Rampion 2 Wind Farm

Category 6: Environmental Statement

Volume 4, Appendix 12.5 Offshore and intertidal ornithology population viability analysis

Date: August 2023

Revision A

Document Reference: 6.4.12.5
Pursuant to: APFP Regulation 5 (2) (a)
Ecodoc number: 004866486-01

Document revisions

Revision	Date	Status/reason for issue	Author	Checked by	Approved by
A	04/08/2023	Final for DCO Application	APEM Ltd	RED	RED

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1. Introduction

1.1.1 This section outlines the proposed development and the need for population viability analysis to inform the environmental impact assessment.

1.2 Purpose of this report

1.2.1 This report has been produced for the purpose of describing the methods and presenting the results of population viability analysis (PVA) run for selected species, which form part of the Environmental Impact Assessment (EIA) for the proposed Rampion 2 offshore wind farm.

1.3 Project background

1.3.1 Rampion Extension Development (RED; 'the Applicant') is proposing to develop the Rampion 2 Offshore Wind Farm ('Rampion 2'). Rampion 2 will be sited adjacent to the existing Rampion 1 Offshore Wind Farm (OWF), located in the English Channel, 14km off the coast of Brighton and Hove and approximately 30km east of the Isle of Wight. For the purposes of clarification, in this document, the existing Rampion 1 OWF is referred to as 'Rampion 1' hereon in to enable clear differentiation with Rampion 2. The existing Rampion 1 project was developed following award of Zone 6 in the United Kingdom Round 3 offshore wind development leasing round run by The Crown Estate (TCE) in 2009 and occupies 78km^2. Rampion 2 will comprise both offshore and onshore infrastructure including offshore wind turbine generators (WTGs) and associated foundations and inter-array cabling, offshore substations, offshore export cables within a defined cable corridor, a landfall site, and an onshore substation for connection to the electricity transmission network. The offshore element of Rampion 2 will be located within an Area of Search adjacent to the west and south east of the existing Rampion 1 project, together with a small link or 'bridge' area between the two areas for cabling.

1.3.2 APEM Ltd (hereafter APEM) was commissioned to undertake an impact assessment of offshore and intertidal ornithology, including the characterisation within the area that may be influenced by Rampion 2. A separate report (**Appendix 12.1: Offshore and intertidal ornithology baseline technical report, Volume 4** of the ES (Document Reference: 6.4.12)) provides the findings from offshore and intertidal ornithology data to determine the receptors that characterise the baseline and are of relevance to the assessment of potential impacts from Rampion 2. This technical appendix has been produced to support the findings in the impact assessments in **Chapter 12: Offshore and intertidal ornithology, Volume 2** of the ES (Document Reference: 6.2.12).

1.4 Population Viability Analysis

1.4.1 Renewable energy projects in the marine environment, such as OWFs, have the potential to impact on seabirds through a number of processes such as collision with turbine blades resulting in mortality, or displacement from an area due to the presence of Wind Turbine Generators (WTGs). These processes affect individuals, but the cumulative effects (when the project alone effects are considered alongside any effects from other projects on the same receptor) have the potential to affect the productivity or elevate the baseline mortality of a population. The EIA process provides the assessment of such potential effects as a consequence of OWFs at varying population scales.

1.4.2 One method to estimate the effect that developments alone or cumulatively may have on a population is through PVA. PVA provides a robust framework using demographic parameters to predict changes in the population, using statistical population models to forecast future changes over a set period. Comparisons are made between 'baseline' conditions whereby conditions remain unimpacted and under 'scenario' conditions where an impact is applied to a population by the alteration of demographic parameters.

1.4.3 This report provides PVAs modelled on Biologically Defined Minimum Population (BDMPS) population scales to aid the analysis of the following the species, based on Natural England's Section 42 responses to the Preliminary Environmental Information Report (PEIR):

- gannet, *Morus bassanus*;
- great black-backed gull, *Larus marinus*; and
- herring gull, *Larus Argentatus*

1.4.4 These three species were requested by Natural England to further assess the predicted cumulative impacts only, due to the predicted impacts at a cumulative scale exceeding a 1% increase relative to the baseline mortality at the BDMPS scale, with a 1% increase being the level which is regarded as the threshold for undertaking further assessments such as PVA. For the project alone, as detailed in **Chapter 12: Offshore and intertidal ornithology, Volume 2** of the ES (Document Reference: 6.2.12) the assessments concluded no significant effect.

1.4.5 PVA was undertaken using the Seabird PVA Tool developed by Natural England (Searle et al., 2019). The Seabird PVA Tool was accessed via the 'Shiny App' interface, which is a user-friendly graphical user interface accessible via a standard web-browser that uses the nepva R package to perform the modelling and analysis. The advantages of using an online platform for modelling and analysis purposes are that users are not required to use any R code, users are not required to install or maintain R, and updates to the model are made directly to the server. The tool is capable of assessing any type of impact in terms of change to demographic parameters, or as a cull or harvest of a fixed size per year (Searle et al., 2019).

2. Methodology

This section describes the method used for PVA.

2.1 Guidance and models

Overview

2.1.1 The user guide for the Seabird PVA Tool provided by Natural England (Mobbs et al., 2020) has been followed for modelling and assessment of potential impacts.

2.1.2 The demographic parameters used for the PVA are presented in **Section 2.2: PVA demographic parameters**, whilst the input log and outputs from the Shiny App are included in **0** of this report.

2.2 PVA demographic parameters

Modelling approach

2.2.1 All PVA models were undertaken using the 'Simulation' run type, which is used to simulate population trajectories based on the specified demographic parameters, initial population sizes and scenarios the user inputs into the model.

2.2.2 The Seabird PVA Tool uses a Leslie matrix to construct a PVA model (Caswell 2000) based on the parameters provided by the user. Users can specify whether they wish the model to include demographic stochasticity, environmental stochasticity, density dependence, density independence or whether they want the model to run an entirely deterministic model.

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

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

2.2.5 All PVA modelling in this report was undertaken with environmental and demographic stochasticity. To ensure robust results, all simulations were set to run 5,000 times. All models were run for a 30-year time span, representing the likely lifespan of Rampion 2.

2.2.6 Demographic processes such as growth, survival, productivity, and recruitment are density-dependent, as their rates change in relation to the number of individuals in a population. Density dependence can be described as either compensatory or depensatory (Begon, Townsend and Harper 2005). Compensation is characterised by demographic changes that cause a stabilising effect on a populations long-term average. Depensation acts to further decrease the rate of population growth in declining populations and can delay the rate of recovery. This is typically exhibited in populations that have been significantly depleted in size and is caused by a reduction in the benefits associated with conspecific presence.

2.2.7 Density dependence is self-evident in the natural environment, as without density dependence, populations would grow exponentially. For seabird populations, the mechanisms as to how this operates are largely uncertain. If density dependence is mis-specified in an assessment, the modelled predictions may be unreliable. Therefore, it is more typical to use density independent models for seabird assessments, despite the lack of biologically necessary density dependence. As such, density independent models lack any means by which a population can recover once it has been reduced beyond a certain point, they are therefore appropriate for impact assessment purposes on the grounds of precaution (i.e. another source of precaution in the assessment process) (Ridge et al., 2019).

Species demographics

2.2.8 The Shiny App offers the users the choice of using pre-set demographic parameters or the ability to enter custom values. The pre-set demographic values are available for a total of 15 different species. The values are derived from previously reported national or colony specific demographic parameters sourced from the Joint Nature Conservation Committee (JNCC) Seabird Monitoring Programme (SMP 2020), divided into eight regional classifications (further information on the eight regional classifications can be found in Mobbs et al. (2020)) for breeding success data or Horswill and Robinson (2015) for survival rate. **Table 2-1** summarises the species-specific values selected for the two species that are the focus of this report.

2.2.9 After reviewing the pre-formulated productivity rates within the tool for the eight regional classifications, due to the age of the data (productivity data spanning over 50 years in some instances) feeding into the productivity rates, none of the pre-formulated values for productivity were representative of the populations assessed within this report. The national productivity values presented within Horswill and Robinson (2015) were instead used for assessment, due to providing a more representative productivity rate of the populations assessed.

2.2.10 For both species, the initial population size inputted into all PVAs for the BDMPS were taken from the review undertaken by Furness (2015).

2.2.11 The survival rates for gannet were kept as the national values presented within the tool, which match the mean estimates presented in Horswill and Robinson (2015).

2.2.12 The survival rates for great black-backed gull presented in Horswill and Robinson (2015) are limited and are based on a relatively old study by Glutz von Blotzheim and Bauer (1982). Due to the limited amount of data Horswill and Robinson (2015) recommended using the survival rates of other large gull species when conducting population modelling for great black-backed gull. Therefore, the survival rates for great black-backed gull used for the PVA are based on adult and juvenile rates for herring gull as presented in Horswill & Robinson (2015).

2.2.13 The survival rates for herring gull were set to the national value mean estimates presented in Horswill and Robinson (2015).For age at first breeding and maximum brood size per pair parameters, the pre-formulated values within the tool were selected.

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Table 2-1 BDMPS population demographic parameters selected for gannet, great black-backed gull and herring gull.

Species	Productivity rate + SD	BDMPS population size (all individuals)	Mean adult survival rate + SD	Mean immature age class 0-1 survival rate + SD	Mean immature age class 1-2 survival rate + SD	Mean immature age class 2-3 survival rate + SD	Mean immature age class 3-4 survival rate + SD	Mean immature age class 4-5 survival rate + SD
Gannet	0.700 ± 0.082	456,298	0.919 ± 0.042	0.424 ± 0.045	0.829 ± 0.026	0.891 ± 0.019	0.895 ± 0.019	0.919 ± 0.042
Great black-backed gull	1.139 ± 0.533	17,742	0.834 ± 0.034	0.798 ± 0.092	0.834 ± 0.034	0.834 ± 0.034	0.834 ± 0.034	0.834 ± 0.034
Herring gull	0.920 ± 0.477	466,511	0.834 ± 0.034	0.798 ± 0.092	0.834 ± 0.034	0.834 ± 0.034	0.834 ± 0.034	0.834 ± 0.034

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2.3 Impact values assessed

2.3.1 For both species generic impact levels have been modelled only. The reason for using generic impact levels rather than the predicted cumulative totals presented in **Chapter 12: Offshore and intertidal ornithology, Volume 2** of the ES (Document Reference: 6.2.12), is to account for the uncertainty in project totals for developments which have yet to gain consent future proofing the results and due to SNCBs preferring a range based approach to assessment, over a single impact value. The impact levels modelled for each species are included in **Table 3-1**, **Table 3-2** and **Table 3-3** in the “Increase in Mortality” column.

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3. Results

This section provides the PVA outputs for each of the species considered.

3.1 Introduction

The outputs of the Seabird PVA Tool are set out in **Table 3-1, Table 3-2**, and **Table 3-3** below for the three species. The metrics used to summarise the PVA results are based on the counterfactual of population growth and counterfactual of population size.

3.2 Gannet

3.2.1 **Table 3-1** presents the PVA results for gannet when considering the North Sea and English Channel BDMPS.

Table 3-1 Gannet PVA results using the Seabird PVA Tool

Increase in mortality	Density independent counterfactual metric (after 30 years)		Reduction in growth rate	Reduction in population size
	Growth rate	Population size		
300	0.999	0.976	0.08%	2.37%
400	0.999	0.968	0.10%	3.16%
1000	0.997	0.923	0.26%	7.73%
1500	0.996	0.886	0.39%	11.37%
2000	0.995	0.851	0.52%	14.87%
2250	0.994	0.834	0.58%	16.58%
2500	0.994	0.817	0.65%	18.25%
2750	0.993	0.801	0.71%	19.89%
3000	0.992	0.785	0.78%	21.50%
3100	0.992	0.779	0.80%	22.12%
3200	0.992	0.772	0.83%	22.75%
3300	0.991	0.766	0.86%	23.36%
3400	0.991	0.760	0.88%	23.98%

Increase in mortality	Density independent counterfactual metric (after 30 years)		Reduction in growth rate	Reduction in population size
	Growth rate	Population size		
3500	0.992	0.754	0.91%	24.60%
3600	0.991	0.748	0.93%	25.21%
3700	0.990	0.742	0.96%	25.81%
3800	0.990	0.736	0.99%	26.41%
3900	0.990	0.730	1.01%	27.00%
4000	0.990	0.724	1.04%	27.60%

3.3 Great black-backed gull

3.3.1 **Table 3-2** presents the PVA results for great black-backed gull when considering the South Western and English Channel BDMPS.

Table 3-2 Great black-backed gull PVA results using the Seabird PVA Tool.

Increase in mortality	Density independent counterfactual metric (after 30 years)		Reduction in growth rate	Reduction in population size
	Growth rate	Population size		
5	1.000	0.990	0.03%	1.08%
10	0.999	0.979	0.07%	2.10%
15	0.999	0.970	0.10%	3.07%
20	0.999	0.959	0.14%	4.14%
30	0.998	0.939	0.20%	6.15%
40	0.997	0.920	0.27%	8.06%
50	0.997	0.900	0.34%	10.06%
60	0.996	0.882	0.41%	11.84%
75	0.995	0.854	0.51%	14.65%
100	0.993	0.810	0.68%	19.03%

3.4 Herring gull

3.4.1 **Table 3-3** presents the PVA results for herring gull when considering the South Western and English Channel BDMPS.

Table 3-3 Herring gull PVA results using the Seabird PVA Tool.

Increase in mortality	Density independent counterfactual metric (after 30 years)		Reduction in growth rate	Reduction in population size
	Growth rate	Population size		
600	0.998	0.949	0.17%	5.08%
650	0.998	0.949	0.17%	5.09%
700	0.998	0.945 5	0.18%	5.47%
750	0.998	0.946	0.19%	5.84%
800	0.998	0.938	0.21%	6.22%
850	0.998	0.934	0.22%	6.59%
900	0.998	0.930	0.23%	6.97%
950	0.998	0.927	0.25%	7.34%
1000	0.997	0.923	0.26%	7.71%
1050	0.997	0.919	0.27%	8.09%
1100	0.997	0.916	0.28%	8.44%
1150	0.997	0.912	0.30%	8.81%
1200	0.997	0.908	0.31%	9.17%

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4. Glossary of terms and abbreviations

Table 4-1 Glossary of terms and abbreviations

Term (acronym)	Definition
EIA	Environmental Impact Assessment
ES	Environmental Statement
JNCC	Joint Nature Conservation Committee
km	Kilometres
OWF	Offshore Wind Farm
PVA	Population Visibility Analysis
RED	Rampion Extension Development Limited (the Applicant)
TCE	The Crown Estate
SMP	Sea Monitoring Programme
WTG	Wind Turbine Generators

5. References

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Annex A
Seabird PVA Tool Input Log

Gannet parameter log

The log file was created on: 2023-05-18 16:03:35 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 “Ramp2_GX_EIA_Range_”.

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: 4321.

Years for burn-in: 10.

Case study selected: None.

Baseline demographic rates

Species chosen to set initial values: Northern Gannet.

Region type to use for breeding success data: Global.

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

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: all.individuals

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

Population 1

Initial population values: Initial population 456298 in 2023

Productivity rate per pair: mean: 0.7 , sd: 0.082

Adult survival rate: mean: 0.919 , sd: 0.042

Immatures survival rates:

Age class 0 to 1 - mean: 0.424 , sd: 0.045 , DD: NA

Age class 1 to 2 - mean: 0.829 , sd: 0.026 , DD: NA

Age class 2 to 3 - mean: 0.891 , sd: 0.019 , DD: NA

Age class 3 to 4 - mean: 0.895 , sd: 0.019 , 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?: No

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: No

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

Years in which impacts are assumed to begin and end: 2030 to 2060Impact on Demographic Rates

Scenario A - Name: 300

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.000657 , se: NA

Scenario B - Name: 400

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.000877 , se: NA

Scenario C - Name: 1000

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.002192 , se: NA

Scenario D - Name: 1500

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.003287 , se: NA

Scenario E - Name: 2000

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.004383 , se: NA

Scenario F - Name: 2250

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.004931 , se: NA

Scenario G - Name: 2500

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.005479 , se: NA

Scenario H - Name: 2750

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.006027 , se: NA

Scenario I - Name: 3000

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.006575 , se: NA

Scenario J - Name: 3100

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.006794 , se: NA

Scenario A - Name: 3200

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.007013 , se: NA

Scenario B - Name: 3300

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.007232 , se: NA

Scenario C - Name: 3400

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.007451 , se: NA

Scenario D - Name: 3500

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.00767 , se: NA

Scenario E - Name: 3600

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.00789 , se: NA

Scenario F - Name: 3700

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.008109 , se: NA

Scenario G - Name: 3800

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.008328 , se: NA

Scenario H - Name: 3900

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.008547 , se: NA

Scenario I - Name: 4000

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.008766 , se: NAOutput:

First year to include in outputs: 2030

Final year to include in outputs: 2060

How should outputs be produced, in terms of ages?: whole.population

Target population size to use in calculating impact metrics: NA

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

Great Black-backed gull parameter log

Set up

The log file was created on: 2023-05-19 09:28:49 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 “Ramp2_EIA_GBBG_Range_1”.

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: 4567.

Years for burn-in: 10.

Case study selected: None.

Baseline demographic rates

Species chosen to set initial values: Great Black-Backed Gull.

Region type to use for breeding success data: Global.

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

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 3 per pair.

Number of subpopulations: 1.

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

Units for initial population size: all.individuals

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

Population 1

Initial population values: Initial population 17742 in 2022

Productivity rate per pair: mean: 1.139 , sd: 0.533

Adult survival rate: mean: 0.834 , sd: 0.034

Immatures survival rates:

Age class 0 to 1 - mean: 0.798 , sd: 0.092 , DD: NA

Age class 1 to 2 - mean: 0.834 , sd: 0.034 , DD: NA

Age class 2 to 3 - mean: 0.834 , sd: 0.034 , DD: NA

Age class 3 to 4 - mean: 0.834 , sd: 0.034 , DD: NA

Age class 4 to 5 - mean: 0.834 , sd: 0.034 , DD: NA

Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: No

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: No

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

Years in which impacts are assumed to begin and end: 2030 to 2060

Impact on Demographic Rates

Scenario A - Name: 5

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.000282 , se: NA

Scenario B - Name: 10

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.000564 , se: NA

Scenario C - Name: 15

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.000845 , se: NA

Scenario D - Name: 20

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.001127 , se: NA

Scenario E - Name: 30

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.001691 , se: NA

Scenario F - Name: 40

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.002255 , se: NA

Scenario G - Name: 50

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.002818 , se: NA

Scenario H - Name: 60

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.003382 , se: NA

Scenario I - Name: 75

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.004227 , se: NA

Scenario J - Name: 100

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.005636 , se: NA

Output:

First year to include in outputs: 2030

Final year to include in outputs: 2060

How should outputs be produced, in terms of ages?: whole.population

Target population size to use in calculating impact metrics: NA

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

Herring Gull Parameter log

Set up

The log file was created on: 2023-05-19 09:56:32 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 “Ramp2_EIA_HG_Range_1”.

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: 9876.

Years for burn-in: 10.

Case study selected: None.

Baseline demographic rates

Species chosen to set initial values: Herring Gull.

Region type to use for breeding success data: Global.

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

Age at first breeding: 5.

Is there an upper constraint on productivity in the model?: Yes, constrained to 3 per pair.

Number of subpopulations: 1.

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

Units for initial population size: all.individuals

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

Population 1

Initial population values: Initial population 466511 in 2022

Productivity rate per pair: mean: 0.92 , sd: 0.477

Adult survival rate: mean: 0.834 , sd: 0.034

Immatures survival rates:

Age class 0 to 1 - mean: 0.798 , sd: 0.092 , DD: NA

Age class 1 to 2 - mean: 0.834 , sd: 0.034 , DD: NA

Age class 2 to 3 - mean: 0.834 , sd: 0.034 , DD: NA

Age class 3 to 4 - mean: 0.834 , sd: 0.034 , DD: NA

Age class 4 to 5 - mean: 0.834 , sd: 0.034 , DD: NA

Impacts

Number of impact scenarios: 10.

Are impacts applied separately to each subpopulation?: No

Are impacts of scenarios specified separately for immatures?: No

Are standard errors of impacts available?: No

Should random seeds be matched for impact scenarios?: No

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

Years in which impacts are assumed to begin and end: 2030 to 2060

Impact on Demographic Rates

Scenario A - Name: 600

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.001393 , se: NA

Scenario B - Name: 650

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.001393 , se: NA

Scenario C - Name: 700

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.001501 , se: NA

Scenario D - Name: 750

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.001608 , se: NA

Scenario E - Name: 800

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.001715 , se: NA

Scenario F - Name: 850

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.001822 , se: NA

Scenario G - Name: 900

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.001929 , se: NA

Scenario H - Name: 950

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.002036 , se: NA

Scenario I - Name: 1000

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.002144 , se: NA

Scenario J - Name: 1050

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.002251 , se: NA

Scenario K - Name: 1100

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.002358 , se: NA

Scenario L - Name: 1150

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.002465 , se: NA

Scenario M - Name: 1200

All subpopulations

Impact on productivity rate mean: 0 , se: NA

Impact on adult survival rate mean: 0.002572 , se: NA

Output:

First year to include in outputs: 2030

Final year to include in outputs: 2060

How should outputs be produced, in terms of ages?: whole.population

Target population size to use in calculating impact metrics: NA

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

Rampion 2
WIND FARM