective breeding season in-combination mortality on the SPA populations (giving estimated adult proportions of 0.861 and 0.937, respectively (see **Annex B** of this appendix)). For the remaining three species, age class apportioning was based on the stable age distributions from the population models, using the same distributions as for the regional population mortality due the Bellrock Wind Farm Infrastructure-alone (**Section 2.2.2.1**). This was on the basis that digital aerial survey -derived estimates of age distribution (as used for kittiwake and gannet)

<sup>9</sup> As agreed by NatureScot in email from NatureScot to the Applicant on 27 January 2025. Please see Section 10.3 in **Chapter 10: Offshore Ornithology (Volume II)**.

are project (or site) specific, whereas estimates from the stable age distributions of population models are generic.

- Non-breeding periods for all species except guillemot:
  - All plans and projects included in the NEEOG Interim CEF contributed to the cumulative mortality for the non-breeding periods on the basis that the regional populations are assumed to be distributed throughout the North Sea (for kittiwake) or North Sea and Channel (for razorbill, puffin and gannet) BDMPS regions during these periods;
  - The cumulative mortality in the non-breeding periods was apportioned to age classes in the same way as for the Bellrock Wind Farm Infrastructure-alone, using the ratio of adults to subadults in the relevant BDMPS population (as detailed in **Section 2.2.2.1**); and
  - The estimated mortality of kittiwake and razorbill was corrected according to the ratio of the regional population size to the BDMPS population size (with this calculated separately by age classes), as undertaken for the Bellrock Wind Farm Infrastructure-alone (see **Section 2.2.2.1**). No such correction was applied to puffin and gannet mortality because the BDMPS populations were smaller than the regional populations.
- Non-breeding period for guillemot<sup>10</sup>:
  - In contrast to the other four species, the regional guillemot population is assumed to occupy the same region in the non-breeding period as during the breeding season (NatureScot, 2023d), with this as defined in **Section 2.2.1**;
  - Thus, the cumulative mortality for the non-breeding period was derived from the same subset of plans and projects as for the breeding season; and
  - Apportioning of the cumulative mortality to age classes was based upon the stable age distribution estimates, as for the breeding season.

50. As for the in-combination mortality (**Section 2.1.2.2**), the cumulative mortality scenarios were considered both with the mortality from the Berwick Bank Wind Farm included and with this mortality excluded.

51. **Table 2.18** to **Table 2.20** below detail the annual cumulative mortality for the breeding adult and the subadult age classes of each regional population, together with the associated percentage point change to the annual adult mortality rate. This is presented for displacement (**Table 2.18**), collisions (**Table 2.19**) and displacement plus collisions (**Table 2.20**). The cumulative mortality for all scenarios and all species is associated with an increase of greater than 0.02 percentage points in the annual baseline mortality rate of the regional population. For each of the five species, detailed breakdowns of the different mortalities resulting from the Bellrock Wind Farm Infrastructure acting cumulatively with other plans and projects are presented in Table C 5 in **Annex C** of this appendix.

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<sup>10</sup> The cumulative totals for guillemot recognise only a single non-breeding period, in accordance with the standard NatureScot guidance on seasonal periods (NatureScot, 2020). This differs from the treatment of non-breeding periods for the Bellrock Wind Farm Infrastructure-alone, for which a post-breeding dispersal period is recognised in addition to the winter period, with this being in accordance with the advice provided by NatureScot in email to the Applicant on 8 October 2024. Please see Section 10.3 in **Chapter 10: Offshore Ornithology (Volume II)**.

**Table 2.18: Cumulative Displacement Mortality for the Bellrock Wind Farm Infrastructure with Other Plans and Projects and the Associated Percentage Point Change in Breeding Adult Mortality for Regional Populations of Each Species**

Species	Number of Breeding Adults in Population	Cumulative Scenario	Annual Displacement Mortality				Percentage Point Increase in Breeding Adult Mortality <sup>1</sup>	
			Lower		Upper		Displacement Lower	Displacement Upper
			Adults	Subadults	Adults	Subadults		
Kittiwake	313,061	Excluding Berwick Bank	332.77	206.81	998.32	620.35	0.1063	0.3189
		All projects	415.15	246.36	1245.44	738.99	0.1326	0.3978
Guillemot	1,003,449	Excluding Berwick Bank	3051.16	3135.92	6348.24	6460.53	0.3041	0.6326
		All projects	3813.08	3926.54	7796.84	7952.87	0.3800	0.7770
Razorbill	26,583	Excluding Berwick Bank	205.92	232.94	426.06	476.77	0.7746	1.6028
		All projects	243.89	276.47	496.59	557.09	0.9175	1.8681
Puffin	278,750	Excluding Berwick Bank	379.31	293.17	853.22	523.95	0.1361	0.3061
		All projects	460.26	344.18	1049.46	618.77	0.1651	0.3765
Gannet	379,768	Excluding Berwick Bank	307.65	125.20	922.89	375.54	0.0810	0.2430
		All projects	342.42	132.85	1027.20	398.50	0.0902	0.2705

Notes:

<sup>1</sup> Text in red indicates a percentage point change of at least 0.02.

**Table 2.19: Cumulative Collision Mortality for the Bellrock Wind Farm Infrastructure with Other Plans and Projects and the Associated Percentage Point Change in Breeding Adult Mortality within for the Regional Kittiwake and Gannet Populations**

Species	Number of Breeding Adults in Population	Cumulative Scenario	Annual Collision Mortality		Percentage Point Increase in Breeding Adult Mortality <sup>1</sup>
			Adults	Subadults	
Kittiwake	313,061	Excluding Berwick Bank	1470.51	756.03	0.4697
		All projects	1935.06	929.01	0.6181
Gannet	379,768	Excluding Berwick Bank	800.96	117.80	0.2109
		All projects	907.74	127.65	0.2390

Notes:  
<sup>1</sup> Text in red indicates a percentage point change of at least 0.02.

**Table 2.20: Cumulative Combined Displacement and Collision Mortality for the Bellrock Wind Farm Infrastructure with Other Plans and Projects and the Associated Percentage Point Change in Breeding Adult Mortality for the Regional Kittiwake and Gannet Populations**

Species	Number of Breeding Adults in Population	Cumulative Scenario	Annual Displacement Plus Collision Mortality				Percentage Point Increase in Breeding Adult Mortality	
			Lower		Upper		Displacement Lower and Collision	Displacement Upper and Collision
			Adults	Subadults	Adults	Subadults		
Kittiwake	313,061	Excluding Berwick Bank	1803.29	962.83	2468.83	1376.38	0.5760	0.7886
		All projects	2350.21	1175.37	3180.50	1668.00	0.7507	1.0159
Gannet	379,768	Excluding Berwick Bank	1108.61	243.00	1723.85	493.34	0.2919	0.4539
		All projects	1250.16	260.50	1934.94	526.16	0.3292	0.5095

Notes:  
<sup>1</sup> Text in red indicates a percentage point change of at least 0.02.

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### 2.2.3 Population Viability Analysis for Regional Populations

52. As for the SPA populations (**Section 2.1.3**), investigation of population-level impacts using PVA was undertaken in cases where the percentage point increase in the baseline annual mortality rate of breeding adults in the regional populations due to the predicted wind farm effects exceeded 0.02 (NatureScot, 2023a). This was in relation to the effects resulting from the Bellrock Wind Farm Infrastructure-alone and the Bellrock Wind Farm Infrastructure acting cumulatively with other plans and projects (and as determined in **Table 2.15** to **Table 2.20**).
53. The approach and methods used to undertake the PVAs on the regional populations were as described for the SPA populations in **Section 2.1.3**. The starting population sizes (in terms of the number of breeding adults) for PVAs on each species were as given in **Table 2.15** to **Table 2.20**. Demographic rates for kittiwake, razorbill, puffin and gannet were as specified in **Table 2.9** to **Table 2.12**, with the breeding productivity values used for kittiwake and gannet being the respective East region values and for puffin the national average value (with justification for this given in **Section 2.2.1**). Demographic rates used in the guillemot PVAs are presented in **Table 2.21**.

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**Table 2.21: Demographic Rates Used in Population Viability Analysis for the Guillemot Regional Population**

Maximum Brood Size	Age of First Breeding (Years)	Survival Rates for Subadult Year Classes and Adults (SD <sup>1</sup> ) <sup>2</sup>							Number of Chicks Fledged per Pair	
		0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	Adult	Source <sup>3</sup>	Estimate (SD <sup>1</sup> )
1	6	0.560 (0.026)	0.792 (0.068)	0.917 (0.044)	0.939 (0.015)	0.939 (0.015)	0.939 (0.015)	0.939 (0.015)	East region	0.659 (0.133)

Notes:

<sup>1</sup> SD = standard deviation.

<sup>2</sup> Horswill and Robinson (2015) only give the standard error associated with the mean survival rates for year classes 0 - 1, 1 - 2 and 2 - 3, so these have been doubled to approximate the SD values.

<sup>3</sup> East region breeding productivity estimate used because most birds in the regional population will derive from colonies in this region.

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54. The impacts specified in the PVAs for the regional populations equated to the predicted mortality from either displacement, collisions or displacement plus collisions (with these including both the lower and upper levels of displacement mortality impacts). For the Bellrock Wind Farm Infrastructure-alone, the predicted mortality produced an increase of greater than 0.02 percentage points in the annual mortality rate of breeding adults only in the case of the razorbill population (**Table 2.15**), but for the Bellrock Wind Farm Infrastructure acting cumulatively with the other plans and projects, this threshold was exceeded for all scenarios and species (**Table 2.18 to Table 2.20**). Thus, in relation to the Bellrock Wind Farm Infrastructure-alone, PVA was undertaken only for the regional razorbill population (incorporating both lower and upper levels of displacement mortality). However, for the cumulative effects, PVA was undertaken on the regional populations of all five species (resulting in a total of 22 different impact scenarios being considered). All PVAs encompassed both the 35 and 50-year projection periods.
55. Within the PVAs for the regional populations, impacts (for both the breeding adult and the subadult age classes) were specified in the same way as for the PVAs for SPA populations (see **Section 2.2.3**).
56. The impact values for the breeding adult and the subadult age classes used in each PVA for the regional populations are given in **Table E 2 of Annex E** of this appendix, whilst copies of the input files produced in the runs of the nepva tool for these PVAs are provided in **Annex D** of this appendix.

## 3 Results

### 3.1 Population Viability Analysis Outputs

57. The key outputs from the PVAs that are required for assessing the Bellrock Wind Farm Infrastructure-related effects on SPA and regional seabird populations are presented in **Tables 3.1 to 3.11** in this section. These are presented separately for the SPA populations and regional populations and, in each of these cases, for effects of both the Bellrock Wind Farm Infrastructure-alone and in-combination (SPA populations) or cumulatively (regional populations) with other plans and projects.
58. In each case the outputs are presented for both projection periods<sup>11</sup>, with the baseline scenario (i.e. un-impacted population with no wind farm effects) compared against the impact scenarios (i.e. population impacted with wind farm effects). The two projection periods are:
- 35 years, incorporating Bellrock Wind Farm Infrastructure-related effects for the entire operational period; and
  - 50 years, incorporating wind farm effects for the first 35 years, followed by a 15-year recovery period without any Bellrock Wind Farm Infrastructure-related effects<sup>12</sup>.
59. The outputs presented in each case are:
- Median population size at the end of the projection period;
  - Median annual population growth rate;
  - The counterfactual of population growth rate (CPGR) metric – defined as the median of the ratio of the annual growth rate of the impacted to un-impacted population, expressed as a proportion;
  - The counterfactual for population size (CPS) metric - defined as the median of the ratio of the end-point size of the impacted to un-impacted population, expressed as a proportion; and
  - Centile metric – defined as the centile of the un-impacted population that matches the median (i.e. 50th centile) of the impacted population<sup>13</sup>.

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<sup>11</sup> Email from NatureScot to the Applicant on 26 May 2025. Please see Section 10.3 in **Chapter 10: Offshore Ornithology (Volume II)**.

<sup>12</sup> Given the PVAs use the most recent colony population estimates as their starting points and have a five-year 'burn-in' period, the nominal end years for the 35 and 50 year projections have been made 2067 and 2087, respectively. However, this does not relate in any specific way to the proposed start and end times for the Project O&M phase. Rather, the PVAs simply reflect the application of these projection periods to the most recent colony population estimates.

<sup>13</sup> This is based upon the distribution of the end-point population-sizes generated by the multiple replications of the model runs, with the value expected to be less than 50 because the median for the impacted population is not expected to exceed that for the un-impacted population (although this can occasionally result from the stochasticity where impacts are very small).

60. Of the above, the CPGR, CPS and centile metrics are based upon comparisons of the impacted population relative to the baseline population, so that they are presented only for the impact scenarios. NatureScot guidance is that the CPGR and CPS metrics should be used for the interpretation of PVAs (NatureScot, 2023a), with these metrics shown to have relatively low sensitivity to factors such as varying population status and the misspecification of the demographic rates underpinning the population model (Cook and Robinson, 2015; Jitlal et al. 2017). The centile metric is also presented on the basis that it is part of the default outputs from the nepva tool (noting that it has previously been recommended for aiding the interpretation of PVAs (Jitlal et al. 2017)). The full set of outputs from the PVAs are provided in **Annex G** of this appendix.

## 3.2 Population Viability Analysis for Special Protection Area Populations

The following sections present the results of the PVA for SPA populations, by species. Results are provided first for the Bellrock Wind Farm Infrastructure-alone, and then in-combination. The full PVA outputs are provided in **Annex G**.

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### 3.2.1 Project-alone

61. PVA outputs for effects of the Bellrock Wind Farm Infrastructure-alone on SPA populations is provided in **Table 3.1** below.

#### 3.2.1.1 Razorbill

**Table 3.1: Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure-alone on the Fowlsheugh Special Protection Area Razorbill**

Population	Projection Period	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
Fowlsheugh SPA	35-year	<b>Baseline (no impact)</b>	<b>58,220</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Displacement lower	57,272	1.0250	1.0000	0.9830	47.90
		Displacement upper	56,520	1.0240	0.9990	0.9720	46.50
	50-year	<b>Baseline (no impact)</b>	<b>83,899</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Displacement lower	82,335	1.0250	1.0000	0.9830	48.10
		Displacement upper	81,464	1.0240	0.9990	0.9720	47.10

### 3.2.2 In-combination

62. PVA outputs for effects of the Bellrock Wind Farm Infrastructure in-combination on SPA populations is provided in **Table 3.2** to **Table 3.5** below. PVA results excluding mortalities from Berwick Bank are shaded in grey.

#### 3.2.2.1 Kittiwake

**Table 3.2: Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects on Kittiwake Special Protection Area Populations**

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile
Buchan Ness to Collieston Coast SPA	35-year	N/A	<b>Baseline (no impact)</b>	<b>114,728</b>	<b>1.0337</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank <sup>1</sup>	Displacement lower only	112,357	1.0331	0.9994	0.9792	47.90
			Displacement upper only	108,618	1.0322	0.9985	0.9477	43.70
			Collision only	106,107	1.0315	0.9979	0.9262	40.84
			Displacement lower and collision	103,973	1.0309	0.9973	0.9065	39.02
			Displacement upper and collision	100,407	1.0300	0.9964	0.8775	35.48
		All projects	Displacement lower only	111,904	1.0330	0.9994	0.9773	47.44
			Displacement upper only	107,863	1.0319	0.9983	0.9406	42.72
			Collision only	104,931	1.0312	0.9976	0.9161	39.74
			Displacement lower and collision	102,760	1.0305	0.9969	0.8951	37.76
	Displacement upper and collision		98,826	1.0294	0.9959	0.8614	34.18	
	50-year	N/A	<b>Baseline (no impact)</b>	<b>190,974</b>	<b>1.0337</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile
		Excluding Berwick Bank	Displacement lower only	186,819	1.0333	0.9996	0.9795	48.20
			Displacement upper only	181,204	1.0326	0.9990	0.9485	45.70
			Collision only	176,714	1.0322	0.9985	0.9268	43.44
			Displacement lower and collision	172,884	1.0317	0.9981	0.9073	41.74
			Displacement upper and collision	167,669	1.0311	0.9975	0.8784	39.04
		All projects	Displacement lower only	186,029	1.0332	0.9995	0.9777	47.84
			Displacement upper only	179,229	1.0325	0.9988	0.9413	44.62
			Collision only	174,555	1.0319	0.9983	0.9170	42.28
			Displacement lower and collision	171,041	1.0315	0.9978	0.8962	40.78
			Displacement upper and collision	164,346	1.0307	0.9971	0.8626	37.28
Copinsay SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>8,772</b>	<b>1.0339</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	8,715	1.0337	0.9998	0.9917	49.50
			Displacement upper only	8,562	1.0331	0.9993	0.9741	47.72
			Collision only	8,514	1.0331	0.9992	0.9703	47.14
			Displacement lower and collision	8,423	1.0327	0.9989	0.9621	46.08
			Displacement upper and collision	8,289	1.0323	0.9984	0.9446	44.84
		All projects	Displacement lower only	8,689	1.0336	0.9997	0.9899	49.38
			Displacement upper only	8,525	1.0330	0.9991	0.9704	47.24
			Collision only	8,455	1.0329	0.9990	0.9660	46.38

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile			
			Displacement lower and collision	8,406	1.0326	0.9987	0.9547	45.92			
			Displacement upper and collision	8,199	1.0321	0.9981	0.9352	43.52			
	50-year	N/A	<b>Baseline (no impact)</b>	<b>14,385</b>	<b>1.0339</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>			
			Excluding Berwick Bank	Displacement lower only	14,311	1.0337	0.9998	0.9918	49.58		
				Displacement upper only	14,049	1.0333	0.9995	0.9745	47.86		
				Collision only	13,961	1.0333	0.9994	0.9706	47.30		
				Displacement lower and collision	13,804	1.0331	0.9992	0.9622	46.40		
				Displacement upper and collision	13,561	1.0327	0.9989	0.9458	44.76		
				All projects	Displacement lower only	14,287	1.0337	0.9998	0.9898	49.50	
			Displacement upper only		13,965	1.0332	0.9994	0.9698	47.34		
			Collision only		13,923	1.0332	0.9993	0.9665	47.04		
			Displacement lower and collision		13,752	1.0329	0.9991	0.9563	46.10		
			Displacement upper and collision		13,445	1.0325	0.9987	0.9362	44.10		
			East Caithness Coast SPA	35-year	N/A	<b>Baseline (no impact)</b>	<b>151,586</b>	<b>1.0338</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
						Excluding Berwick Bank	Displacement lower only	143,765	1.0322	0.9985	0.9485
Displacement upper only	129,871	1.0294					0.9957	0.8575	34.80		
Collision only	130,162	1.0293					0.9957	0.8574	35.00		
Displacement lower and collision	123,476	1.0279					0.9943	0.8133	30.10		

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile	
			Displacement upper and collision	111,319	1.0250	0.9915	0.7354	21.24	
		All projects	Displacement lower only	143,297	1.0321	0.9984	0.9445	44.28	
			Displacement upper only	128,137	1.0290	0.9954	0.8460	33.54	
			Collision only	128,039	1.0289	0.9953	0.8438	33.50	
			Displacement lower and collision	120,931	1.0273	0.9937	0.7969	28.18	
			Displacement upper and collision	108,346	1.0242	0.9907	0.7138	18.96	
		50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>249,080</b>	<b>1.0338</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
			Excluding Berwick Bank	Displacement lower only	236,747	1.0328	0.9990	0.9492	45.90
				Displacement upper only	213,846	1.0307	0.9970	0.8591	36.52
				Collision only	214,161	1.0308	0.9970	0.8589	36.74
	Displacement lower and collision			203,233	1.0297	0.9960	0.8152	32.00	
	Displacement upper and collision			183,542	1.0277	0.9941	0.7378	24.18	
	All projects		Displacement lower only	235,180	1.0327	0.9989	0.9450	45.10	
			Displacement upper only	211,608	1.0305	0.9968	0.8477	35.46	
			Collision only	210,643	1.0304	0.9967	0.8454	35.18	
			Displacement lower and collision	199,188	1.0293	0.9956	0.7989	30.32	
		Displacement upper and collision	178,259	1.0271	0.9935	0.7164	22.14		
	Fair Isle SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>1,726</b>	<b>1.0145</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
				Displacement lower only	1,691	1.0137	0.9994	0.9785	48.44

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile
		Excluding Berwick Bank	Displacement upper only	1,627	1.0127	0.9982	0.9385	44.92
			Collision only	1,602	1.0123	0.9980	0.9308	43.44
			Displacement lower and collision	1,567	1.0117	0.9974	0.9111	41.14
			Displacement upper and collision	1,505	1.0107	0.9963	0.8751	37.38
		All projects	Displacement lower only	1,683	1.0136	0.9993	0.9743	47.94
			Displacement upper only	1,600	1.0123	0.9979	0.9286	43.34
			Collision only	1,578	1.0120	0.9976	0.9171	41.98
			Displacement lower and collision	1,544	1.0112	0.9969	0.8946	39.72
			Displacement upper and collision	1,472	1.0099	0.9957	0.8543	35.28
		50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>2,120</b>	<b>1.0143</b>	<b>N/A</b>	<b>N/A</b>
	Excluding Berwick Bank		Displacement lower only	2,086	1.0138	0.9995	0.9783	48.84
			Displacement upper only	2,004	1.0130	0.9987	0.9368	45.60
			Collision only	1,972	1.0128	0.9986	0.9303	44.04
			Displacement lower and collision	1,937	1.0124	0.9981	0.9093	42.40
			Displacement upper and collision	1,867	1.0116	0.9974	0.8761	39.64
	All projects		Displacement lower only	2,060	1.0137	0.9995	0.9764	47.76
			Displacement upper only	1,970	1.0128	0.9985	0.9282	43.94
			Collision only	1,948	1.0126	0.9984	0.9200	43.00

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile
			Displacement lower and collision	1,896	1.0121	0.9978	0.8949	40.74
			Displacement upper and collision	1,814	1.0111	0.9969	0.8553	37.34
Farne Islands SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>24,009</b>	<b>1.0337</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	23,526	1.0332	0.9995	0.9815	48.32
			Displacement upper only	22,749	1.0322	0.9984	0.9458	44.52
			Collision only	22,269	1.0316	0.9979	0.9290	42.38
			Displacement lower and collision	21,844	1.0311	0.9974	0.9112	40.46
			Displacement upper and collision	21,025	1.0300	0.9964	0.8783	36.64
			All projects	Displacement lower only	23,235	1.0330	0.9991	0.9687
		Displacement upper only		21,830	1.0311	0.9974	0.9097	40.44
		Collision only		20,580	1.0294	0.9957	0.8559	34.82
		Displacement lower and collision		19,873	1.0284	0.9948	0.8295	31.92
	Displacement upper and collision	18,686		1.0266	0.9931	0.7793	26.30	
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>39,299</b>	<b>1.0338</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	38,584	1.0334	0.9996	0.9813	48.24
			Displacement upper only	37,296	1.0327	0.9989	0.9465	45.56
			Collision only	36,405	1.0323	0.9986	0.9298	43.24
Displacement lower and collision			35,884	1.0320	0.9982	0.9123	42.06	

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile
		All projects	Displacement upper and collision	34,547	1.0312	0.9975	0.8795	38.58
			Displacement lower only	38,142	1.0332	0.9994	0.9690	47.46
			Displacement upper only	35,796	1.0319	0.9982	0.9110	41.78
			Collision only	33,840	1.0307	0.9970	0.8582	36.72
			Displacement lower and collision	32,738	1.0301	0.9964	0.8316	33.70
			Displacement upper and collision	30,751	1.0288	0.9952	0.7820	28.28
Flamborough & Filey Coast SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	396,038	1.0340	N/A	N/A	N/A
		Excluding Berwick Bank	Displacement lower only	391,681	1.0337	0.9997	0.9899	48.72
			Displacement upper only	384,073	1.0332	0.9992	0.9702	46.82
			Collision only	344,444	1.0300	0.9962	0.8704	35.90
			Displacement lower and collision	341,020	1.0298	0.9959	0.8618	35.06
			Displacement upper and collision	334,020	1.0292	0.9953	0.8447	33.02
		All projects	Displacement lower only	391,319	1.0337	0.9997	0.9882	48.66
			Displacement upper only	382,242	1.0330	0.9990	0.9654	46.30
			Collision only	342,472	1.0299	0.9960	0.8652	35.46
			Displacement lower and collision	338,029	1.0295	0.9957	0.8552	34.16
			Displacement upper and collision	330,797	1.0289	0.9950	0.8352	32.16
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	650,023	1.0338	N/A	N/A	N/A
		Displacement lower only	643,223	1.0336	0.9998	0.9898	48.94	

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile
		Excluding Berwick Bank	Displacement upper only	631,493	1.0332	0.9994	0.9707	47.40
			Collision only	567,442	1.0311	0.9973	0.8724	38.30
			Displacement lower and collision	561,573	1.0308	0.9971	0.8639	37.40
			Displacement upper and collision	550,590	1.0305	0.9967	0.8469	35.82
		All projects	Displacement lower only	642,731	1.0336	0.9998	0.9883	48.90
			Displacement upper only	628,005	1.0331	0.9993	0.9658	46.98
			Collision only	563,588	1.0309	0.9972	0.8673	37.72
			Displacement lower and collision	557,194	1.0307	0.9970	0.8572	36.74
			Displacement upper and collision	543,996	1.0302	0.9965	0.8373	34.86
		Forth Islands SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>54,386</b>	<b>1.0338</b>	<b>N/A</b>
Excluding Berwick Bank	Displacement lower only			53,273	1.0332	0.9995	0.9808	48.10
	Displacement upper only			51,440	1.0323	0.9985	0.9477	44.48
	Collision only			51,434	1.0322	0.9985	0.9478	44.48
	Displacement lower and collision			50,538	1.0317	0.9980	0.9301	42.38
	Displacement upper and collision			48,875	1.0307	0.9970	0.8985	39.44
All projects	Displacement lower only			52,956	1.0330	0.9993	0.9746	47.60
	Displacement upper only			50,475	1.0317	0.9980	0.9287	42.24
	Collision only			49,369	1.0310	0.9973	0.9072	40.36

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile			
			Displacement lower and collision	48,082	1.0302	0.9966	0.8840	37.68			
			Displacement upper and collision	45,820	1.0288	0.9953	0.8426	33.26			
	50-year	N/A	<b>Baseline (no impact)</b>	<b>89,320</b>	<b>1.0338</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>			
			Excluding Berwick Bank	Displacement lower only	87,527	1.0334	0.9996	0.9811	48.28		
				Displacement upper only	84,387	1.0327	0.9990	0.9485	45.32		
				Collision only	84,531	1.0328	0.9990	0.9485	45.44		
				Displacement lower and collision	83,150	1.0324	0.9986	0.9313	44.28		
				Displacement upper and collision	80,308	1.0317	0.9979	0.8997	40.92		
				All projects	Displacement lower only	87,111	1.0333	0.9995	0.9749	47.96	
			Displacement upper only		82,753	1.0324	0.9986	0.9297	43.70		
			Collision only		80,984	1.0319	0.9981	0.9087	41.58		
			Displacement lower and collision		78,901	1.0313	0.9976	0.8858	39.42		
			Displacement upper and collision		75,417	1.0304	0.9967	0.8448	35.26		
			Fowlsheugh SPA	35-year	N/A	<b>Baseline (no impact)</b>	<b>129,248</b>	<b>1.0340</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
						Excluding Berwick Bank	Displacement lower only	126,794	1.0334	0.9995	0.9809
Displacement upper only	121,898	1.0322					0.9984	0.9431	44.38		
Collision only	118,562	1.0314					0.9975	0.9150	41.70		
Displacement lower and collision	115,941	1.0308					0.9970	0.8975	39.56		
Displacement upper and collision	111,390	1.0297					0.9959	0.8630	35.82		

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile		
		All projects	Displacement lower only	125,536	1.0331	0.9992	0.9716	47.24		
			Displacement upper only	118,409	1.0314	0.9976	0.9167	41.56		
			Collision only	111,197	1.0296	0.9958	0.8602	35.66		
			Displacement lower and collision	107,935	1.0288	0.9950	0.8352	32.94		
			Displacement upper and collision	101,823	1.0271	0.9934	0.7883	27.76		
	50-year	N/A	<b>Baseline (no impact)</b>	<b>211,913</b>	<b>1.0339</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>		
		Excluding Berwick Bank	Displacement lower only	207,717	1.0335	0.9996	0.9814	48.28		
			Displacement upper only	199,945	1.0328	0.9989	0.9437	45.34		
			Collision only	194,007	1.0321	0.9983	0.9157	42.58		
			Displacement lower and collision	190,640	1.0318	0.9979	0.8987	40.98		
			Displacement upper and collision	183,212	1.0310	0.9971	0.8643	37.52		
		All projects	Displacement lower only	206,280	1.0334	0.9994	0.9719	47.68		
			Displacement upper only	194,760	1.0321	0.9983	0.9180	42.70		
			Collision only	182,784	1.0309	0.9971	0.8622	37.40		
			Displacement lower and collision	177,688	1.0304	0.9965	0.8375	34.96		
			Displacement upper and collision	167,688	1.0292	0.9954	0.7908	31.12		
		Hoy SPA	35-year	N/A	<b>Baseline (no impact)</b>	<b>2,444</b>	<b>1.034</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile
		Excluding Berwick Bank	Displacement lower only	2,397	1.0330	0.9990	0.9800	48.20
			Displacement upper only	2,293	1.0320	0.9980	0.9420	44.20
			Collision only	2,263	1.0320	0.9980	0.9230	43.00
			Displacement lower and collision	2,226	1.0310	0.9970	0.9060	41.40
			Displacement upper and collision	2,132	1.0300	0.9960	0.8710	37.20
		All projects	Displacement lower only	2,384	1.0330	0.9990	0.9770	47.60
			Displacement upper only	2,280	1.0320	0.9980	0.9330	43.80
			Collision only	2,241	1.0310	0.9980	0.9170	42.10
			Displacement lower and collision	2,176	1.0310	0.9970	0.8940	39.20
			Displacement upper and collision	2,073	1.0290	0.9960	0.8510	34.50
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>3,991</b>	<b>1.034</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	3,940	1.0340	1.0000	0.9810	49.00
			Displacement upper only	3,771	1.0330	0.9990	0.9440	44.90
			Collision only	3,714	1.0320	0.9980	0.9240	43.70
			Displacement lower and collision	3,633	1.0320	0.9980	0.9090	41.80
			Displacement upper and collision	3,491	1.0310	0.9970	0.8730	38.40
		All projects	Displacement lower only	3,897	1.0330	1.0000	0.9760	48.00
			Displacement upper only	3,740	1.0320	0.9990	0.9330	44.30
			Collision only	3,677	1.0320	0.9980	0.9160	42.90

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile
			Displacement lower and collision	3,581	1.0320	0.9980	0.8950	40.50
			Displacement upper and collision	3,437	1.0310	0.9970	0.8510	37.00
North Caithness Cliffs SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>74,963</b>	<b>1.0337</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	73,228	1.0332	0.9995	0.9804	47.92
			Displacement upper only	71,136	1.0323	0.9986	0.9497	44.98
			Collision only	70,284	1.0319	0.9982	0.9377	43.70
			Displacement lower and collision	68,850	1.0314	0.9977	0.9195	41.46
			Displacement upper and collision	66,684	1.0305	0.9968	0.8910	38.52
			All projects	Displacement lower only	73,106	1.0332	0.9994	0.9781
		Displacement upper only		70,527	1.0321	0.9984	0.9430	44.08
		Collision only		69,651	1.0317	0.9980	0.9304	42.64
		Displacement lower and collision		68,085	1.0311	0.9974	0.9106	40.36
	Displacement upper and collision	65,659		1.0300	0.9964	0.8776	37.18	
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>123,006</b>	<b>1.0338</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	120,834	1.0334	0.9996	0.9807	48.52
			Displacement upper only	116,821	1.0328	0.9990	0.9500	45.84
Collision only			115,318	1.0326	0.9987	0.9382	44.88	

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile
			Displacement lower and collision	113,118	1.0321	0.9984	0.9203	42.98
			Displacement upper and collision	109,714	1.0315	0.9978	0.8920	40.26
		All projects	Displacement lower only	120,025	1.0334	0.9996	0.9786	48.08
			Displacement upper only	115,866	1.0327	0.9989	0.9435	45.22
			Collision only	114,374	1.0324	0.9986	0.9310	43.96
			Displacement lower and collision	112,177	1.0319	0.9982	0.9115	42.12
			Displacement upper and collision	108,100	1.0312	0.9975	0.8784	38.86
St Abb's Head to Fast Castle SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>49,814</b>	<b>1.0338</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	48,826	1.0333	0.9996	0.9850	48.30
			Displacement upper only	47,635	1.0325	0.9987	0.9555	45.76
			Collision only	47,270	1.0323	0.9986	0.9514	44.98
			Displacement lower and collision	46,434	1.0319	0.9982	0.9366	43.20
			Displacement upper and collision	45,190	1.0310	0.9973	0.9084	40.26
		All projects	Displacement lower only	46,130	1.0317	0.9980	0.9294	42.24
			Displacement upper only	39,886	1.0274	0.9939	0.8013	28.56
			Collision only	31,403	1.0207	0.9873	0.6307	11.66

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile	
			Displacement lower and collision	29,136	1.0185	0.9853	0.5860	8.32	
			Displacement upper and collision	25,085	1.0143	0.9812	0.5053	4.02	
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>81,751</b>	<b>1.0339</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	
	Excluding Berwick Bank	Displacement lower only	80,469	1.0336	0.9997	0.9852	48.86		
		Displacement upper only	78,132	1.0329	0.9991	0.9554	46.42		
		Collision only	77,752	1.0328	0.9990	0.9515	46.04		
		Displacement lower and collision	76,426	1.0325	0.9987	0.9378	44.34		
		Displacement upper and collision	74,396	1.0319	0.9981	0.9092	42.20		
		All projects	Displacement lower only	75,764	1.0323	0.9986	0.9302	43.52	
			Displacement upper only	65,534	1.0294	0.9957	0.8040	30.98	
	Collision only		51,839	1.0247	0.9912	0.6357	15.38		
	Displacement lower and collision		48,172	1.0232	0.9898	0.5913	11.78		
	Displacement upper and collision		41,640	1.0203	0.9869	0.5112	6.72		
	Troup, Pennan, & Lion's Heads SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>97,583</b>	<b>1.0339</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
			Excluding Berwick Bank	Displacement lower only	95,106	1.0331	0.9992	0.9711	47.28
Displacement upper only				90,543	1.0317	0.9979	0.9257	42.64	
Collision only				89,556	1.0314	0.9975	0.9149	41.38	

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile	
			Displacement lower and collision	86,908	1.0305	0.9967	0.8894	39.02	
			Displacement upper and collision	82,857	1.0292	0.9954	0.8472	34.40	
		All projects	Displacement lower only	94,903	1.0329	0.9991	0.9685	47.24	
			Displacement upper only	89,742	1.0314	0.9976	0.9171	41.62	
			Collision only	88,612	1.0310	0.9972	0.9045	40.70	
			Displacement lower and collision	85,775	1.0301	0.9963	0.8758	37.66	
			Displacement upper and collision	81,053	1.0285	0.9948	0.8295	32.20	
		50-year	N/A	<b>Baseline (no impact)</b>	<b>160,297</b>	<b>1.0339</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
			Excluding Berwick Bank	Displacement lower only	155,774	1.0333	0.9994	0.9717	47.72
	Displacement upper only			148,690	1.0324	0.9985	0.9266	43.82	
	Collision only			146,739	1.0322	0.9983	0.9152	42.62	
	Displacement lower and collision			142,840	1.0315	0.9977	0.8900	39.98	
	Displacement upper and collision			136,048	1.0306	0.9968	0.8484	36.10	
	All projects		Displacement lower only	155,061	1.0332	0.9994	0.9689	47.32	
			Displacement upper only	147,481	1.0322	0.9983	0.9179	43.16	
			Collision only	145,378	1.0319	0.9980	0.9052	41.62	
			Displacement lower and collision	140,342	1.0313	0.9974	0.8768	38.46	

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile
			Displacement upper and collision	133,004	1.0302	0.9964	0.8306	34.18
West Westray SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>25,461</b>	<b>1.0339</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	24,152	1.0325	0.9986	0.9494	45.14
			Displacement upper only	21,715	1.0295	0.9957	0.8565	35.18
			Collision only	21,258	1.0289	0.9951	0.8369	33.22
			Displacement lower and collision	20,114	1.0274	0.9937	0.7946	28.28
			Displacement upper and collision	18,188	1.0243	0.9908	0.7168	21.14
		All projects	Displacement lower only	23,885	1.0322	0.9983	0.9415	44.30
			Displacement upper only	21,147	1.0288	0.9950	0.8339	32.92
			Collision only	20,566	1.0279	0.9942	0.8108	30.12
			Displacement lower and collision	19,419	1.0261	0.9926	0.7638	25.74
	Displacement upper and collision		17,178	1.0228	0.9892	0.6764	16.92	
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>41,656</b>	<b>1.0339</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	39,509	1.0329	0.9990	0.9494	45.86
			Displacement upper only	35,773	1.0308	0.9970	0.8576	37.12
			Collision only	34,865	1.0303	0.9965	0.8382	35.20
			Displacement lower and collision	33,141	1.0293	0.9956	0.7958	31.42
			Displacement upper and collision	29,899	1.0273	0.9936	0.7188	23.96

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50th Centile
		All projects	Displacement lower only	39,246	1.0328	0.9988	0.9421	45.24
			Displacement upper only	34,799	1.0303	0.9965	0.8351	35.02
			Collision only	33,778	1.0297	0.9959	0.8116	32.72
			Displacement lower and collision	31,881	1.0285	0.9948	0.7656	28.46
			Displacement upper and collision	28,210	1.0261	0.9924	0.6783	20.68

Notes:

<sup>1</sup> PVA results excluding mortalities from Berwick Bank are shaded in grey.

### 3.2.2.2 Razorbill

**Table 3.3: Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects on Razorbill Special Protection Area Populations**

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
East Caithness Cliffs SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>124,935</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank <sup>2</sup>	Displacement lower	111,211	1.0220	0.9970	0.8890	37.40
			Displacement upper	98,429	1.0180	0.9930	0.7890	25.10
		All projects	Displacement lower	110,538	1.0220	0.9970	0.8860	36.70
			Displacement upper	97,188	1.0180	0.9930	0.7780	24.10
		50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>179,947</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>
	Excluding Berwick Bank		Displacement lower	160,049	1.0230	0.9980	0.8900	38.30
			Displacement upper	141,843	1.0200	0.9950	0.7890	27.50
	All projects		Displacement lower	159,124	1.0230	0.9980	0.8860	37.70
		Displacement upper	139,940	1.0200	0.9950	0.7790	26.50	
Flamborough & Filey Coast SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>184,409</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	170,450	1.0230	0.9980	0.9250	41.00
			Displacement upper	158,224	1.0210	0.9960	0.8580	32.80
		All projects	Displacement lower	170,030	1.0230	0.9980	0.9230	40.80
			Displacement upper	157,087	1.0210	0.9960	0.8530	32.10
		50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>265,466</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
		Excluding Berwick Bank	Displacement lower	245,506	1.0240	0.9980	0.9260	42.30
			Displacement upper	228,213	1.0220	0.9970	0.8610	35.10
		All projects	Displacement lower	245,106	1.0230	0.9980	0.9240	42.20
			Displacement upper	226,475	1.0220	0.9970	0.8550	34.40
Forth Islands SPA	35-year	N/A	<b>Baseline (no impact)</b>	<b>23,875</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	19,849	1.0200	0.9950	0.8310	29.10
			Displacement upper	16,777	1.0150	0.9900	0.7030	15.80
		All projects	Displacement lower	18,899	1.0180	0.9940	0.7920	24.60
			Displacement upper	15,379	1.0130	0.9880	0.6450	10.60
	50-year	N/A	<b>Baseline (no impact)</b>	<b>34,611</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	28,755	1.0210	0.9960	0.8320	31.90
			Displacement upper	24,351	1.0180	0.9930	0.7040	18.60
		All projects	Displacement lower	27,342	1.0200	0.9950	0.7920	27.40
			Displacement upper	22,368	1.0160	0.9910	0.6460	13.80

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
Fowlsheugh SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>58,220</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	50,352	1.0210	0.9960	0.8660	34.20
			Displacement upper	44,618	1.0180	0.9930	0.7670	22.40
		All projects	Displacement lower	49,251	1.0200	0.9950	0.8450	31.90
			Displacement upper	42,677	1.0160	0.9910	0.7330	19.00
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>83,899</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	72,613	1.0220	0.9970	0.8660	35.50
			Displacement upper	64,271	1.0200	0.9950	0.7680	25.30
		All projects	Displacement lower	70,768	1.0220	0.9970	0.8450	33.00
			Displacement upper	61,533	1.0190	0.9940	0.7340	22.00
Mingulay & Berneray SPA <sup>1</sup>	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>82,792</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement upper	82,011	1.0250	1.0000	0.9900	48.90
		All projects	Displacement upper	81,777	1.0250	1.0000	0.9890	48.60
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>119,287</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement upper	117,875	1.0250	1.0000	0.9900	48.90
		All projects	Displacement upper	117,971	1.0250	1.0000	0.9890	49.00
	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>14,820</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
			Displacement lower	13,840	1.0230	0.9980	0.9340	42.30

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
North Caithness Cliffs SPA		Excluding Berwick Bank	Displacement upper	12,721	1.0210	0.9960	0.8570	33.50
		All projects	Displacement lower	13,830	1.0230	0.9980	0.9310	42.20
			Displacement upper	12,514	1.0200	0.9950	0.8460	32.20
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>21,308</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	19,915	1.0240	0.9990	0.9350	43.10
			Displacement upper	18,333	1.0220	0.9970	0.8580	35.00
		All projects	Displacement lower	19,843	1.0240	0.9990	0.9310	42.90
			Displacement upper	18,086	1.0220	0.9970	0.8460	33.80
Rathlin Island SPA <sup>1</sup>	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>92,130</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement upper	91,418	1.0250	1.0000	0.9920	49.00
		All projects	Displacement upper	91,361	1.0250	1.0000	0.9910	48.90
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>132,647</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement upper	131,651	1.0250	1.0000	0.9920	49.30
		All projects	Displacement upper	131,364	1.0250	1.0000	0.9910	49.10
Troup, Pennan, & Lion's Heads SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>18,670</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	17,635	1.0230	0.9980	0.9430	43.00
			Displacement upper	16,327	1.0210	0.9960	0.8730	35.20

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile	
		All projects	Displacement lower	17,478	1.0230	0.9980	0.9360	42.00	
			Displacement upper	15,489	1.0200	0.9950	0.8280	30.30	
	50-year	N/A	<b>Baseline (no impact)</b>	<b>26,919</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	
			Excluding Berwick Bank	Displacement lower	25,358	1.0240	0.9990	0.9440	43.90
				Displacement upper	23,547	1.0220	0.9970	0.8740	36.60
			All projects	Displacement lower	25,170	1.0240	0.9990	0.9360	43.10
				Displacement upper	22,262	1.0210	0.9960	0.8280	31.00

Notes:

<sup>1</sup> Some impact scenarios are not included because the additional mortality was not associated with an increase of more than 0.02 percentage points to the baseline annual mortality rate and no PVA was undertaken.

<sup>2</sup> PVA results excluding mortalities from Berwick Bank are shaded in grey.

### 3.2.2.3 Puffin

**Table 3.4: Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects on Puffin Special Protection Area Populations**

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
Farne Islands SPA	35-year	N/A	<b>Baseline (no impact)</b>	<b>79,460</b>	<b>0.9946</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank <sup>1</sup>	Displacement lower	78,563	0.9942	0.9997	0.9879	48.98
			Displacement upper	78,154	0.9940	0.9995	0.9805	48.38
		All projects	Displacement lower	78,004	0.9940	0.9995	0.9814	48.28
			Displacement upper	77,089	0.9937	0.9992	0.9701	47.50
	50-year	N/A	<b>Baseline (no impact)</b>	<b>73,172</b>	<b>0.9946</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	72,329	0.9944	0.9998	0.9878	49.20
			Displacement upper	71,783	0.9943	0.9996	0.9805	48.60
		All projects	Displacement lower	71,852	0.9943	0.9996	0.9814	48.76
			Displacement upper	71,142	0.9941	0.9994	0.9700	48.02
Forth Islands SPA	35-year	N/A	<b>Baseline (no impact)</b>	<b>382,494</b>	<b>1.0282</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	362,689	1.0267	0.9985	0.9478	44.74
			Displacement upper	350,423	1.0257	0.9976	0.9156	41.24
		All projects	Displacement lower	360,427	1.0265	0.9983	0.9418	44.16
			Displacement upper	346,861	1.0254	0.9973	0.9060	40.32
	50-year	N/A	<b>Baseline (no impact)</b>	<b>583,395</b>	<b>1.0282</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
		Excluding Berwick Bank	Displacement lower	552,825	1.0271	0.9989	0.9478	45.46
			Displacement upper	534,719	1.0264	0.9983	0.9158	42.78
		All projects	Displacement lower	549,612	1.0270	0.9988	0.9421	45.14
			Displacement upper	529,521	1.0262	0.9981	0.9062	41.82
North Caithness Cliffs SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>20,791</b>	<b>1.0251</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	16,833	1.0192	0.9942	0.8105	31.70
			Displacement upper	14,714	1.0154	0.9905	0.7080	21.66
		All projects	Displacement lower	16,792	1.0192	0.9942	0.8095	31.36
			Displacement upper	14,653	1.0154	0.9904	0.7071	21.40
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>30,278</b>	<b>1.0251</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	24,592	1.0210	0.9959	0.8109	33.98
			Displacement upper	21,481	1.0182	0.9933	0.7085	24.92
		All projects	Displacement lower	24,515	1.0210	0.9959	0.8098	33.78
			Displacement upper	21,373	1.0182	0.9933	0.7078	24.64

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
Coquet Island SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>38,949</b>	<b>0.9948</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	38,666	0.9945	0.9998	0.9920	49.66
			Displacement upper	38,444	0.9944	0.9997	0.9873	49.14
		All projects	Displacement lower	38,454	0.9944	0.9997	0.9884	49.20
			Displacement upper	38,184	0.9942	0.9995	0.9818	48.76
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>35,873</b>	<b>0.9947</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	35,581	0.9945	0.9998	0.9921	49.46
			Displacement upper	35,420	0.9944	0.9998	0.9875	49.16
		All projects	Displacement lower	35,516	0.9945	0.9998	0.9885	49.32
			Displacement upper	35,199	0.9943	0.9996	0.9818	48.62

Notes:  
<sup>1</sup> PVA results excluding mortalities from Berwick Bank are shaded in grey.

### 3.2.2.4 Gannet

Table 3.5: Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure In-combination with Other Plans and Projects on Gannet Special Protection Area Populations.

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
Fair Isle SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>14,457</b>	<b>1.0061</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank <sup>2</sup>	Displacement lower only	14,332	1.0058	0.9997	0.9880	48.04
			Displacement upper only	13,955	1.0051	0.9990	0.9645	43.14
			Collision only	14,333	1.0058	0.9997	0.9889	48.06
			Displacement lower and collision	14,171	1.0054	0.9994	0.9773	45.88
			Displacement upper and collision	13,817	1.0048	0.9987	0.9539	41.10
		All projects	Displacement lower only	14,315	1.0058	0.9997	0.9875	47.84
			Displacement upper only	13,919	1.0050	0.9989	0.9626	42.58
			Collision only	14,325	1.0058	0.9997	0.9891	47.94
			Displacement lower and collision	14,129	1.0054	0.9993	0.9759	45.32
	Displacement upper and collision		13,805	1.0047	0.9986	0.9512	40.94	
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>15,906</b>	<b>1.0061</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	15,743	1.0059	0.9998	0.9887	48.44
			Displacement upper only	15,336	1.0054	0.9993	0.9644	43.96
			Collision only	15,748	1.0059	0.9998	0.9893	48.52
Displacement lower and collision			15,560	1.0057	0.9996	0.9776	46.38	

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
			Displacement upper and collision	15,200	1.0051	0.9991	0.9538	42.74
		All projects	Displacement lower only	15,696	1.0059	0.9998	0.9877	47.88
			Displacement upper only	15,326	1.0053	0.9992	0.9620	43.88
			Collision only	15,736	1.0059	0.9998	0.9888	48.34
			Displacement lower and collision	15,543	1.0056	0.9995	0.9761	46.16
			Displacement upper and collision	15,134	1.0051	0.9990	0.9512	42.10
Flamborough & Filey Coast SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>40,865</b>	<b>1.0061</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	38,023	1.0041	0.9980	0.9297	36.86
			Displacement upper only	32,887	1.0000	0.9939	0.8039	15.52
			Collision only	35,550	1.0022	0.9961	0.8696	25.56
			Displacement lower and collision	33,087	1.0002	0.9941	0.8085	16.02
			Displacement upper and collision	28,559	0.9961	0.9901	0.6988	5.46
	All projects	Displacement lower only	38,061	1.0041	0.9980	0.9290	37.04	
		Displacement upper only	32,810	1.0000	0.9939	0.8023	15.28	
		Collision only	35,593	1.0022	0.9961	0.8686	25.68	
		Displacement lower and collision	33,008	1.0001	0.9941	0.8068	15.86	
		Displacement upper and collision	28,485	0.9961	0.9900	0.6968	5.40	
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>44,970</b>	<b>1.0061</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
		Excluding Berwick Bank	Displacement lower only	41,860	1.0047	0.9986	0.9304	38.36
			Displacement upper only	36,265	1.0019	0.9958	0.8062	19.90
			Collision only	39,245	1.0034	0.9973	0.8720	29.26
			Displacement lower and collision	36,525	1.0020	0.9959	0.8114	20.64
			Displacement upper and collision	31,581	0.9992	0.9931	0.7028	8.50
		All projects	Displacement lower only	41,855	1.0046	0.9986	0.9302	38.36
			Displacement upper only	36,224	1.0018	0.9958	0.8049	19.78
			Collision only	39,178	1.0033	0.9973	0.8708	29.02
			Displacement lower and collision	36,424	1.0019	0.9959	0.8096	20.36
			Displacement upper and collision	31,500	0.9991	0.9930	0.7002	8.36

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
Forth Islands SPA	35-year	N/A	<b>Baseline (no impact)</b>	<b>135,351</b>	<b>1.0062</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	130,214	1.0051	0.9989	0.9608	43.04
			Displacement upper only	120,102	1.0029	0.9967	0.8872	29.46
			Collision only	120,398	1.0030	0.9968	0.8903	29.80
			Displacement lower and collision	115,820	1.0019	0.9957	0.8552	24.10
			Displacement upper and collision	107,043	0.9997	0.9935	0.7896	13.84
		All projects	Displacement lower only	129,052	1.0049	0.9986	0.9525	41.56
			Displacement upper only	116,986	1.0021	0.9959	0.8632	25.50
			Collision only	117,176	1.0022	0.9960	0.8651	25.86
			Displacement lower and collision	111,486	1.0008	0.9946	0.8237	18.50
	Displacement upper and collision		101,073	0.9981	0.9919	0.7465	8.58	
	50-year	N/A	<b>Baseline (no impact)</b>	<b>147,721</b>	<b>1.0061</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	142,079	1.0054	0.9992	0.9610	43.90
			Displacement upper only	131,120	1.0038	0.9977	0.8874	32.00
			Collision only	131,842	1.0039	0.9978	0.8916	32.62
			Displacement lower and collision	126,569	1.0031	0.9970	0.8568	26.96
			Displacement upper and collision	116,953	1.0015	0.9954	0.7911	17.80
		All projects	Displacement lower only	140,783	1.0052	0.9990	0.9527	42.40

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
			Displacement upper only	127,675	1.0033	0.9971	0.8639	28.16
			Collision only	128,116	1.0033	0.9972	0.8670	28.66
			Displacement lower and collision	121,954	1.0024	0.9962	0.8255	22.44
			Displacement upper and collision	110,620	1.0005	0.9943	0.7487	12.10
Hermaness, Saxa Vord & Valla Field SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>51,382</b>	<b>1.0061</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	50,245	1.0055	0.9994	0.9778	46.14
			Displacement upper only	48,036	1.0042	0.9981	0.9349	38.18
			Collision only	50,531	1.0057	0.9995	0.9838	47.20
			Displacement lower and collision	49,388	1.0050	0.9989	0.9625	43.00
			Displacement upper and collision	47,252	1.0038	0.9977	0.9202	35.22
			All projects	Displacement lower only	50,248	1.0054	0.9994	0.9769
		Displacement upper only		47,795	1.0041	0.9980	0.9321	37.12
		Collision only		50,476	1.0056	0.9995	0.9836	46.92
		Displacement lower and collision		49,291	1.0050	0.9989	0.9609	42.70
	Displacement upper and collision	47,059		1.0037	0.9976	0.9168	34.72	
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>56,425</b>	<b>1.0061</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	55,107	1.0056	0.9996	0.9777	46.06
			Displacement upper only	52,755	1.0048	0.9987	0.9348	39.38

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile		
			Collision only	55,500	1.0058	0.9997	0.9839	47.04		
			Displacement lower and collision	54,265	1.0054	0.9992	0.9622	43.64		
			Displacement upper and collision	51,865	1.0045	0.9984	0.9199	36.78		
		All projects	Displacement lower only	55,104	1.0056	0.9995	0.9767	46.06		
			Displacement upper only	52,553	1.0047	0.9986	0.9316	38.74		
			Collision only	55,475	1.0058	0.9997	0.9834	46.94		
			Displacement lower and collision	54,200	1.0053	0.9992	0.9608	43.32		
					Displacement upper and collision	51,699	1.0044	0.9983	0.9163	36.30
		North Rona & Sula Sgeir SPA <sup>1</sup>	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>25,986</b>	<b>1.0073</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
				Excluding Berwick Bank	Displacement upper only	25,742	1.0070	0.9997	0.9898	48.40
Displacement upper and collision	25,619				1.0069	0.9996	0.9865	47.56		
All projects	Displacement upper only			25,686	1.0070	0.9997	0.9885	47.98		
	Displacement upper and collision			25,602	1.0069	0.9996	0.9851	47.42		
50-year	<b>N/A</b>		<b>Baseline (no impact)</b>	<b>28,776</b>	<b>1.0073</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>		
	Excluding Berwick Bank		Displacement upper only	28,503	1.0071	0.9998	0.9895	48.18		
			Displacement upper and collision	28,437	1.0070	0.9997	0.9862	47.84		
	All projects		Displacement upper only	28,496	1.0071	0.9998	0.9887	48.10		
			Displacement upper and collision	28,364	1.0069	0.9997	0.9852	47.36		

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
Noss SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>32,240</b>	<b>1.0063</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	31,698	1.0058	0.9995	0.9831	47.16
			Displacement upper only	30,603	1.0048	0.9986	0.9502	40.96
			Collision only	31,794	1.0058	0.9996	0.9871	47.76
			Displacement lower and collision	31,264	1.0054	0.9992	0.9702	44.64
			Displacement upper and collision	30,196	1.0044	0.9982	0.9378	38.38
		All projects	Displacement lower only	31,665	1.0058	0.9995	0.9821	46.98
			Displacement upper only	30,521	1.0047	0.9985	0.9483	40.50
			Collision only	31,801	1.0059	0.9996	0.9863	47.80
			Displacement lower and collision	31,187	1.0054	0.9991	0.9694	44.12
	Displacement upper and collision		30,141	1.0044	0.9981	0.9353	38.24	
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>35,155</b>	<b>1.0061</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	34,540	1.0058	0.9997	0.9832	47.10
			Displacement upper only	33,418	1.0051	0.9990	0.9500	42.40
			Collision only	34,676	1.0059	0.9997	0.9868	47.68
			Displacement lower and collision	34,070	1.0055	0.9994	0.9700	44.92
			Displacement upper and collision	32,986	1.0049	0.9987	0.9372	40.60
		All projects	Displacement lower only	34,546	1.0058	0.9996	0.9817	47.16
			Displacement upper only	33,323	1.0051	0.9989	0.9482	41.90

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
			Collision only	34,611	1.0059	0.9997	0.9864	47.40
			Displacement lower and collision	34,043	1.0055	0.9994	0.9693	44.82
			Displacement upper and collision	32,855	1.0048	0.9987	0.9351	39.98
Sule Skerry & Sule Stack SPA	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>20,266</b>	<b>1.0061</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	19,998	1.0058	0.9996	0.9871	47.54
			Displacement upper only	19,510	1.0051	0.9989	0.9623	43.22
			Collision only	19,194	1.0046	0.9985	0.9467	39.98
			Displacement lower and collision	18,934	1.0042	0.9981	0.9342	37.68
			Displacement upper and collision	18,446	1.0034	0.9974	0.9103	33.46
		All projects	Displacement lower only	20,029	1.0057	0.9996	0.9869	47.72
			Displacement upper only	19,496	1.0050	0.9989	0.9617	43.00
			Collision only	19,187	1.0046	0.9985	0.9461	39.86
			Displacement lower and collision	18,913	1.0042	0.9981	0.9334	37.50
	Displacement upper and collision		18,422	1.0035	0.9974	0.9094	33.34	
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>22,314</b>	<b>1.0061</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	21,999	1.0058	0.9997	0.9871	48.02
			Displacement upper only	21,401	1.0053	0.9992	0.9622	43.44
			Collision only	21,100	1.0050	0.9989	0.9459	41.10
Displacement lower and collision			20,836	1.0047	0.9987	0.9335	39.44	

Population	Projection Period	In-combination Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
			Displacement upper and collision	20,287	1.0043	0.9982	0.9099	35.20
		All projects	Displacement lower only	22,015	1.0058	0.9997	0.9871	48.16
			Displacement upper only	21,450	1.0053	0.9992	0.9613	43.78
			Collision only	21,081	1.0050	0.9989	0.9454	41.02
			Displacement lower and collision	20,788	1.0047	0.9986	0.9335	39.08
			Displacement upper and collision	20,281	1.0042	0.9981	0.9089	35.18

Notes:

<sup>1</sup> Some impact scenarios are not included because the additional mortality was not associated with an increase of more than 0.02 percentage points to the baseline annual mortality rate and no PVA was undertaken.

<sup>2</sup> PVA results excluding mortalities from Berwick Bank are shaded in grey.

## 3.3 Population Viability Analysis for Regional Populations

### 3.3.1 Project-alone

63. PVA outputs for effects of the Bellrock Wind Farm Infrastructure-alone on regional populations is provided in **Table 3.6** below.

#### 3.3.1.1 Razorbill

**Table 3.6: Population Viability Analysis Outputs for Effects of the Bellrock on the Razorbill Regional Population**

Projection Period	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
35-year	<b>Baseline (no impact)</b>	<b>75,596</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
	Displacement lower	74,445	1.0245	0.9995	0.9835	47.94
	Displacement upper	73,709	1.0242	0.9992	0.9727	46.72
50-year	<b>Baseline (no impact)</b>	<b>109,730</b>	<b>1.0249</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
	Displacement lower	107,849	1.0246	0.9997	0.9838	48.06
	Displacement upper	106,619	1.0243	0.9995	0.9727	46.46

### 3.3.2 Cumulative

64. PVA outputs for effects of the Bellrock Wind Farm Infrastructure cumulatively with regional SPA populations is provided in **Table 3.7** to **Table 3.11** below. PVA results excluding mortalities from Berwick Bank are shaded in grey.

#### 3.3.2.1 Kittiwake

**Table 3.7: Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure Acting Cumulatively with Other Plans and Projects on the Kittiwake Regional Population**

Projection Period	Cumulative Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
35-year	N/A	<b>Baseline (no impact)</b>	<b>1,296,943</b>	<b>1.034</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
	Excluding Berwick Bank <sup>1</sup>	Displacement lower only	1,251,785	1.033	0.999	0.965	46.5
		Displacement upper only	1,166,456	1.031	0.997	0.899	39.3
		Collision only	1,116,636	1.03	0.996	0.862	35.2
		Displacement lower and collision	1,078,025	1.029	0.995	0.832	31.9
		Displacement upper and collision	1,004,534	1.026	0.993	0.774	25.6
	All projects	Displacement lower only	1,240,171	1.033	0.999	0.957	45.7
		Displacement upper only	1,137,633	1.03	0.996	0.877	37
		Collision only	1,070,772	1.028	0.995	0.825	31.2
		Displacement lower and collision	1,022,949	1.027	0.993	0.789	27.2
		Displacement upper and collision	938,943	1.025	0.991	0.723	20.1

Projection Period	Cumulative Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
50-year	N/A	<b>Baseline (no impact)</b>	<b>2,130,223</b>	<b>1.034</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
	Excluding Berwick Bank	Displacement lower only	2,057,882	1.033	0.999	0.965	47.1
		Displacement upper only	1,918,896	1.032	0.998	0.9	41.2
		Collision only	1,837,855	1.031	0.997	0.863	36.9
		Displacement lower and collision	1,773,592	1.03	0.996	0.833	33.7
		Displacement upper and collision	1,652,579	1.029	0.995	0.776	27.9
	All projects	Displacement lower only	2,040,057	1.033	0.999	0.958	46.5
		Displacement upper only	1,867,845	1.031	0.997	0.878	38.5
		Collision only	1,761,918	1.03	0.996	0.826	33
		Displacement lower and collision	1,683,087	1.029	0.995	0.791	29.4
		Displacement upper and collision	1,541,777	1.027	0.994	0.725	22.8

Notes:

<sup>1</sup> PVA results excluding mortalities from Berwick Bank are shaded in grey.

### 3.3.2.2 Guillemot

Table 3.8: Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure Acting Cumulatively with Other Plans and Projects on the Guillemot Regional Population

Projection Period	Cumulative Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>4,018,386</b>	<b>1.0331</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
	Excluding Berwick Bank <sup>1</sup>	Displacement lower	3,547,552	1.0295	0.9965	0.8824	14.04
		Displacement upper	3,100,595	1.0257	0.9928	0.7713	1.46
	All projects	Displacement lower	3,436,715	1.0286	0.9957	0.8552	8.06
		Displacement upper	2,919,532	1.0240	0.9912	0.7265	0.36
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>6,526,986</b>	<b>1.0330</b>	<b>N/A</b>	<b>N/A</b>
Excluding Berwick Bank		Displacement lower	5,753,874	1.0305	0.9975	0.8817	15.98
		Displacement upper	5,027,178	1.0278	0.9949	0.7700	2.38
All projects		Displacement lower	5,576,046	1.0298	0.9969	0.8543	10.92
		Displacement upper	4,732,964	1.0265	0.9937	0.7250	0.80

Notes:

<sup>1</sup> PVA results excluding mortalities from Berwick Bank are shaded in grey.

### 3.3.2.3 Razorbill

**Table 3.9: Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure Acting Cumulatively with Other Plans and Projects on the Razorbill Regional Population**

Modelled Population	Projection Period	Cumulative Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
Regional population	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>75,596</b>	<b>1.0250</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank <sup>1</sup>	Displacement lower	54,599	1.0158	0.9910	0.7215	17.14
			Displacement upper	38,536	1.0059	0.9814	0.5087	2.98
		All projects	Displacement lower	51,307	1.0140	0.9893	0.6790	13.34
			Displacement upper	34,408	1.0027	0.9783	0.4538	1.46
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>109,730</b>	<b>1.0249</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	79,198	1.0184	0.9936	0.7211	20.66
			Displacement upper	55,728	1.0114	0.9868	0.5080	5.06
		All projects	Displacement lower	74,437	1.0172	0.9924	0.6784	16.38
			Displacement upper	49,570	1.0091	0.9846	0.4532	2.56

Notes:

<sup>1</sup> PVA results excluding mortalities from Berwick Bank are shaded in grey.

### 3.3.2.4 Puffin

**Table 3.10: Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure Acting Cumulatively with Other Plans and Projects on the Puffin Regional Population**

Modelled Population	Projection Period	Cumulative Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at Impacted 50 <sup>th</sup> Centile
Regional population	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>787,048</b>	<b>1.0249</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank <sup>1</sup>	Displacement lower	749,773	1.0235	0.9987	0.9528	45.08
			Displacement upper	710,293	1.0220	0.9972	0.9033	40.16
		All projects	Displacement lower	742,745	1.0233	0.9984	0.9437	44.12
			Displacement upper	695,199	1.0214	0.9966	0.8836	38.08
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>1,143,303</b>	<b>1.0248</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower	1,089,788	1.0239	0.9991	0.9530	46.50
			Displacement upper	1,034,565	1.0228	0.9980	0.9040	41.86
		All projects	Displacement lower	1,079,708	1.0237	0.9989	0.9441	45.74
			Displacement upper	1,012,747	1.0223	0.9976	0.8845	39.94

Notes:

<sup>1</sup> PVA results excluding mortalities from Berwick Bank are shaded in grey.

### 3.3.2.5 Gannet

**Table 3.11: Population Viability Analysis Outputs for Effects of the Bellrock Wind Farm Infrastructure Acting Cumulatively with Other Plans and Projects on the Gannet Regional Population**

Modelled population	Projection Period	Cumulative Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at impacted 50 <sup>th</sup> Centile
Regional population	35-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>492,472</b>	<b>1.0061</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank <sup>1</sup>	Displacement lower only	478,430	1.0053	0.9992	0.9723	44.68
			Displacement upper only	452,824	1.0038	0.9977	0.9193	35.12
			Collision only	462,221	1.0044	0.9983	0.9390	38.84
			Displacement lower and collision	449,684	1.0036	0.9975	0.9131	34.20
			Displacement upper and collision	425,116	1.0020	0.9959	0.8632	24.82
		All projects	Displacement lower only	477,401	1.0052	0.9991	0.9695	44.24
			Displacement upper only	448,805	1.0035	0.9974	0.9114	33.86
			Collision only	458,633	1.0041	0.9980	0.9315	37.32
			Displacement lower and collision	444,756	1.0033	0.9972	0.9032	32.44
	Displacement upper and collision		417,853	1.0015	0.9955	0.8489	22.18	
	50-year	<b>N/A</b>	<b>Baseline (no impact)</b>	<b>541,073</b>	<b>1.0061</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
		Excluding Berwick Bank	Displacement lower only	526,180	1.0055	0.9994	0.9723	45.38
			Displacement upper only	497,375	1.0044	0.9984	0.9196	36.58
Collision only			508,137	1.0049	0.9988	0.9398	40.36	

Modelled population	Projection Period	Cumulative Scenario	Impact Scenario	Median Population Size	Annual Growth Rate (Median)	Median CPGR	Median CPS	Unimpacted Centile at impacted 50 <sup>th</sup> Centile
			Displacement lower and collision	494,265	1.0043	0.9982	0.9139	35.72
			Displacement upper and collision	467,199	1.0032	0.9971	0.8640	27.78
		All projects	Displacement lower only	524,457	1.0055	0.9994	0.9696	44.90
			Displacement upper only	493,165	1.0043	0.9982	0.9117	35.34
			Collision only	504,395	1.0047	0.9986	0.9323	38.82
			Displacement lower and collision	488,958	1.0041	0.9980	0.9041	34.38
			Displacement upper and collision	459,831	1.0029	0.9968	0.8500	25.56

Notes:

<sup>1</sup> PVA results excluding mortalities from Berwick Bank are shaded in grey.

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# Annex A: Project Alone Mortality Apportionment Calculations

This annex contains the project alone mortality apportionment calculations for each species SPA populations and regional populations where the potential for LSE has been determined. It also includes the respective percentage point change in adult survival calculations used to determine which scenarios would be taken forward for PVA.

These are provided for the following impact scenarios (where relevant to the respective species):

- Displacement (Lower);
- Displacement (Upper);
- Collisions;
- Displacement (Lower) + Collisions; and
- Displacement (Upper) + Collisions.

See **Appendix 10.4 Annex A - Project Alone Mortality Apportionment Calculations.zip (RHDV\_BEL\_CST\_REP\_0004\_031)** of the digital version of this document for the associated excel spreadsheet. The excel files are included in hard copy.

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# Annex B: The NEEOG Interim CEF With Derived In-Combination and Cumulative Mortalities

This annex consists of a document that details the North East and East Ornithology Group (NEEOG) Interim Cumulative Effects Framework (CEF) report, including a summary of the 2025 update to this report. Together with the data files for the in-combination and cumulative totals for the other plans and projects as derived from the NEEOG Interim CEF for use in the assessments of the Bellrock Wind Farm Infrastructure in-combination with other plans and projects and cumulatively with other plans and projects.

See **Appendix 10.4 Annex B2 The NEEOG Interim CEF With Derived In-Combination and Cumulative Mortalities.zip (RHDV\_BEL\_CST\_REP\_0004\_033)** of the digital version of this document for the associated excel spreadsheet. The excel files are included in hard copy.

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# Bellrock Offshore Wind Farm

## Wind Farm Development Area

Environmental Impact Assessment Report - Volume IV

**Annex 10.4-B: NEEOG Interim CEF and Derived In-combination and Cumulative Mortalities**

**Date: April 2026**

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Rev.	Prepared By	Checked By	Approved By	Date
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# Contents

**1 Introduction ..... 1**

**Table of Annexes:**

**Annex 10.4-B1: The 2024 NEEOG Interim CEF Report**

**Annex 10.4-B2: Derived In-combination and Cumulative Mortalities**

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# 1 Introduction

1. This Annex includes the North East and East Ornithology Group (NEEOG) Interim Cumulative Effects Framework (CEF), and also presents the in-combination and cumulative totals for the other plans and projects as derived from the NEEOG Interim CEF, for use in the Bellrock Wind Farm Infrastructure's in-combination assessment and cumulative assessment with other plans and projects.
2. The NEEOG Interim CEF is provided in full (as requested in email from NatureScot to the Applicant on 27 January 2025) and comprises:
  - The original report on the work from July 2024 (see Annex 10.4-B1); and
  - The series of spreadsheets providing the in-combination and cumulative collations for all species included in the NEEOG Interim CEF, as presented in its April 2025 update (see Annex 10.4-B2).
3. The updates to the Interim CEF were finalised in early April 2025 and included the addition of the numbers from new projects for which such information had become available or from projects which had undergone 'revisions' (i.e. West of Orkney and English projects progressing from PEIR or through examination) between the first production in May 2024 and the end of March 2025. In addition, updates were also made to the gannet collision estimates to incorporate the 70% macro-avoidance rate for the non-breeding periods (which aligns with current NatureScot advice).
4. The new projects which were added to the Interim CEF collations in the April 2025 update were:
  - Ossian;
  - Salamander;
  - Cenos;
  - Muir Mhor; and
  - Caledonia.
5. The projects for which information was revised in the April 2025 update according to new submissions were:
  - West of Orkney;
  - Five Estuaries;
  - Outer Dowsing;
  - North Falls; and
  - Dogger Bank South.

6. Information from the Culzean wind farm was not included in the April 2025 update because this project comprises a single turbine and has a predicted total impact of approximately .07 kittiwakes.
7. Following the April 2025 update, the instructions for interpreting and using the Interim CEF remained as detailed in the July 2024 report (Annex 10.4-B1) and, as previously, the sources used to derive the numbers from each project were detailed in the relevant spreadsheets (including for all of the material derived from new, or revised, projects).
8. Two further spreadsheets set out the in-combination and cumulative collations as they have been derived from the data in the NEEOG Interim CEF for use in the current assessment (with each having a series of worksheets for each species). The in-combination collations have been derived from the range of spreadsheets (and worksheets within individual spreadsheets) from the NEEOG Interim CEF which relate to the species and SPA populations of interest, whilst the cumulative collations have been derived from the following sources within the NEEOG Interim CEF:
  - Kittiwake collisions: WF collisions worksheet in the KI passage collisions\_2025Q1 file;
  - Kittiwake displacement: KI cumulative displace worksheet in the KI displacement\_2025Q1 file;
  - Guillemot: GU\_cumulative worksheet in the GU\_2025Q1 file;
  - Razorbill: RA cumulative totals worksheet in the RA\_2025Q1 file;
  - Puffin: PU\_cumulative totals worksheet in the PU\_2025Q1 file;
  - Gannet collisions: WF collisions worksheet in the GX passage collisions\_2025Q1 file; and
  - Gannet displacement: GX cum & passage in-comb worksheet in the GX displacement\_2025Q1 file.
9. In addition, the NEEOG Interim CEF collations for guillemot did not encompass all projects relevant to the cumulative assessment as NatureScot advised that this was to be based on the maximum breeding season foraging range of guillemot (email from NatureScot to the Applicant on 8 October 2024). The totals from the additional projects that had to be considered for guillemot are provided in the spreadsheet for the cumulative collations as derived for use in the current assessment.

# Annex 10.4-B1: The 2024 NEEOG Interim CEF Report

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## REPORT

# **In-combination and Cumulative Totals for Seabird Species of Key Importance to Northeast and East ScotWind Projects**

In-combination and cumulative totals

Client: NE and E ScotWind developers

Reference: PC4885-102-RHD-XX-XX-RP-X-0001

Status: Final/01

Date: 11 July 2024

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Northeast and East ScotWind Projects  
Subtitle: In-combination and cumulative totals  
Reference: PC4885-102-RHD-XX-XX-RP-X-0001  
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Status: Final/01  
Date: 11 July 2024  
Project name: Cumulatives Variation  
Project number: PC4885-102  
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## Table of Contents

<b>Introduction</b>	<b>1</b>
<b>Species and effects</b>	<b>1</b>
<b>Approach to the producing the in-combination and cumulative totals</b>	<b>2</b>
General approach	2
Species-specific details	4
Gannet 4	
Kittiwake 5	
Herring gull	5
Guillemot6	
Razorbill 6	
Puffin 6	
<b>Outputs</b>	<b>6</b>
<b>References</b>	<b>9</b>

## Introduction

The in-combination and cumulative effects of offshore wind farms on breeding seabird populations are of critical importance in the environmental assessments that are undertaken for these projects. In particular, the in-combination effects on qualifying features of seabird breeding colony Special Protection Areas (SPAs) have become a major factor in complicating and delaying the progress of offshore wind projects due to such effects frequently being assessed as having the potential to lead to an Adverse Effect on Integrity (AEoI) for one or more SPAs.

Consequently, the data on which in-combination and cumulative effects for seabird populations are based are subject to considerable scrutiny from stakeholders. With multiple projects being progressed simultaneously in the Northeast (NE) and East (E) ScotWind regions, it will be of considerable value to these projects to have a common and consistent data source for the purpose of predicting the in-combination and cumulative effects.

This report details work undertaken by Royal HaskoningDHV to collate a comprehensive set of in-combination and cumulative 'totals' for key seabird species which can be applied within the assessments that are to be undertaken by the NE and E ScotWind region projects. The in-combination totals refer to the combined effects of different projects on specific SPA populations and are relevant to Habitats Regulations Appraisals (HRA), whilst cumulative totals refer to the combined effects from different projects on wider, or regional-level, populations, as relevant to Environmental Impact Assessment (EIA). The report comprises a description of the approach that has been used to collate the relevant data, together with a series of spreadsheets that contain the collated cumulative and in-combination data.

## Species and effects

As set out in the proposal for this work, in relation to the NE and E ScotWind regions, collations of in-combination and cumulative 'totals' were considered to be most urgently required for the following six seabird species:

- Gannet
- Kittiwake
- Herring gull
- Guillemot
- Razorbill
- Puffin

The collations are undertaken for predicted collision mortality and displacement effects (with the latter essentially being assumed to also encompass barrier effects within offshore wind farm assessments—SNCBs 2017). Both of these effects are relevant to the operational phase for offshore wind farms and they receive most attention and scrutiny within assessments. This is due to the fact that they are predicted to have the potential to cause seabird mortality (directly in the case of collisions and indirectly for displacement), with this mortality being assumed (within assessments) to accrue over the operational lifetime of the wind farm (which may exceed 25 years). Both effects are also quantified (e.g. via collision risk modelling), so potential mortality estimates are generated for each project. Thus, the potential mortality estimates (or the measures from which they are derived – e.g. abundance within the array area and buffer in the case of displacement) from relevant plans and projects can be collated to generate in-combination and cumulative 'totals'.

Of the six seabird species for which the current collations have been undertaken, collisions and displacement are both relevant to gannet and kittiwake, collisions (but not displacement) are relevant to herring gull and displacement (but not collisions) is relevant to guillemot, razorbill and puffin.

## Approach to the producing the in-combination and cumulative totals

### General approach

As outlined in the proposal for this work, the approach taken to the collations of the in-combination and cumulative 'totals' for the Berwick Bank Wind Farm submission is used to provide the foundation for the current work. This is on the basis that Berwick Bank Wind Farm represents a recent submission for a major development in the same region, for which the work undertaken for the ornithological assessment was subject to considerable scrutiny by stakeholders, and for which no concerns over the in-combination and cumulative assessments were raised by NatureScot (2023a).

Thus, recent existing collations of collision estimates, displacement mortality estimates or of mean peak abundances (from which displacement effects are derived) for the relevant seasonal periods for each species provide the starting points. These existing collations have been augmented with data derived from projects for which predicted collision or displacement effects were published after the existing collations. This encompasses submitted applications as well as Preliminary Environmental Information Reports (PEIR). As far as is possible, the seasonal periods for which the totals are collated align with the current understanding of NatureScot advice and guidance on the seasonal periods relevant to each of the six seabird species, which applies the breeding periods as set out in NatureScot (2020) and uses the non-breeding periods as defined by Furness (2015) but with adjustment to avoid overlap with the defined breeding periods (NatureScot 2021). Thus, as far as possible, the collated totals are aligned with the seasonal periods in Table 1.

*Table 1. Seasonal periods for the seabird species considered in this report, as based upon applying the advised NatureScot (2020) breeding period with the non-breeding periods from Furness (2015)*

	Breeding season	Autumn passage	Migration-free winter or full non-breeding period	Spring passage
Gannet	mid-Mar - Sep	Oct - Nov	-	Dec – mid-Mar
Kittiwake	mid-Apr - Aug	Sep - Dec	-	Jan – mid-Apr
Herring gull	Apr - Aug	-	Sep - Mar	-
Guillemot	Apr – mid-Aug	-	mid-Aug - Mar	-
Razorbill	Apr – mid-Aug	mid-Aug - Oct	Nov - Dec	Jan - Mar
Puffin	Apr – mid-Aug	-	mid-Aug - Mar	-

However, there will be inconsistency in this respect because most projects from English waters use the advised seasonal periods from Furness (2015) which, for some species, differ slightly to those defined above (due to differences in the specified breeding periods).

In terms of the broad, general, approach, the collations were undertaken as follows:

- Breeding season effects for SPAs other than the Flamborough and Filey Coast:  
This involved extracting the effects as assigned to each SPA directly from the assessment documents of each relevant project, and sometimes also from Marine Scotland Appropriate Assessments. For older projects (e.g. the Aberdeen, Moray East and Kincardine wind farms), the effects were often

derived from secondary sources (e.g. the HRA for the revised Inch Cape Wind Farm design, the Moray West HRA/Addendum or the in-combination totals in the East Anglia ONE North / TWO submissions).

Given the nature of these extractions, the data pertaining to displacement effects were usually extracted as mortality estimates which had been apportioned in the original assessments (or relevant secondary sources) to the individual SPA populations of relevance (as opposed to the mean peak abundances from which the predicted displacement mortality is obtained). For some of these projects, the data on displacement effects were only readily available as mortality estimates, meaning that for consistency the displacement effects are presented as the apportioned mortality estimates (as opposed to the apportioned mean peak abundance). Within assessments, these mortality estimates were derived by applying an assumed displacement rate and an assumed mortality rate for displaced birds to the mean peak abundance value. A range of such rates may be applied in assessments, with the species-specific rates advised by NatureScot and / or Marine Directorate having been subject to change over the years (e.g. compare Marine Scotland 2017 and 2022). For the purposes of the current collations, predicted mortality has been presented assuming a single set of displacement and mortality rates for each relevant species. These can be readily amended to reflect the mortality that would be predicted by a different combination of displacement and mortality rates via simple proportionate increases or reductions (e.g. mortality estimates based upon a displacement rate of 30% and mortality rate of 2% can be amended to reflect rates of 30% displacement and 3% mortality by multiplying by a factor of 1.5).

Corrections to the breeding season mortality estimates from collisions and displacement to account for adult birds of breeding age which do not breed in a particular year (referred to as sabbaticals) are incorporated for some projects. Incorporation is generally limited to those projects which have applied the corrections in their assessments, although in a small number of cases they have also been applied to updated or re-worked estimates where it has been considered appropriate. Thus, it is largely the more recent projects in Scottish waters that have such corrections applied, with the details provided in the footnotes of the excel spreadsheet which set out the outputs from this work. With some rare exceptions, these rates have not been applied to projects in English waters on the basis that Natural England do not agree with their application and because few such projects have breeding season effects on Scottish SPA populations. The exceptions in this regard concern the collision and displacement effects from the Dogger Bank projects as apportioned in the breeding season to Scottish SPA gannet populations. The species-specific sabbatical rates that have been used are also detailed in the footnotes of accompanying spreadsheets, with the rates being as advised to date by NatureScot (e.g. NatureScot 2021).

- Breeding season effects for the Flamborough and Filey Coast SPA:  
Existing published collations for breeding season effects apportioned to this SPA are available from several previous projects. Thus, recent collations (e.g. as for East Anglia ONE North / East Anglia TWO, Hornsea Four or Sheringham Shoal and Dudgeon Extension projects) were used as the starting point, with these being updated and augmented according to the data on effects as apportioned to this SPA in subsequent projects. In relation to displacement effects, these collations present the mean peak abundance for the breeding season, as apportioned to the Flamborough and Filey Coast SPA, so that the potential displacement mortality is obtained by applying a particular combination of displacement and mortality rates to these abundance values.

The number of projects contributing to in-combination effects on the Flamborough and Filey Coast SPA during the breeding season is substantially greater than for other SPAs due to the larger number of projects in English waters in the North Sea (and hence the larger number of projects which are

within the breeding season foraging range of seabirds from this SPA, meaning that there is considered to be breeding season connectivity between these projects and this SPA).

- Non-breeding season effects for all SPAs:

As detailed and explained below, non-breeding season effects for gannet, kittiwake and razorbill are based upon the regions and seasonal periods<sup>1</sup> defined by the Biologically Defined Minimum Population Scales (BDMPS) (Furness 2015), whereas for herring gull and guillemot a different approach is taken (and for puffin they are only extracted and presented in terms of cumulative effects).

For gannet, kittiwake and razorbill, the collations were generally undertaken using the same broad approach and the same (or similar) sources as for the breeding season effects for the Flamborough and Filey Coast SPA. In these cases, the cumulative collision estimates or abundances (from which displacement effects are derived) were then related to the SPA apportioning (as derived from the BDMPS approach) to obtain the seasonally and SPA-specific effects.

However, for herring gull and guillemot, the non-breeding season effects are considered over the same spatial scale as the breeding season effects, following recent NatureScot advice and guidance (NatureScot 2021, 2023b). This meant that the extraction of the relevant data was directly from the assessment documents of each relevant project (or secondary sources for older projects). As for the breeding season collations for SPAs (except Flamborough and Filey Coast), displacement effects on SPA populations were extracted (and presented) as a mortality estimate for a given displacement rate and mortality rate.

- Cumulatives:

Existing published collations provided the starting points, with these being updated and augmented according to the data from subsequent projects. In relation to displacement, these provided estimates of the seasonal mean peak abundance.

Details of the sources, and (where required) explanations relevant to how data have been extracted from these sources, are provided in a series of detailed footnotes to the tables of in-combination and cumulative totals that are presented in the accompanying spreadsheets.

## Species-specific details

### Gannet

Both collision estimates and displacement effects are relevant to gannet.

Collision estimates are presented according to several different permutations, as follows:

- With the 'old' or 'original' avoidance rates (i.e. as applied in the project assessment or as used in existing collations) and with the estimates amended according to the new avoidance rates for which revised NatureScot guidance is anticipated (and which are expected to be based on Ozsanlev-Harris et al. 2023). This amendment is only applied to those estimates for which the 'original' avoidance rate is known and (clearly) does not affect the more recent estimates which already use the new avoidance rates. A complication is that some of the more recent assessments (from projects in English waters) also apply a macro-avoidance rate in estimating gannet collisions (as now advised by Natural England, based upon the findings of Pavat et al. 2023). At the time of writing, the NatureScot position on the use of the macro-avoidance rate for gannet collision estimation appears to be unclear. Given

<sup>1</sup> With these seasonal periods adjusted to align with the NatureScot periods where feasible.

this, a macro-avoidance rate has not been applied to the collision estimates retrospectively, although it is retained within those estimates which already incorporate it.

- With and without account being taken of corrections due to differences between the 'as-built' and the consented wind farm designs (as determined in MacArthur Green 2017). Given the projects for which such differences were identified (which are mainly in English waters), this mainly affects the in-combination and cumulative collision totals for the non-breeding passage periods (because the affected projects rarely have breeding season connectivity with more northern SPAs).
- Collision estimates for Berwick Bank Wind Farm estimated according to the scoping or developer approach. The Scoping Opinion for Berwick Bank required the collision estimates to be based upon the maximum, as opposed to mean, monthly densities of birds in flight within the array area (Marine Scotland 2022). This deviates from the 'standard' approach (as used in all other recent UK assessments for offshore wind farms) and, consequently, the Berwick Bank assessment also included estimates derived using the mean monthly densities (i.e. the developer approach). This has a marked effect on the in-combination breeding season collision totals for some SPAs.

Apportioning of collision and displacement effects during the non-breeding passage periods is undertaken following the approach used in the East Anglia THREE assessment. This approach uses the BDMPS as its basis but with updated information on the flight directions of birds from different colonies during passage based on data from tracking studies combined with observations made at coastal observatories (MacArthur Green 2015, Furness 2015). Based on this information, the proportions of the different breeding colony populations which take northerly or southerly passage routes through the North Sea and English Channel are estimated for both the autumn and spring passage periods. This, in turn, enables estimation of the proportion of birds within each wind farm site that are expected to be from the different colony populations during each of the two passage periods (MacArthur Green 2015, Royal HaskoningDHV et al. 2015, Furness 2015).

## Kittiwake

Both collisions and displacement effects are relevant to kittiwake.

Collision estimates are presented according to the same permutations as for gannet. In the case of kittiwake, there is no additional complication due to any considerations over the application of a macro-avoidance rate.

In relation to displacement, prior to the assessment for the Berwick Bank Wind Farm there was no requirement to consider effects on kittiwakes during the non-breeding periods (either for Scottish or English projects). Thus, collations for determining displacement effects during the non-breeding periods are more limited than for other species or seasons (due to the problems in extracting the required information from older projects).

Apportioning of collision and displacement effects during the non-breeding passage periods has been undertaken following the BDMPS approach (Furness 2015).

## Herring gull

Only collision effects are relevant to herring gull, with estimates presented according to (i) 'old / original' and updated avoidance rates and (ii) Berwick Bank collisions estimated by the scoping and developer approaches. Differences between consented and 'as-built' designs have not been considered as these affect only one of the projects (and to a minor extent – i.e. the Aberdeen Wind Farm) contributing to the in-combination and cumulative totals.

In accordance with NatureScot advice (NatureScot 2021), during the non-breeding period SPA breeding populations have been assumed to remain within the 'region' of the breeding colony (as defined by the mean maximum plus 1 SD breeding season foraging range – Woodward *et al.* 2019). Thus, the approach and data sources for the collations are as for the breeding season. In addition (and again aligned with recent NatureScot advice), a correction to account for the influx of birds from continental and western UK breeding colonies has been applied to the in-combination estimates for the non-breeding period, with this based upon the assumption that 32.5% of the birds within the regional population will derive from these 'other' breeding areas (Furness 2015).

Given that birds from breeding colonies are assumed to remain within the breeding season foraging range, the cumulative collision totals are derived from the more northern projects in UK North Sea waters only.

## Guillemot

Only displacement effects are relevant to guillemot. In accordance with NatureScot advice (NatureScot 2021, 2023b), during the non-breeding period SPA breeding populations are assumed to remain within the 'region' of the breeding colony (as defined by the mean maximum plus 1 SD breeding season foraging range – Woodward *et al.* 2019). Thus, the approach taken to data extraction and the assessments for which data are extracted for the collations are as for the breeding season.

Given that birds from breeding colonies are assumed to remain within the breeding season foraging range, the cumulative displacement totals are derived from the more northern projects in UK North Sea waters only.

## Razorbill

Only displacement effects are relevant to razorbill. Apportioning of displacement effects during the non-breeding passage periods is undertaken following the BDMPS approach (Furness 2015).

## Puffin

Only displacement effects are relevant to puffin. In accordance with recent NatureScot advice (NatureScot 2021), no in-combination totals are collated for the non-breeding period due to the highly dispersive nature of puffin following the breeding season. Cumulative numbers are presented for both breeding and non-breeding periods.

## Outputs

The collated in-combination and cumulative totals for each species are presented in a series of excel spreadsheets. Where relevant these include the apportioning estimates which are used in generating the apportioned in-combination effects.

Details of these spreadsheets are as follows:

- Gannet
  - GX breeding season collisions: Comprises three worksheets.
    - 'SPA breed collisions\_old ARs' and 'SPA breed collisions\_updt ARs' present in-combination breeding season collisions according to 'old / original' and updated avoidance rates, respectively, for all SPAs except the Flamborough and Filey Coast.
    - 'FFC breed collisions\_by ARs' presents the breeding season in-combination collisions for the Flamborough and Filey Coast SPA according to both 'old / original' and updated avoidance rates and also with and without account of 'as-built' designs.

- GX passage collisions: Comprises four worksheets.
  - 'SPA collisions\_original ARs' and 'SPA collisions\_updated ARs' contain the in-combination collisions for the autumn and spring passage periods. Each of these worksheets presents the estimates for the relevant SPAs for both passage periods, according to inclusion (or not) of 'as-built' designs, with the former based on the 'old / original' avoidance rates and the latter with avoidance rates updated.
  - 'WF collisions' worksheet provides some of the inputs for the above two worksheets and also presents the cumulative collision estimates by seasonal period.
  - 'SPA proportions' worksheet provides the proportional contribution of each SPA population (for adults and immatures) to the autumn and spring passage numbers within each wind farm, so when combined with the passage period collision numbers for each wind farm (as given in 'WF collisions' and using data in the columns with seasonal adjustment) enables estimation of the passage period SPA collisions at the wind farm (as given in 'SPA collisions\_original ARs' and 'SPA collisions\_updated ARs').
- GX displacement: Comprises four worksheets, with three of these containing the key outputs.
  - 'SPA breeding season displace' presents breeding season displacement mortality estimates for SPAs other than the Flamborough and Filely Coast. These mortality estimates are based on a displacement rate of 70% and mortality rate of 1%.
  - 'FFC breeding season displace' presents the cumulative mean peak abundances as apportioned to the Flamborough and Filely Coast SPA. Appropriate displacement and mortality rates can be applied to these totals to obtain the predicted in-combination displacement mortality.
  - 'GX cum & passage in-comb' presents the cumulative mean peak abundances as apportioned to the relevant SPAs for the autumn and spring passage periods. The worksheet also includes the cumulative seasonal mean peak abundances.
  - 'SPA proportions' is as above for GX passage collisions. Combining the SPA proportional contribution for each wind farm with the respective passage period mean abundance estimate (as given in 'GX cum & passage in-comb') enables estimation of the contribution of each SPA population to the mean abundance at the wind farm (also as given in 'GX cum & passage in-comb').
- Kittiwake
  - KI breeding season collisions: Comprises four worksheets.
    - 'SPA breed collisions\_old ARs' and 'SPA breed collisions\_updt ARs' present in-combination breeding season collisions according to 'old / original' and updated avoidance rates, respectively, for all SPAs except the Flamborough and Filely Coast.
    - 'FFC breed collisions\_old ARs' and 'FFC breed collisions\_updt ARs' present in-combination breeding season collisions for the Flamborough and Filely Coast SPA according to 'old / original' and updated avoidance rates, respectively.
  - KI passage collisions: Comprises three worksheets.
    - 'SPA collisions\_BB scoping' and 'SPA collisions\_BB developer' present the in-combination collisions for the autumn and spring passage periods. Each of these worksheets presents the estimates for the relevant SPAs for both passage periods, according to inclusion (or not) of 'as-built' designs and according to whether the 'old / original' or updated avoidance rates are used. The former incorporates the Berwick Bank estimates as derived from the scoping approach and the latter incorporates the Berwick Bank estimates as derived by the developer approach.
    - 'WF collisions' worksheet provides the input for the above two worksheets to enable estimation of the SPA-specific collision estimates for each passage period. This is

achieved by combining the total collision estimate for a particular passage period (as given in 'WF collisions' and using data from columns with seasonal adjustment) with the proportional contribution of the SPA population, by age class, for the respective passage period. This worksheet also presents the cumulative collision estimates by seasonal period.

- KI displacement: Comprises three worksheets.
  - 'SPA KI displacement breeding' presents breeding season displacement mortality estimates for SPAs. These mortality estimates are based on a displacement rate of 30% and mortality rate of 2%.
  - 'SPA KI displacement passage' presents the cumulative mean peak abundances as apportioned to the relevant SPAs for the autumn and spring passage periods.
  - 'KI cumulative passage displace' presents the cumulative seasonal mean peak abundances (with the passage period totals providing an input to 'SPA KI displacement passage' to enable estimation of the number of birds (by age class) from each SPA population which are at risk of displacement during each passage period.
- Herring gull
  - HG: Comprises five worksheets.
    - 'HG\_old ARs\_breeding' and 'HG\_old ARs\_nonbreeding' present the in-combination collision estimates for the 'old / original' avoidance rates for the breeding and non-breeding periods, respectively.
    - 'HG\_updt ARs\_breeding' and 'HG\_updt ARs\_nonbreeding' present the in-combination collision estimates for the updated avoidance rates for the breeding and non-breeding periods, respectively.
    - 'HG cumulative' presents the cumulative collision estimates.
- Guillemot
  - GU: Comprises three worksheets.
    - 'GU\_breeding' and 'GU\_nonbreeding' present the in-combination breeding and non-breeding season displacement mortality estimates for SPAs. These mortality estimates are based on a displacement rate of 60% and mortality rate of 1%.
    - GU cumulative presents the cumulative mean peak abundances for the breeding and non-breeding periods.
- Razorbill
  - RA: Comprises three worksheets.
    - 'SPA RA\_breeding' presents the in-combination breeding season displacement mortality estimates for SPAs. These mortality estimates are based on a displacement rate of 60% and mortality rate of 1%.
    - 'SPA RA\_non-breeding' presents the cumulative mean peak abundances as apportioned to the relevant SPAs for the passage and winter periods.
    - 'RA cumulative totals' presents the cumulative seasonal mean peak abundances.
- Puffin
  - PU: Comprises three worksheets.
    - 'SPA PU breed' presents the in-combination breeding season displacement mortality estimates for SPAs other than the Flamborough and Filey Coast. These mortality estimates are based on a displacement rate of 60% and mortality rate of 2%.
    - 'FFC Puffin' presents the presents the cumulative mean peak abundances as apportioned to the Flamborough and Filey Coast SPA for the breeding and non-breeding periods.
    - 'PU cumulative totals' presents the cumulative mean peak abundances for the breeding and non-breeding periods.

## References

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- Pavat *et al.* (2023). Consideration of avoidance behaviour of northern gannet (*Morus bassanus*) in collision risk modelling for offshore wind farm impact assessments. Natural England Commissioned Report NERC512.
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- SNCBs (2017). Joint SNCB interim displacement advice note. [Joint SNCB Interim Displacement Advice Note \(jncc.gov.uk\)](#)
- Woodward *et al.* (2019). Desk-based revision of seabird foraging ranges used for HRA screening. BTO report no. 724

# Annex 10.4-B2: Derived In-combination and Cumulative Mortalities

See zip folder (**Appendix 10.4 Annex B2 - The NEEOG Interim CEF With Derived In-Combination and Cumulative Mortalities.zip (RHDV\_BEL\_CST\_REP\_0004\_033)**) of the digital version of this document for the associated excel spreadsheets. Print outs of the excel files are included in the hard copy version of this document.

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# Annex C: In-Combination Mortality Apportionment Calculations

This annex contains the in-combination mortality apportionment calculations for each species SPA populations and regional populations where the potential for LSE has been determined. It also includes the respective percentage point change in adult survival calculations used to determine which scenarios would be taken forward for PVA.

These are provided for the following impact scenarios (where relevant to the respective species) both including and excluding the mortalities from the Berwick Bank Offshore Wind Farm:

- Displacement (Lower);
- Displacement (Upper);
- Collisions;
- Displacement (Lower) + Collisions; and
- Displacement (Upper) + Collisions.

See zip **Appendix 10.4 Annex C -In-Combination Mortality Apportionment Calculations.zip (RHDV\_BEL\_CST\_REP\_0004\_034)** of the digital version of this document for the associated excel spreadsheets. The excel files are included in hard copy

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## Annex D: PVA Input Files

This annex consists of the input files produced by the NE PVA tool for each of the impact scenarios for which PVAs were run in this assessment. See the cover tab for an example of the folder layout, and the information page for details on file naming conventions and PVA-related acronyms.

Note that for some PVA runs, i.e. Cumulative Regional Kittiwake, there are two input files for two runs of the model, one for Berwick Bank included and the other excluded. The PVA tool does not always function with a full set (10) of scenarios, and therefore often runs must be made separately.

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# **Regional Population>Project Alone>Razorbill**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-06-27 11:45:02 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "ProjAloneRegion\_RA\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Razorbill.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 26583 in 2024

**Productivity rate per pair:** mean: 0.643 , sd: 0.057

**Adult survival rate:** mean: 0.895 , sd: 0.067

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 1 to 2 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 2 to 3 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 4 to 5 - mean: 0.895 , sd: 0.067 , DD: NA

## Impacts

Number of impact scenarios: 2.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: DisplacementLower**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00039511 , se: NA

**Impact on immature survival rate** mean: 0.000424773 , se: NA

## Scenario B - Name: DisplacementUpper

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.000660326 , se: NA

**Impact on immature survival rate** mean: 0.000709756 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **Regional Population>Cumulative>Gannet**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-07 13:02:58 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "CumulativeRegional\_GX\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Northern Gannet.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 379768 in 2024

**Productivity rate per pair:** mean: 0.698 , sd: 0.071

**Adult survival rate:** mean: 0.919 , sd: 0.042

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.424 , sd: 0.014 , DD: NA

Age class 1 to 2 - mean: 0.829 , sd: 0.008 , DD: NA

Age class 2 to 3 - mean: 0.891 , sd: 0.006 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.006 , DD: NA

Age class 4 to 5 - mean: 0.919 , sd: 0.042 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: DMin\_Excl BB**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.000810097 , se: NA

**Impact on immature survival rate** mean: 0.000402275 , se: NA

## Scenario B - Name: DMin\_All OWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.000901649 , se: NA

**Impact on immature survival rate** mean: 0.000426866 , se: NA

## Scenario C - Name: DMax\_Excl BB

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00243015 , se: NA

**Impact on immature survival rate** mean: 0.00120667 , se: NA

## Scenario D - Name: DMax\_All OWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00270481 , se: NA

**Impact on immature survival rate** mean: 0.00128045 , se: NA

## Scenario E - Name: Col\_Excl BB

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00210908 , se: NA

**Impact on immature survival rate** mean: 0.000378504 , se: NA

## Scenario F - Name: Col\_All OWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00239025 , se: NA

**Impact on immature survival rate** mean: 0.000410165 , se: NA

## Scenario G - Name: DMinCol\_Excl BB

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00291917 , se: NA

**Impact on immature survival rate** mean: 0.000780778 , se: NA

## Scenario H - Name: DMinCol\_All OWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0032919 , se: NA

**Impact on immature survival rate** mean: 0.000837032 , se: NA

## Scenario I - Name: DMaxCol\_Excl BB

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00453923 , se: NA

**Impact on immature survival rate** mean: 0.00158518 , se: NA

## Scenario J - Name: DMaxCol\_All OWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00509505 , se: NA

**Impact on immature survival rate** mean: 0.00169061 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **Regional Population>Cumulative>Guillemot**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-06-27 07:34:00 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "CumulativeRegional\_GU\_35+15Y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Common Guillemot.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 6.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 1003449 in 2024

**Productivity rate per pair:** mean: 0.659 , sd: 0.133

**Adult survival rate:** mean: 0.939 , sd: 0.015

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.56 , sd: 0.026 , DD: NA

Age class 1 to 2 - mean: 0.792 , sd: 0.068 , DD: NA

Age class 2 to 3 - mean: 0.917 , sd: 0.044 , DD: NA

Age class 3 to 4 - mean: 0.939 , sd: 0.015 , DD: NA

Age class 4 to 5 - mean: 0.939 , sd: 0.015 , DD: NA

Age class 5 to 6 - mean: 0.939 , sd: 0.015 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: DisplLower\_Excl BB**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00304068 , se: NA

**Impact on immature survival rate** mean: 0.0031985 , se: NA

## Scenario B - Name: DisplLower\_ALLOWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00379998 , se: NA

**Impact on immature survival rate** mean: 0.00400489 , se: NA

## Scenario C - Name: DisplUpper\_Excl BB

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00632642 , se: NA

**Impact on immature survival rate** mean: 0.00658945 , se: NA

## Scenario D - Name: DisplUpper\_ALLOWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00777004 , se: NA

**Impact on immature survival rate** mean: 0.00811156 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **Regional Population>Cumulative>Kittiwake**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-06-26 08:38:44 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "CumulativeRegional\_PU\_35+15Y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Atlantic Puffin.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 278750 in 2024

**Productivity rate per pair:** mean: 0.617 , sd: 0.151

**Adult survival rate:** mean: 0.906 , sd: 0.083

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 1 to 2 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 2 to 3 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 3 to 4 - mean: 0.76 , sd: 0.093 , DD: NA

Age class 4 to 5 - mean: 0.805 , sd: 0.083 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: DisplLower\_Excl BB**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00136076 , se: NA

**Impact on immature survival rate** mean: 0.00090533 , se: NA

## Scenario B - Name: DisplLower\_ALLOWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00165114 , se: NA

**Impact on immature survival rate** mean: 0.00106286 , se: NA

## Scenario C - Name: DisplUpper\_Excl BB

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00306089 , se: NA

**Impact on immature survival rate** mean: 0.00161801 , se: NA

## Scenario D - Name: DisplUpper\_ALLOWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00376486 , se: NA

**Impact on immature survival rate** mean: 0.00191085 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-12-17 15:19:51 using Tool version 2, with R version 4.2.2, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.8"
## shiny	"shiny"	"1.8.0"
## shinyjs	"shinyjs"	"2.1.0"
## shinydashboard	"shinydashboard"	"0.7.3"
## shinyWidgets	"shinyWidgets"	"0.8.2"
## DT	"DT"	"0.33"
## plotly	"plotly"	"4.10.4"
## rmarkdown	"rmarkdown"	"2.25"
## dplyr	"dplyr"	"1.1.4"
## tidyr	"tidyr"	"1.3.1"

## Basic information

This run had reference name "CumulativeReg\_KI\_35\_Hoy\_AsBuilt\_ExclBB".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 4.

Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 313061 in 2024

**Productivity rate per pair:** mean: 0.819 , sd: 0.332

**Adult survival rate:** mean: 0.854 , sd: 0.051

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 5.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: DMin\_ExclBB**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00106297 , se: NA

**Impact on immature survival rate** mean: 0.00055419 , se: NA

**Scenario B - Name: DMax\_ExclBB**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00318889 , se: NA

**Impact on immature survival rate** mean: 0.00166235 , se: NA

**Scenario C - Name: Col\_ExclBB**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00469721 , se: NA

**Impact on immature survival rate** mean: 0.00202593 , se: NA

**Scenario D - Name: DMinCol\_ExclBB**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00576018 , se: NA

**Impact on immature survival rate** mean: 0.00258011 , se: NA

**Scenario E - Name: DMaxCol\_ExclBB**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0078861 , se: NA

**Impact on immature survival rate** mean: 0.00368828 , se: NA

**Output:**

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-12-17 14:53:12 using Tool version 2, with R version 4.2.2, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.8"
## shiny	"shiny"	"1.8.0"
## shinyjs	"shinyjs"	"2.1.0"
## shinydashboard	"shinydashboard"	"0.7.3"
## shinyWidgets	"shinyWidgets"	"0.8.2"
## DT	"DT"	"0.33"
## plotly	"plotly"	"4.10.4"
## rmarkdown	"rmarkdown"	"2.25"
## dplyr	"dplyr"	"1.1.4"
## tidyr	"tidyr"	"1.3.1"

## Basic information

This run had reference name "CumulativeReg\_KI\_35\_Hoy\_AsBuilt".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 4.

Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 313061 in 2024

**Productivity rate per pair:** mean: 0.819 , sd: 0.332

**Adult survival rate:** mean: 0.854 , sd: 0.051

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 5.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DMin

#### *All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00132609 , se: NA

**Impact on immature survival rate** mean: 0.00066016 , se: NA

### Scenario B - Name: DMax

#### *All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00397826 , se: NA

**Impact on immature survival rate** mean: 0.00198028 , se: NA

**Scenario C - Name: Col**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00618111 , se: NA

**Impact on immature survival rate** mean: 0.00248948 , se: NA

**Scenario D - Name: DMinCol**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0075072 , se: NA

**Impact on immature survival rate** mean: 0.00314964 , se: NA

**Scenario E - Name: DMaxCol**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.01015937 , se: NA

**Impact on immature survival rate** mean: 0.00446976 , se: NA

**Output:**

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

**Regional Population>Cumulative>Puffin**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-06-26 08:38:44 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "CumulativeRegional\_PU\_35+15Y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Atlantic Puffin.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 278750 in 2024

**Productivity rate per pair:** mean: 0.617 , sd: 0.151

**Adult survival rate:** mean: 0.906 , sd: 0.083

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 1 to 2 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 2 to 3 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 3 to 4 - mean: 0.76 , sd: 0.093 , DD: NA

Age class 4 to 5 - mean: 0.805 , sd: 0.083 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: DisplLower\_Excl BB**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00136076 , se: NA

**Impact on immature survival rate** mean: 0.00090533 , se: NA

## Scenario B - Name: DisplLower\_ALLOWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00165114 , se: NA

**Impact on immature survival rate** mean: 0.00106286 , se: NA

## Scenario C - Name: DisplUpper\_Excl BB

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00306089 , se: NA

**Impact on immature survival rate** mean: 0.00161801 , se: NA

## Scenario D - Name: DisplUpper\_ALLOWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00376486 , se: NA

**Impact on immature survival rate** mean: 0.00191085 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# Regional Population>Cumulative>Razorbill

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-06-26 07:39:26 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "CumulativeRegional\_RA\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Razorbill.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 26583 in 2024

**Productivity rate per pair:** mean: 0.643 , sd: 0.057

**Adult survival rate:** mean: 0.895 , sd: 0.067

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 1 to 2 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 2 to 3 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 4 to 5 - mean: 0.895 , sd: 0.067 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: DisplLower\_Excl BB**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00774616 , se: NA

**Impact on immature survival rate** mean: 0.00813414 , se: NA

## Scenario B - Name: DisplLower\_ALLOWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00917482 , se: NA

**Impact on immature survival rate** mean: 0.00965433 , se: NA

## Scenario C - Name: DisplUpper\_Excl BB

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0160277 , se: NA

**Impact on immature survival rate** mean: 0.0166488 , se: NA

## Scenario D - Name: DisplUpper\_ALLOWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0186807 , se: NA

**Impact on immature survival rate** mean: 0.0194535 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **Buchan Collieston SPA>Kittiwake>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-07 09:13:54 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "Buchan\_KI\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 4.

Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 27094 in 2023

**Productivity rate per pair:** mean: 0.819 , sd: 0.332

**Adult survival rate:** mean: 0.854 , sd: 0.051

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DMin\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0007255 , se: NA

**Impact on immature survival rate** mean: 0.00021119 , se: NA

### Scenario B - Name: DMin\_All OWFs (Excl GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0008085 , se: NA

**Impact on immature survival rate** mean: 0.00023574 , se: NA

### **Scenario C - Name: DMax\_Excl BB (& GV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00179297 , se: NA

**Impact on immature survival rate** mean: 0.00063353 , se: NA

### **Scenario D - Name: DMax\_All OWFs (Excl GV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00204197 , se: NA

**Impact on immature survival rate** mean: 0.00070717 , se: NA

### **Scenario E - Name: Col\_Excl BB (& GV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00248229 , se: NA

**Impact on immature survival rate** mean: 0.00099083 , se: NA

### **Scenario F - Name: Col\_All OWFs (Excl GV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00286444 , se: NA

**Impact on immature survival rate** mean: 0.00108337 , se: NA

### **Scenario G - Name: DMinCol\_Excl BB (& GV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00320779 , se: NA

**Impact on immature survival rate** mean: 0.00120202 , se: NA

## Scenario H - Name: DMinCol\_All OWFs (Excl GV)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00367294 , se: NA

**Impact on immature survival rate** mean: 0.00131911 , se: NA

## Scenario I - Name: DMaxCol\_Excl BB (& GV)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00427526 , se: NA

**Impact on immature survival rate** mean: 0.00162437 , se: NA

## Scenario J - Name: DMaxCol\_All OWFs (Excl GV)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00490641 , se: NA

**Impact on immature survival rate** mean: 0.00179054 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **Copinsay SPA>Kittiwake>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-04 10:50:06 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "Copinsay\_KI\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 4.

Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 1910 in 2021

**Productivity rate per pair:** mean: 0.819 , sd: 0.332

**Adult survival rate:** mean: 0.854 , sd: 0.051

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: DisplMin\_Excl BB (& GV)**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00028303 , se: NA

**Impact on immature survival rate** mean: 0.00012364 , se: NA

**Scenario B - Name: DisplMin\_ALLOWFs**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00032748 , se: NA

**Impact on immature survival rate** mean: 0.00014212 , se: NA

### Scenario C - Name: DisplMax\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00084907 , se: NA

**Impact on immature survival rate** mean: 0.00037086 , se: NA

### Scenario D - Name: DisplMax\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00098242 , se: NA

**Impact on immature survival rate** mean: 0.00042632 , se: NA

### Scenario E - Name: Col\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00096738 , se: NA

**Impact on immature survival rate** mean: 0.00043547 , se: NA

### Scenario F - Name: Col\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00112381 , se: NA

**Impact on immature survival rate** mean: 0.00050177 , se: NA

### Scenario G - Name: DisplMinCol\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00125041 , se: NA

**Impact on immature survival rate** mean: 0.0005591 , se: NA

## Scenario H - Name: DisplMinCol\_ALLOWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00145129 , se: NA

**Impact on immature survival rate** mean: 0.00064389 , se: NA

## Scenario I - Name: DisplMaxCol\_Excl BB (& GV)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00181645 , se: NA

**Impact on immature survival rate** mean: 0.00080633 , se: NA

## Scenario J - Name: DisplMaxCol\_ALLOWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00210623 , se: NA

**Impact on immature survival rate** mean: 0.0009281 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **Coquet Island SPA>Puffin>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-06-25 12:10:14 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "Coquet\_PU\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Atlantic Puffin.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 50058 in 2019

**Productivity rate per pair:** mean: 0.415 , sd: 0.219

**Adult survival rate:** mean: 0.906 , sd: 0.083

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 1 to 2 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 2 to 3 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 3 to 4 - mean: 0.76 , sd: 0.093 , DD: NA

Age class 4 to 5 - mean: 0.805 , sd: 0.083 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: DisplacementLower\_ExclBB(andGV)**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00025298 , se: NA

**Impact on immature survival rate** mean: 8.019e-05 , se: NA

## Scenario B - Name: DisplacementLower\_ALLOWFs(Excl GV)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0003249 , se: NA

**Impact on immature survival rate** mean: 0.00019847 , se: NA

## Scenario C - Name: DisplacementUpper\_ExclBB(andGV)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00039759 , se: NA

**Impact on immature survival rate** mean: 0.00013358 , se: NA

## Scenario D - Name: DisplacementUpper\_ALLOWFs(ExclGV)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00051746 , se: NA

**Impact on immature survival rate** mean: 0.00033072 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **East Caithness Cliffs SPA>Kittiwake>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-07 10:36:43 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "ECC\_KI\_InComb\_35+15y".  
PVA model run type: simplescenarios.  
Model to use for environmental stochasticity: betagamma.  
Model for density dependence: nodd.  
Include demographic stochasticity in model?: Yes.  
Number of simulations: 5000.  
Random seed: 10.  
Years for burn-in: 5.  
Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.  
Region type to use for breeding success data: .  
Available colony-specific survival rate: . Sector to use within breeding success region: .  
Age at first breeding: 4.  
Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.  
Number of subpopulations: 1.  
Are demographic rates applied separately to each subpopulation?: No.  
Units for initial population size: breeding.adults  
Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 36600 in 2024

**Productivity rate per pair:** mean: 0.819 , sd: 0.332

**Adult survival rate:** mean: 0.854 , sd: 0.051

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DMin\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0018804 , se: NA

**Impact on immature survival rate** mean: 0.00046193 , se: NA

### Scenario B - Name: DMin\_All OWFs (Excl GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00202251 , se: NA

**Impact on immature survival rate** mean: 0.00052048 , se: NA

### **Scenario C - Name: DMax\_Excl BB (& GV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00543335 , se: NA

**Impact on immature survival rate** mean: 0.00138564 , se: NA

### **Scenario D - Name: DMax\_All OWFs (Excl GV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00585968 , se: NA

**Impact on immature survival rate** mean: 0.00156128 , se: NA

### **Scenario E - Name: Col\_Excl BB (& GV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00515004 , se: NA

**Impact on immature survival rate** mean: 0.00172769 , se: NA

### **Scenario F - Name: Col\_All OWFs (Excl GV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0056553 , se: NA

**Impact on immature survival rate** mean: 0.00193767 , se: NA

### **Scenario G - Name: DMinCol\_Excl BB (& GV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00703043 , se: NA

**Impact on immature survival rate** mean: 0.00218962 , se: NA

## Scenario H - Name: DMinCol\_All OWFs (Excl GV)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0076778 , se: NA

**Impact on immature survival rate** mean: 0.00245814 , se: NA

## Scenario I - Name: DMaxCol\_Excl BB (& GV)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.01058339 , se: NA

**Impact on immature survival rate** mean: 0.00311333 , se: NA

## Scenario J - Name: DMaxCol\_All OWFs (Excl GV)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.01151498 , se: NA

**Impact on immature survival rate** mean: 0.00349895 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **East Caithness Cliffs SPA>Razorbill>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-02 13:32:19 using Tool version 2, with R version 4.2.2, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.8"
## shiny	"shiny"	"1.8.0"
## shinyjs	"shinyjs"	"2.1.0"
## shinydashboard	"shinydashboard"	"0.7.3"
## shinyWidgets	"shinyWidgets"	"0.8.2"
## DT	"DT"	"0.33"
## plotly	"plotly"	"4.10.4"
## rmarkdown	"rmarkdown"	"2.25"
## dplyr	"dplyr"	"1.1.4"
## tidyr	"tidyr"	"1.3.1"

## Basic information

This run had reference name "ECC\_RA\_InComb\_35+15y".  
PVA model run type: simplescenarios.  
Model to use for environmental stochasticity: betagamma.  
Model for density dependence: nodd.  
Include demographic stochasticity in model?: Yes.  
Number of simulations: 5000.  
Random seed: 10.  
Years for burn-in: 5.  
Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Razorbill.  
Region type to use for breeding success data: .  
Available colony-specific survival rate: . Sector to use within breeding success region: .  
Age at first breeding: 5.  
Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.  
Number of subpopulations: 1.  
Are demographic rates applied separately to each subpopulation?: No.  
Units for initial population size: breeding.adults  
Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 40373 in 2021

**Productivity rate per pair:** mean: 0.643 , sd: 0.057

**Adult survival rate:** mean: 0.895 , sd: 0.067

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 1 to 2 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 2 to 3 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 4 to 5 - mean: 0.895 , sd: 0.067 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: DisplLower\_Excl BB(& GV)**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00330611 , se: NA

**Impact on immature survival rate** mean: 0.00220328 , se: NA

**Scenario B - Name: DisplLower\_ALLOWFs (Excl GV)**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00343803 , se: NA

**Impact on immature survival rate** mean: 0.00228525 , se: NA

**Scenario C - Name: DisplUpper\_Excl BB(& GV)**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00679156 , se: NA

**Impact on immature survival rate** mean: 0.00436547 , se: NA

**Scenario D - Name: DisplUpper\_ALLOWFs (excl GV)**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00715762 , se: NA

**Impact on immature survival rate** mean: 0.00458993 , se: NA

**Output:**

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

## **Fair Isle SPA>Gannet>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-01 15:10:43 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "FairIsle\_GX\_InComb\_35.15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Northern Gannet.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 11184 in 2024

**Productivity rate per pair:** mean: 0.698 , sd: 0.071

**Adult survival rate:** mean: 0.919 , sd: 0.042

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.424 , sd: 0.014 , DD: NA

Age class 1 to 2 - mean: 0.829 , sd: 0.008 , DD: NA

Age class 2 to 3 - mean: 0.891 , sd: 0.006 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.006 , DD: NA

Age class 4 to 5 - mean: 0.919 , sd: 0.042 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: D Min Excl BB (& GV if AEol)**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00029213 , se: NA

**Impact on immature survival rate** mean: 0.00027355 , se: NA

## Scenario B - Name: D Min all OWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00031193 , se: NA

**Impact on immature survival rate** mean: 0.00028438 , se: NA

## Scenario C - Name: D Max Excl BB (& GV if AEol)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00087628 , se: NA

**Impact on immature survival rate** mean: 0.00082052 , se: NA

## Scenario D - Name: D Max all OWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00093566 , se: NA

**Impact on immature survival rate** mean: 0.00085302 , se: NA

## Scenario E - Name: Col Excl BB (& GV if AEol)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00030061 , se: NA

**Impact on immature survival rate** mean: 0.00019483 , se: NA

## Scenario F - Name: Col all OWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00032413 , se: NA

**Impact on immature survival rate** mean: 0.00019883 , se: NA

## Scenario G - Name: D Min + Col Excl BB (& GV if AEol)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00059275 , se: NA

**Impact on immature survival rate** mean: 0.00046837 , se: NA

## Scenario H - Name: D Min + Col all OWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00063606 , se: NA

**Impact on immature survival rate** mean: 0.00048321 , se: NA

## Scenario I - Name: D Max + Col Excl BB (& GV if AEol)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00117689 , se: NA

**Impact on immature survival rate** mean: 0.00101535 , se: NA

## Scenario J - Name: D Max + Col all OWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00125979 , se: NA

**Impact on immature survival rate** mean: 0.00105185 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **Fair Isle SPA>Kittiwake>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-04 15:10:26 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "FairIsle\_KI\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 4.

Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 896 in 2021

**Productivity rate per pair:** mean: 0.69 , sd: 0.296

**Adult survival rate:** mean: 0.854 , sd: 0.051

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DisplMin\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00064228 , se: NA

**Impact on immature survival rate** mean: 0.00027637 , se: NA

### Scenario B - Name: DisplMin\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00075197 , se: NA

**Impact on immature survival rate** mean: 0.000322 , se: NA

### **Scenario C - Name: DisplMax\_Excl BB (& GV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00192664 , se: NA

**Impact on immature survival rate** mean: 0.00082899 , se: NA

### **Scenario D - Name: DisplMax\_ALLOWFs**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00225571 , se: NA

**Impact on immature survival rate** mean: 0.00096588 , se: NA

### **Scenario E - Name: Col\_Excl BB (& GV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00224053 , se: NA

**Impact on immature survival rate** mean: 0.00095638 , se: NA

### **Scenario F - Name: Col\_ALLOWFs**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00262656 , se: NA

**Impact on immature survival rate** mean: 0.00112003 , se: NA

### **Scenario G - Name: DisplMinCol\_Excl BB (& GV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0028828 , se: NA

**Impact on immature survival rate** mean: 0.00123275 , se: NA

## Scenario H - Name: DisplMinCol\_ALLOWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00337853 , se: NA

**Impact on immature survival rate** mean: 0.00144203 , se: NA

## Scenario I - Name: DisplMaxCol\_Excl BB (& GV)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00416716 , se: NA

**Impact on immature survival rate** mean: 0.00178537 , se: NA

## Scenario J - Name: DisplMaxCol\_ALLOWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00488227 , se: NA

**Impact on immature survival rate** mean: 0.00208591 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **Farne Islands SPA>Kittiwake>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-04 13:01:54 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "Farnes\_KI\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 4.

Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 5790 in 2024

**Productivity rate per pair:** mean: 0.819 , sd: 0.332

**Adult survival rate:** mean: 0.854 , sd: 0.051

### **Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DisplMin\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00062688 , se: NA

**Impact on immature survival rate** mean: 0.00021242 , se: NA

### Scenario B - Name: DisplMin\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00113446 , se: NA

**Impact on immature survival rate** mean: 0.00025844 , se: NA

### Scenario C - Name: DisplMax\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00188103 , se: NA

**Impact on immature survival rate** mean: 0.00063719 , se: NA

### Scenario D - Name: DisplMax\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00340377 , se: NA

**Impact on immature survival rate** mean: 0.00077526 , se: NA

### Scenario E - Name: Col\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00258311 , se: NA

**Impact on immature survival rate** mean: 0.00073492 , se: NA

### Scenario F - Name: Col\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00588961 , se: NA

**Impact on immature survival rate** mean: 0.00093231 , se: NA

### Scenario G - Name: DisplMinCol\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00320999 , se: NA

**Impact on immature survival rate** mean: 0.00094733 , se: NA

### Scenario H - Name: DisplMinCol\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00702407 , se: NA

**Impact on immature survival rate** mean: 0.00119075 , se: NA

### Scenario I - Name: DisplMaxCol\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00446414 , se: NA

**Impact on immature survival rate** mean: 0.00137211 , se: NA

### Scenario J - Name: DisplMaxCol\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00929338 , se: NA

**Impact on immature survival rate** mean: 0.00170757 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **Farne Islands SPA>Puffin>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-06-25 10:53:49 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "Farnes\_PU\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Atlantic Puffin.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 100206 in 2024

**Productivity rate per pair:** mean: 0.415 , sd: 0.219

**Adult survival rate:** mean: 0.906 , sd: 0.083

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 1 to 2 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 2 to 3 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 3 to 4 - mean: 0.76 , sd: 0.093 , DD: NA

Age class 4 to 5 - mean: 0.805 , sd: 0.083 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: DisplacementLower\_ExclBB(andGV)**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00030338 , se: NA

**Impact on immature survival rate** mean: 0.00028846 , se: NA

**Scenario B - Name: DisplacementLower\_ALLOWFs(Excl GV)**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00043152 , se: NA

**Impact on immature survival rate** mean: 0.00049927 , se: NA

### Scenario C - Name: DisplacementUpper\_ExclBB(andGV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00047762 , se: NA

**Impact on immature survival rate** mean: 0.00048068 , se: NA

### Scenario D - Name: DisplacementUpper\_ALLOWFs(ExclGV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00069118 , se: NA

**Impact on immature survival rate** mean: 0.00083204 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# FFC SPA>Gannet>In-Combination

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-06-25 10:53:49 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "Farnes\_PU\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Atlantic Puffin.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 100206 in 2024

**Productivity rate per pair:** mean: 0.415 , sd: 0.219

**Adult survival rate:** mean: 0.906 , sd: 0.083

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 1 to 2 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 2 to 3 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 3 to 4 - mean: 0.76 , sd: 0.093 , DD: NA

Age class 4 to 5 - mean: 0.805 , sd: 0.083 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: DisplacementLower\_ExclBB(andGV)**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00030338 , se: NA

**Impact on immature survival rate** mean: 0.00028846 , se: NA

**Scenario B - Name: DisplacementLower\_ALLOWFs(Excl GV)**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00043152 , se: NA

**Impact on immature survival rate** mean: 0.00049927 , se: NA

### Scenario C - Name: DisplacementUpper\_ExclBB(andGV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00047762 , se: NA

**Impact on immature survival rate** mean: 0.00048068 , se: NA

### Scenario D - Name: DisplacementUpper\_ALLOWFs(ExclGV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00069118 , se: NA

**Impact on immature survival rate** mean: 0.00083204 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **FFC SPA>Kittiwake>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-03 11:03:16 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "FFC\_InComb\_35.15y".  
PVA model run type: simplescenarios.  
Model to use for environmental stochasticity: betagamma.  
Model for density dependence: nodd.  
Include demographic stochasticity in model?: Yes.  
Number of simulations: 5000.  
Random seed: 10.  
Years for burn-in: 5.  
Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Northern Gannet.  
Region type to use for breeding success data: .  
Available colony-specific survival rate: . Sector to use within breeding success region: .  
Age at first breeding: 5.  
Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.  
Number of subpopulations: 1.  
Are demographic rates applied separately to each subpopulation?: No.  
Units for initial population size: breeding.adults  
Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 31588 in 2024

**Productivity rate per pair:** mean: 0.698 , sd: 0.071

**Adult survival rate:** mean: 0.919 , sd: 0.042

### Immatures survival rates:

Age class 0 to 1 - mean: 0.424 , sd: 0.014 , DD: NA

Age class 1 to 2 - mean: 0.829 , sd: 0.008 , DD: NA

Age class 2 to 3 - mean: 0.891 , sd: 0.006 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.006 , DD: NA

Age class 4 to 5 - mean: 0.919 , sd: 0.042 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: D Min Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00252521 , se: NA

**Impact on immature survival rate** mean: 0.00029817 , se: NA

### Scenario B - Name: D Min all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00254481 , se: NA

**Impact on immature survival rate** mean: 0.0003051 , se: NA

### Scenario C - Name: D Max Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00757548 , se: NA

**Impact on immature survival rate** mean: 0.00089439 , se: NA

### Scenario D - Name: D Max all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00763428 , se: NA

**Impact on immature survival rate** mean: 0.00091516 , se: NA

### Scenario E - Name: Col Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00506448 , se: NA

**Impact on immature survival rate** mean: 0.00018006 , se: NA

### Scenario F - Name: Col all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00511307 , se: NA

**Impact on immature survival rate** mean: 0.0001826 , se: NA

### Scenario G - Name: D Min + Col Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00758969 , se: NA

**Impact on immature survival rate** mean: 0.00047824 , se: NA

### Scenario H - Name: D Min + Col all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00765788 , se: NA

**Impact on immature survival rate** mean: 0.00048769 , se: NA

## Scenario I - Name: D Max + Col Excl BB (& GV if AEol)

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.01263996 , se: NA

**Impact on immature survival rate** mean: 0.00107445 , se: NA

## Scenario J - Name: D Max + Col all OWFs

### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.01274734 , se: NA

**Impact on immature survival rate** mean: 0.00109775 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **FFC SPA>Razorbill>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-02 14:28:07 using Tool version 2, with R version 4.2.2, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.8"
## shiny	"shiny"	"1.8.0"
## shinyjs	"shinyjs"	"2.1.0"
## shinydashboard	"shinydashboard"	"0.7.3"
## shinyWidgets	"shinyWidgets"	"0.8.2"
## DT	"DT"	"0.33"
## plotly	"plotly"	"4.10.4"
## rmarkdown	"rmarkdown"	"2.25"
## dplyr	"dplyr"	"1.1.4"
## tidyr	"tidyr"	"1.3.1"

## Basic information

This run had reference name "FFC\_RA\_InComb\_35+15y".  
PVA model run type: simplescenarios.  
Model to use for environmental stochasticity: betagamma.  
Model for density dependence: nodd.  
Include demographic stochasticity in model?: Yes.  
Number of simulations: 5000.  
Random seed: 10.  
Years for burn-in: 5.  
Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Razorbill.  
Region type to use for breeding success data: .  
Available colony-specific survival rate: . Sector to use within breeding success region: .  
Age at first breeding: 5.  
Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.  
Number of subpopulations: 1.  
Are demographic rates applied separately to each subpopulation?: No.  
Units for initial population size: breeding.adults  
Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 61345 in 2022

**Productivity rate per pair:** mean: 0.643 , sd: 0.057

**Adult survival rate:** mean: 0.895 , sd: 0.067

### Immatures survival rates:

Age class 0 to 1 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 1 to 2 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 2 to 3 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 4 to 5 - mean: 0.895 , sd: 0.067 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

### Impact on Demographic Rates

#### Scenario A - Name: DisplLower\_Excl BB(& GV)

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00309383 , se: NA

**Impact on immature survival rate** mean: 0.00027412 , se: NA

#### Scenario B - Name: DisplLower\_ALLOWFs

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00315156 , se: NA

**Impact on immature survival rate** mean: 0.00030881 , se: NA

#### Scenario C - Name: DisplUpper\_Excl BB(& GV)

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00583154 , se: NA

**Impact on immature survival rate** mean: 0.00082218 , se: NA

#### Scenario D - Name: DisplUpper\_ALLOWFs

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00600473 , se: NA

**Impact on immature survival rate** mean: 0.00092625 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **Forth Islands SPA>Gannet>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-02 09:47:37 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "ForthIslands\_InComb\_35.15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Northern Gannet.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 103688 in 2023

**Productivity rate per pair:** mean: 0.698 , sd: 0.071

**Adult survival rate:** mean: 0.919 , sd: 0.042

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.424 , sd: 0.014 , DD: NA

Age class 1 to 2 - mean: 0.829 , sd: 0.008 , DD: NA

Age class 2 to 3 - mean: 0.891 , sd: 0.006 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.006 , DD: NA

Age class 4 to 5 - mean: 0.919 , sd: 0.042 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: D Min Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0011317 , se: NA

**Impact on immature survival rate** mean: 0.00060715 , se: NA

### Scenario B - Name: D Min all OWFs (excl GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.001447 , se: NA

**Impact on immature survival rate** mean: 0.00064238 , se: NA

### **Scenario C - Name: D Max Excl BB (& GV if AEol)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00339488 , se: NA

**Impact on immature survival rate** mean: 0.00182125 , se: NA

### **Scenario D - Name: D Max all OWFs (excl GV if AEol)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00434076 , se: NA

**Impact on immature survival rate** mean: 0.00192694 , se: NA

### **Scenario E - Name: Col Excl BB (& GV if AEol)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0040188 , se: NA

**Impact on immature survival rate** mean: 0.00051118 , se: NA

### **Scenario F - Name: Col all OWFs (excl GV if AEol)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00506017 , se: NA

**Impact on immature survival rate** mean: 0.00053657 , se: NA

### **Scenario G - Name: D Min + Col Excl BB (& GV if AEol)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0051505 , se: NA

**Impact on immature survival rate** mean: 0.00111833 , se: NA

### **Scenario H - Name: D Min + Col all OWFs (excl GV if AEol)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00650717 , se: NA

**Impact on immature survival rate** mean: 0.00117895 , se: NA

### Scenario I - Name: D Max + Col Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00741368 , se: NA

**Impact on immature survival rate** mean: 0.00233243 , se: NA

### Scenario J - Name: D Max + Col all OWFs (excl GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00940093 , se: NA

**Impact on immature survival rate** mean: 0.00246351 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **Forth Islands SPA>Kittiwake>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-06-25 11:14:54 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "Forth\_PU\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Atlantic Puffin.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 117960 in 2024

**Productivity rate per pair:** mean: 0.642 , sd: 0.135

**Adult survival rate:** mean: 0.906 , sd: 0.083

### **Immatures survival rates:**

Age class 0 to 1 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 1 to 2 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 2 to 3 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 3 to 4 - mean: 0.76 , sd: 0.093 , DD: NA

Age class 4 to 5 - mean: 0.805 , sd: 0.083 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DisplacementLower\_ExclBB(andGV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00137795 , se: NA

**Impact on immature survival rate** mean: 0.00120217 , se: NA

### Scenario B - Name: DisplacementLower\_ALLOWFs(Excl GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00153157 , se: NA

**Impact on immature survival rate** mean: 0.0013528 , se: NA

### **Scenario C - Name: DisplacementUpper\_ExclBB(andGV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0022389 , se: NA

**Impact on immature survival rate** mean: 0.00200357 , se: NA

### **Scenario D - Name: DisplacementUpper\_ALLOWFs(ExclGV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00249492 , se: NA

**Impact on immature survival rate** mean: 0.00225461 , se: NA

### **Output:**

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-04 12:22:28 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "Forth\_KI\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 4.

Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 13114 in 2024

**Productivity rate per pair:** mean: 0.819 , sd: 0.332

**Adult survival rate:** mean: 0.854 , sd: 0.051

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DisplMin\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00072092 , se: NA

**Impact on immature survival rate** mean: 0.00011272 , se: NA

### Scenario B - Name: DisplMin\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00099125 , se: NA

**Impact on immature survival rate** mean: 0.00013165 , se: NA

### Scenario C - Name: DisplMax\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00201038 , se: NA

**Impact on immature survival rate** mean: 0.00033814 , se: NA

### Scenario D - Name: DisplMax\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00282139 , se: NA

**Impact on immature survival rate** mean: 0.00039494 , se: NA

### Scenario E - Name: Col\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00191879 , se: NA

**Impact on immature survival rate** mean: 0.00044985 , se: NA

### Scenario F - Name: Col\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0037274 , se: NA

**Impact on immature survival rate** mean: 0.00054598 , se: NA

### Scenario G - Name: DisplMinCol\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00263971 , se: NA

**Impact on immature survival rate** mean: 0.00056257 , se: NA

### Scenario H - Name: DisplMinCol\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00471865 , se: NA

**Impact on immature survival rate** mean: 0.00067763 , se: NA

### Scenario I - Name: DisplMaxCol\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00392918 , se: NA

**Impact on immature survival rate** mean: 0.00078799 , se: NA

### Scenario J - Name: DisplMaxCol\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00654878 , se: NA

**Impact on immature survival rate** mean: 0.00094092 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **Forth Islands SPA>Puffin>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-06-25 11:14:54 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "Forth\_PU\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Atlantic Puffin.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 117960 in 2024

**Productivity rate per pair:** mean: 0.642 , sd: 0.135

**Adult survival rate:** mean: 0.906 , sd: 0.083

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 1 to 2 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 2 to 3 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 3 to 4 - mean: 0.76 , sd: 0.093 , DD: NA

Age class 4 to 5 - mean: 0.805 , sd: 0.083 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: DisplacementLower\_ExclBB(andGV)**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00137795 , se: NA

**Impact on immature survival rate** mean: 0.00120217 , se: NA

**Scenario B - Name: DisplacementLower\_ALLOWFs(Excl GV)**

**All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00153157 , se: NA

**Impact on immature survival rate** mean: 0.0013528 , se: NA

### **Scenario C - Name: DisplacementUpper\_ExclBB(andGV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0022389 , se: NA

**Impact on immature survival rate** mean: 0.00200357 , se: NA

### **Scenario D - Name: DisplacementUpper\_ALLOWFs(ExclGV)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00249492 , se: NA

**Impact on immature survival rate** mean: 0.00225461 , se: NA

### **Output:**

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **Forth Islands SPA>Razorbill>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-02 12:40:03 using Tool version 2, with R version 4.2.2, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.8"
## shiny	"shiny"	"1.8.0"
## shinyjs	"shinyjs"	"2.1.0"
## shinydashboard	"shinydashboard"	"0.7.3"
## shinyWidgets	"shinyWidgets"	"0.8.2"
## DT	"DT"	"0.33"
## plotly	"plotly"	"4.10.4"
## rmarkdown	"rmarkdown"	"2.25"
## dplyr	"dplyr"	"1.1.4"
## tidyr	"tidyr"	"1.3.1"

## Basic information

This run had reference name "Forth\_RA\_InComb\_35+15y".  
PVA model run type: simplescenarios.  
Model to use for environmental stochasticity: betagamma.  
Model for density dependence: nodd.  
Include demographic stochasticity in model?: Yes.  
Number of simulations: 5000.  
Random seed: 10.  
Years for burn-in: 5.  
Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Razorbill.  
Region type to use for breeding success data: .  
Available colony-specific survival rate: . Sector to use within breeding success region: .  
Age at first breeding: 5.  
Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.  
Number of subpopulations: 1.  
Are demographic rates applied separately to each subpopulation?: No.  
Units for initial population size: breeding.adults  
Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 8379 in 2024

**Productivity rate per pair:** mean: 0.643 , sd: 0.057

**Adult survival rate:** mean: 0.895 , sd: 0.067

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 1 to 2 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 2 to 3 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 4 to 5 - mean: 0.895 , sd: 0.067 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DisplLower\_Excl BB(& GV)

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0049472 , se: NA

**Impact on immature survival rate** mean: 0.00385012 , se: NA

### Scenario B - Name: DisplLower\_ALLOWFs

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00621579 , se: NA

**Impact on immature survival rate** mean: 0.00490278 , se: NA

**Scenario C - Name: DisplUpper\_Excl BB(& GV)**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00954272 , se: NA

**Impact on immature survival rate** mean: 0.00711898 , se: NA

**Scenario D - Name: DisplUpper\_ALLOWFs**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.01180495 , se: NA

**Impact on immature survival rate** mean: 0.00896229 , se: NA

**Output:**

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **Fowlsheugh SPA>Kittiwake>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-07 08:26:20 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "Fowlsheugh\_KI\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 4.

Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 28078 in 2021

**Productivity rate per pair:** mean: 0.819 , sd: 0.332

**Adult survival rate:** mean: 0.854 , sd: 0.051

### **Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DMin\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00071217 , se: NA

**Impact on immature survival rate** mean: 0.0001533 , se: NA

### Scenario B - Name: DMin\_All OWFs (Excl GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00109291 , se: NA

**Impact on immature survival rate** mean: 0.00018139 , se: NA

### Scenario C - Name: DMax\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00213696 , se: NA

**Impact on immature survival rate** mean: 0.00045988 , se: NA

### Scenario D - Name: DMax\_All OWFs (Excl GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00327916 , se: NA

**Impact on immature survival rate** mean: 0.00054415 , se: NA

### Scenario E - Name: Col\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00317373 , se: NA

**Impact on immature survival rate** mean: 0.00076772 , se: NA

### Scenario F - Name: Col\_All OWFs (Excl GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00572143 , se: NA

**Impact on immature survival rate** mean: 0.00090049 , se: NA

### Scenario G - Name: DMinCol\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0038859 , se: NA

**Impact on immature survival rate** mean: 0.00092102 , se: NA

### Scenario H - Name: DMinCol\_All OWFs (Excl GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00681433 , se: NA

**Impact on immature survival rate** mean: 0.00108188 , se: NA

### Scenario I - Name: DMaxCol\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00531069 , se: NA

**Impact on immature survival rate** mean: 0.0012276 , se: NA

### Scenario J - Name: DMaxCol\_All OWFs (Excl GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00900059 , se: NA

**Impact on immature survival rate** mean: 0.00144465 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **Fowlsheugh SPA>Razorbill>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-02 08:46:10 using Tool version 2, with R version 4.2.2, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.8"
## shiny	"shiny"	"1.8.0"
## shinyjs	"shinyjs"	"2.1.0"
## shinydashboard	"shinydashboard"	"0.7.3"
## shinyWidgets	"shinyWidgets"	"0.8.2"
## DT	"DT"	"0.33"
## plotly	"plotly"	"4.10.4"
## rmarkdown	"rmarkdown"	"2.25"
## dplyr	"dplyr"	"1.1.4"
## tidyr	"tidyr"	"1.3.1"

## Basic information

This run had reference name "Fowlsheugh\_RA\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Razorbill.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 18844 in 2021

**Productivity rate per pair:** mean: 0.643 , sd: 0.057

**Adult survival rate:** mean: 0.895 , sd: 0.067

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 1 to 2 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 2 to 3 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 4 to 5 - mean: 0.895 , sd: 0.067 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DisplacementLower\_ExclBB(andGV)

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00394877 , se: NA

**Impact on immature survival rate** mean: 0.00287827 , se: NA

### Scenario B - Name: DisplacementLower\_ALLOWFs

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00462526 , se: NA

**Impact on immature survival rate** mean: 0.00336141 , se: NA

**Scenario C - Name: DisplacementUpper\_ExclBB(andGV)**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00733448 , se: NA

**Impact on immature survival rate** mean: 0.00521618 , se: NA

**Scenario D - Name: DisplacementUpper\_ALLOWFs**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00855026 , se: NA

**Impact on immature survival rate** mean: 0.00607446 , se: NA

**Output:**

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **Fowlsheugh SPA>Razorbill>Project Alone**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-01 15:02:02 using Tool version 2, with R version 4.2.2, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.8"
## shiny	"shiny"	"1.8.0"
## shinyjs	"shinyjs"	"2.1.0"
## shinydashboard	"shinydashboard"	"0.7.3"
## shinyWidgets	"shinyWidgets"	"0.8.2"
## DT	"DT"	"0.33"
## plotly	"plotly"	"4.10.4"
## rmarkdown	"rmarkdown"	"2.25"
## dplyr	"dplyr"	"1.1.4"
## tidyr	"tidyr"	"1.3.1"

## Basic information

This run had reference name "Fowlsheugh\_RA\_ProjAlon\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Razorbill.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 18844 in 2021

**Productivity rate per pair:** mean: 0.643 , sd: 0.057

**Adult survival rate:** mean: 0.895 , sd: 0.067

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 1 to 2 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 2 to 3 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 4 to 5 - mean: 0.895 , sd: 0.067 , DD: NA

## Impacts

Number of impact scenarios: 2.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: Displacement Lower

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00040305 , se: NA

**Impact on immature survival rate** mean: 0.000433217 , se: NA

### Scenario B - Name: Displacement Upper

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.000672307 , se: NA

**Impact on immature survival rate** mean: 0.000722357 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **Hermaness Saxa Valla SPA>Gannet>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-02 15:52:21 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "HermSaxVord\_InComb\_35.15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Northern Gannet.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 39606 in 2024

**Productivity rate per pair:** mean: 0.698 , sd: 0.071

**Adult survival rate:** mean: 0.919 , sd: 0.042

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.424 , sd: 0.014 , DD: NA

Age class 1 to 2 - mean: 0.829 , sd: 0.008 , DD: NA

Age class 2 to 3 - mean: 0.891 , sd: 0.006 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.006 , DD: NA

Age class 4 to 5 - mean: 0.919 , sd: 0.042 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: D Min Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00053186 , se: NA

**Impact on immature survival rate** mean: 0.00052001 , se: NA

### Scenario B - Name: D Min all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00055874 , se: NA

**Impact on immature survival rate** mean: 0.0005418 , se: NA

### Scenario C - Name: D Max Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00159537 , se: NA

**Impact on immature survival rate** mean: 0.00155983 , se: NA

### Scenario D - Name: D Max all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.001676 , se: NA

**Impact on immature survival rate** mean: 0.0016252 , se: NA

### Scenario E - Name: Col Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00039657 , se: NA

**Impact on immature survival rate** mean: 0.00033251 , se: NA

### Scenario F - Name: Col all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00041932 , se: NA

**Impact on immature survival rate** mean: 0.00034056 , se: NA

### Scenario G - Name: D Min + Col Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00092843 , se: NA

**Impact on immature survival rate** mean: 0.00085252 , se: NA

### Scenario H - Name: D Min + Col all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00097806 , se: NA

**Impact on immature survival rate** mean: 0.00088236 , se: NA

### Scenario I - Name: D Max + Col Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00199194 , se: NA

**Impact on immature survival rate** mean: 0.00189233 , se: NA

### Scenario J - Name: D Max + Col all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00209532 , se: NA

**Impact on immature survival rate** mean: 0.00196576 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# Hoy SPA>Kittiwake>In-Combination

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2026-01-09 11:16:46 using Tool version 2, with R version 4.2.2, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.8"
## shiny	"shiny"	"1.8.0"
## shinyjs	"shinyjs"	"2.1.0"
## shinydashboard	"shinydashboard"	"0.7.3"
## shinyWidgets	"shinyWidgets"	"0.8.2"
## DT	"DT"	"0.33"
## plotly	"plotly"	"4.10.4"
## rmarkdown	"rmarkdown"	"2.25"
## dplyr	"dplyr"	"1.1.4"
## tidyr	"tidyr"	"1.3.1"

## Basic information

This run had reference name "Hoy\_InCom\_V2\_asbuilt\_35".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 4.

Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 532 in 2021

**Productivity rate per pair:** mean: 0.819 , sd: 0.332

**Adult survival rate:** mean: 0.854 , sd: 0.051

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 5.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

**Scenario A - Name: DMin**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00072737 , se: NA

**Impact on immature survival rate** mean: 0.00034208 , se: NA

**Scenario B - Name: DMax**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00218202 , se: NA

**Impact on immature survival rate** mean: 0.00102614 , se: NA

**Scenario C - Name: Col**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0026647 , se: NA

**Impact on immature survival rate** mean: 0.00130326 , se: NA

**Scenario D - Name: DMinCol**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00339207 , se: NA

**Impact on immature survival rate** mean: 0.00164534 , se: NA

**Scenario E - Name: DMaxCol**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00484672 , se: NA

**Impact on immature survival rate** mean: 0.0023294 , se: NA

**Output:**

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2026-01-09 14:37:46 using Tool version 2, with R version 4.2.2, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.8"
## shiny	"shiny"	"1.8.0"
## shinyjs	"shinyjs"	"2.1.0"
## shinydashboard	"shinydashboard"	"0.7.3"
## shinyWidgets	"shinyWidgets"	"0.8.2"
## DT	"DT"	"0.33"
## plotly	"plotly"	"4.10.4"
## rmarkdown	"rmarkdown"	"2.25"
## dplyr	"dplyr"	"1.1.4"
## tidyr	"tidyr"	"1.3.1"

## Basic information

This run had reference name "Hoy\_InCom\_V2\_asbuilt\_35\_ExBB".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 4.

Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 532 in 2021

**Productivity rate per pair:** mean: 0.819 , sd: 0.332

**Adult survival rate:** mean: 0.854 , sd: 0.051

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 5.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DMin\_ExBB

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00063224 , se: NA

**Impact on immature survival rate** mean: 0.00030249 , se: NA

### Scenario B - Name: DMax\_ExBB

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00189664 , se: NA

**Impact on immature survival rate** mean: 0.00090738 , se: NA

### Scenario C - Name: Col\_ExBB

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00232991 , se: NA

**Impact on immature survival rate** mean: 0.00116129 , se: NA

**Scenario D - Name: DMinCol\_ExBB**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00296216 , se: NA

**Impact on immature survival rate** mean: 0.00146378 , se: NA

**Scenario E - Name: DMaxCol\_ExBB**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00422656 , se: NA

**Impact on immature survival rate** mean: 0.00206867 , se: NA

**Output:**

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **Mingulay & Berneray SPA>Razorbill>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-02 14:44:36 using Tool version 2, with R version 4.2.2, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.8"
## shiny	"shiny"	"1.8.0"
## shinyjs	"shinyjs"	"2.1.0"
## shinydashboard	"shinydashboard"	"0.7.3"
## shinyWidgets	"shinyWidgets"	"0.8.2"
## DT	"DT"	"0.33"
## plotly	"plotly"	"4.10.4"
## rmarkdown	"rmarkdown"	"2.25"
## dplyr	"dplyr"	"1.1.4"
## tidyr	"tidyr"	"1.3.1"

## Basic information

This run had reference name "MinBer\_RA\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Razorbill.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 26787 in 2021

**Productivity rate per pair:** mean: 0.643 , sd: 0.057

**Adult survival rate:** mean: 0.895 , sd: 0.067

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 1 to 2 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 2 to 3 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 4 to 5 - mean: 0.895 , sd: 0.067 , DD: NA

## Impacts

Number of impact scenarios: 2.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DisplUpper\_Excl BB(& GV)

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00030898 , se: NA

**Impact on immature survival rate** mean: 0.00018423 , se: NA

### Scenario B - Name: DisplUpper\_ALLOWFs

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00032517 , se: NA

**Impact on immature survival rate** mean: 0.0002003 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **North Caithness Cliffs SPA>Kittiwake>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-04 11:30:24 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "NCC\_KI\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 4.

Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 18058 in 2024

**Productivity rate per pair:** mean: 0.819 , sd: 0.332

**Adult survival rate:** mean: 0.854 , sd: 0.051

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DisplMin\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00065658 , se: NA

**Impact on immature survival rate** mean: 0.00021502 , se: NA

### Scenario B - Name: DisplMin\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00072823 , se: NA

**Impact on immature survival rate** mean: 0.00024483 , se: NA

### Scenario C - Name: DisplMax\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00168164 , se: NA

**Impact on immature survival rate** mean: 0.00064499 , se: NA

### Scenario D - Name: DisplMax\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00189659 , se: NA

**Impact on immature survival rate** mean: 0.0007344 , se: NA

### Scenario E - Name: Col\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00204906 , se: NA

**Impact on immature survival rate** mean: 0.00083659 , se: NA

### Scenario F - Name: Col\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00230122 , se: NA

**Impact on immature survival rate** mean: 0.00094349 , se: NA

### Scenario G - Name: DisplMinCol\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00270563 , se: NA

**Impact on immature survival rate** mean: 0.00105161 , se: NA

### Scenario H - Name: DisplMinCol\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00302945 , se: NA

**Impact on immature survival rate** mean: 0.00118831 , se: NA

### Scenario I - Name: DisplMaxCol\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00373069 , se: NA

**Impact on immature survival rate** mean: 0.00148158 , se: NA

### Scenario J - Name: DisplMaxCol\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00419781 , se: NA

**Impact on immature survival rate** mean: 0.00167789 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **North Caithness Cliffs SPA>Puffin>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-06-25 14:09:36 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "NCC\_PU\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Atlantic Puffin.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 6078 in 2016

**Productivity rate per pair:** mean: 0.617 , sd: 0.151

**Adult survival rate:** mean: 0.906 , sd: 0.083

### **Immatures survival rates:**

Age class 0 to 1 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 1 to 2 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 2 to 3 - mean: 0.892 , sd: 0.046 , DD: NA

Age class 3 to 4 - mean: 0.76 , sd: 0.093 , DD: NA

Age class 4 to 5 - mean: 0.805 , sd: 0.083 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DisplLower\_Excl BB & GV

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00545967 , se: NA

**Impact on immature survival rate** mean: 0.00455314 , se: NA

### Scenario B - Name: DisplLower\_ALLOWFs(ExclGV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00546954 , se: NA

**Impact on immature survival rate** mean: 0.00456164 , se: NA

### Scenario C - Name: DisplUpper\_Excl BB & GV

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00890201 , se: NA

**Impact on immature survival rate** mean: 0.00758855 , se: NA

### Scenario D - Name: DisplUpper\_ALLOWFs(ExclGV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00891846 , se: NA

**Impact on immature survival rate** mean: 0.00760272 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **North Caithness Cliffs SPA>Razorbill>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-02 13:51:48 using Tool version 2, with R version 4.2.2, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.8"
## shiny	"shiny"	"1.8.0"
## shinyjs	"shinyjs"	"2.1.0"
## shinydashboard	"shinydashboard"	"0.7.3"
## shinyWidgets	"shinyWidgets"	"0.8.2"
## DT	"DT"	"0.33"
## plotly	"plotly"	"4.10.4"
## rmarkdown	"rmarkdown"	"2.25"
## dplyr	"dplyr"	"1.1.4"
## tidyr	"tidyr"	"1.3.1"

## Basic information

This run had reference name "NCC\_RA\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Razorbill.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 4796 in 2021

**Productivity rate per pair:** mean: 0.643 , sd: 0.057

**Adult survival rate:** mean: 0.895 , sd: 0.067

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 1 to 2 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 2 to 3 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 4 to 5 - mean: 0.895 , sd: 0.067 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DisplLower\_Excl BB(& GV)

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00198757 , se: NA

**Impact on immature survival rate** mean: 0.0011477 , se: NA

### Scenario B - Name: DisplLower\_ALLOWFs

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00210722 , se: NA

**Impact on immature survival rate** mean: 0.00122312 , se: NA

**Scenario C - Name: DisplUpper\_Excl BB(& GV)**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00454234 , se: NA

**Impact on immature survival rate** mean: 0.00270713 , se: NA

**Scenario D - Name: DisplUpper\_ALLOWFs**

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00490128 , se: NA

**Impact on immature survival rate** mean: 0.00293341 , se: NA

**Output:**

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# North Rona Sula Sgeir SPA>Gannet>In-Combination

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-02 17:26:36 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "NorthRona\_InComb\_35.15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Northern Gannet.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 18990 in 2023

**Productivity rate per pair:** mean: 0.71 , sd: 0.105

**Adult survival rate:** mean: 0.919 , sd: 0.042

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.424 , sd: 0.014 , DD: NA

Age class 1 to 2 - mean: 0.829 , sd: 0.008 , DD: NA

Age class 2 to 3 - mean: 0.891 , sd: 0.006 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.006 , DD: NA

Age class 4 to 5 - mean: 0.919 , sd: 0.042 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: D Max Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00026127 , se: NA

**Impact on immature survival rate** mean: 0.00022832 , se: NA

### Scenario B - Name: D Max all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.000287 , se: NA

**Impact on immature survival rate** mean: 0.00023823 , se: NA

### Scenario C - Name: D Max + Col Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0003593 , se: NA

**Impact on immature survival rate** mean: 0.00028707 , se: NA

### Scenario D - Name: D Max + Col all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00038627 , se: NA

**Impact on immature survival rate** mean: 0.00029822 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

## **Noss SPA>Gannet>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-03 09:21:07 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "Noss\_InComb\_35.15y".  
PVA model run type: simplescenarios.  
Model to use for environmental stochasticity: betagamma.  
Model for density dependence: nodd.  
Include demographic stochasticity in model?: Yes.  
Number of simulations: 5000.  
Random seed: 10.  
Years for burn-in: 5.  
Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Northern Gannet.  
Region type to use for breeding success data: .  
Available colony-specific survival rate: . Sector to use within breeding success region: .  
Age at first breeding: 5.  
Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.  
Number of subpopulations: 1.  
Are demographic rates applied separately to each subpopulation?: No.  
Units for initial population size: breeding.adults  
Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 24670 in 2023

**Productivity rate per pair:** mean: 0.698 , sd: 0.071

**Adult survival rate:** mean: 0.919 , sd: 0.042

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.424 , sd: 0.014 , DD: NA

Age class 1 to 2 - mean: 0.829 , sd: 0.008 , DD: NA

Age class 2 to 3 - mean: 0.891 , sd: 0.006 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.006 , DD: NA

Age class 4 to 5 - mean: 0.919 , sd: 0.042 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: D Min Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0004054 , se: NA

**Impact on immature survival rate** mean: 0.00038968 , se: NA

### Scenario B - Name: D Min all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0004256 , se: NA

**Impact on immature survival rate** mean: 0.0004058 , se: NA

### Scenario C - Name: D Max Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00121606 , se: NA

**Impact on immature survival rate** mean: 0.00116889 , se: NA

### Scenario D - Name: D Max all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00127665 , se: NA

**Impact on immature survival rate** mean: 0.00121725 , se: NA

### Scenario E - Name: Col Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00034303 , se: NA

**Impact on immature survival rate** mean: 0.0002559 , se: NA

### Scenario F - Name: Col all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00036669 , se: NA

**Impact on immature survival rate** mean: 0.00026185 , se: NA

### Scenario G - Name: D Min + Col Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00074843 , se: NA

**Impact on immature survival rate** mean: 0.00064557 , se: NA

### Scenario H - Name: D Min + Col all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00079228 , se: NA

**Impact on immature survival rate** mean: 0.00066765 , se: NA

### Scenario I - Name: D Max + Col Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00155909 , se: NA

**Impact on immature survival rate** mean: 0.00142479 , se: NA

### Scenario J - Name: D Max + Col all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00164334 , se: NA

**Impact on immature survival rate** mean: 0.0014791 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **Rathlin Island SPA>Razorbill>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-02 15:00:28 using Tool version 2, with R version 4.2.2, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.8"
## shiny	"shiny"	"1.8.0"
## shinyjs	"shinyjs"	"2.1.0"
## shinydashboard	"shinydashboard"	"0.7.3"
## shinyWidgets	"shinyWidgets"	"0.8.2"
## DT	"DT"	"0.33"
## plotly	"plotly"	"4.10.4"
## rmarkdown	"rmarkdown"	"2.25"
## dplyr	"dplyr"	"1.1.4"
## tidyr	"tidyr"	"1.3.1"

## Basic information

This run had reference name "Rathlin\_RA\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Razorbill.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 29803 in 2021

**Productivity rate per pair:** mean: 0.643 , sd: 0.057

**Adult survival rate:** mean: 0.895 , sd: 0.067

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 1 to 2 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 2 to 3 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 4 to 5 - mean: 0.895 , sd: 0.067 , DD: NA

## Impacts

Number of impact scenarios: 2.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DisplUpper\_Excl BB(& GV)

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00024915 , se: NA

**Impact on immature survival rate** mean: 0.00013118 , se: NA

### Scenario B - Name: DisplUpper\_ALLOWFs

*All subpopulations*

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00026537 , se: NA

**Impact on immature survival rate** mean: 0.00014903 , se: NA

## Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **St Abb's Fast Castle SPA>Kittiwake>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-04 13:40:14 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "StAbbs\_KI\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 4.

Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 11992 in 2024

**Productivity rate per pair:** mean: 0.819 , sd: 0.332

**Adult survival rate:** mean: 0.854 , sd: 0.051

### **Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DisplMin\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00055505 , se: NA

**Impact on immature survival rate** mean: 0.00011528 , se: NA

### Scenario B - Name: DisplMin\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00300116 , se: NA

**Impact on immature survival rate** mean: 0.00020028 , se: NA

### Scenario C - Name: DisplMax\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00166538 , se: NA

**Impact on immature survival rate** mean: 0.00034582 , se: NA

### Scenario D - Name: DisplMax\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00900372 , se: NA

**Impact on immature survival rate** mean: 0.00060082 , se: NA

### Scenario E - Name: Col\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00180654 , se: NA

**Impact on immature survival rate** mean: 0.00041479 , se: NA

### Scenario F - Name: Col\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.01896945 , se: NA

**Impact on immature survival rate** mean: 0.00095717 , se: NA

### Scenario G - Name: DisplMinCol\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00236159 , se: NA

**Impact on immature survival rate** mean: 0.00053007 , se: NA

### Scenario H - Name: DisplMinCol\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.02197061 , se: NA

**Impact on immature survival rate** mean: 0.00115746 , se: NA

### Scenario I - Name: DisplMaxCol\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00347192 , se: NA

**Impact on immature survival rate** mean: 0.0007606 , se: NA

### Scenario J - Name: DisplMaxCol\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.02797317 , se: NA

**Impact on immature survival rate** mean: 0.001558 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **Sule Skerry Sule Stack SPA>Gannet>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-03 09:49:35 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "SuleSkerry\_InComb\_35.15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Northern Gannet.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 15648 in 2024

**Productivity rate per pair:** mean: 0.698 , sd: 0.071

**Adult survival rate:** mean: 0.919 , sd: 0.042

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.424 , sd: 0.014 , DD: NA

Age class 1 to 2 - mean: 0.829 , sd: 0.008 , DD: NA

Age class 2 to 3 - mean: 0.891 , sd: 0.006 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.006 , DD: NA

Age class 4 to 5 - mean: 0.919 , sd: 0.042 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: D Min Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00031095 , se: NA

**Impact on immature survival rate** mean: 0.0002897 , se: NA

### Scenario B - Name: D Min all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00031964 , se: NA

**Impact on immature survival rate** mean: 0.00029199 , se: NA

### **Scenario C - Name: D Max Excl BB (& GV if AEol)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00093283 , se: NA

**Impact on immature survival rate** mean: 0.00086907 , se: NA

### **Scenario D - Name: D Max all OWFs**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00095889 , se: NA

**Impact on immature survival rate** mean: 0.00087594 , se: NA

### **Scenario E - Name: Col Excl BB (& GV if AEol)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00128003 , se: NA

**Impact on immature survival rate** mean: 0.00132329 , se: NA

### **Scenario F - Name: Col all OWFs**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00130413 , se: NA

**Impact on immature survival rate** mean: 0.00132415 , se: NA

### **Scenario G - Name: D Min + Col Excl BB (& GV if AEol)**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00159098 , se: NA

**Impact on immature survival rate** mean: 0.00161299 , se: NA

### **Scenario H - Name: D Min + Col all OWFs**

#### **All subpopulations**

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00162376 , se: NA

**Impact on immature survival rate** mean: 0.00161614 , se: NA

### Scenario I - Name: D Max + Col Excl BB (& GV if AEol)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00221286 , se: NA

**Impact on immature survival rate** mean: 0.00219236 , se: NA

### Scenario J - Name: D Max + Col all OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00226302 , se: NA

**Impact on immature survival rate** mean: 0.00220009 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **Troup Pennan Lion's SPA>Kittiwake>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-07 09:56:13 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "TPL\_KI\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 4.

Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 21232 in 2021

**Productivity rate per pair:** mean: 0.819 , sd: 0.332

**Adult survival rate:** mean: 0.854 , sd: 0.051

### **Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DMin\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00101901 , se: NA

**Impact on immature survival rate** mean: 0.00028223 , se: NA

### Scenario B - Name: DMin\_All OWFs (Excl GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00112022 , se: NA

**Impact on immature survival rate** mean: 0.00031943 , se: NA

### Scenario C - Name: DMax\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00260496 , se: NA

**Impact on immature survival rate** mean: 0.0008466 , se: NA

### Scenario D - Name: DMax\_All OWFs (Excl GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00290859 , se: NA

**Impact on immature survival rate** mean: 0.0009582 , se: NA

### Scenario E - Name: Col\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0027702 , se: NA

**Impact on immature survival rate** mean: 0.00123334 , se: NA

### Scenario F - Name: Col\_All OWFs (Excl GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00317744 , se: NA

**Impact on immature survival rate** mean: 0.00136964 , se: NA

### Scenario G - Name: DMinCol\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00378921 , se: NA

**Impact on immature survival rate** mean: 0.00151557 , se: NA

### Scenario H - Name: DMinCol\_All OWFs (Excl GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00429765 , se: NA

**Impact on immature survival rate** mean: 0.00168907 , se: NA

### Scenario I - Name: DMaxCol\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00537517 , se: NA

**Impact on immature survival rate** mean: 0.00207994 , se: NA

### Scenario J - Name: DMaxCol\_All OWFs (Excl GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00608602 , se: NA

**Impact on immature survival rate** mean: 0.00232784 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# **Troup Pennan Lion's SPA>Razorbill>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-07 10:56:35 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "TPL\_RA\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Razorbill.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 1 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 6054 in 2021

**Productivity rate per pair:** mean: 0.643 , sd: 0.057

**Adult survival rate:** mean: 0.895 , sd: 0.067

**Immatures survival rates:**

Age class 0 to 1 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 1 to 2 - mean: 0.794 , sd: 0.134 , DD: NA

Age class 2 to 3 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.067 , DD: NA

Age class 4 to 5 - mean: 0.895 , sd: 0.067 , DD: NA

## Impacts

Number of impact scenarios: 4.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DMin\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00177341 , se: NA

**Impact on immature survival rate** mean: 0.00095587 , se: NA

### Scenario B - Name: DMin\_All OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0020075 , se: NA

**Impact on immature survival rate** mean: 0.00110912 , se: NA

### Scenario C - Name: DMax\_Excl BB (& GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00405994 , se: NA

**Impact on immature survival rate** mean: 0.00223816 , se: NA

### Scenario D - Name: DMax\_All OWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00458603 , se: NA

**Impact on immature survival rate** mean: 0.00257527 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

# **West Westray SPA>Kittiwake>In-Combination**

# Population Viability Analysis Parameter log

## Set up

The log file was created on: 2025-07-08 15:09:55 using Tool version 2, with R version 3.5.1, PVA package version: 4.18 (with UI version 1.7)

##	Package	Version
## popbio	"popbio"	"2.4.4"
## shiny	"shiny"	"1.1.0"
## shinyjs	"shinyjs"	"1.0"
## shinydashboard	"shinydashboard"	"0.7.1"
## shinyWidgets	"shinyWidgets"	"0.4.5"
## DT	"DT"	"0.5"
## plotly	"plotly"	"4.8.0"
## rmarkdown	"rmarkdown"	"1.10"
## dplyr	"dplyr"	"0.7.6"
## tidyr	"tidyr"	"0.8.1"

## Basic information

This run had reference name "Westray\_KI\_InComb\_35+15y".

PVA model run type: simplescenarios.

Model to use for environmental stochasticity: betagamma.

Model for density dependence: nodd.

Include demographic stochasticity in model?: Yes.

Number of simulations: 5000.

Random seed: 10.

Years for burn-in: 5.

Case study selected: None.

## Baseline demographic rates

Species chosen to set initial values: Black-Legged Kittiwake.

Region type to use for breeding success data: .

Available colony-specific survival rate: . Sector to use within breeding success region: .

Age at first breeding: 4.

Is there an upper constraint on productivity in the model?: Yes, constrained to 2 per pair.

Number of subpopulations: 1.

Are demographic rates applied separately to each subpopulation?: No.

Units for initial population size: breeding.adults

Are baseline demographic rates specified separately for immatures?: Yes.

## Population 1

**Initial population values:** Initial population 5510 in 2021

**Productivity rate per pair:** mean: 0.819 , sd: 0.332

**Adult survival rate:** mean: 0.854 , sd: 0.051

### **Immatures survival rates:**

Age class 0 to 1 - mean: 0.79 , sd: 0.047 , DD: NA

Age class 1 to 2 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 2 to 3 - mean: 0.854 , sd: 0.051 , DD: NA

Age class 3 to 4 - mean: 0.854 , sd: 0.051 , DD: NA

## Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: Yes

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: Yes

Are impacts specified as a relative value or absolute harvest?: relative

Years in which impacts are assumed to begin and end: 2032 to 2067

## Impact on Demographic Rates

### Scenario A - Name: DMin\_ExclBB (&GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0016309 , se: NA

**Impact on immature survival rate** mean: 0.00069607 , se: NA

### Scenario B - Name: DMin\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.0019098 , se: NA

**Impact on immature survival rate** mean: 0.00081208 , se: NA

### Scenario C - Name: DMax\_ExclBB (&GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00489197 , se: NA

**Impact on immature survival rate** mean: 0.00208789 , se: NA

### Scenario D - Name: DMax\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00572866 , se: NA

**Impact on immature survival rate** mean: 0.00243593 , se: NA

### Scenario E - Name: Col\_ExclBB (&GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00563655 , se: NA

**Impact on immature survival rate** mean: 0.00239385 , se: NA

### Scenario F - Name: Col\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00661807 , se: NA

**Impact on immature survival rate** mean: 0.00280993 , se: NA

### Scenario G - Name: DMinCol\_ExclBB (&GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00726746 , se: NA

**Impact on immature survival rate** mean: 0.00308991 , se: NA

### Scenario H - Name: DMinCol\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.00852787 , se: NA

**Impact on immature survival rate** mean: 0.00362201 , se: NA

### Scenario I - Name: DMaxCol\_ExclBB (&GV)

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.01052852 , se: NA

**Impact on immature survival rate** mean: 0.00448174 , se: NA

### Scenario J - Name: DMaxCol\_ALLOWFs

#### All subpopulations

**Impact on productivity rate** mean: 0 , se: NA

**Impact on adult survival rate** mean: 0.01234673 , se: NA

**Impact on immature survival rate** mean: 0.00524587 , se: NA

### Output:

First year to include in outputs: 2032

Final year to include in outputs: 2082

How should outputs be produced, in terms of ages?: breeding.adults

Target population size to use in calculating impact metrics: NA

Quasi-extinction threshold to use in calculating impact metrics: NA

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# Annex E: PVA Impact Values Inputs

This annex consists of a table detailing the impact values for the breeding adults and subadults for each of the impact scenarios for which PVAs were run in this assessment. This table summarises the values, the calculation of which can be found in Annexes A and C.

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# **Bellrock Offshore Wind Farm**

## **Wind Farm Development Area**

**Environmental Impact Assessment Report - Volume IV**

**Annex 10.4-E: Adult and Subadult Survival Rates for PVA Input**

**Date: April 2026**

Document Number: RHDHV\_BEL\_CST\_REP\_0004\_036

Revision Number: Rev 1

Classification: Public



**Revision History**

<b>Rev.</b>	<b>Prepared By</b>	<b>Checked By</b>	<b>Approved By</b>	<b>Date</b>
1	Haskoning	SA	BMcG	01/04/2026

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# Contents

**Annex 10.4-E: Adult and Subadult Survival Rates for PVA Input** Error! Bookmark not defined.

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**Table E-1: Impact on Adult and Subadult Survival Rates for Each Mortality Scenario Used in the PVAs for SPA Populations**

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
<b>SPA Project Alone Impacts</b>				
Razorbill	Fowlsheugh	Lower displacement	0.000403050	0.000433217
		Upper displacement	0.000672307	0.000722357
<b>SPA In-combination Impacts</b>				
Kittiwake	Fowlsheugh	Lower displacement only (excluding Berwick Bank)	0.00071217	0.00015330
		Lower displacement only (all projects)	0.00109291	0.00018139
		Upper displacement only (excluding Berwick Bank)	0.00213696	0.00045988
		Upper displacement only (all projects)	0.00327916	0.00054415
		Collision only (excluding Berwick Bank)	0.00317373	0.00076772
		Collision only (all projects)	0.00572143	0.00090049
		Lower displacement and collision (excluding Berwick Bank)	0.00388590	0.00092102
		Lower displacement and collision (all projects)	0.00681433	0.00108188
		Upper displacement and collision (excluding Berwick Bank)	0.00531069	0.00122760
		Upper displacement and collision (all projects)	0.00900059	0.00144465
	Buchan Ness to Collieston Coast	Lower displacement only (excluding Berwick Bank)	0.00072550	0.00021119
		Lower displacement only (all projects)	0.00080850	0.00023574

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
		Upper displacement only (excluding Berwick Bank)	0.00179297	0.00063353
		Upper displacement only (all projects)	0.00204197	0.00070717
		Collision only (excluding Berwick Bank)	0.00248229	0.00099083
		Collision only (all projects)	0.00286444	0.00108337
		Lower displacement and collision (excluding Berwick Bank)	0.00320779	0.00120202
		Lower displacement and collision (all projects)	0.00367294	0.00131911
		Upper displacement and collision (excluding Berwick Bank)	0.00427526	0.00162437
		Upper displacement and collision (all projects)	0.00490641	0.00179054
	Flamborough & Filey Coast	Lower displacement only (excluding Berwick Bank)	0.00031938	0.00013349
		Lower displacement only (all projects)	0.00037373	0.00015586
		Upper displacement only (excluding Berwick Bank)	0.00095812	0.00040040
		Upper displacement only (all projects)	0.00112117	0.00046753
		Collision only (excluding Berwick Bank)	0.00557026	0.00044477
		Collision only (all projects)	0.00576364	0.00052502
		Lower displacement and collision (excluding Berwick Bank)	0.00588964	0.00057826
		Lower displacement and collision (all projects)	0.00613737	0.00068088
		Upper displacement and collision (excluding Berwick Bank)	0.00652839	0.00084518
		Upper displacement and collision (all projects)	0.00688482	0.00099255

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
	Troup, Pennan & Lion's Heads	Lower displacement only (excluding Berwick Bank)	0.00101901	0.00028223
		Lower displacement only (all projects)	0.00112022	0.00031943
		Upper displacement only (excluding Berwick Bank)	0.00260496	0.00084660
		Upper displacement only (all projects)	0.00290859	0.00095820
		Collision only (excluding Berwick Bank)	0.00277020	0.00123334
		Collision only (all projects)	0.00317744	0.00136964
		Lower displacement and collision (excluding Berwick Bank)	0.00378921	0.00151557
		Lower displacement and collision (all projects)	0.00429765	0.00168907
		Upper displacement and collision (excluding Berwick Bank)	0.00537517	0.00207994
		Upper displacement and collision (all projects)	0.00608602	0.00232784
	East Caithness Cliffs	Lower displacement only (excluding Berwick Bank)	0.00188040	0.00046193
		Lower displacement only (all projects)	0.00202251	0.00052048
		Upper displacement only (excluding Berwick Bank)	0.00543335	0.00138564
		Upper displacement only (all projects)	0.00585968	0.00156128
		Collision only (excluding Berwick Bank)	0.00515004	0.00172769
		Collision only (all projects)	0.00565530	0.00193767
		Lower displacement and collision (excluding Berwick Bank)	0.00703043	0.00218962

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
		Lower displacement and collision (all projects)	0.00767780	0.00245814
		Upper displacement and collision (excluding Berwick Bank)	0.01058339	0.00311333
		Upper displacement and collision (all projects)	0.01151498	0.00349895
	St Abb's Head to Fast Castle	Lower displacement only (excluding Berwick Bank)	0.00055505	0.00011528
		Lower displacement only (all projects)	0.00300116	0.00020028
		Upper displacement only (excluding Berwick Bank)	0.00166538	0.00034582
		Upper displacement only (all projects)	0.00900372	0.00060082
		Collision only (excluding Berwick Bank)	0.00180654	0.00041479
		Collision only (all projects)	0.01896945	0.00095717
		Lower displacement and collision (excluding Berwick Bank)	0.00236159	0.00053007
		Lower displacement and collision (all projects)	0.02197061	0.00115746
		Upper displacement and collision (excluding Berwick Bank)	0.00347192	0.00076060
		Upper displacement and collision (all projects)	0.02797317	0.00155800
	Farne Islands	Lower displacement only (excluding Berwick Bank)	0.00062688	0.00021242
		Lower displacement only (all projects)	0.00113446	0.00025844
		Upper displacement only (excluding Berwick Bank)	0.00188103	0.00063719
Upper displacement only (all projects)		0.00340377	0.00077526	

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
		Collision only (excluding Berwick Bank)	0.00258311	0.00073492
		Collision only (all projects)	0.00588961	0.00093231
		Lower displacement and collision (excluding Berwick Bank)	0.00320999	0.00094733
		Lower displacement and collision (all projects)	0.00702407	0.00119075
		Upper displacement and collision (excluding Berwick Bank)	0.00446414	0.00137211
		Upper displacement and collision (all projects)	0.00929338	0.00170757
	Forth Islands	Lower displacement only (excluding Berwick Bank)	0.00072092	0.00011272
		Lower displacement only (all projects)	0.00099125	0.00013165
		Upper displacement only (excluding Berwick Bank)	0.00201038	0.00033814
		Upper displacement only (all projects)	0.00282139	0.00039494
		Collision only (excluding Berwick Bank)	0.00191879	0.00044985
		Collision only (all projects)	0.00372740	0.00054598
		Lower displacement and collision (excluding Berwick Bank)	0.00263971	0.00056257
		Lower displacement and collision (all projects)	0.00471865	0.00067763
		Upper displacement and collision (excluding Berwick Bank)	0.00392918	0.00078799
		Upper displacement and collision (all projects)	0.00654878	0.00094092

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
	North Caithness Cliffs	Lower displacement only (excluding Berwick Bank)	0.00065658	0.00021502
		Lower displacement only (all projects)	0.00072823	0.00024483
		Upper displacement only (excluding Berwick Bank)	0.00168164	0.00064499
		Upper displacement only (all projects)	0.00189659	0.00073440
		Collision only (excluding Berwick Bank)	0.00204906	0.00083659
		Collision only (all projects)	0.00230122	0.00094349
		Lower displacement and collision (excluding Berwick Bank)	0.00270563	0.00105161
		Lower displacement and collision (all projects)	0.00302945	0.00118831
		Upper displacement and collision (excluding Berwick Bank)	0.00373069	0.00148158
		Upper displacement and collision (all projects)	0.00419781	0.00167789
	Copinsay	Lower displacement only (excluding Berwick Bank)	0.00028303	0.00012364
		Lower displacement only (all projects)	0.00032748	0.00014212
		Upper displacement only (excluding Berwick Bank)	0.00084907	0.00037086
		Upper displacement only (all projects)	0.00098242	0.00042632
		Collision only (excluding Berwick Bank)	0.00096738	0.00043547
		Collision only (all projects)	0.00112381	0.00050177
		Lower displacement and collision (excluding Berwick Bank)	0.00125041	0.00055910

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
		Lower displacement and collision (all projects)	0.00145129	0.00064389
		Upper displacement and collision (excluding Berwick Bank)	0.00181645	0.00080633
		Upper displacement and collision (all projects)	0.00210623	0.00092810
	Fair Isle	Lower displacement only (excluding Berwick Bank)	0.00064228	0.00027637
		Lower displacement only (all projects)	0.00075197	0.00032200
		Upper displacement only (excluding Berwick Bank)	0.00192664	0.00082899
		Upper displacement only (all projects)	0.00225571	0.00096588
		Collision only (excluding Berwick Bank)	0.00224053	0.00095638
		Collision only (all projects)	0.00262656	0.00112003
		Lower displacement and collision (excluding Berwick Bank)	0.00288280	0.00123275
		Lower displacement and collision (all projects)	0.00337853	0.00144203
		Upper displacement and collision (excluding Berwick Bank)	0.00416716	0.00178537
		Upper displacement and collision (all projects)	0.00488227	0.00208591
	Hoy	Lower displacement only (excluding Berwick Bank)	0.00063224	0.00030249
		Lower displacement only (all projects)	0.00072737	0.00034208
		Upper displacement only (excluding Berwick Bank)	0.00189664	0.00090738
		Upper displacement only (all projects)	0.00218202	0.00102614

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
		Collision only (excluding Berwick Bank)	0.00232991	0.00116129
		Collision only (all projects)	0.00266470	0.00130326
		Lower displacement and collision (excluding Berwick Bank)	0.00296216	0.00146378
		Lower displacement and collision (all projects)	0.00339207	0.00164534
		Upper displacement and collision (excluding Berwick Bank)	0.00422656	0.00206867
		Upper displacement and collision (all projects)	0.00484672	0.00232940
	West Westray	Lower displacement only (excluding Berwick Bank)	0.00163090	0.00069607
		Lower displacement only (all projects)	0.00190980	0.00081208
		Upper displacement only (excluding Berwick Bank)	0.00489197	0.00208789
		Upper displacement only (all projects)	0.00572866	0.00243593
		Collision only (excluding Berwick Bank)	0.00563655	0.00239385
		Collision only (all projects)	0.00661807	0.00280993
		Lower displacement and collision (excluding Berwick Bank)	0.00726746	0.00308991
		Lower displacement and collision (all projects)	0.00852787	0.00362201
		Upper displacement and collision (excluding Berwick Bank)	0.01052852	0.00448174
		Upper displacement and collision (all projects)	0.01234673	0.00524587

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
Razorbill	Fowlsheugh	Lower displacement only (excluding Berwick Bank)	0.00394877	0.00287827
		Lower displacement only (all projects)	0.00462526	0.00336141
		Upper displacement only (excluding Berwick Bank)	0.00733448	0.00521618
		Upper displacement only (all projects)	0.00855026	0.00607446
	Forth Islands	Lower displacement only (excluding Berwick Bank)	0.00494720	0.00385012
		Lower displacement only (all projects)	0.00621579	0.00490278
		Upper displacement only (excluding Berwick Bank)	0.00954272	0.00711898
		Upper displacement only (all projects)	0.01180495	0.00896229
	Troup, Pennan & Lion's Heads	Lower displacement only (excluding Berwick Bank)	0.00177341	0.00095587
		Lower displacement only (all projects)	0.00200750	0.00110912
		Upper displacement only (excluding Berwick Bank)	0.00405994	0.00223816
		Upper displacement only (all projects)	0.00458603	0.00257527
	East Caithness Cliffs	Lower displacement only (excluding Berwick Bank)	0.00330611	0.00220328
		Lower displacement only (all projects)	0.00343803	0.00228525
		Upper displacement only (excluding Berwick Bank)	0.00679156	0.00436547
		Upper displacement only (all projects)	0.00715762	0.00458993

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
	North Caithness Cliffs	Lower displacement only (excluding Berwick Bank)	0.00198757	0.00114770
		Lower displacement only (all projects)	0.00210722	0.00122312
		Upper displacement only (excluding Berwick Bank)	0.00454234	0.00270713
		Upper displacement only (all projects)	0.00490128	0.00293341
	Flamborough & Filey Coast	Lower displacement only (excluding Berwick Bank)	0.00309383	0.00027412
		Lower displacement only (all projects)	0.00315156	0.00030881
		Upper displacement only (excluding Berwick Bank)	0.00583154	0.00082218
		Upper displacement only (all projects)	0.00600473	0.00092625
	Mingulay & Berneray	Upper displacement only (excluding Berwick Bank)	0.00030898	0.00018423
		Upper displacement only (all projects)	0.00032517	0.00020030
	Rathlin Island	Upper displacement only (excluding Berwick Bank)	0.00024915	0.00013118
		Upper displacement only (all projects)	0.00026537	0.00014903
Puffin	Farne Islands	Lower displacement only (excluding Berwick Bank)	0.00030338	0.00028846
		Lower displacement only (all projects)	0.00043152	0.00049927
		Upper displacement only (excluding Berwick Bank)	0.00047762	0.00048068
		Upper displacement only (all projects)	0.00069118	0.00083204

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
	Forth Islands	Lower displacement only (excluding Berwick Bank)	0.00137795	0.00120217
		Lower displacement only (all projects)	0.00153157	0.00135280
		Upper displacement only (excluding Berwick Bank)	0.00223890	0.00200357
		Upper displacement only (all projects)	0.00249492	0.00225461
	North Caithness Cliffs	Lower displacement only (excluding Berwick Bank)	0.00545967	0.00455314
		Lower displacement only (all projects)	0.00546954	0.00456164
		Upper displacement only (excluding Berwick Bank)	0.00890201	0.00758855
		Upper displacement only (all projects)	0.00891846	0.00760272
	Coquet Island	Lower displacement only (excluding Berwick Bank)	0.00025298	0.00008019
		Lower displacement only (all projects)	0.00032490	0.00019847
		Upper displacement only (excluding Berwick Bank)	0.00039759	0.00013358
		Upper displacement only (all projects)	0.00051746	0.00033072
Gannet	Fair Isle	Lower displacement only (excluding Berwick Bank)	0.00029213	0.00027355
		Lower displacement only (all projects)	0.00031193	0.00028438
		Upper displacement only (excluding Berwick Bank)	0.00087628	0.00082052
		Upper displacement only (all projects)	0.00093566	0.00085302
		Collision only (excluding Berwick Bank)	0.00030061	0.00019483

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
		Collision only (all projects)	0.00032413	0.00019883
		Lower displacement and collision (excluding Berwick Bank)	0.00059275	0.00046837
		Lower displacement and collision (all projects)	0.00063606	0.00048321
		Upper displacement and collision (excluding Berwick Bank)	0.00117689	0.00101535
		Upper displacement and collision (all projects)	0.00125979	0.00105185
	Forth Islands	Lower displacement only (excluding Berwick Bank)	0.00113170	0.00060715
		Lower displacement only (all projects)	0.00144700	0.00064238
		Upper displacement only (excluding Berwick Bank)	0.00339488	0.00182125
		Upper displacement only (all projects)	0.00434076	0.00192694
		Collision only (excluding Berwick Bank)	0.00401880	0.00051118
		Collision only (all projects)	0.00506017	0.00053657
		Lower displacement and collision (excluding Berwick Bank)	0.00515050	0.00111833
		Lower displacement and collision (all projects)	0.00650717	0.00117895
		Upper displacement and collision (excluding Berwick Bank)	0.00741368	0.00233243
		Upper displacement and collision (all projects)	0.00940093	0.00246351
	Hermaness, Saxa Vord & Valla Field	Lower displacement only (excluding Berwick Bank)	0.00053186	0.00052001
		Lower displacement only (all projects)	0.00055874	0.00054180

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
		Upper displacement only (excluding Berwick Bank)	0.00159537	0.00155983
		Upper displacement only (all projects)	0.00167600	0.00162520
		Collision only (excluding Berwick Bank)	0.00039657	0.00033251
		Collision only (all projects)	0.00041932	0.00034056
		Lower displacement and collision (excluding Berwick Bank)	0.00092843	0.00085252
		Lower displacement and collision (all projects)	0.00097806	0.00088236
		Upper displacement and collision (excluding Berwick Bank)	0.00199194	0.00189233
		Upper displacement and collision (all projects)	0.00209532	0.00196576
	North Rona & Sula Sgeir	Upper displacement only (excluding Berwick Bank)	0.00026127	0.00022832
		Upper displacement only (all projects)	0.00028700	0.00023823
		Upper displacement and collision (excluding Berwick Bank)	0.00035930	0.00028707
		Upper displacement and collision (all projects)	0.00038627	0.00029822
	Noss	Lower displacement only (excluding Berwick Bank)	0.00040540	0.00038968
		Lower displacement only (all projects)	0.00042560	0.00040580
		Upper displacement only (excluding Berwick Bank)	0.00121606	0.00116889
		Upper displacement only (all projects)	0.00127665	0.00121725
		Collision only (excluding Berwick Bank)	0.00034303	0.00025590

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
		Collision only (all projects)	0.00036669	0.00026185
		Lower displacement and collision (excluding Berwick Bank)	0.00074843	0.00064557
		Lower displacement and collision (all projects)	0.00079228	0.00066765
		Upper displacement and collision (excluding Berwick Bank)	0.00155909	0.00142479
		Upper displacement and collision (all projects)	0.00164334	0.00147910
	Sule Skerry & Sule Stack	Lower displacement only (excluding Berwick Bank)	0.00031095	0.00028970
		Lower displacement only (all projects)	0.00031964	0.00029199
		Upper displacement only (excluding Berwick Bank)	0.00093283	0.00086907
		Upper displacement only (all projects)	0.00095889	0.00087594
		Collision only (excluding Berwick Bank)	0.00128003	0.00132329
		Collision only (all projects)	0.00130413	0.00132415
		Lower displacement and collision (excluding Berwick Bank)	0.00159098	0.00161299
		Lower displacement and collision (all projects)	0.00162376	0.00161614
		Upper displacement and collision (excluding Berwick Bank)	0.00221286	0.00219236
		Upper displacement and collision (all projects)	0.00226302	0.00220009
	Flamborough & Filey Coast	Lower displacement only (excluding Berwick Bank)	0.00252521	0.00029817
		Lower displacement only (all projects)	0.00254481	0.00030510

Species	SPA	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
		Upper displacement only (excluding Berwick Bank)	0.00757548	0.00089439
		Upper displacement only (all projects)	0.00763428	0.00091516
		Collision only (excluding Berwick Bank)	0.00506448	0.00018006
		Collision only (all projects)	0.00511307	0.00018260
		Lower displacement and collision (excluding Berwick Bank)	0.00758969	0.00047824
		Lower displacement and collision (all projects)	0.00765788	0.00048769
		Upper displacement and collision (excluding Berwick Bank)	0.01263996	0.00107445
		Upper displacement and collision (all projects)	0.01274734	0.00109775

Notes:

The impact values are obtained by expressing the predicted mortality as a proportion of the population size at the start of the projection and are as required to specify mortality as relative within the NEPVA Tool (See PVA **Appendix 10.4: Offshore Ornithology Population Viability Technical Report (Volume IV)** for details).

**Table E-2: Impact on Adult and Subadult Survival Rates for Each Mortality Scenario Used in the PVAs for the Regional Populations**

Species	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
<b>Project Alone Impacts on Regional Population</b>			
Razorbill	Lower displacement	0.00039511	0.000424773
	Upper displacement	0.000660326	0.000709756
<b>Cumulative Impacts on Regional Population</b>			
Gannet	Lower displacement only (excluding Berwick Bank)	0.000810097	0.000402275
	Lower displacement only (all projects)	0.000901649	0.000426866
	Upper displacement only (excluding Berwick Bank)	0.00243015	0.00120667
	Upper displacement only (all projects)	0.00270481	0.00128045
	Collision only (excluding Berwick Bank)	0.00210908	0.000378504
	Collision only (all projects)	0.00239025	0.000410165
	Lower displacement and collision (excluding Berwick Bank)	0.00291917	0.000780778
	Lower displacement and collision (all projects)	0.00329190	0.000837032
	Upper displacement and collision (excluding Berwick Bank)	0.00453923	0.00158518
	Upper displacement and collision (all projects)	0.00509505	0.00169061

<b>Species</b>	<b>Mortality Scenario</b>	<b>Impact on Adult Survival Rate Mean</b>	<b>Impact on Subadult Survival Rate Mean</b>
Kittiwake	Lower displacement only (excluding Berwick Bank)	0.00106297	0.0055419
	Lower displacement only (all projects)	0.00132609	0.00066016
	Upper displacement only (excluding Berwick Bank)	0.00318889	0.00166235
	Upper displacement only (all projects)	0.00397826	0.00198028
	Collision only (excluding Berwick Bank)	0.00469721	0.00202593
	Collision only (all projects)	0.00618111	0.00248948
	Lower displacement and collision (excluding Berwick Bank)	0.00576018	0.00258011
	Lower displacement and collision (all projects)	0.00750720	0.00314964
	Upper displacement and collision (excluding Berwick Bank)	0.00788610	0.00368828
	Upper displacement and collision (all projects)	0.01015937	0.00446976
Guillemot	Lower displacement only (excluding Berwick Bank)	0.00304068	0.00319850
	Lower displacement only (all projects)	0.00379998	0.004004892
	Upper displacement only (excluding Berwick Bank)	0.00632642	0.00658945
	Upper displacement only (all projects)	0.00777004	0.008111565
Puffin	Lower displacement only (excluding Berwick Bank)	0.00136076	0.000905328
	Lower displacement only (all projects)	0.00165114	0.001062858
	Upper displacement only (excluding Berwick Bank)	0.00306089	0.001618005
	Upper displacement only (all projects)	0.00376486	0.001910845

Species	Mortality Scenario	Impact on Adult Survival Rate Mean	Impact on Subadult Survival Rate Mean
Razorbill	Lower displacement only (excluding Berwick Bank)	0.00774616	0.008134140
	Lower displacement only (all projects)	0.00917482	0.009654326
	Upper displacement only (excluding Berwick Bank)	0.01602770	0.016648846
	Upper displacement only (all projects)	0.01868069	0.019453520
<p>Notes:</p> <p>The impact values are obtained by expressing the predicted mortality as a proportion of the population size at the start of the projection and are as required to specify mortality as relative within the NEPVA Tool (see <b>Section 2.1.3</b> for details).</p>			

# Annex F: Regional Population Colony Counts

This annex consists of a table detailing the population estimates of each breeding colony contributing to the regional populations of each seabird species assessed, the survey year / s which the population estimate is derived and the source of this data. These populations are used in Annexes A and C for calculating impact on species from certain SPA colonies or the wider regional population.

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# **Bellrock Offshore Wind Farm**

## **Wind Farm Development Area**

**Environmental Impact Assessment Report - Volume IV**

**Annex 10.4-F Regional Population Colony Counts**

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# Contents

**Annex 10.4-F: Breeding Colonies Contributing to the Regional Populations of Each Species with the Associated Population Size Estimates ..... Error!**  
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## List of Tables

Table F- 1: Breeding Colonies Contributing to the Regional Breeding Populations, with Associated Population Size Estimates

## Glossary of Abbreviations

<b>Term</b>	<b>Definition</b>
AOB	Apparently Occupied Burrows
AON	Apparently Occupied Nests
AOS	Apparently Occupied Sites
SMP	Seabird Monitoring Programme
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest

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**Table F- 1: Breeding Colonies Contributing to the Regional Breeding Populations, with Associated Population Size Estimates**

Species	Site	Number of Breeding Adults	Year(s) of Counts	Source
Kittiwake	Fowlsheugh SPA	28,078	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	Buchan Ness to Collieston Coast SPA	27,094	2023	Seabird Monitoring Programme (SMP, 2025)
	Flamborough & Filey Coast SPA	89,148	2022	Clarkson et al. 2022
	Troup, Pennan & Lion's Heads SPA	21,232	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	East Caithness Cliffs SPA	36,600	2018 and 2024	Seabird Monitoring Programme (SMP, 2025)
	St Abb's Head to Fast Castle SPA	11,992	2024	Seabird Monitoring Programme (SMP, 2025)
	Farne Islands SPA	5,790	2024	Seabird Monitoring Programme (SMP, 2025)
	Forth Islands SPA	13,114	2024	Seabird Monitoring Programme (SMP, 2025)
	North Caithness Cliffs SPA	18,058	2023 - 2024	Seabird Monitoring Programme (SMP, 2025)
	Copinsay SPA	1,910	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	Fair Isle SPA	896	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	Hoy SPA	532	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	Coquet Island SPA	694	2024	Seabird Monitoring Programme (SMP, 2025)
	Firth of Forth SPA	2,310	2007	Seabirds Count (Burnell et al. 2023)
	Ythan Estuary, Sands of Forvie and Meikle Loch SPA	774	2019	Seabirds Count (Burnell et al. 2023)
	Pentland Firth Islands SPA	262	2016 - 2021	Seabirds Count (Burnell et al. 2023)
	Girdle Ness to Hare Ness	4,186	2017	Seabird Monitoring Programme (SMP, 2025)
	Catterline to Inverbervie	4,093	2017	Seabird Monitoring Programme (SMP, 2025)

<b>Species</b>	<b>Site</b>	<b>Number of Breeding Adults</b>	<b>Year(s) of Counts</b>	<b>Source</b>
	Lunan Bay to Arbroath	3,302	2018	Seabird Monitoring Programme (SMP, 2025)
	Findon Ness - Hare Ness	2,354	2017	Seabird Monitoring Programme (SMP, 2025)
	Burn of Daff	2,186	2017	Seabird Monitoring Programme (SMP, 2025)
	Berwick to Scottish Border	3,054	2000	Seabird Monitoring Programme (SMP, 2025)
	Marsden Bay	4,776	2016	Seabird Monitoring Programme (SMP, 2025)
	Scarborough to Osgodby Point	5,918	2011 and 2021	Seabird Monitoring Programme (SMP, 2025)
	Howick - Cullornose Point - Dunstanburgh Castle Point	2,136	2019	Seabird Monitoring Programme (SMP, 2025)
	River Tyne to Seaton Sluice	2,514	2015	Seabird Monitoring Programme (SMP, 2025)
	Eyemouth to Burnmouth	1,418	2018	Seabird Monitoring Programme (SMP, 2025)
	Boulby Cliffs	2,880	2020	Seabird Monitoring Programme (SMP, 2025)
	Saltburn Coast	2,220	2020	Seabird Monitoring Programme (SMP, 2025)
	Stonehaven to Wine Cove	621	2018 and 2021	Seabird Monitoring Programme (SMP, 2025)
	Newtonhill - Hall Bay	596	2017	Seabird Monitoring Programme (SMP, 2025)
	Montrose to Lunan Bay	740	2017	Seabird Monitoring Programme (SMP, 2025)
	Carr Craig, Eyebroughy and Haystack	1,130	2021	Seabird Monitoring Programme (SMP, 2025)
	Staithees to Sandsend	1,562	2019	Seabird Monitoring Programme (SMP, 2025)
	Portsoy to Cullen	1,032	2017	Seabird Monitoring Programme (SMP, 2025)
	Cayton Bay to Filey	1,580	2015 and 2017	Seabird Monitoring Programme (SMP, 2025)
	Hopeman Bay	1,120	2019	Seabird Monitoring Programme (SMP, 2025)

<b>Species</b>	<b>Site</b>	<b>Number of Breeding Adults</b>	<b>Year(s) of Counts</b>	<b>Source</b>
	Whitby to Robin Hood's Bay	946	2002 and 2021	Seabird Monitoring Programme (SMP, 2025)
	Seahouses	412	2019	Seabird Monitoring Programme (SMP, 2025)
	River Tees Mouth	754	2018	Seabird Monitoring Programme (SMP, 2025)
	Hall Bay to Craigeven Bay	158	2017	Seabird Monitoring Programme (SMP, 2025)
	North Sutor to Shandwick	578	2021	Seabird Monitoring Programme (SMP, 2025)
	Fraserburgh	162	2021	Seabird Monitoring Programme (SMP, 2025)
	Hartlepool Fish Quay	322	2018	Seabird Monitoring Programme (SMP, 2025)
	Melvich to Duncansby Stacks SSSI	554	2021	Seabird Monitoring Programme (SMP, 2025)
	Peterhead	66	2021	Seabird Monitoring Programme (SMP, 2025)
	Stronsay	315	2018 and 2019	Seabird Monitoring Programme (SMP, 2025)
	Rosehearty to Bay of Cullen	56	2017	Seabird Monitoring Programme (SMP, 2025)
	Horse of Copinsay	144	2015	Seabird Monitoring Programme (SMP, 2025)
	Portknockie	62	2018	Seabird Monitoring Programme (SMP, 2025)
	Scalby to Rocky Point	90	2015, 2018 and 2021	Seabird Monitoring Programme (SMP, 2025)
	South Sutor	106	2021	Seabird Monitoring Programme (SMP, 2025)
	Caithness - Wick Bay to Freshwick Bay	90	2018	Seabird Monitoring Programme (SMP, 2025)
	South Ronaldsay	102	2016/ and 201	Seabird Monitoring Programme (SMP, 2025)
	Hartlepool	48	2020	Seabird Monitoring Programme (SMP, 2025)
	Hoy and Southwalls	66	2019	Seabird Monitoring Programme (SMP, 2025)

Species	Site	Number of Breeding Adults	Year(s) of Counts	Source
	Scapa Bay to St. Marys	46	2021	Seabird Monitoring Programme (SMP, 2025)
	Shapinsay (Coastal)	34	2016 and 2021	Seabird Monitoring Programme (SMP, 2025)
	Holm	28	2018	Seabird Monitoring Programme (SMP, 2025)
	Newton Hill	4	2017	Seabird Monitoring Programme (SMP, 2025)
	Deerness	10	2002, 2018 and 2019	Seabird Monitoring Programme (SMP, 2025)
	Auskerry SPA	0	2016	Seabird Monitoring Programme (SMP, 2025)
	Fishtown of Usan to River North Esk	0	2018	Seabird Monitoring Programme (SMP, 2025)
	Ravenscar to Robin Hood's Bay	0	2019	Seabird Monitoring Programme (SMP, 2025)
	St Abbs to Eyemouth	0	2018	Seabird Monitoring Programme (SMP, 2025)
	Switha	0	2019	Seabird Monitoring Programme (SMP, 2025)
	Rerwick Head to Mirkady Point	6	2019	Seabird Monitoring Programme (SMP, 2025)
	<b>Total</b>		<b>313,061</b>	
Guillemot	Buchan Ness to Collieston Coast SPA	45,326	2023	Seabird Monitoring Programme (SMP, 2025)
	Calf of Eday SPA	5,205	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	Copinsay SPA	12,184	2023	Seabird Monitoring Programme (SMP, 2025)
	East Caithness Cliffs SPA	222,350	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	Fair Isle SPA	27,260	2021	Seabird Monitoring Programme (SMP, 2025)
	Farne Islands SPA	63,909	2024	Seabird Monitoring Programme (SMP, 2025)
	Flamborough & Filey Coast SPA	166,768	2022	Clarkson et al. 2022

Species	Site	Number of Breeding Adults	Year(s) of Counts	Source
	Forth Islands SPA	25,935	2024	Seabird Monitoring Programme (SMP, 2025)
	Fowlsheugh SPA	104,044	2015 - 2021	Seabird Monitoring Programme (SMP, 2025)
	Hoy SPA	18,175	2016 - 2017	Seabird Monitoring Programme (SMP, 2025)
	Marwick Head SPA	14,232	2023	Seabird Monitoring Programme (SMP, 2025)
	North Caithness Cliffs SPA	57,958	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	Rousay SPA	8,807	2016 - 2018	Seabird Monitoring Programme (SMP, 2025)
	St Abb's Head to Fast Castle SPA	68,282	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	Sumburgh Head SPA	26,537	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	Troup, Pennan & Lion's Heads SPA	35,463	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	West Westray SPA	42,759	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	Auskerry SPA	136	2016	Seabird Monitoring Programme (SMP, 2025)
	Berwick to Scottish Border	67	2000	Seabird Monitoring Programme (SMP, 2025)
	Birsay Cliffs - Point of Buckquoy to Loop of Cruie	36	2021	Seabird Monitoring Programme (SMP, 2025)
	Brough of Birsay	399	2017	Seabird Monitoring Programme (SMP, 2025)
	Burn of Daff	517	2017	Seabird Monitoring Programme (SMP, 2025)
	Caithness - Wick Bay to Freshwick Bay	346	2018	Seabird Monitoring Programme (SMP, 2025)
	Carr Craig, Eyebroughy and Haystack	110	2024	Seabird Monitoring Programme (SMP, 2025)
	Catterline to Inverbervie	6,712	2017	Seabird Monitoring Programme (SMP, 2025)
	Cayton Bay to Filey	9,259	2017	Seabird Monitoring Programme (SMP, 2025)

Species	Site	Number of Breeding Adults	Year(s) of Counts	Source
	Costa Head	7,563	2018	Seabird Monitoring Programme (SMP, 2025)
	Deerness	2,815	2018 - 2019	Seabird Monitoring Programme (SMP, 2025)
	Eyemouth to Burnmouth	1,067	2018	Seabird Monitoring Programme (SMP, 2025)
	Findon Ness - Hare Ness	1,754	2017	Seabird Monitoring Programme (SMP, 2025)
	Flotta & Calf of Flotta	95	2019	Seabird Monitoring Programme (SMP, 2025)
	Girdle Ness to Hare Ness	331	2017	Seabird Monitoring Programme (SMP, 2025)
	Holm	1,066	2018 - 2021	Seabird Monitoring Programme (SMP, 2025)
	Horse Island, Colsay, Little and Ladies Holm to Fitful Head	61	2021	Seabird Monitoring Programme (SMP, 2025)
	Horse of Copinsay	1,150	2023	Seabird Monitoring Programme (SMP, 2025)
	Hoy and Southwalls	1,857	2016 - 2019	Seabird Monitoring Programme (SMP, 2025)
	Lunan Bay to Arbroath	2,388	2018	Seabird Monitoring Programme (SMP, 2025)
	Melvich to Duncansby Stacks SSSI	3,345	2022	Seabird Monitoring Programme (SMP, 2025)
	Montrose to Lunan Bay	30	2017	Seabird Monitoring Programme (SMP, 2025)
	Newton Hill	4	2017	Seabird Monitoring Programme (SMP, 2025)
	Newtonhill - Hall Bay	463	2017	Seabird Monitoring Programme (SMP, 2025)
	North Sutor to Shandwick	1,326	2023	Seabird Monitoring Programme (SMP, 2025)
	Papa Westray (North Hill and Holm) SPA	262	2021	Seabird Monitoring Programme (SMP, 2025)
	Pentland Firth Islands SPA	659	2002 - 2021	Seabird Monitoring Programme (SMP, 2025)

Species	Site	Number of Breeding Adults	Year(s) of Counts	Source
	Portknockie	73	2018	Seabird Monitoring Programme (SMP, 2025)
	Shapinsay (Coastal)	143	2016- 2 021	Seabird Monitoring Programme (SMP, 2025)
	South Aberdeenshire - Tysties	37	2024	Seabird Monitoring Programme (SMP, 2025)
	South Ronaldsay	4,993	2021	Seabird Monitoring Programme (SMP, 2025)
	Stromness Area, Hundland	4	2016	Seabird Monitoring Programme (SMP, 2025)
	Stronsay	1,119	2018	Seabird Monitoring Programme (SMP, 2025)
	Sumburgh Head Quarries	843	2017	Seabird Monitoring Programme (SMP, 2025)
	Switha	122	2019	Seabird Monitoring Programme (SMP, 2025)
	Westray	442	2002	Seabird Monitoring Programme (SMP, 2025)
	Yesnaby - Ness Point, Stromness	54	2016	Seabird Monitoring Programme (SMP, 2025)
	Yesnaby to Marwick (West Mainland)	6,589	2018 - 2019	Seabird Monitoring Programme (SMP, 2025)
	Ythan Estuary, Sands of Forvie and Meikle Loch SPA	18	2024	Seabird Monitoring Programme (SMP, 2025)
	<b>Total</b>	<b>1,003,449</b>		
Razorbill	Fowlsheugh SPA	18,844	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	Buchan Ness to Collieston Coast SPA	7,654	2023	Seabird Monitoring Programme (SMP, 2025)
	Ythan Estuary, Sands of Forvie & Meikle Loch SPA	84	2024	Seabird Monitoring Programme (SMP, 2025)
	<b>Total</b>	<b>26,583</b>		
Puffin	Farne Islands SPA	100,206	2024	Seabird Monitoring Programme (SMP, 2025)
	Forth Islands SPA	117,960	2024	Seabird Monitoring Programme (SMP, 2025)

<b>Species</b>	<b>Site</b>	<b>Number of Breeding Adults</b>	<b>Year(s) of Counts</b>	<b>Source</b>
	North Caithness Cliffs SPA	6,078	2015 - 2016	Seabirds Count (Burnell et al. 2023)
	Coquet Island SPA	50,058	2019	Seabird Monitoring Programme (SMP, 2025)
	Fowlsheugh SPA	178	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	Buchan Ness to Collieston Coast SPA	118	2023	Seabird Monitoring Programme (SMP, 2025)
	East Caithness Cliffs SPA	189	2015 - 2021	Seabirds Count (Burnell et al. 2023)
	Troup, Pennan and Lion's Heads SPA	60	2017	Seabirds Count (Burnell et al. 2023)
	Carr Craig, Eyebroughy and Haystack	3,800	2021 and 2022	Seabird Monitoring Programme (SMP, 2025)
	Lunan Bay to Arbroath	26	2018	Seabird Monitoring Programme (SMP, 2025)
	Findon Ness - Hare Ness	19	2015 and 2017	Seabird Monitoring Programme (SMP, 2025)
	Portsoy to Cullen	32	2017	Seabird Monitoring Programme (SMP, 2025)
	Catterline to Inverbervie	10	2017	Seabird Monitoring Programme (SMP, 2025)
	Burn of Daff	7	2017	Seabird Monitoring Programme (SMP, 2025)
	Newtonhill - Hall Bay	3	2017	Seabird Monitoring Programme (SMP, 2025)
	Newton Hill	2	2017	Seabird Monitoring Programme (SMP, 2025)
	Stonehaven to Wine Cove	1	2018 and 2021	Seabird Monitoring Programme (SMP, 2025)
	Caithness - Wick Bay to Freshwick Bay	3	2018	Seabird Monitoring Programme (SMP, 2025)
	St Abb's Head to Fast Castle SPA	0	2016 - 2019	Seabird Monitoring Programme (SMP, 2025)
	Eyemouth to Burnmouth	0	2018	Seabird Monitoring Programme (SMP, 2025)
	Girdle Ness to Hare Ness	0	2017	Seabird Monitoring Programme (SMP, 2025)
	<b>Total</b>	<b>278,750</b>		

Species	Site	Number of Breeding Adults	Year(s) of Counts	Source
Gannet	Forth Islands SPA	103,688	2023	Harris et al. 2023
	Flamborough & Filey Coast SPA	31,588	2024	Seabird Monitoring Programme (SMP, 2025)
	St Kilda	118,410	2023	Seabird Monitoring Programme (SMP, 2025)
	Hermaness, Saxa Vord & Valla Field SPA	39,606	2024	Seabird Monitoring Programme (SMP, 2025)
	Noss SPA	24,670	2023	Seabird Monitoring Programme (SMP, 2025)
	Sule Skerry & Sule Stack SPA	15,648	2013 and 2024	Seabird Monitoring Programme (SMP, 2025)
	North Rona & Sula Sgeir SPA	18,990	2023	Seabird Monitoring Programme (SMP, 2025)
	Fair Isle SPA	11,184	2024	Seabird Monitoring Programme (SMP, 2025)
	Troup, Pennan and Lion's Heads SPA	8,752	2023	Seabird Monitoring Programme (SMP, 2025)
	Foula SPA	4,172	2023	Seabird Monitoring Programme (SMP, 2025)
	Noup Cliffs (West Westray SPA)	2,766	2023	Seabird Monitoring Programme (SMP, 2025)
	St Abb's Head to Fast Castle SPA	236	2024	Seabird Monitoring Programme (SMP, 2025)
	Marwick Head SPA	58	2023	Seabird Monitoring Programme (SMP, 2025)
	<b>Total</b>		<b>379,768</b>	

Notes:

**Grey** cells represent colonies that are not a Special Protection Area (SPA) for the Given Species.

The number of breeding adults is derived by doubling the number of Apparently Occupied Sites (AOS), Apparently Occupied Nests (AON) or Apparently Occupied Burrows (AOB) for kittiwake, gannet and (in some cases) puffin. The number of individuals is used for puffin, where the count unit is post-laying individuals and not AOB. For guillemot and razorbill, estimates are derived by multiplying the count of individuals by 1.49 and 1.34, respectively. See Burnell et al. (2023) for details.

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## Annex G: PVA Output Files

This annex consists of the output files produced by the NE PVA tool for each of the impact scenarios for which PVAs were run in this assessment. See the cover tab for an example of the folder layout, and the information page for details on file naming conventions and PVA-related acronyms, or descriptions of the outputs contained within each file.

Note that for some PVA runs, i.e. Cumulative Regional Kittiwake, there are two output files for two runs of the model, one for Berwick Bank included and the other excluded. The PVA tool does not always function with a full set (10) of scenarios, and therefore often runs must be made separately.

See zip folder **Appendix 10.4 Annex G PVA Outputs Files.zip (RHDV\_BEL\_CST\_REP\_0004\_038)** of the digital version of this document for the associated excel spreadsheets. The excel files are included in hard copy.

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