Technical Appendix 11.7: Population Viability Analysis (PVA)

MachairWind Offshore Ornithology

ScottishPower Renewables (SPR)

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SLR Project No.: 413.058018.00001

Client Reference No: MCW-DWF-ENV-REP-RHS-000150

23 April 2026

Revision: 4

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
Rev 1	5 December 2025	NG	SO	SO
Rev 2	25 February 2026	NG	SO	SO
Rev 3	9 April 2026	NG	SO	SO
Rev 4	23 April 2026	NG	SO	SO

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1.0 Introduction

1.1 Project Summary

1. MachairWind Limited ('the Applicant') is proposing the development of the MachairWind Windfarm ('the Project'), an Offshore Windfarm, located off the west coast of Scotland approximately 15 kilometres (km) to the northwest of Islay and approximately 12.4 km west of Colonsay at the closest points (**Figure 1**).

2. The Offshore Project will comprise up to 144 wind turbine generators (WTGs) with fixed-bottom foundations. The area within which the WTGs and associated infrastructure will be located is the Windfarm Development Area (WDA). The WDA covers an area of 448 km^2.

1.2 Purpose of this report

3. This **Technical Appendix 11.7: Population Viability Analysis (PVA)** for Project alone and cumulative/in-combination impacts provides details of Population Viability Analyses (PVA) conducted to assess changes in survival impacting regional seabird populations for the Environmental Impact Assessment (EIA) presented in Chapter 11 Offshore Ornithology of the Environmental Impact Assessment Report (EIAR) and seabird populations that are qualifying features of Special Protection Areas (SPAs) for the Habitats Regulations Appraisal (HRA) presented in the Report to Inform Appropriate Assessment (RIAA).

4. This technical appendix describes methods and parameters used in undertaking PVA. It also provides the full results obtained from PVAs. For each run of the PVA, complete tables of all input values are provided, together with the outputs which are presented in both tabulated and graphical form. The PVAs undertaken for all species and the SPAs at which they are a qualifying feature are summarised in **Table 1**.

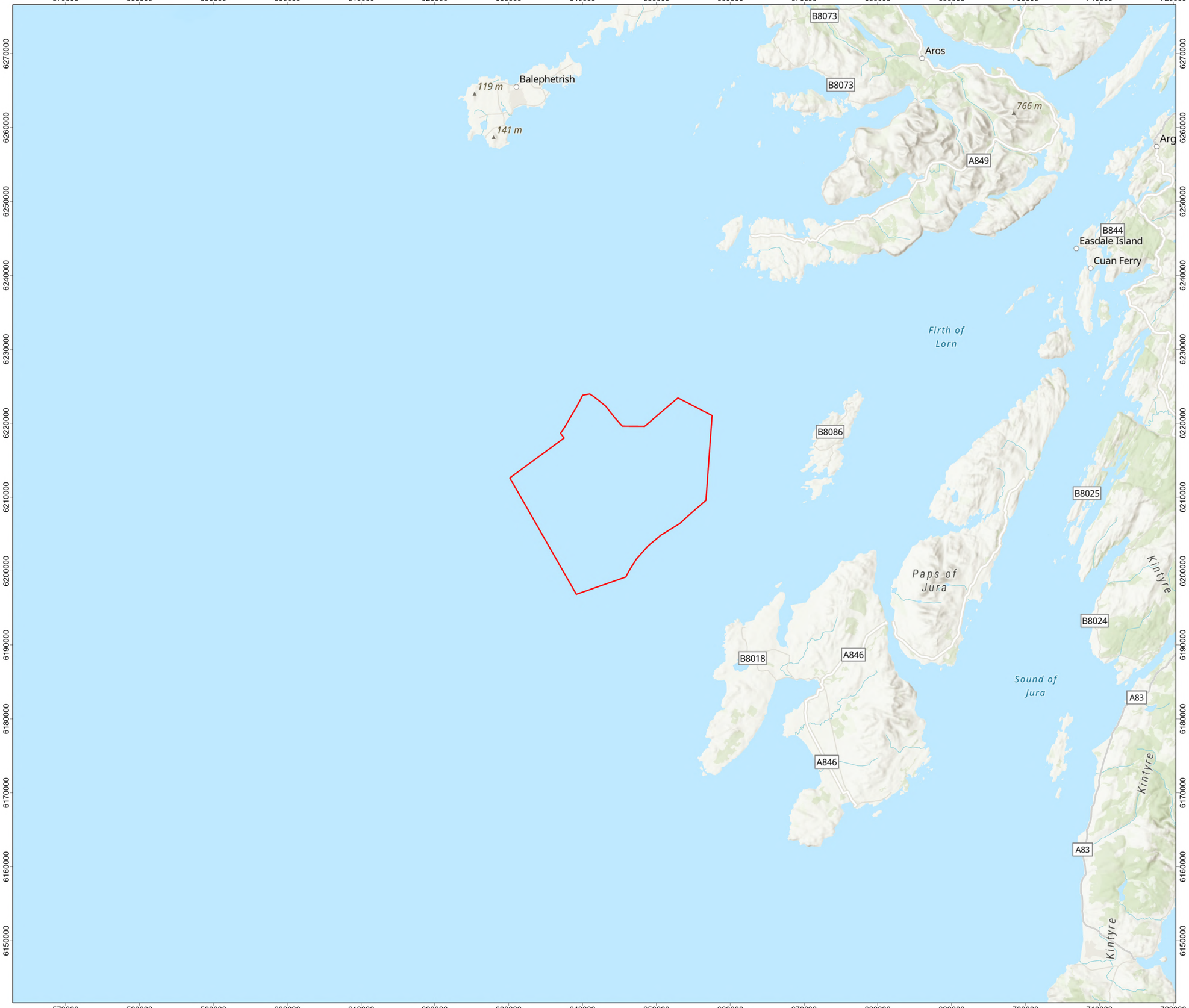
5. Collision mortality and displacement mortality (including upper and lower displacement scenarios) estimated for the Project are presented in **Technical Appendix 11.3: Collision Risk Modelling** and **Technical Appendix 11.4: Displacement** respectively. For the HRA, these Project mortality estimates were apportioned to SPAs, as described in **Technical Appendix 11.6: Apportioning for HRA**; this report also evaluates whether a PVA was required for a feature of an SPA, from either Project alone or in-combination impacts. NatureScot have advised that a PVA is only required when:

    - Project-alone: the increase in baseline mortality rate is equal to or greater than 0.02%; and,
    - In-combination: the increase in baseline mortality rate is equal to or greater than 0.02% and project alone annual mortality is equal to or greater than 0.2 birds per annum.

6. Note that in the context of this technical appendix, the term 'Project alone' relates to impacts from the WDA (collision mortality) and from the WDA plus a 2 km buffer (displacement mortality for all species except great northern diver) or the WDA plus a 4 km buffer (displacement mortality for great northern diver only).

7. Estimated changes in survival rates for regional seabird populations (EIA) arising from impacts from the Project alone and cumulatively with other offshore windfarms are provided in this technical appendix in **Section 2.0**. For the HRA, estimated changes in annual adult mortality rate impacting SPA populations, arising from impacts from the Project alone and in-combination with other offshore windfarms are provided in **Technical Appendix 11.6: Apportioning for HRA**. Mortality impacts derived from other offshore windfarms are presented in **Technical Appendix 11.5 Cumulative and In-combination Mortality**.

8. The PVAs presented in this technical appendix are for species and SPAs where changes in survival rates for regional and SPA populations exceeded the threshold advised by NatureScot and therefore PVAs were required.



Windfarm Development Area (WDA)

N

0 5 10 20
Kilometres

REV	REV DATE	GIS CREATOR	GIS REVIEWER	TECHNICAL CHECKER	TECHNICAL APPROVER
1	21/04/2026	MMM	MMM	NG/SO	NG/SO

DRAWING NJMBER	MCW-DWF-ENV-MAP-RHS-000203		
DATUM	ETRS89	PROJECTION	UTM Zone 29N
SCALE	1:500,000	PAGE SIZE	A3
PROJECT TITLE	MachairWind		
DRAWING TITLE	**MachairWind** **Windfarm Development Area**		

NOT TO BE USED FOR NAVIGATION

MacArthur Green | PART OF SLR

ScottishPower Renewables

Table 1: Assessment populations and species for which a PVA met the PVA threshold for Project alone, cumulatively (EIA) and in-combination (HRA) with other offshore windfarm projects. Species and SPA for which a PVA was undertaken is indicated with a highlighted 'X'.

Assessment population for PVA: Regional population (EIA) or SPA population (HRA)	Great northern diver[1]		Arctic tern			Common tern			Kittiwake			Great black-backed gull			Herring gull			Guillemot			Razorbill			Puffin			Fulmar[3]			Gannet		
	Project alone	Cumulative	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination
Regional population	X	X	X	X		X	X		X	X		X	X		X			X			X	X			X						X	
Ailsa Craig SPA									X		X																					X
Canna and Sanday SPA									X		X																					
Cape Wrath SPA									X		X										X		X									
Flannan Isles SPA									X		X										X											
Handa SPA											X										X		X									
Mingulay and Berneray SPA									X		X										X		X									

Assessment population for PVA: Regional population (EIA) or SPA population (HRA)	Great northern diver[1]		Arctic tern			Common tern			Kittiwake			Great black-backed gull			Herring gull			Guillemot			Razorbill			Puffin			Fulmar[3]			Gannet		
	Project alone	Cumulative	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination
North Colonsay and Western Cliffs SPA									X		X	X						X														
North Rona and Sula Sgeir SPA									X		X										X		X									
Rathlin Island SPA									X		X							X			X		X	X		X						
Rum SPA									X		X																					
Shiant Isles SPA																					X		X									
Skomer SPA[2]																					X		X									
St Kilda SPA									X												X											
Sule Skerry & Sule Stack SPA																										X						

Assessment population for PVA: Regional population (EIA) or SPA population (HRA)	Great northern diver[1]		Arctic tern			Common tern			Kittiwake			Great black-backed gull			Herring gull			Guillemot			Razorbill			Puffin			Fulmar[3]			Gannet		
	Project alone	Cumulative	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination	Project alone	Cumulative	In-combination

[1] Great northern diver assessment is not required for the HRA, therefore there is no-combination assessment.

[2] Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA.

[3] Fulmar did not meet PVA threshold for the Project alone, cumulative or in-combination impacts.

2.0 EIA PVA requirements

2.1 Regional populations for EIA assessment

9. For the EIA, collision and displacement mortalities estimated for the Project alone (presented in **Technical Appendix 11.3: Collision Risk Modelling** and **Technical Appendix 11.4: Displacement** respectively) and for each offshore windfarm added to the cumulative assessment (presented in **Technical Appendix 11.5: Cumulative and In-Combination Mortality**) are assessed against a reference population.

10. Reference populations are species-specific and are calculated as regional breeding populations that have potential connectivity to the Project. Breeding season mortalities are directly assigned to the regional breeding population, but for the non-breeding season, mortalities are assigned to the regional breeding population in proportion.

11. There are two steps involved with assigning mortality to a regional population for the EIA:

    1) Calculate the regional breeding population for each assessment species; and,

    2) Calculate proportion of the breeding regional population that could be impacted in the non-breeding season.

2.1.1 Method to calculate the regional breeding population

12. For each species assessed in the EIA, a regional breeding population was defined as the sum of all birds (adults and immature birds) from all colonies (both SPA, and non-SPA) within foraging range from the Project (foraging ranges are provided in NatureScot Guidance Note 3[1], based on Woodward et al., 2019).

13. To calculate regional breeding populations, the number of breeding adult birds recorded at both SPA and non-SPA colonies within an 'at-sea' (i.e. diverting around land) recommended species specific foraging range (NatureScot Guidance Note 3[1]) from the WDA plus 2 km buffer were added together to provide a total breeding adult population for each species. Full details of how these breeding adult populations were derived are provided in **Annex 11.2M: Regional Breeding Adult Population Estimates** and a summary of the populations are also presented in **Table 2**. Colony counts are only of adult breeding birds; non-breeding sabbatical adults (i.e. adults that have elected to take a year off breeding) and immature birds are not included. As the regional population includes all birds of all ages and breeding status, it is necessary to add sabbatical and immature birds to the colony counts.

14. Regional populations of all birds were calculated by adding the proportion of adults on sabbatical to the adult population (by dividing the breeding adult population by 1-sabbatical rate) and then dividing this number by the estimate of the proportion of adult birds in the wider population. Sabbatical rates presented in **Table 2** are those agreed with NatureScot for a recent previous offshore windfarm development (West of Orkney Offshore Windfarm[2]), with the exception of herring gull where the sabbatical rate was obtained from Calladine & Harris (1997). As agreed with NatureScot at the Expert Topic Group meeting 4 (ETG 4, 2 December 2025), the proportion of adult birds was taken from the stable age structure, as used in the Biologically Defined Minimum Population Size (BDMPS) report (Furness, 2015). By dividing colony counts by the assumed proportion of adult birds (e.g. 0.53 for kittiwake),

[1] NatureScot Guidance Note Number 3 (Version 1: January 2023): Guidance Note 3: Guidance to support Offshore Wind applications: Marine Birds - Identifying theoretical connectivity with breeding site Special Protection Areas using breeding season foraging ranges | NatureScot

[2] Offshore Environmental Impact Assessment Report - Additional Information - West of Orkney Windfarm - West of Hoy, Orkney | marine.gov.scot

an estimate of the whole population associated with that colony, including immatures, can be calculated (**Table 2**).

Table 2: Regional breeding population estimates

Species	Breeding adult population (Individuals)[1]	Sabbatical rate	Proportion of adults[2]	Regional population (including sabbatical birds and all aged individuals)[3]
Arctic tern	1,468	0	0.63	2,330
Common tern	42	0	0.6	70
Fulmar	666,606	0	0.62	1,075,171
Gannet	280,332	0.1	0.55	566,327
Great black-backed gull	936	0.35	0.44	3,273
Guillemot	260,944	0.07	0.57	492,254
Herring gull	6,502	0.35	0.48	20,840
Kittiwake	97,366	0.1	0.53	204,122
Razorbill	74,319	0.07	0.57	140,198
Puffin	462,196	0.07	0.55	903,609

[1] Breeding adult populations are provided in Annex 11.2M: Regional Breeding Adult Population Estimates. Note there is no breeding population provided for great northern diver as this species does not breed in the UK.

[2] The proportion of populations assumed to be adults was taken from the stable age structures presented in the BDMPS report (Furness, 2015).

[3] Breeding season all individuals regional population is calculated by dividing the total number of individual adults by [1-sabbatical rate] / proportion of adults.

2.1.2 Method to calculate the non-breeding proportion

15. During the non-breeding season, individuals from outside of the regional breeding population will be present within the WDA plus 2 km buffer, including individuals from overseas (Furness, 2015). To assess non-breeding season impacts to the regional population, it is necessary to estimate the proportion of birds using the WDA that are from the regional population and the proportion that are from elsewhere. This was done by calculating a 'non-breeding season regional population ratio' which was the regional population divided by the BDMPS population.

16. As the Project is located on the west coast of the UK, the relevant BDMPS population was the UK Western waters and Channel (applicable for kittiwake and fulmar), UK Western waters (applicable for gannet; common tern; Arctic tern; guillemot; razorbill; puffin) or the UK West of Scotland waters BDMPS population (applicable for great northern diver and great black-backed gull), taken from Furness (2015). These west coast BDMPS populations are collectively referred to as 'Western waters' BDMPS populations in this report, as presented in **Table 3**.

Table 3: Western waters BDMPS population sizes, taken from Furness (2015)

Species	Non-breeding BDMPS (all individuals)[1]			
	Non-breeding	Spring migration	Autumn migration	Winter
Great northern diver	2,000	N/A	N/A	N/A
Arctic tern	N/A	71,398	71,398	N/A
Common tern	N/A	64,659	64,659	N/A
Fulmar	N/A	828,194	828,194	556,367
Gannet	N/A	661,888	545,954	N/A
Great black-backed gull	34,380	N/A	N/A	N/A
[2]Guillemot	260,944	N/A	N/A	N/A
[2]Herring gull	6,502	N/A	N/A	N/A
Kittiwake	N/A	691,526	911,586	N/A
Razorbill	N/A	606,914	606,914	341,422
Puffin	304,557	N/A	N/A	N/A

[1] Non-breeding BDMPS populations are from Furness (2015).

[2] Guillemot and herring gull non-breeding populations are considered to be the same as the breeding season, as advised by NatureScot in their response to the Scoping Report (22 November 2024).

17. To calculate non-breeding season ratios, for each species, the breeding season regional populations (sabbaticals plus all aged individuals; **Table 2**) was divided by the BDMPS population (all individuals; **Table 3**). Non-breeding season ratios are presented in **Table 4**.

Table 4: Non-breeding season regional population ratios (regional population size divided by BDMPS population size). The category 'non-breeding' is for species for which there is only a single non-breeding season BDMPS, rather than a specific spring migration, autumn migration or winter period, specified in Furness (2015).

Species[1]	Non-breeding	Spring migration	Autumn migration	Winter
Arctic tern	N/A	0.03	0.03	N/A
Common tern	N/A	0.001	0.001	N/A
Fulmar	N/A	1	1	1
Gannet	N/A	0.86	1	N/A
Great black-backed gull	0.095	N/A	N/A	N/A
[2]Guillemot	1	N/A	N/A	N/A
[2]Herring gull	1	N/A	N/A	N/A
Kittiwake	N/A	0.30	0.22	N/A
Razorbill	N/A	0.23	0.23	0.41
Puffin	1	N/A	N/A	N/A

[1] Non-breeding season regional population ratio was not calculated for great northern diver because there is no regional breeding population available for this species (Table 2).

[2] Guillemot and herring gull non-breeding populations are assumed to be the same as the breeding season, as advised by NatureScot in their response to the Scoping Report (22 November 2024).

18. To calculate the proportion of the non-breeding season project-alone and cumulative mortality, that was for birds from the regional population, mortalities were multiplied by the non-breeding season ratio (**Table 4**).

19. **Table 5** presents for each species, the estimated seasonal collision risk and displacement mortality for the Project (as presented in **Technical Appendix 11.3: Collision Risk Modelling** and **Technical Appendix 11.4: Displacement** respectively) and cumulative mortality with other offshore windfarms (presented in **Technical Appendix 11.5: Cumulative and In-Combination Mortality**), the seasonal regional mortality after the non-breeding season ratios (**Table 4**) have been applied to the estimated non-breeding season mortality as well as the annual totals (non-breeding plus breeding season mortality).

2.1.3 Method to calculate total seasonal and annual mortality for regional population

20. For both the Project alone and other offshore windfarms included in the cumulative assessment, the total seasonal and annual mortality that was predicted to occur in each regional population was calculated.

21. Seasonal mortality was calculated by summing all collision and displacement mortality (including both lower and upper displacement scenarios, refer to **Technical Appendix 11.4: Displacement**) from the Project in a particular season. For example, total kittiwake breeding season mortality was calculated as collision mortality plus lower displacement mortality as well as collision mortality plus upper displacement mortality. The same additions were carried out for kittiwake spring and autumn non-breeding season mortality after the non-breeding mortality had been multiplied by the non-breeding season ratio (**Section 1.1.1**).

22. **Table 5** presents annual mortalities that were calculated by adding breeding and non-breeding season(s) mortality together.

2.2 Threshold for Determining Whether a PVA is Required

23. NatureScot Guidance Note 11[3] provides recommendations on how to quantify population response to Offshore Windfarm mortality, using PVA. Whilst this guidance note refers to SPAs and in-combination impacts, as part of the HRA, the same guidance applies to EIA and cumulative impacts.

24. The change in baseline annual adult mortality rate was calculated for each regional population by dividing the total annual mortality (**Section 2.1.3**) from the Project alone and/or cumulative offshore windfarms by the breeding regional population (in the units of individual birds including sabbaticals and all ages) and then multiplying by 100 to give the percentage point change in annual mortality rate.

25. NatureScot advise using a threshold of 0.02 percentage point change in annual baseline mortality for determining whether a PVA is needed (for details of NatureScot advice, refer to **Technical Appendix 11.6: Apportioning for HRA**). Therefore, a PVA was run for all cases where Project alone or cumulative mortality resulted in a change in annual survival of >= 0.02%.rounded up to 2 decimal places, as requested by NatureScot at the Expert Topic Group meeting 4 (ETG 4, 2 December 2025).

26. **Table 6** presents, for each species, estimated annual mortality, change in baseline mortality rate and whether a PVA is required for either the Project alone and/or cumulatively with other offshore windfarms for the EIA.

[3] NatureScot Guidance Note 11 (version 1, January 2023): https://www.nature.scot/doc/guidance-note-11-guidance-support-offshore-wind-applications-marine-ornithology-recommendations

Table 5: Seasonal collision risk and displacement mortality for the Project and cumulative mortality with other offshore windfarms before (referred to as 'Estimated mortality') and after (referred to as 'Regional mortality') the non-breeding season ratios (Table 4) have been applied to the estimated non-breeding season mortality. Annual total regional mortality (non-breeding plus breeding season mortality) is also presented.

Species[1]	Season[2]	Project alone										Cumulative									
		Estimated mortality[3]			Regional mortality[4]			Annual Regional mortality					Estimated mortality[4]			Regional mortality[3]			Annual Regional mortality				
		Collisions	Lower Displacement	Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions + Lower Displacement	Collisions + Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions + Lower Displacement	Collisions + Upper Displacement
ND	NBR	N/A	0.4	0.6	N/A	0.4	0.6	N/A	0.4	0.6	0.4	0.6	0	0.4	0.6	0	0.4	0.6	0	0.4	0.6	0.4	0.6
AE	BR	0.593	0.8	1.4	0.593	0.8	1.4	0.6	0.8	1.5	1.4	2.1	0.6	0.8	1.4	0.6	0.8	1.4	0.6	0.8	1.5	1.5	2.1
	Sp	0.005	0.8	1.4	0.0002	0.03	0.05						0.7	0.8	1.5	0.02	0.03	0.05					
	Au	0.016	0.3	0.5	0.0005	0.01	0.02						0.2	0.7	1.2	0.01	0.02	0.04					
CN	BR	0.328	0.6	0.9	0.328	0.6	0.9	0.3	0.6	0.9	0.9	1.2	0.3	0.6	0.9	0.3	0.6	0.9	0.3	0.6	0.9	0.9	1.2
	Sp	0.026	0	0	0.00003	0.000	0.000						1.3	0.0	0.0	0.001	0.000	0.000					
	Au	0.016	0.6	0.9	0.00002	0.001	0.001						7.9	0.6	0.9	0.009	0.001	0.001					
KI	BR	48.71	3.7	11	48.71	3.70	11.00	78.9	10.6	31.7	89.5	110.6	225.0	7.1	21.2	225.0	7.1	21.2	525.1	15.7	46.8	540.8	572.0
	Sp	36.44	10.5	31.4	10.76	3.10	9.27						334.1	14.3	42.6	98.6	4.2	12.6					

Species[1]	Season[2]	Project alone											Cumulative									
		Estimated mortality[3]			Regional mortality[4]			Annual Regional mortality					Estimated mortality[4]			Regional mortality[3]			Annual Regional mortality				
		Collisions	Lower Displacement	Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions + Lower Displacement	Collisions + Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions + Lower Displacement	Collisions + Upper Displacement
	Au	86.92	17.0	50.9	19.46	3.81	11.40						393.5	19.5	58.3	88.1	4.4	13.1					
GB	BR	0.21	N/A	N/A	0.21	N/A	N/A	0.8	N/A	N/A	0.8	0.8	0.21	N/A	N/A	0.21	N/A	N/A	2.11	N/A	N/A	2	12.1
	NBR	6.24	N/A	N/A	0.59	N/A	N/A						19.87	N/A	N/A	1.89	N/A	N/A					
HG[5]	BR	0.34	N/A	N/A	0.34	N/A	N/A	8.0	N/A	N/A	8.0	8.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NBR	7.68	N/A	N/A	7.68	N/A	N/A						N/A	N/A	N/A	N/A	N/A	N/A					
GU[5]	BR	N/A	487.7	812.9	N/A	487.7	812.9	N/A	658.9	1326.5	658.9	1326.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NBR	N/A	171.2	513.6	N/A	171.20	513.60						N/A	N/A	N/A	N/A	N/A	N/A					
RA	BR	N/A	47.4	79.1	N/A	47.4	79.1	N/A	74.1	159.3	74.1	159.3	N/A	48.8	81.4	N/A	48.8	81.4	N/A	147.4	377.0	147.4	377.0
	Sp	N/A	41.7	125.1	N/A	9.63	28.90						N/A	121.2	362.7	N/A	28.0	83.8					
	Au	N/A	18.6	55.7	N/A	4.30	12.87						N/A	124.3	373.4	N/A	28.7	86.3					
	Wi	N/A	31.2	93.6	N/A	12.81	38.43						N/A	99.0	297.0	N/A	40.7	122.0					
PU	BR	N/A	17.5	29.1	N/A	17.5	29.1	N/A	24.7	50.6	24.7	50.6	N/A	145.1	241.7	N/A	145.1	241.7	N/A	167.9	310.1	167.9	310.1
	NBR	N/A	7.2	21.5	N/A	7.2	21.5						N/A	22.8	68.4	N/A	22.8	68.4					

Species[1]	Season[2]	Project alone										Cumulative									
		Estimated mortality[3]			Regional mortality[4]			Annual Regional mortality					Estimated mortality[4]			Regional mortality[3]			Annual Regional mortality				
		Collisions	Lower Displacement	Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions + Lower Displacement	Collisions + Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions	Lower Displacement	Upper Displacement	Collisions + Lower Displacement	Collisions + Upper Displacement
F.	BR	N/A	0.2	0.5	N/A	0.2	0.5	N/A	0.7	1.9	0.7	1.9	0.3	3.3	9.7	0.3	3.3	9.7	0.4	16.0	47.8	16.4	48.2
	Sp	N/A	0.3	0.8	N/A	0.30	0.80						0.0	6.0	18.0	0.0	6.0	18.0					
	Au	N/A	0.1	0.3	N/A	0.10	0.30						0.0	5.0	14.9	0.0	5.0	14.9					
	Wi	N/A	0.1	0.3	N/A	0.10	0.30						0.0	1.7	5.2	0.0	1.7	5.2					
GX	BR	13.42	3	8.9	13.42	3	8.9	14.1	5.0	14.6	19.1	28.7	121.1	45.8	137.2	121.1	45.8	137.2	212.3	77.9	233.4	290.2	445.7
	Sp	0.55	1	2.9	0.47	0.86	2.48						7	6.6	19.6	6.0	5.6	16.8					
	Au	0.25	1.1	3.2	0.25	1.10	3.20						40	26.5	79.4	40.0	26.5	79.4					

[1] Species: ND = Great northern diver, AE = Arctic tern, CN = Common tern, KI = Kittiwake, GB = Great black-backed gull, HG = Herring gull, GU = Guillemot, RA = Razorbill, PU = Puffin, F. = Fulmar, GX = Gannet

[2] Season: BR = Breeding, NBR = Non-breeding, Sp = Spring, Au = Autumn, Wi = Winter

[3] The estimated collision risk and displacement mortality for the Project is presented in **Technical Appendix 11.3: Collision Risk Modelling and Technical Appendix 11.4: Displacement respectively**) and cumulative mortality with other offshore windfarms is presented in **Technical Appendix 11.5: Cumulative and In-Combination Mortality**.

[4] The regional mortality is calculated by multiplying the estimated non-breeding season mortality with the non-breeding season ratios presented in **Table 4**.

[5] There are no offshore windfarms within herring gull or guillemot foraging range to add to the cumulative assessment (refer to **Technical Appendix 11.5: Cumulative and In-Combination Mortality**).

Table 6: Evaluation of whether a PVA was required as part of the EIA for regional populations and species, for mortalities from Project alone and cumulatively with other offshore windfarm projects.

Numbers presented are for Project alone and cumulative summed collision mortality plus lower and upper displacement mortality, resultant percentage change in baseline mortality rate and evaluation of need for PVA (highlighted cells; Project alone: change in mortality >=0.02%; cumulative: change in mortality >=0.02%). Disp. = Displacement.

Species assessed in EIAR	Regional population (Individuals; accounting for sabbatical adults and all sub-adult ages)	The Project				Cumulative				PVA requirement (Yes/No)	
		Annual regional mortality (collision plus lower disp.)	Annual regional mortality (collision plus upper disp.	Change in baseline mortality rate (%) Collision plus lower disp.	Change in baseline mortality rate (%) Collision plus upper disp.	Annual regional mortality (collision plus lower disp.)	Annual regional mortality (collision plus upper disp.	Change in baseline mortality rate (%) Collision plus lower disp.	Change in baseline mortality rate (%) Collision plus upper disp.	The Project alone	Cumulative
Great northern diver	2,000	0.4	0.6	0.02	0.03	0.4	0.6	0.02	0.03	Yes	Yes
Arctic tern	2,330	1.4	2.1	0.06	0.09	1.5	2.1	0.06	0.09	Yes	Yes
Common tern	70	0.9	1.2	1.33	1.76	0.9	1.2	1.30	1.73	Yes	Yes
Kittiwake	204,122	89.5	110.6	0.04	0.05	540.8	572.0	0.26	0.28	Yes	Yes
Great black-backed gull	3,273	0.8	0.8	0.02	0.02	2.1	2.11	0.06	0.06	Yes	Yes
Herring gull	20,840	8.0	8.0	0.04	0.04	N/A	N/A	N/A	N/A	Yes	No
Guillemot	492,254	658.9	1,326.5	0.13	0.27	N/A	N/A	N/A	N/A	Yes	No

Species assessed in EIAR	Regional population (Individuals; accounting for sabbatical adults and all sub-adult ages)	The Project				Cumulative				PVA requirement (Yes/No)	
		Annual regional mortality (collision plus lower disp.)	Annual regional mortality (collision plus upper disp.	Change in baseline mortality rate (%) Collision plus lower disp.	Change in baseline mortality rate (%) Collision plus upper disp.	Annual regional mortality (collision plus lower disp.)	Annual regional mortality (collision plus upper disp.	Change in baseline mortality rate (%) Collision plus lower disp.	Change in baseline mortality rate (%) Collision plus upper disp.	The Project alone	Cumulative
Razorbill	140,198	74.1	159.3	0.05	0.11	147.4	377.0	0.11	0.27	Yes	Yes
Puffin	903,609	24.7	50.6	<0.01	0.01	167.9	310.1	0.02	0.03	No	Yes
Fulmar	1,075,171	0.7	1.9	<0.01	<0.01	16.4	48.2	<0.01	<0.01	No	No
Gannet	566,327	19.1	28.7	<0.01	0.01	302.2	457.6	0.05	0.08	No	Yes

3.0 HRA PVA requirements

27. **Technical Appendix 11.6: Apportioning for HRA** provides a list of SPAs for each species, specifying if a PVA is required for the Project alone and/or in-combination impacts for the HRA. For full details of SPA apportioned mortality, percentage point changes in adult annual mortality rates and PVAs required at each SPA, refer to **Technical Appendix 11.6: Apportioning for HRA**. A summary of PVAs required at SPAs is provided in this technical appendix in **Table 1**.

4.0 PVA Methods

4.1 Population Modelling

4.1.1 Type of Model

28. PVA is an approach to assessing projected future changes to population size and growth rate, using numerical population models. Typically, PVA is used to compare various metrics of a population, such as size or growth rate, under a range of conditions, e.g. to compare population size projected into the future under current (baseline population) conditions with predicted population size in the presence of additional offshore windfarm mortality (impacted population; Searle et al., 2019).

29. The Natural England (NE)-commissioned PVA tool (Searle et al., 2019), (the 'NE PVA tool') was used for this assessment, as recommended in NatureScot Guidance Note 11[3]. The NE PVA tool is a version of a matrix model (Caswell, 1989). This model is written using the R programming language (R Core Team, 2023) and can be used either from within 'R' or via an online interface. The PVA tool for the Project EIAR and RIAA assessment was run using the 'R' Project statistical software R Development Core Team, 2024[4] (version 4.4.2 Patched 2024-12-10, nicknamed 'Pile of leaves').

4.1.2 Time Periods

30. Tabulated outputs are provided at three time points from the simulated projections, after 25, 35 and 50 years. NatureScot Guidance Note 11[3] advises presenting outputs from 25 and 50 year projects as well as the intended period of operation, which for the Project, is 35 years. The results presented from running the model over a 50 year period therefore include 15 years of recovery, with no offshore windfarm impacts present.

31. It is recommended that an initial 'burn-in' period of at least five years is included in a model simulation to allow aspects such as age distributions to equilibrate prior to the simulated period of interest (Searle et al., 2019). A burn-in period of five years was applied for all initial PVA runs, following NatureScot guidance. However, for smaller populations (i.e. ones with an initial size of approx. 5,000 or less) or species for which the suite of demographic parameters predicted baseline population decline, this often halted the simulations (due to one or more simulations declining to zero during the burn-in phase). In these cases, the burn-in period was set to zero. Including a burn-in period is recommended to minimise the risk of starting conditions affecting outputs, however in practice for simulations of more than 10 years these effects are undetectable in the outputs and therefore this will not have affected the results obtained.

[4] R Development Core Team (2024). A Language and Environment for Statistical Computing. R Foundation for Statistical Computing. https://www.R-project.org/

32. Projections were run from a starting year of 2035 to an end year of 2085. Collision and displacement impacts were applied from the starting year for 35 years, i.e. to 2070.

4.1.3 Starting population size – Regional seabird populations (EIA)

33. The starting population sizes for the regional seabird populations including sabbatical adults and all aged birds are provided in **Table 2,** refer to **Section 2.1** for details of how regional populations are calculated.

4.1.4 Starting population size – SPA seabird populations (HRA)

34. For the HRA, the starting population sizes for the PVAs were either SPA populations taken from the most recent seabirds census, Seabirds Count (2015 – 2021, Burnell et al., 2023), available from the Joint Nature Conservation Committee (JNCC) website[5] or more recent counts from the Seabird Monitoring Programme (SMP) database (2022 – 2025)[6]. **Annex 11.2M: Regional Breeding Adult Population Estimates**.

35. All starting population sizes for the HRA PVAs are presented in **Table 7:** Seabirds Count census counts and SMP counts were adjusted to the number of individual breeding adults, using the following methods:

- Kittiwake: Apparently Occupied Nest (AON) * 2 = individuals;
- Guillemot: Individuals (IND) * 0.67 to give the estimated number of pairs, then * 2 = individuals;
- Razorbill: Individuals (IND) * 0.75 to give the estimated number of pairs, then * 2 = individuals (as advised by NatureScot at the Expert Topic Group meeting 4 (ETG 4, 2 December 2025); and,
- Puffin Apparently Occupied Burrows (AOB) * 2 = individuals.

36. This gave an estimated number of breeding adults for each SPA population.

Table 7: SPA starting population sizes for each species and SPA for which a PVA was run.

SPA	SPA population size (individual breeding adults)
Kittiwake	
Ailsa Craig SPA	824[b]
Canna and Sanday SPA	2,956[b]
Cape Wrath SPA	6,460[a]
Flannan Isles SPA	1,632[b]
Handa SPA	9,178[b]
Mingulay and Berneray SPA	4,088[b]
North Colonsay and Western Cliffs SPA	9,852[b]
North Rona and Sula Sgeir SPA	1,424[a]
Rathlin Island SPA	19,258[b]
Rum SPA	1,640[b]

[5] Seabirds Count Datasets 2023 updated July 2024: Seabirds Count Datasets | JNCC Resource Hub

[6] Seabird Monitoring Programme (SMP) Database: Seabird Monitoring Programme | JNCC

SPA	SPA population size (individual breeding adults)
St Kilda SPA	1,658[b]
Great black-backed gull	
North Rona and Sula Sgeir SPA	98[a]
Guillemot	
North Colonsay and Western Cliffs SPA	33,793[a]
Rathlin Island SPA	152,095[a]
Razorbill	
Cape Wrath SPA	4,869[a]
Flannan Isles SPA	1,715[a]
Handa SPA	12,311[a]
Mingulay and Berneray SPA	17,718[b]
North Rona and Sula Sgeir SPA	594[a]
Rathlin Island SPA	33,632[b]
Shiant Isles SPA	12,044[a]
Skomer, Skokholm and the Seas off Pembrokeshire SPA	17,883[a]
St Kilda SPA	1,230[a]
Puffin	
Rathlin Island SPA	2,348[b]
Sule Skerry & Sule Stack SPA	95,484[a]
Gannet	
Ailsa Craig SPA	61,930[b]

[a] SPA population size available in Seabirds Count (Burnell et al., 2023)
[b] SPA population size is available in **Annex 11.2M: Regional Breeding Adult Population Estimates**

4.1.5 Demographic Rates

37. The demographic rates (including age at first breeding, productivity mean and standard deviation (SD), adult survival rate mean and SD, and immature survival rates per year mean and SD used for each species are provided in **Table 8.**

38. For each species (excluding Arctic tern), a PVA was run twice to assess two different productivity values available in the NE PVA tool (Searle et al., 2019):

    1) **'CEH' rates, either 'National' (UK) or 'Scotland'**. 'National' rates (mean and SD) were used for Arctic tern, common tern and kittiwake. 'Scotland' rates were used for guillemot and razorbill. The choice of whether to use National or Scotland rates was based on a judgement regarding the robustness and locality of the data. For example, there is very little data available for Arctic tern, common tern and kittiwake, so 'National' rates were considered to be the more robust rates to use, but for auks, there is more data available and therefore applying 'Scotland' rates was considered appropriate;

2) A **'local' set of rates,** including the **'Minches and Western Scotland'** for common tern, kittiwake, great black-backed gull, herring gull, guillemot and razorbill (selected as 'Reg.Seas' as the region for productivity then 'Minches and Western Scotland' from the sector options in the NE PVA tool), '**Western Scotland and Eastern Ireland**' selected for puffin and '**Irish Seas**' selected for gannet.

39. For each species, the PVAs used the same national average survival rates (provided in the NE PVA tool).

40. For Arctic tern, adult productivity rate and adult survival rate were from Horswill and Robinson (2015), sub-adult survival rates are the same as common tern (provided in the NE PVA tool) as these rates are not available for Arctic tern.

Table 8: Demographic rates used in PVAs.

Demographic rate	Great northern diver[1]	Arctic tern[2]	Common tern	Kittiwake	Great black-backed gull	Herring gull	Guillemot	Razorbill	Puffin	Gannet
Age at first breeding	6	3	3	4	5	5	6	5	5	5
National productivity rate per pair – **mean** - 'CEH National' or 'CEH Scotland' Productivity Rate	0.543 (Scotland)	0.380 (National)	0.564 (National)	0.69 (National)	0.93 (National)	0.553 (National)	0.502 (Scotland)	0.440 (Scotland)	0.415 (National)	0.697 (National)
National productivity rate per pair – **SD** - 'CEH National' or 'CEH Scotland' Productivity Rate	0.17 (Scotland)	0.325 (National)	0.445 (National)	0.296 (National)	0.433 (National)	0.41 (National)	0.208 (Scotland)	0.189 (Scotland)	0.212 (National)	0.086 (National)
Regional productivity rate per pair – mean - 'Minches and Western Scotland' Productivity Rate	-	-	0.45	0.785	0.869	0.437	0.583	0.519	-	-
Regional productivity rate per pair – **SD** - 'Minches and Western Scotland' Productivity Rate	-	-	0.452	0.414	0.43	0.329	0.147	0.052	-	-
Regional productivity rate per pair – **mean** - 'Western Scotland and Eastern Ireland' Productivity Rate	-	-	-	-	-	-	-	-	0.501	-
Regional productivity rate per pair – **SD** - 'Western Scotland and Eastern Ireland' Productivity Rate	-	-	-	-	-	-	-	-	0.274	-

Demographic rate	Great northern diver[1]	Arctic tern[2]	Common tern	Kittiwake	Great black-backed gull	Herring gull	Guillemot	Razorbill	Puffin	Gannet
Regional productivity rate per pair – **mean** - 'Irish Seas' Productivity Rate	-	-	-	-	-	-	-	-	-	0.764
Regional productivity rate per pair – **SD** - 'Irish Seas' Productivity Rate	-	-	-	-	-	-	-	-	-	0.094
Adult survival rate – Mean	0.87	0.837	0.883	0.854	0.93	0.834	0.94	0.895	0.907	0.919
Adult survival rate - SD	0.078	0.035	0.011	0.077	0.05	0.079	0.025	0.067	0.083	0.042
Immatures survival rates 0 to 1 mean	0.81	0.761	0.761	0.79	0.93	0.794	0.56	0.794	0.892	0.424
Immatures survival rates 0 to 1 SD	0.02	0.011	0.011	0.077	0.05	0.079	0.058	0.067	0.083	0.045
Immatures survival rates 1 to 2 mean	0.81	0.761	0.761	0.854	0.93	0.834	0.792	0.794	0.892	0.829
Immatures survival rates 1 to 2 SD	0.02	0.011	0.011	0.077	0.05	0.079	0.152	0.067	0.083	0.026
Immatures survival rates 2 to 3 mean	0.81	0.761	0.761	0.854	0.93	0.834	0.917	0.895	0.892	0.891
Immatures survival rates 2 to 3 SD	0.02	0.011	0.011	0.077	0.05	0.079	0.098	0.067	0.083	0.019
Immatures survival rates 3 to 4 mean	0.87	-	-	0.854	0.93	0.834	0.938	0.895	0.76	0.895
Immatures survival rates 3 to 4 SD	0.078	-	-	0.077	0.05	0.079	0.107	0.067	0.093	0.019

Demographic rate	Great northern diver[1]	Arctic tern[2]	Common tern	Kittiwake	Great black-backed gull	Herring gull	Guillemot	Razorbill	Puffin	Gannet
Immatures survival rates 4 to 5 mean	0.87	-	-	-	0.93	0.834	0.94	0.895	0.805	0.919
Immatures survival rates 4 to 5 SD	0.078	-	-	-	0.05	0.079	0.025	0.067	0.083	0.042
Immatures survival rates 5 to 6 mean	0.87	-	-	-	-	-	0.94	-	-	-
Immatures survival rates 5 to 6 SD		-	-	-	-	-	0.025	-	-	-

[1] Demographic rates from Horswill and Robinson (2015) and Piper et al., (2012)

[2] National-average productivity for Arctic tern provided in Horswill and Robinson (2015)

4.1.6 Stochasticity and density dependence

41. The PVAs were run as stochastic models that incorporate environmental and demographic variability in the input parameters, with 1,000 simulations for each model scenario. A matched runs approach was used where impacted populations had the same stochastic variation as unimpacted (baseline) populations for each individual simulation run.

42. No density dependent regulation was applied to these simulations. This means that average demographic rates remain the same irrespective of population growth or decline, in contrast with the natural processes of resource constraint which prevent unlimited (i.e. exponential) growth and also tend to buffer declining populations through reduced competition.

43. The results for each species' regional population as well as each SPA population include the complete set of input parameters to permit model validation if required (although it should be noted that the random seed specified is applicable to the R based version and is not transferable to the online version).

4.1.7 PVA Metrics to be presented

44. The counterfactuals of population growth rate (C-PGR, the average annual rate of change over the projected period) and population size (C-PS) and the 50th quantiles for unimpacted and impacted populations[7] are provided for each scenario run, at 25, 35 and 50 year projections. Note, C-PGR is the 'overall' growth rate and not the annualised growth rate.

45. As requested in NatureScot Guidance Note 11[3], a graph for each model run is also provided which presents all of the different scenarios on the same axes to allow visualisation of impacted and unimpacted trajectories.

46. The C-PGR and C-PS are provided as the median, mean, standard deviation and 95% confidence intervals. Although the two counterfactual measures may appear to be equally informative with respect to understanding the population consequences of impacts, which one is more appropriate depends on whether density dependent regulation has been included. Consideration of the properties of density-dependent and density-independent population projections illustrates why a population regulated by density dependent feedback will maintain itself around an equilibrium level. Since there is no long-term growth or decline for a population regulated by density-dependent feedback, when an impact is applied the population growth rate will only change in the short term, following which the population will once again settle at a new, lower, equilibrium size. Hence the change in growth rate (i.e. C-PGR) is of limited value for understanding the effect of an impact. In contrast, the change in population size (C-PS) provides useful information on how much smaller the population will be in the presence of the impact. When a population is simulated without regulation (i.e. a density-independent model), the population will grow or decline exponentially. The baseline and impacted predictions will both change in this manner but the difference between the two will increase with duration as the baseline population grows more rapidly. Hence, the time point when the differences are considered is critical to the C-PS value obtained and how this is interpreted. However, the average growth rate of a density independent population is constant and therefore, a comparison of the baseline and impacted growth rates is insensitive to the duration over which the comparison is made. Thus, for density independent PVA, as presented here, the C-PGR is the more robust and reliable metric to use.

[7] The quantile from the unimpacted population that matched the 50% quantile for the impacted population and the quantile from the impacted population that matched the 50% quantile for the unimpacted population, respectively.

47. In the current assessment, only density independent models have been used, and therefore the C-PGR is considered to be the more reliable metric for interpreting the results. However, following NatureScot Guidance Note 11[3], C-PS is also presented for each PVA scenario.

4.1.8 PVA Scenarios

48. PVA scenarios for both EIA and HRA were developed to take into account the following:

- Kittiwake, Arctic tern, common tern and gannet have both collision and displacement impact pathways;
- Great northern diver, guillemot, razorbill and puffin have only displacement impact pathways; and
- Great black-backed gull and herring gull have only collision impact pathways.

49. The PVA outputs are based on the Worst-case Scenario (WCS) collision impacts (refer to **Technical Appendix 11.3: Collision Risk Modelling**).

50. PVA outputs are also based on two displacement scenarios (refer to **Technical Appendix 11.4: Displacement**). There is uncertainty around the proportion of birds that may die as a consequence of being displaced and so NatureScot advise using two displacement mortality rates for most species (see NatureScot Guidance Note 8[8]). The estimated annual lower and upper impact displacement mortality were assessed in PVAs, as two separate scenarios.

51. Project alone and cumulative/in-combination impacts were modelled using the collision WCS and the two displacement scenarios (upper and lower displacement mortality). Annual mortality inputs into the PVA scenarios run to assess breeding regional populations in the EIA are provided in **Table** and in **Technical Appendix 11.6: Apportioning for HRA** to assess SPA populations in the HRA.

[8] NatureScot Guidance Note 8 (version 1 updated January 2023): Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects of Marine birds | NatureScot.

5.0 Results

52. Information for each PVA is presented below, for each species where a PVA is required (**Table 1**):

    - Project alone and cumulative offshore windfarm impacts – PVAs run for Regional Populations (**Section 5.1**); and,
    - Project alone impacts and in-combination offshore windfarm impacts – PVAs run for SPA Populations (**Section 5.2**).

53. For each PVA, an input and an output table, along with a plot of population size against time, are presented. Each row of the output tables and each curve on the plot represent a different scenario. Output tables present results at 25, 35 and 50 years. A Project alone PVA was run when a cumulative or an in-combination PVA was needed, even if Project alone impacts did not meet the thresholds for a PVA.

54. PVA outputs are also summarised in the EIAR and the RIAA.

5.1 PVAs run for EIA Regional populations with Project alone and cumulative offshore windfarm impacts

5.1.1 Great northern diver

Table 9: Great northern diver - Regional population PVA inputs for Project alone. Demographic rates from Horswill and Robinson (2015) and Piper et al. (2012).

Baseline parameters	Settings	Impact parameters	Values
Reference name	GND	Number of scenarios of impact	2
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Great Northern diver	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	6	Scenario A Impact on adult survival rate	2e-04
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	3	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	3e-04
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	2000	Scenario C name	
Year	2030	Scenario C Impact on productivity rate per pair mean	
Productivity rate per pair mean	0.543	Scenario C Impact on adult survival rate per pair mean	
Productivity rate per pair standard deviation	0.17	Scenario C Impact on immature survival rate mean	
Adult survival rate Mean	0.87	Scenario D name	
Adult survival rate standard deviation	0.078	Scenario D Impact on productivity rate per pair mean	
Immatures survival rates 0 to 1 mean	0.81	Scenario D Impact on adult survival rate	
Immatures survival rates 0 to 1 standard deviation	0.02	Scenario D Impact on immature survival rate mean	
Immatures survival rates 1 to 2 mean	0.81	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.02	Scenario E Impact on productivity rate per pair mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 mean	0.81	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.02	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.87	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.078	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.87	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.078	Scenario F Impact on immature survival rate mean	
Immatures survival rates 5 to 6 mean	0.87	Scenario G name	
Immatures survival rates 5 to 6 standard deviation	0.078	Scenario G Impact on productivity rate per pair mean	
Units for output	whole.population	Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 10: Great northern diver - Regional population PVA outputs for Project alone. Demographic rates from Horswill and Robinson (2015) and Piper et al., (2012).

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.4	0.0002	25	0.9998	0.9998	0.0036	0.9926	1.0069	0.9944	0.9990	0.0986	0.8175	1.2051	50.40	49.92
The Project Upper disp	0.6	0.0003	25	0.9997	0.9996	0.0036	0.9925	1.0067	0.9911	0.9948	0.0976	0.8176	1.1967	49.44	50.92
The Project Lower disp	0.4	0.0002	35	0.9998	0.9998	0.0033	0.9934	1.0064	0.9937	1.0000	0.1222	0.7768	1.2659	49.04	50.92
The Project Upper disp	0.6	0.0003	35	0.9996	0.9996	0.0033	0.9932	1.0060	0.9848	0.9933	0.1211	0.7729	1.2514	48.36	51.90
The Project Lower disp	0.4	0.0002	50	0.9999	0.9999	0.0031	0.9938	1.0060	0.9942	1.0082	0.1643	0.7267	1.3631	49.72	50.48
The Project Upper disp	0.6	0.0003	50	0.9998	0.9998	0.0032	0.9936	1.0058	0.9886	1.0001	0.1642	0.7169	1.3554	49.18	50.94

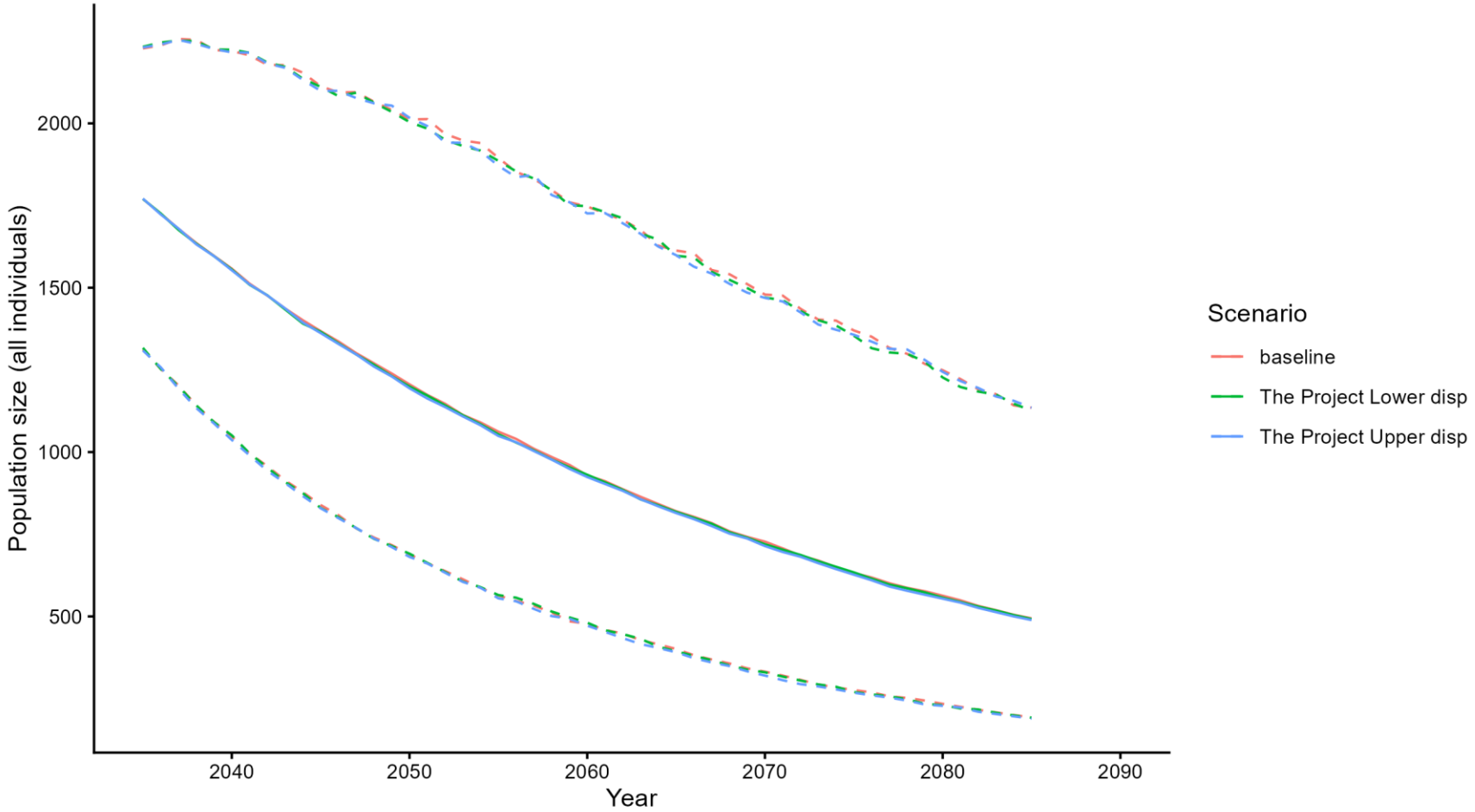


Figure 2: Great northern diver - Regional population PVA outputs for Project alone. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Demographic rates from Horswill and Robinson (2015) and Piper et al. (2012).

5.1.2 Arctic tern

Table 11: Arctic tern - Regional population PVA inputs for Project alone and cumulative offshore windfarms. National-average productivity is taken from Horswill and Robinson (2015).

Baseline parameters	Settings	Impact parameters	Values
Reference name	Arctic tern Regional Pop HW National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Arctic tern	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	3	Scenario A Impact on adult survival rate	0.0003587553
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	4	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	0.0006274716
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	2330	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.38	Scenario C Impact on adult survival rate per pair mean	0.0002548006
Productivity rate per pair standard deviation	0.325	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.837	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.035	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.761	Scenario D Impact on adult survival rate	0.0006135559
Immatures survival rates 0 to 1 standard deviation	0.011	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.761	Scenario E name	The Project WCS CRM plus Upper disp

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 1 to 2 standard deviation	0.011	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.761	Scenario E Impact on adult survival rate	0.0008822722
Immatures survival rates 2 to 3 standard deviation	0.011	Scenario E Impact on immature survival rate mean	0
Units for output	whole.population	Scenario F name	CIA Lower disp
		Scenario F Impact on productivity rate per pair mean	0
		Scenario F Impact on adult survival rate	0.0003643581
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	CIA Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0006386771
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	CIA WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.000270117
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	CIA WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.000634475
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	CIA WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0009087941
		Scenario J Impact on immature survival rate mean	0

Table 12: Arctic tern - Regional population PVA outputs for Project alone and cumulative offshore windfarms.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.8	0.0003588	25	0.9993	0.9992	0.0088	0.9816	1.0163	0.9826	1.0087	0.2440	0.6056	1.5601	49.22	51.84
The Project Upper disp	1.5	0.0006275	25	0.9989	0.9989	0.0089	0.9811	1.0166	0.9714	0.9992	0.2435	0.6013	1.5418	48.52	52.08
The Project WCS CRM	0.6	0.0002548	25	0.9995	0.9995	0.0089	0.9817	1.0171	0.9875	1.0147	0.2463	0.6136	1.5834	49.70	51.16
The Project WCS CRM plus lower disp	1.4	0.0006136	25	0.9991	0.9991	0.0090	0.9813	1.0169	0.9733	1.0056	0.2525	0.5990	1.5840	47.96	52.32
The Project WCS CRM plus Upper disp	2.1	0.0008823	25	0.9987	0.9987	0.0090	0.9806	1.0163	0.9649	0.9952	0.2481	0.5909	1.5671	47.96	52.80
CIA Lower disp	0.8	0.0003644	25	0.9994	0.9995	0.0089	0.9818	1.0176	0.9863	1.0153	0.2516	0.6078	1.6154	49.22	51.18
CIA Upper disp	1.5	0.0006387	25	0.9991	0.9990	0.0090	0.9806	1.0165	0.9752	1.0020	0.2476	0.5978	1.5556	47.96	52.26
CIA WCS CRM	0.6	0.0002701	25	0.9995	0.9996	0.0088	0.9817	1.0178	0.9920	1.0177	0.2495	0.6202	1.6026	49.22	51.08
CIA WCS CRM plus lower disp	1.5	0.0006345	25	0.9990	0.9991	0.0089	0.9818	1.0173	0.9786	1.0039	0.2499	0.6028	1.5850	47.96	52.46
CIA WCS CRM plus upper disp	2.1	0.0009088	25	0.9986	0.9986	0.0088	0.9809	1.0163	0.9630	0.9920	0.2428	0.5955	1.5472	47.40	52.90
The Project Lower disp	0.8	0.0003588	35	0.9992	0.9993	0.0103	0.9783	1.0198	0.9731	1.0489	0.4363	0.4531	2.1001	48.48	52.24
The Project Upper disp	1.5	0.0006275	35	0.9992	0.9992	0.0104	0.9781	1.0194	0.9697	1.0456	0.4525	0.4500	2.0278	48.48	52.80
The Project WCS CRM	0.6	0.0002548	35	0.9993	0.9994	0.0103	0.9785	1.0203	0.9731	1.0505	0.4371	0.4583	2.0911	49.56	51.78
The Project WCS CRM plus lower disp	1.4	0.0006136	35	0.9992	0.9993	0.0104	0.9789	1.0205	0.9683	1.0451	0.4382	0.4625	2.0835	48.48	52.68
The Project WCS CRM plus Upper disp	2.1	0.0008823	35	0.9988	0.9989	0.0103	0.9784	1.0199	0.9556	1.0304	0.4250	0.4490	2.0606	47.28	53.52
CIA Lower disp	0.8	0.0003644	35	0.9996	0.9995	0.0175	0.9790	1.0206	0.9825	1.0624	0.4589	0.4602	2.1111	50.46	50.92
CIA Upper disp	1.5	0.0006387	35	0.9991	0.9992	0.0102	0.9790	1.0203	0.9714	1.0435	0.4279	0.4561	2.0834	49.56	52.36

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
CIA WCS CRM	0.6	0.0002701	35	0.9996	0.9995	0.0175	0.9789	1.0210	0.9873	1.0643	0.4592	0.4595	2.1114	49.56	51.76
CIA WCS CRM plus lower disp	1.5	0.0006345	35	0.9992	0.9990	0.0175	0.9792	1.0195	0.9697	1.0415	0.4467	0.4595	2.0278	48.48	52.62
CIA WCS CRM plus upper disp	2.1	0.0009088	35	0.9987	0.9989	0.0103	0.9785	1.0196	0.9592	1.0316	0.4342	0.4487	2.0417	47.28	53.36
The Project Lower disp	0.8	0.0003588	50	0.9994	0.9917	0.0894	0.9656	1.0285	1.0000	1.2704	1.3404	0.1667	4.2250	51.00	51.06
The Project Upper disp	1.5	0.0006275	50	0.9994	0.9908	0.0927	0.9662	1.0274	0.9630	1.2612	1.4194	0.1695	4.0000	48.70	52.38
The Project WCS CRM	0.6	0.0002548	50	0.9995	0.9919	0.0883	0.9665	1.0279	1.0000	1.2768	1.4473	0.1818	4.0000	48.70	52.42
The Project WCS CRM plus lower disp	1.4	0.0006136	50	0.9994	0.9913	0.0905	0.9674	1.0274	0.9630	1.2566	1.4305	0.1802	4.0000	51.00	52.18
The Project WCS CRM plus Upper disp	2.1	0.0008823	50	0.9991	0.9923	0.0837	0.9653	1.0273	0.9655	1.2490	1.3028	0.1612	4.0000	48.70	53.02
CIA Lower disp	0.8	0.0003644	50	0.9995	0.9935	0.0801	0.9672	1.0296	1.0000	1.3227	1.6344	0.1818	4.4044	51.00	51.32
CIA Upper disp	1.5	0.0006387	50	0.9992	0.9931	0.0800	0.9679	1.0285	0.9630	1.2619	1.3747	0.1818	4.1452	51.00	52.34
CIA WCS CRM	0.6	0.0002701	50	0.9998	0.9939	0.0788	0.9701	1.0292	1.0000	1.2970	1.3850	0.2105	4.2905	51.00	51.46
CIA WCS CRM plus lower disp	1.5	0.0006345	50	0.9995	0.9925	0.0848	0.9691	1.0272	0.9778	1.2562	1.3478	0.2000	4.0000	48.70	52.34
CIA WCS CRM plus upper disp	2.1	0.0009088	50	0.9990	0.9927	0.0812	0.9689	1.0278	0.9487	1.2469	1.3859	0.2000	4.0000	48.70	53.44

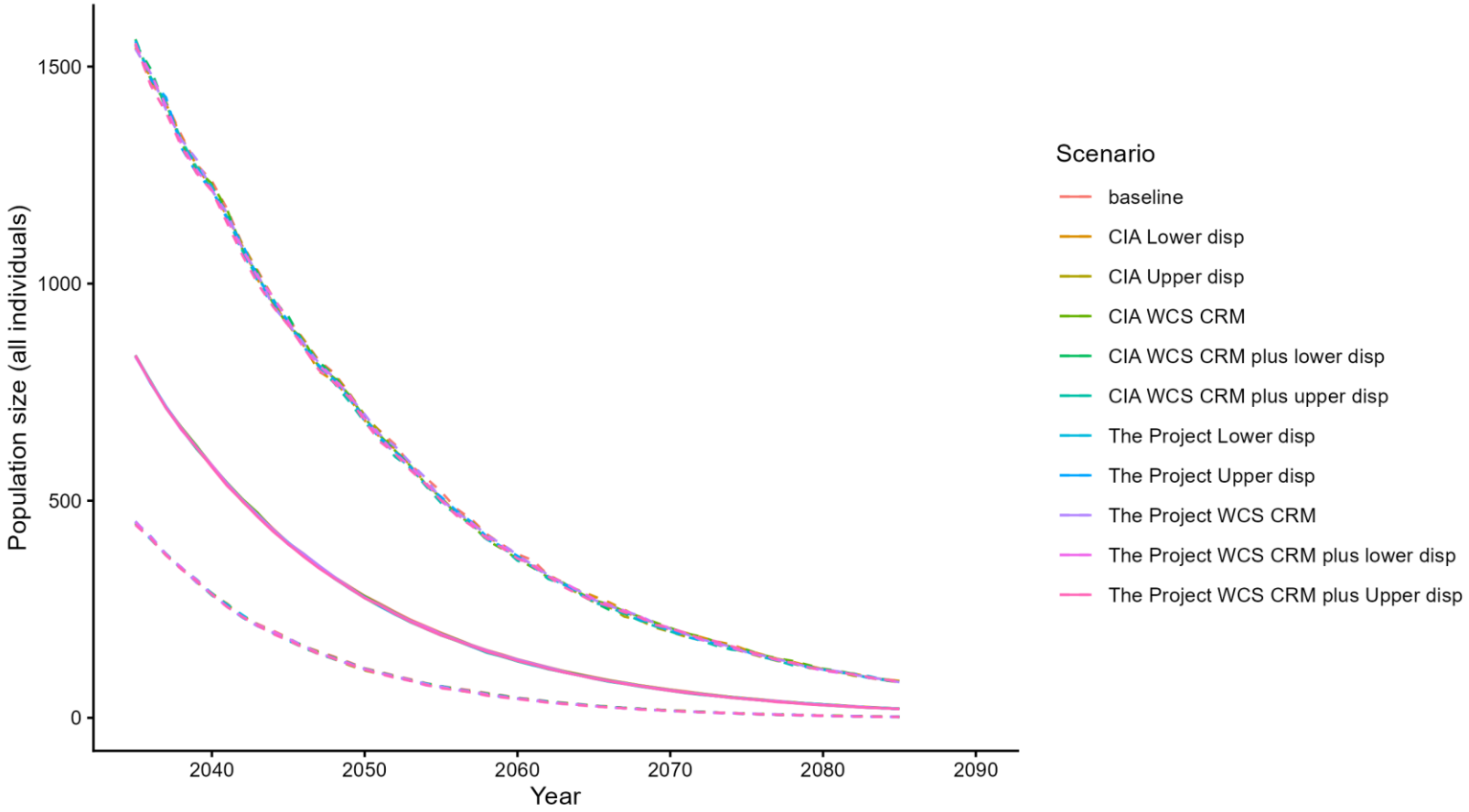


Figure 3: Arctic tern - Regional population PVA outputs for Project alone and cumulative offshore windfarms using National-average productivity from Horswill and Robinson (2015). Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.1.3 Common tern

Table 13: Common tern - Regional population PVA inputs for Project alone and cumulative offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Common tern Regional Pop CEH National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Common tern	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	3	Scenario A Impact on adult survival rate	0.008580708
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	4	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	0.01287106
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	70	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.564	Scenario C Impact on adult survival rate per pair mean	0.004686364
Productivity rate per pair standard deviation	0.445	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.883	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.011	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.761	Scenario D Impact on adult survival rate	0.01326707
Immatures survival rates 0 to 1 standard deviation	0.011	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.761	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.011	Scenario E Impact on productivity rate per pair mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 mean	0.761	Scenario E Impact on adult survival rate	0.01755743
Immatures survival rates 2 to 3 standard deviation	0.011	Scenario E Impact on immature survival rate mean	0
Units for output	whole.population	Scenario F name	CIA Lower disp
		Scenario F Impact on productivity rate per pair mean	0
		Scenario F Impact on adult survival rate	0.008580708
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	CIA Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.01287106
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	CIA WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.004427999
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	CIA WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.01300871
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	CIA WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.01729906
		Scenario J Impact on immature survival rate mean	0

Table 14: Common tern - Regional population PVA outputs for Project alone and cumulative offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.6	0.0085807	25	0.9892	0.9889	0.0238	0.9501	1.0277	0.7429	0.8951	0.6778	0.2192	2.5014	33.92	67.72
The Project Upper disp	0.9	0.0128711	25	0.9840	0.9831	0.0278	0.9429	1.0206	0.6581	0.7758	0.6031	0.1788	2.0527	26.70	75.68
The Project WCS CRM	0.3	0.0046864	25	0.9939	0.9938	0.0233	0.9572	1.0309	0.8498	1.0158	0.7930	0.2647	2.7143	40.82	61.30
The Project WCS CRM plus lower disp	0.9	0.0132671	25	0.9835	0.9830	0.0245	0.9430	1.0223	0.6504	0.7839	0.6474	0.1856	2.1410	26.70	76.04
The Project WCS CRM plus Upper disp	1.2	0.0175574	25	0.9780	0.9769	0.0315	0.9354	1.0158	0.5579	0.6739	0.5136	0.1419	1.9000	20.68	82.56
CIA Lower disp	0.6	0.0085807	25	0.9895	0.9888	0.0276	0.9504	1.0269	0.7468	0.9043	0.7412	0.2191	2.4388	32.84	68.42
CIA Upper disp	0.9	0.0128711	25	0.9836	0.9830	0.0278	0.9422	1.0200	0.6538	0.7756	0.5641	0.1743	2.1429	26.70	76.20
CIA WCS CRM	0.3	0.0044280	25	0.9943	0.9938	0.0272	0.9574	1.0320	0.8477	1.0215	0.7908	0.2667	2.7695	40.82	60.84
CIA WCS CRM plus lower disp	0.9	0.0130087	25	0.9840	0.9829	0.0279	0.9431	1.0210	0.6494	0.7805	0.6259	0.1780	2.1304	26.70	75.64
CIA WCS CRM plus upper disp	1.2	0.0172991	25	0.9786	0.9774	0.0342	0.9365	1.0160	0.5641	0.6823	0.5788	0.1554	1.8581	19.76	82.34
The Project Lower disp	0.6	0.0085807	35	0.9894	0.9868	0.0475	0.9521	1.0227	0.6761	0.8481	0.8451	0.1362	2.6506	30.32	71.20
The Project Upper disp	0.9	0.0128711	35	0.9840	0.9798	0.0615	0.9444	1.0165	0.5545	0.7049	0.8124	0.1095	2.1460	21.28	79.26
The Project WCS CRM	0.3	0.0046864	35	0.9938	0.9930	0.0326	0.9615	1.0263	0.7963	1.0157	1.0627	0.2000	3.0854	38.04	62.06
The Project WCS CRM plus lower disp	0.9	0.0132671	35	0.9834	0.9787	0.0661	0.9419	1.0175	0.5438	0.7064	0.7905	0.1005	2.2262	21.28	80.52
The Project WCS CRM plus Upper disp	1.2	0.0175574	35	0.9778	0.9699	0.0869	0.9339	1.0119	0.4440	0.5772	0.5875	0.0738	1.8333	15.26	86.84
CIA Lower disp	0.6	0.0085807	35	0.9892	0.9870	0.0473	0.9531	1.0232	0.6667	0.8664	1.1965	0.1498	2.6268	29.54	70.84
CIA Upper disp	0.9	0.0128711	35	0.9837	0.9785	0.0689	0.9430	1.0165	0.5496	0.7027	0.7422	0.1053	2.1808	22.04	80.16

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
CIA WCS CRM	0.3	0.0044280	35	0.9941	0.9916	0.0514	0.9595	1.0273	0.8019	1.0177	0.9470	0.1881	3.1699	38.04	62.34
CIA WCS CRM plus lower disp	0.9	0.0130087	35	0.9836	0.9789	0.0662	0.9421	1.0175	0.5499	0.7104	0.7789	0.0974	2.2500	22.04	79.46
CIA WCS CRM plus upper disp	1.2	0.0172991	35	0.9784	0.9706	0.0848	0.9328	1.0121	0.4528	0.5765	0.6128	0.0735	1.8000	15.98	86.30
The Project Lower disp	0.6	0.0085807	50	0.9920	0.9805	0.1066	0.9531	1.0215	0.6590	0.9600	1.7285	0.0746	3.5000	31.10	69.08
The Project Upper disp	0.9	0.0128711	50	0.9879	0.9729	0.1206	0.9423	1.0174	0.5271	0.7800	1.2922	0.0433	2.7098	24.06	76.94
The Project WCS CRM	0.3	0.0046864	50	0.9954	0.9877	0.0890	0.9629	1.0249	0.7825	1.1408	2.0851	0.1255	4.0000	38.70	61.24
The Project WCS CRM plus lower disp	0.9	0.0132671	50	0.9875	0.9707	0.1275	0.9351	1.0186	0.5215	0.8024	1.5175	0.0313	3.0303	23.32	77.54
The Project WCS CRM plus Upper disp	1.2	0.0175574	50	0.9833	0.9564	0.1605	0.0000	1.0146	0.4250	0.6295	0.9234	0.0000	2.4182	18.02	83.92
CIA Lower disp	0.6	0.0085807	50	0.9922	0.9827	0.0951	0.9536	1.0222	0.6532	0.9677	1.6266	0.0791	3.6229	30.62	69.42
CIA Upper disp	0.9	0.0128711	50	0.9879	0.9673	0.1408	0.9335	1.0167	0.5258	0.7746	1.4049	0.0277	2.8863	24.06	77.38
CIA WCS CRM	0.3	0.0044280	50	0.9954	0.9874	0.0901	0.9609	1.0246	0.7898	1.1315	1.6367	0.1098	4.0000	39.54	61.26
CIA WCS CRM plus lower disp	0.9	0.0130087	50	0.9879	0.9682	0.1374	0.9340	1.0191	0.5385	0.7959	1.3665	0.0215	3.0699	24.06	76.72
CIA WCS CRM plus upper disp	1.2	0.0172991	50	0.9837	0.9537	0.1695	0.0000	1.0150	0.4391	0.6376	1.0506	0.0000	2.3963	18.02	83.44

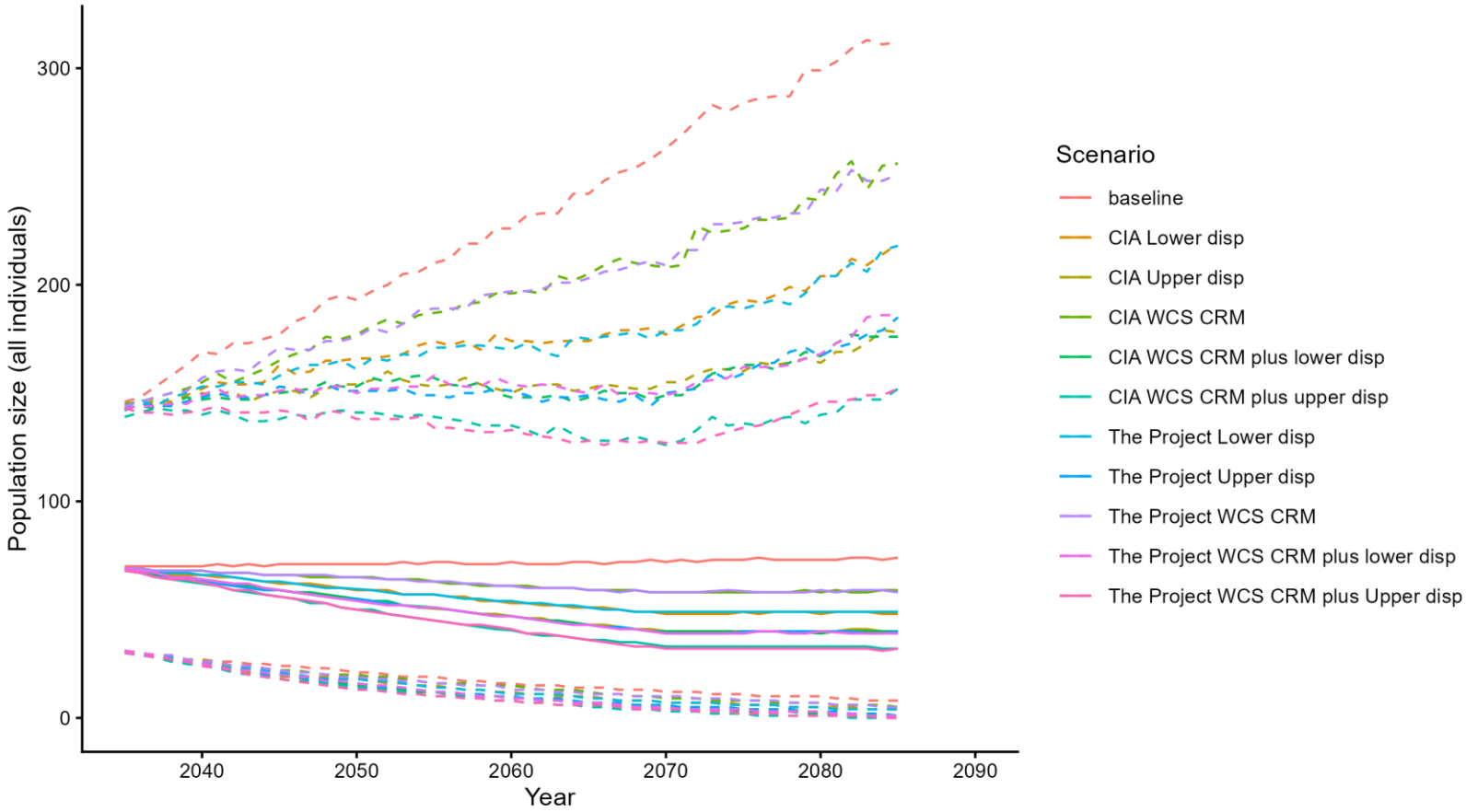


Figure 4: Common tern - Regional population PVA outputs for Project alone and cumulative offshore windfarms using 'CEH National' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 15: Common tern - Regional population PVA inputs for Project alone and cumulative offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Common tern Regional Pop Minches and W Scot rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Common tern	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	3	Scenario A Impact on adult survival rate	0.008580708
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	4	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	0.01287106
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	70	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.45	Scenario C Impact on adult survival rate per pair mean	0.004686364
Productivity rate per pair standard deviation	0.452	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.883	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.011	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.761	Scenario D Impact on adult survival rate	0.01326707
Immatures survival rates 0 to 1 standard deviation	0.011	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.761	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.011	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.761	Scenario E Impact on adult survival rate	0.01755743

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.011	Scenario E Impact on immature survival rate mean	0
Units for output	whole.population	Scenario F name	CIA Lower disp
		Scenario F Impact on productivity rate per pair mean	0
		Scenario F Impact on adult survival rate	0.008580708
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	CIA Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.01287106
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	CIA WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.004427999
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	CIA WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.01300871
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	CIA WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.01729906
		Scenario J Impact on immature survival rate mean	0

Table 16: Common tern - Regional population PVA outputs for Project alone and cumulative offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.6	0.0085807	25	0.9904	0.9844	0.0798	0.9302	1.0436	0.7805	1.0479	1.1711	0.1304	3.5517	38.98	64.04
The Project Upper disp	0.9	0.0128711	25	0.9834	0.9725	0.1072	0.9150	1.0395	0.6486	0.9036	1.1987	0.0791	3.1696	30.24	72.30
The Project WCS CRM	0.3	0.0046864	25	0.9937	0.9887	0.0774	0.9380	1.0466	0.8500	1.1725	1.5340	0.1667	4.0650	42.96	59.06
The Project WCS CRM plus lower disp	0.9	0.0132671	25	0.9841	0.9752	0.0969	0.9202	1.0390	0.6596	0.9082	1.1549	0.0963	3.0000	30.24	71.22
The Project WCS CRM plus Upper disp	1.2	0.0175574	25	0.9781	0.9600	0.1337	0.8968	1.0295	0.5556	0.7624	0.9053	0.0476	2.6667	23.36	78.48
CIA Lower disp	0.6	0.0085807	25	0.9893	0.9822	0.0900	0.9316	1.0440	0.7500	1.0581	1.4316	0.1364	3.5167	36.92	65.04
CIA Upper disp	0.9	0.0128711	25	0.9846	0.9770	0.0878	0.9196	1.0394	0.6667	0.9160	1.1454	0.0952	3.2923	30.24	71.52
CIA WCS CRM	0.3	0.0044280	25	0.9948	0.9909	0.0695	0.9406	1.0481	0.8727	1.2007	1.4914	0.1667	4.2000	44.80	57.90
CIA WCS CRM plus lower disp	0.9	0.0130087	25	0.9840	0.9751	0.0969	0.9172	1.0389	0.6564	0.9012	1.0473	0.0909	3.1429	30.24	71.20
CIA WCS CRM plus upper disp	1.2	0.0172991	25	0.9785	0.9649	0.1176	0.9017	1.0330	0.5714	0.7826	1.0018	0.0606	2.6375	23.36	77.38
The Project Lower disp	0.6	0.0085807	35	0.9895	0.9610	0.1678	0.0000	1.0365	0.6923	1.0484	1.6569	0.0000	4.0000	35.16	67.56
The Project Upper disp	0.9	0.0128711	35	0.9823	0.9386	0.2068	0.0000	1.0349	0.5294	0.8675	1.5016	0.0000	3.6533	25.46	75.80
The Project WCS CRM	0.3	0.0046864	35	0.9931	0.9708	0.1519	0.9143	1.0428	0.7857	1.2318	1.8651	0.0333	5.3950	42.36	60.12
The Project WCS CRM plus lower disp	0.9	0.0132671	35	0.9823	0.9433	0.1961	0.0000	1.0340	0.5333	0.8782	1.6352	0.0000	4.0000	28.34	76.12
The Project WCS CRM plus Upper disp	1.2	0.0175574	35	0.9765	0.9086	0.2520	0.0000	1.0263	0.4167	0.6985	1.3037	0.0000	3.0000	19.98	82.16

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
CIA Lower disp	0.6	0.0085807	35	0.9885	0.9575	0.1753	0.0000	1.0387	0.6667	1.0477	1.7889	0.0000	4.2500	35.16	68.28
CIA Upper disp	0.9	0.0128711	35	0.9832	0.9395	0.2064	0.0000	1.0318	0.5455	0.8742	1.4618	0.0000	3.5810	28.34	75.06
CIA WCS CRM	0.3	0.0044280	35	0.9937	0.9715	0.1513	0.9197	1.0427	0.8000	1.2691	2.0790	0.0385	5.2178	42.36	60.16
CIA WCS CRM plus lower disp	0.9	0.0130087	35	0.9825	0.9340	0.2163	0.0000	1.0318	0.5238	0.8503	1.4411	0.0000	3.6533	28.34	74.72
CIA WCS CRM plus upper disp	1.2	0.0172991	35	0.9772	0.9174	0.2373	0.0000	1.0280	0.4333	0.7064	1.2601	0.0000	3.0000	19.98	82.12
The Project Lower disp	0.6	0.0085807	50	0.9906	0.8903	0.3033	0.0000	1.0349	0.6154	1.2014	2.3294	0.0000	6.0000	38.34	64.44
The Project Upper disp	0.9	0.0128711	50	0.9841	0.8411	0.3526	0.0000	1.0313	0.4444	0.9368	1.8921	0.0000	5.0000	29.70	73.00
The Project WCS CRM	0.3	0.0046864	50	0.9939	0.9062	0.2859	0.0000	1.0383	0.7308	1.4472	3.1141	0.0000	7.7458	41.44	59.14
The Project WCS CRM plus lower disp	0.9	0.0132671	50	0.9851	0.8424	0.3520	0.0000	1.0309	0.4615	0.9752	2.3308	0.0000	5.0000	29.70	72.82
The Project WCS CRM plus Upper disp	1.2	0.0175574	50	0.9789	0.7869	0.3954	0.0000	1.0271	0.3333	0.7584	1.8499	0.0000	4.1583	23.66	79.36
CIA Lower disp	0.6	0.0085807	50	0.9898	0.8869	0.3066	0.0000	1.0348	0.5938	1.1926	2.6344	0.0000	6.4917	35.60	66.10
CIA Upper disp	0.9	0.0128711	50	0.9857	0.8439	0.3508	0.0000	1.0313	0.4762	0.9627	1.9525	0.0000	5.3333	29.70	71.76
CIA WCS CRM	0.3	0.0044280	50	0.9939	0.9126	0.2766	0.0000	1.0379	0.7500	1.4209	3.0291	0.0000	7.0000	44.28	58.96
CIA WCS CRM plus lower disp	0.9	0.0130087	50	0.9852	0.8385	0.3559	0.0000	1.0304	0.4615	0.9618	2.0238	0.0000	5.2500	29.70	72.38
CIA WCS CRM plus upper disp	1.2	0.0172991	50	0.9796	0.7969	0.3879	0.0000	1.0271	0.3333	0.7746	1.8116	0.0000	4.1900	23.66	79.50

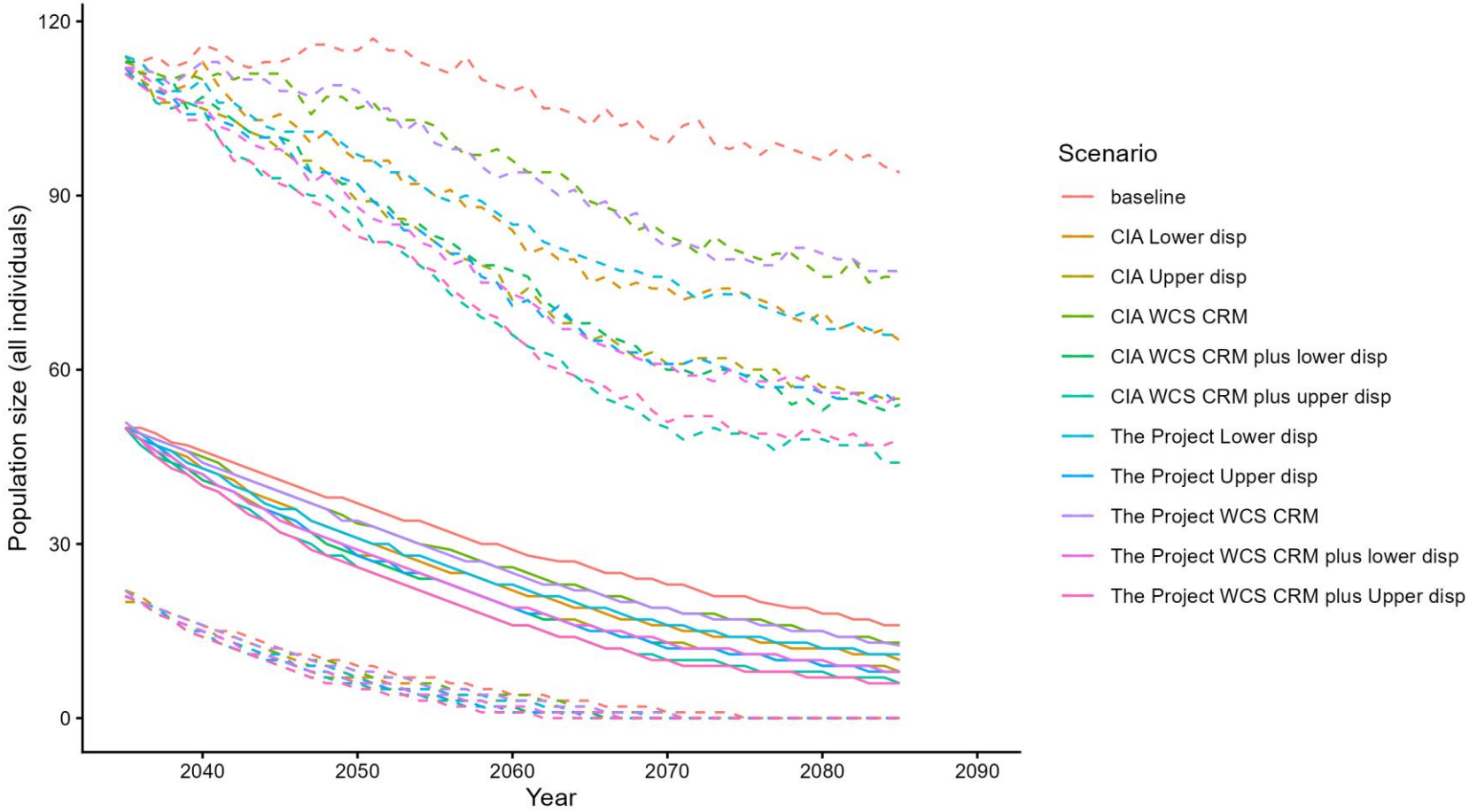


Figure 5: Common tern - Regional population PVA outputs for Project alone and cumulative offshore windfarms using Local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.1.4 Kittiwake

Table 17: Kittiwake - Regional population PVA inputs for Project alone and cumulative offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Regional Pop CEH National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	5.195897e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	0.0001551327
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	204122	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.69	Scenario C Impact on adult survival rate per pair mean	0.0003866769
Productivity rate per pair standard deviation	0.296	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0004386358
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0005418096
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	CIA Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	7.681683e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	CIA Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0002294894
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	CIA WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.00257263
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	CIA WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.002649447
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	CIA WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.002802119
		Scenario J Impact on immature survival rate mean	0

Table 18: Kittiwake - Regional population PVA outputs for Project alone and cumulative offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	10.6	0.0000520	25	0.9999	0.9999	0.0003	0.9994	1.0005	0.9985	0.9984	0.0085	0.9819	1.0152	49.96	50.10
The Project Upper disp	31.7	0.0001551	25	0.9998	0.9998	0.0003	0.9993	1.0003	0.9952	0.9952	0.0085	0.9783	1.0118	49.74	50.32
The Project WCS CRM	78.9	0.0003867	25	0.9995	0.9995	0.0003	0.9990	1.0000	0.9881	0.9883	0.0084	0.9719	1.0049	49.22	51.04
The Project WCS CRM plus lower disp	89.5	0.0004386	25	0.9995	0.9995	0.0003	0.9990	1.0000	0.9864	0.9866	0.0083	0.9702	1.0030	48.94	51.18
The Project WCS CRM plus Upper disp	110.6	0.0005418	25	0.9994	0.9994	0.0003	0.9988	0.9999	0.9833	0.9834	0.0085	0.9668	1.0000	48.56	51.32
CIA Lower disp	15.7	0.0000768	25	0.9999	0.9999	0.0003	0.9994	1.0004	0.9979	0.9978	0.0085	0.9810	1.0146	49.96	50.14
CIA Upper disp	46.8	0.0002295	25	0.9997	0.9997	0.0003	0.9992	1.0002	0.9930	0.9931	0.0085	0.9760	1.0096	49.72	50.42
CIA WCS CRM	525.1	0.0025726	25	0.9970	0.9970	0.0003	0.9964	0.9975	0.9239	0.9238	0.0080	0.9079	0.9395	42.98	56.18
CIA WCS CRM plus lower disp	540.8	0.0026494	25	0.9969	0.9969	0.0003	0.9963	0.9974	0.9215	0.9214	0.0079	0.9058	0.9370	42.92	56.48
CIA WCS CRM plus upper disp	572.0	0.0028021	25	0.9967	0.9967	0.0003	0.9961	0.9972	0.9172	0.9172	0.0080	0.9012	0.9333	42.46	56.76
The Project Lower disp	10.6	0.0000520	35	0.9999	0.9999	0.0002	0.9995	1.0004	0.9978	0.9978	0.0093	0.9792	1.0162	49.92	50.10
The Project Upper disp	31.7	0.0001551	35	0.9998	0.9998	0.0002	0.9994	1.0002	0.9933	0.9933	0.0091	0.9750	1.0116	49.42	50.54
The Project WCS CRM	78.9	0.0003867	35	0.9995	0.9995	0.0002	0.9991	1.0000	0.9836	0.9837	0.0092	0.9660	1.0020	48.80	51.22
The Project WCS CRM plus lower disp	89.5	0.0004386	35	0.9995	0.9995	0.0002	0.9991	0.9999	0.9813	0.9814	0.0090	0.9638	0.9994	48.74	51.40
The Project WCS CRM plus Upper disp	110.6	0.0005418	35	0.9994	0.9994	0.0002	0.9989	0.9998	0.9771	0.9771	0.0092	0.9587	0.9949	48.34	51.72
CIA Lower disp	15.7	0.0000768	35	0.9999	0.9999	0.0002	0.9995	1.0003	0.9968	0.9968	0.0094	0.9779	1.0152	49.82	50.12
CIA Upper disp	46.8	0.0002295	35	0.9997	0.9997	0.0002	0.9993	1.0002	0.9901	0.9903	0.0093	0.9720	1.0091	49.14	50.66

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
CIA WCS CRM	525.1	0.0025726	35	0.9970	0.9970	0.0002	0.9965	0.9974	0.8960	0.8959	0.0084	0.8790	0.9127	41.96	58.48
CIA WCS CRM plus lower disp	540.8	0.0026494	35	0.9969	0.9969	0.0002	0.9964	0.9973	0.8929	0.8928	0.0085	0.8757	0.9097	41.56	58.72
CIA WCS CRM plus upper disp	572.0	0.0028021	35	0.9967	0.9967	0.0002	0.9962	0.9971	0.8872	0.8872	0.0085	0.8700	0.9038	41.04	58.98
The Project Lower disp	10.6	0.0000520	50	1.0000	1.0000	0.0002	0.9996	1.0003	0.9978	0.9979	0.0101	0.9783	1.0180	49.84	50.16
The Project Upper disp	31.7	0.0001551	50	0.9999	0.9999	0.0002	0.9995	1.0002	0.9932	0.9932	0.0100	0.9734	1.0129	49.40	50.48
The Project WCS CRM	78.9	0.0003867	50	0.9997	0.9997	0.0002	0.9993	1.0000	0.9835	0.9837	0.0101	0.9642	1.0040	48.96	51.12
The Project WCS CRM plus lower disp	89.5	0.0004386	50	0.9996	0.9996	0.0002	0.9993	1.0000	0.9813	0.9815	0.0099	0.9621	1.0011	48.88	51.14
The Project WCS CRM plus Upper disp	110.6	0.0005418	50	0.9995	0.9995	0.0002	0.9992	0.9999	0.9772	0.9772	0.0100	0.9570	0.9967	48.42	51.40
CIA Lower disp	15.7	0.0000768	50	0.9999	0.9999	0.0002	0.9996	1.0003	0.9968	0.9968	0.0102	0.9768	1.0177	49.82	50.30
CIA Upper disp	46.8	0.0002295	50	0.9998	0.9998	0.0002	0.9995	1.0002	0.9900	0.9902	0.0102	0.9701	1.0109	49.28	50.58
CIA WCS CRM	525.1	0.0025726	50	0.9978	0.9978	0.0002	0.9975	0.9982	0.8960	0.8960	0.0092	0.8776	0.9141	42.70	56.68
CIA WCS CRM plus lower disp	540.8	0.0026494	50	0.9978	0.9978	0.0002	0.9974	0.9981	0.8929	0.8929	0.0093	0.8743	0.9112	42.60	56.98
CIA WCS CRM plus upper disp	572.0	0.0028021	50	0.9977	0.9977	0.0002	0.9973	0.9980	0.8871	0.8872	0.0092	0.8690	0.9054	42.16	57.38

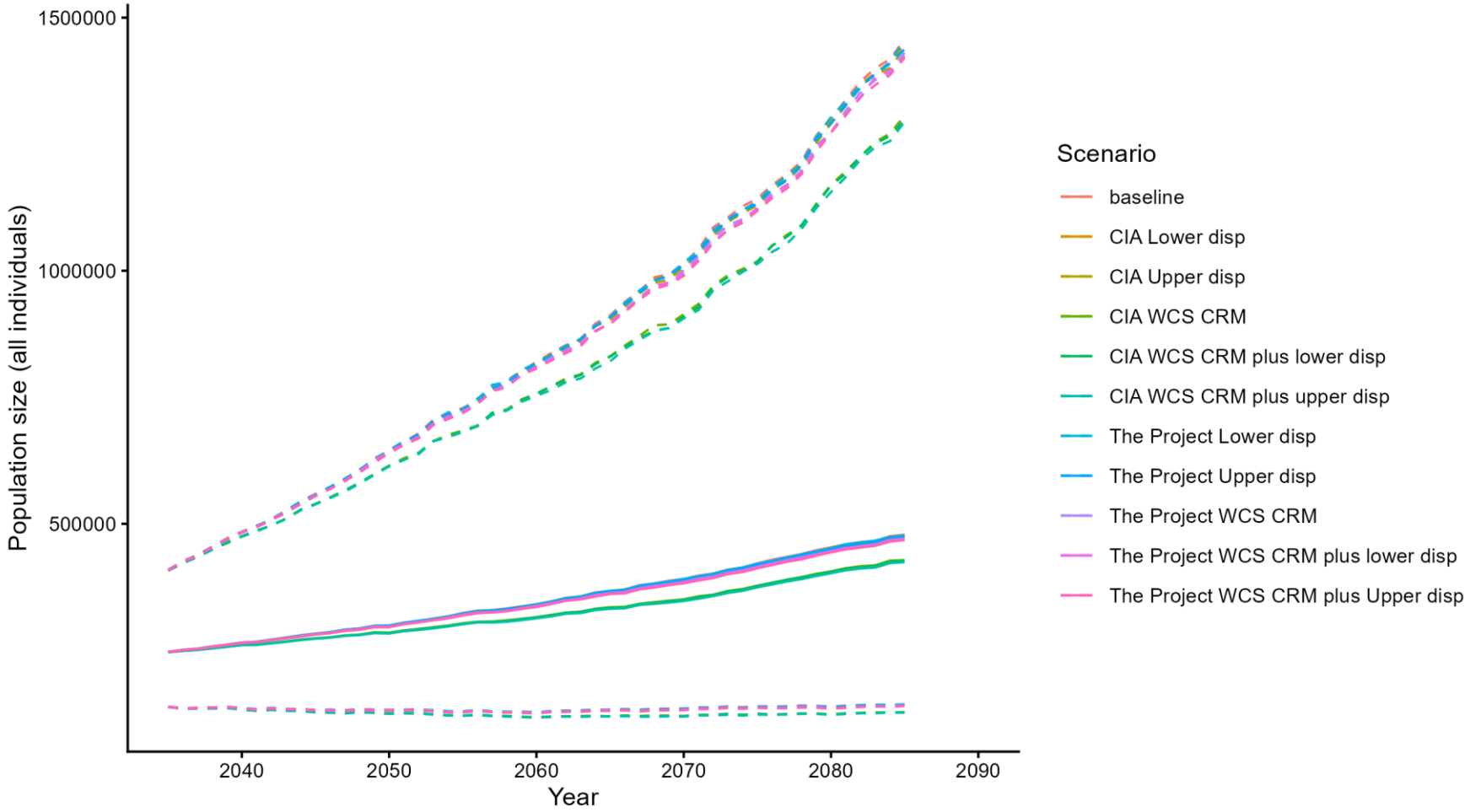


Figure 6: Kittiwake - Regional population PVA outputs for Project alone and cumulative offshore windfarms using 'CEH National' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 19: Kittiwake - Regional population PVA inputs for Project alone and cumulative offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Regional Pop Minches and W Scot rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	5.195897e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	0.0001551327
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	204122	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.785	Scenario C Impact on adult survival rate per pair mean	0.0003866769
Productivity rate per pair standard deviation	0.414	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0004386358
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0005418096
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	CIA Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	7.681683e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	CIA Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0002294894
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	CIA WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.00257263
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	CIA WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.002649447
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	CIA WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.002802119
		Scenario J Impact on immature survival rate mean	0

Table 20: Kittiwake - Regional population PVA outputs for Project alone and cumulative offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	10.6	0.0000520	25	0.9999	0.9999	0.0002	0.9995	1.0004	0.9984	0.9984	0.0077	0.9830	1.0137	49.96	50.12
The Project Upper disp	31.7	0.0001551	25	0.9998	0.9998	0.0002	0.9994	1.0002	0.9951	0.9952	0.0076	0.9809	1.0107	49.76	50.28
The Project WCS CRM	78.9	0.0003867	25	0.9995	0.9995	0.0002	0.9991	1.0000	0.9882	0.9883	0.0075	0.9738	1.0037	48.76	50.70
The Project WCS CRM plus lower disp	89.5	0.0004386	25	0.9995	0.9995	0.0002	0.9990	0.9999	0.9867	0.9868	0.0075	0.9724	1.0018	48.72	50.96
The Project WCS CRM plus Upper disp	110.6	0.0005418	25	0.9994	0.9994	0.0002	0.9989	0.9998	0.9836	0.9837	0.0075	0.9684	0.9987	48.42	51.26
CIA Lower disp	15.7	0.0000768	25	0.9999	0.9999	0.0002	0.9995	1.0003	0.9974	0.9976	0.0076	0.9828	1.0128	49.86	50.22
CIA Upper disp	46.8	0.0002295	25	0.9997	0.9997	0.0002	0.9993	1.0002	0.9930	0.9931	0.0075	0.9785	1.0080	49.32	50.48
CIA WCS CRM	525.1	0.0025726	25	0.9970	0.9970	0.0002	0.9965	0.9974	0.9237	0.9238	0.0071	0.9098	0.9378	43.70	55.68
CIA WCS CRM plus lower disp	540.8	0.0026494	25	0.9969	0.9969	0.0002	0.9964	0.9973	0.9215	0.9216	0.0072	0.9075	0.9359	43.60	55.82
CIA WCS CRM plus upper disp	572.0	0.0028021	25	0.9967	0.9967	0.0002	0.9962	0.9971	0.9172	0.9172	0.0071	0.9030	0.9314	43.44	56.12
The Project Lower disp	10.6	0.0000520	35	0.9999	0.9999	0.0002	0.9996	1.0003	0.9978	0.9977	0.0081	0.9816	1.0141	49.88	50.08
The Project Upper disp	31.7	0.0001551	35	0.9998	0.9998	0.0002	0.9995	1.0002	0.9931	0.9934	0.0081	0.9779	1.0096	49.44	50.42
The Project WCS CRM	78.9	0.0003867	35	0.9995	0.9995	0.0002	0.9992	0.9999	0.9835	0.9837	0.0080	0.9685	1.0003	48.86	51.00
The Project WCS CRM plus lower disp	89.5	0.0004386	35	0.9995	0.9995	0.0002	0.9991	0.9998	0.9815	0.9816	0.0079	0.9663	0.9976	48.52	51.08
The Project WCS CRM plus Upper disp	110.6	0.0005418	35	0.9994	0.9994	0.0002	0.9990	0.9997	0.9773	0.9774	0.0079	0.9617	0.9932	48.38	51.40
CIA Lower disp	15.7	0.0000768	35	0.9999	0.9999	0.0002	0.9996	1.0003	0.9965	0.9966	0.0081	0.9809	1.0121	49.70	50.18
CIA Upper disp	46.8	0.0002295	35	0.9997	0.9997	0.0002	0.9994	1.0001	0.9903	0.9904	0.0078	0.9753	1.0065	49.40	50.42

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
CIA WCS CRM	525.1	0.0025726	35	0.9970	0.9970	0.0002	0.9966	0.9973	0.8958	0.8960	0.0074	0.8814	0.9104	43.02	57.12
CIA WCS CRM plus lower disp	540.8	0.0026494	35	0.9969	0.9969	0.0002	0.9965	0.9972	0.8930	0.8930	0.0074	0.8783	0.9074	42.66	57.38
CIA WCS CRM plus upper disp	572.0	0.0028021	35	0.9967	0.9967	0.0002	0.9963	0.9970	0.8872	0.8872	0.0073	0.8727	0.9018	41.88	57.80
The Project Lower disp	10.6	0.0000520	50	1.0000	1.0000	0.0001	0.9997	1.0002	0.9978	0.9977	0.0087	0.9802	1.0152	49.86	50.14
The Project Upper disp	31.7	0.0001551	50	0.9999	0.9999	0.0001	0.9996	1.0001	0.9933	0.9933	0.0086	0.9767	1.0106	49.70	50.30
The Project WCS CRM	78.9	0.0003867	50	0.9997	0.9997	0.0001	0.9994	1.0000	0.9835	0.9837	0.0086	0.9670	1.0016	48.92	51.04
The Project WCS CRM plus lower disp	89.5	0.0004386	50	0.9996	0.9996	0.0001	0.9994	0.9999	0.9816	0.9816	0.0083	0.9655	0.9983	48.80	51.06
The Project WCS CRM plus Upper disp	110.6	0.0005418	50	0.9995	0.9995	0.0001	0.9993	0.9998	0.9773	0.9774	0.0085	0.9607	0.9946	48.62	51.44
CIA Lower disp	15.7	0.0000768	50	0.9999	0.9999	0.0001	0.9997	1.0002	0.9965	0.9966	0.0086	0.9798	1.0137	49.76	50.12
CIA Upper disp	46.8	0.0002295	50	0.9998	0.9998	0.0001	0.9995	1.0001	0.9904	0.9904	0.0084	0.9744	1.0072	49.38	50.68
CIA WCS CRM	525.1	0.0025726	50	0.9978	0.9978	0.0001	0.9976	0.9981	0.8959	0.8959	0.0078	0.8802	0.9115	43.66	56.56
CIA WCS CRM plus lower disp	540.8	0.0026494	50	0.9978	0.9978	0.0001	0.9975	0.9981	0.8930	0.8930	0.0080	0.8770	0.9086	43.44	56.58
CIA WCS CRM plus upper disp	572.0	0.0028021	50	0.9977	0.9977	0.0001	0.9974	0.9979	0.8872	0.8872	0.0078	0.8715	0.9026	43.14	57.08

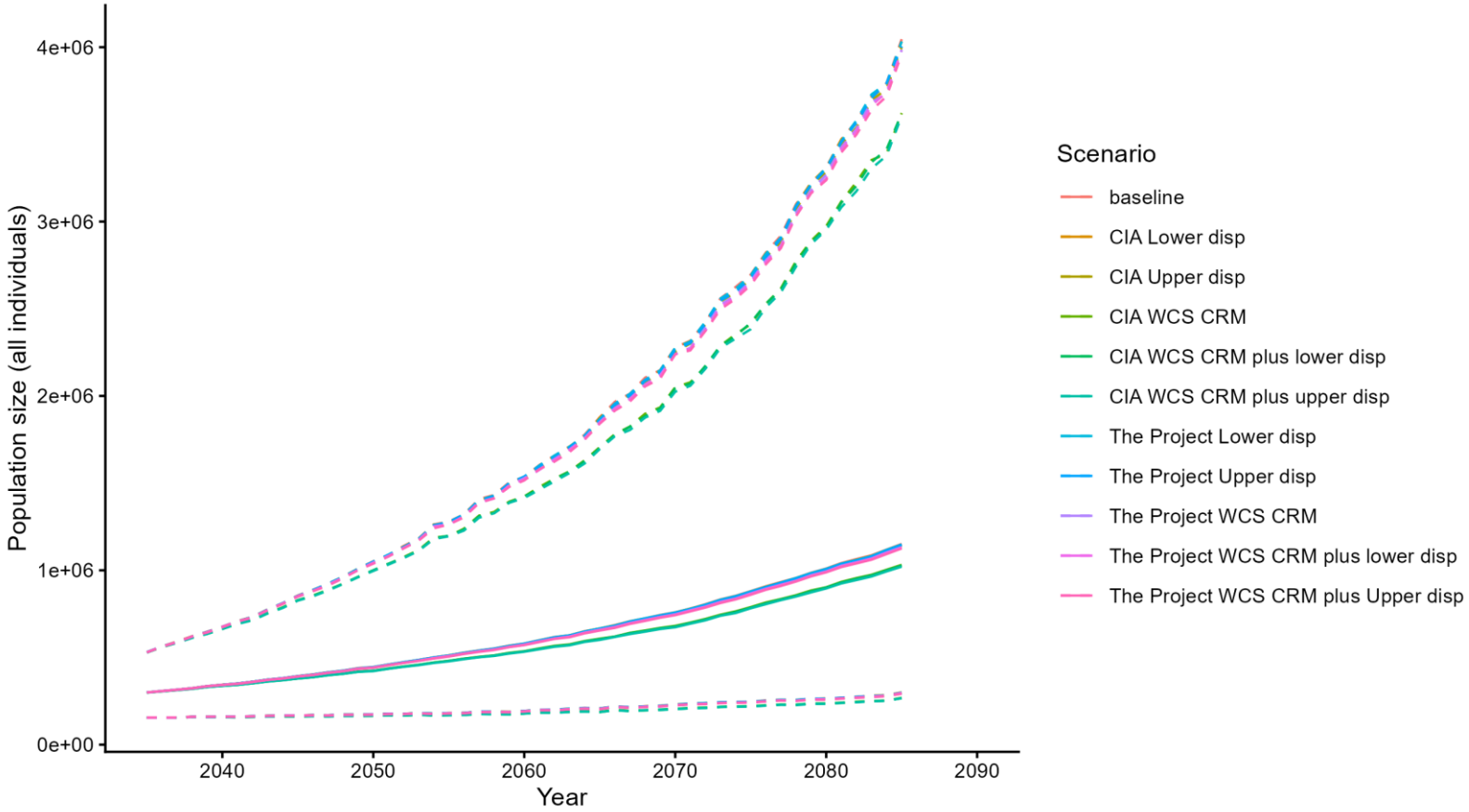


Figure 7: Kittiwake - Regional population PVA outputs for Project alone and cumulative offshore windfarms using Local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.1.5 Guillemot

Table 21: Guillemot - Regional population PVA inputs for Project alone. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Guillemot Regional Pop CEH Scotland rates	Number of scenarios of impact	2
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Common Guillemot	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	6	Scenario A Impact on adult survival rate	0.001338537
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	0.002694747
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	492254	Scenario C name	CIA Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.502	Scenario C Impact on adult survival rate per pair mean	0
Productivity rate per pair standard deviation	0.208	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.94	Scenario D name	CIA Upper disp
Adult survival rate standard deviation	0.025	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.56	Scenario D Impact on adult survival rate	0
Immatures survival rates 0 to 1 standard deviation	0.058	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.792	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.152	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.917	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.098	Scenario E Impact on immature survival rate mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.938	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.107	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.94	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.025	Scenario F Impact on immature survival rate mean	
Immatures survival rates 5 to 6 mean	0.94	Scenario G name	
Immatures survival rates 5 to 6 standard deviation	0.025	Scenario G Impact on productivity rate per pair mean	
Units for output	whole.population	Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 22: Guillemot - Regional population PVA outputs for Project alone. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	658.9	0.0013385	25	0.9985	0.9985	0.0001	0.9983	0.9987	0.9617	0.9618	0.0034	0.9550	0.9684	42.74	56.84
The Project Upper disp	1,326.5	0.0026947	25	0.9970	0.9970	0.0001	0.9968	0.9972	0.9246	0.9246	0.0033	0.9181	0.9310	35.76	63.88
The Project Lower disp	658.9	0.0013385	35	0.9985	0.9985	0.0001	0.9983	0.9987	0.9475	0.9475	0.0036	0.9403	0.9546	41.14	58.82
The Project Upper disp	1,326.5	0.0026947	35	0.9970	0.9970	0.0001	0.9968	0.9972	0.8972	0.8972	0.0035	0.8904	0.9040	32.86	67.30
The Project Lower disp	658.9	0.0013385	50	0.9989	0.9989	0.0001	0.9988	0.9991	0.9475	0.9475	0.0039	0.9395	0.9552	42.90	57.48
The Project Upper disp	1,326.5	0.0026947	50	0.9979	0.9979	0.0001	0.9977	0.9980	0.8972	0.8972	0.0038	0.8897	0.9045	35.48	65.50

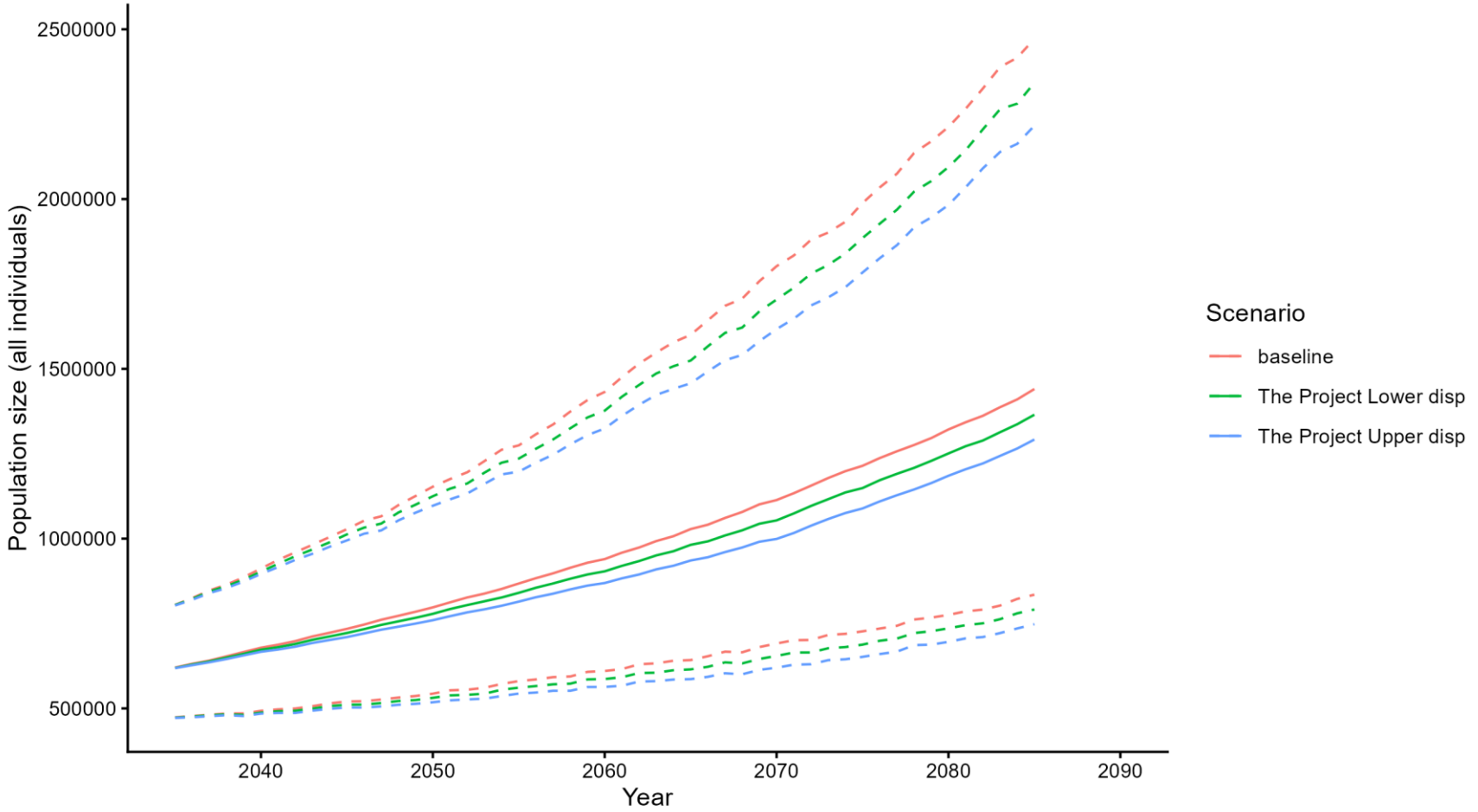


Figure 8: Guillemot - Regional population PVA outputs for Project alone using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 23: Guillemot - Regional population PVA inputs for Project alone. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Guillemot Regional Pop Minches and W Scot rates	Number of scenarios of impact	2
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Common Guillemot	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	6	Scenario A Impact on adult survival rate	0.001338537
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	0.002694747
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	492254	Scenario C name	CIA Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.583	Scenario C Impact on adult survival rate per pair mean	0
Productivity rate per pair standard deviation	0.147	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.94	Scenario D name	CIA Upper disp
Adult survival rate standard deviation	0.025	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.56	Scenario D Impact on adult survival rate	0
Immatures survival rates 0 to 1 standard deviation	0.058	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.792	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.152	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.917	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.098	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.938	Scenario F name	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 standard deviation	0.107	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.94	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.025	Scenario F Impact on immature survival rate mean	
Immatures survival rates 5 to 6 mean	0.94	Scenario G name	
Immatures survival rates 5 to 6 standard deviation	0.025	Scenario G Impact on productivity rate per pair mean	
Units for output	whole.population	Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 24: Guillemot - Regional population PVA outputs for Project alone. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	658.9	0.0013385	25	0.9985	0.9985	0.0001	0.9983	0.9987	0.9617	0.9617	0.0031	0.9556	0.9680	41.84	58.42
The Project Upper disp	1,326.5	0.0026947	25	0.9970	0.9970	0.0001	0.9968	0.9972	0.9245	0.9244	0.0031	0.9183	0.9305	34.28	66.94
The Project Lower disp	658.9	0.0013385	35	0.9985	0.9985	0.0001	0.9983	0.9986	0.9473	0.9474	0.0033	0.9408	0.9540	40.30	60.88
The Project Upper disp	1,326.5	0.0026947	35	0.9970	0.9970	0.0001	0.9968	0.9971	0.8969	0.8968	0.0032	0.8907	0.9032	30.78	70.36
The Project Lower disp	658.9	0.0013385	50	0.9989	0.9989	0.0001	0.9988	0.9991	0.9474	0.9474	0.0035	0.9404	0.9545	40.78	58.78
The Project Upper disp	1,326.5	0.0026947	50	0.9979	0.9979	0.0001	0.9977	0.9980	0.8968	0.8969	0.0034	0.8903	0.9035	32.40	67.48

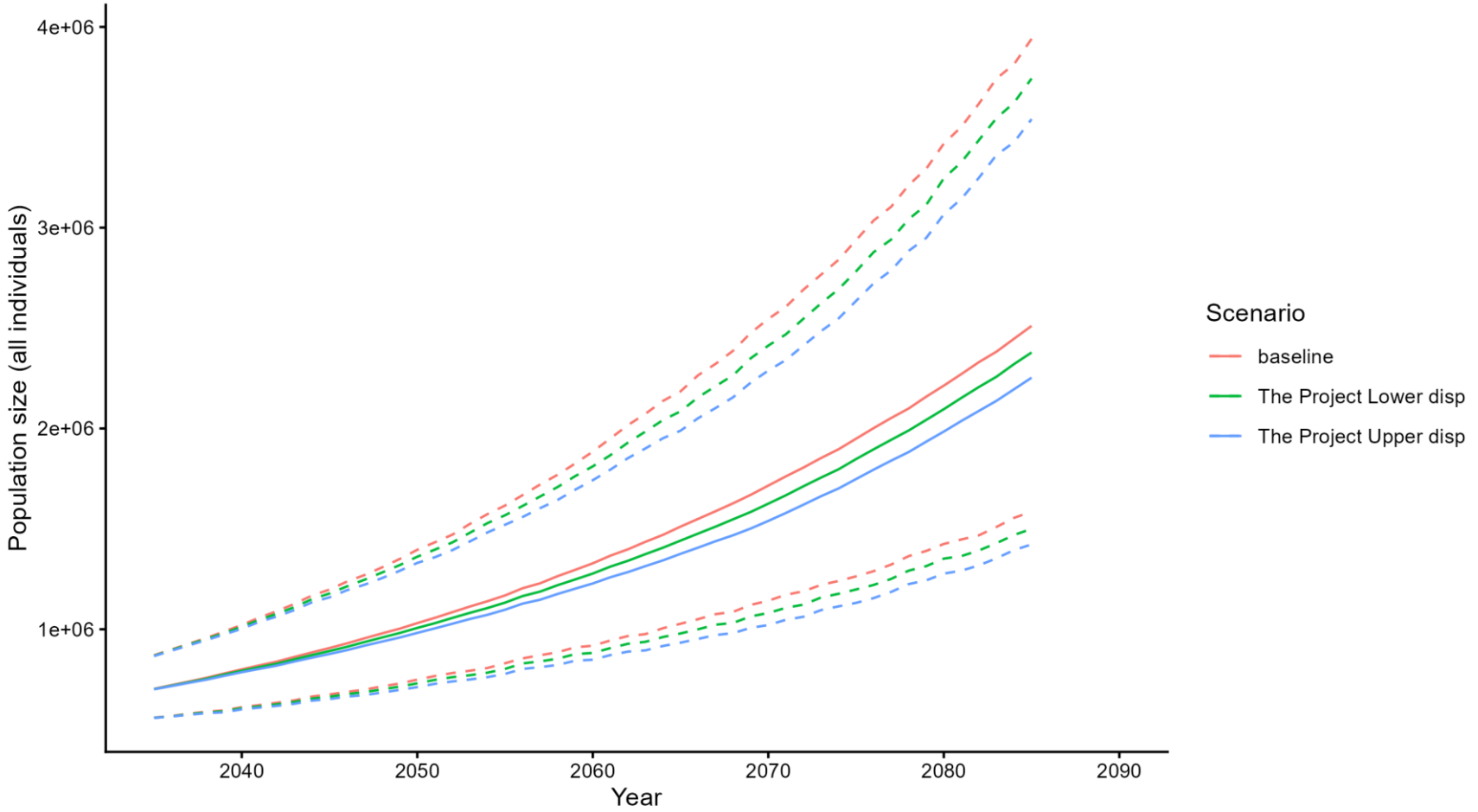


Figure 9: Guillemot - Regional population PVA outputs for Project alone using Local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.1.6 Razorbill

Table 25: Razorbill - Regional population PVA inputs for Project alone and cumulative offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Regional Pop CEH Scotland rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.000528831
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	0.00113625
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	140198	Scenario C name	CIA Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.44	Scenario C Impact on adult survival rate per pair mean	0.001051108
Productivity rate per pair standard deviation	0.189	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	CIA Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.002689035
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 26: Razorbill - Regional population PVA outputs for Project alone and cumulative offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	74.1	0.0005288	25	0.9994	0.9994	0.0003	0.9987	1.0000	0.9842	0.9843	0.0100	0.9643	1.0042	48.40	51.56
The Project Upper disp	159.3	0.0011363	25	0.9987	0.9987	0.0003	0.9981	0.9994	0.9671	0.9670	0.0098	0.9479	0.9867	46.70	53.78
CIA Lower disp	147.4	0.0010511	25	0.9988	0.9988	0.0003	0.9982	0.9995	0.9694	0.9693	0.0099	0.9498	0.9890	46.72	53.64
CIA Upper disp	377.0	0.0026890	25	0.9969	0.9969	0.0003	0.9963	0.9976	0.9232	0.9233	0.0096	0.9043	0.9425	42.02	58.34
The Project Lower disp	74.1	0.0005288	35	0.9994	0.9994	0.0003	0.9988	0.9999	0.9783	0.9785	0.0114	0.9559	1.0011	47.78	52.20
The Project Upper disp	159.3	0.0011363	35	0.9987	0.9987	0.0003	0.9981	0.9993	0.9546	0.9546	0.0112	0.9325	0.9768	45.58	54.22
CIA Lower disp	147.4	0.0010511	35	0.9988	0.9988	0.0003	0.9982	0.9994	0.9578	0.9578	0.0112	0.9357	0.9797	45.94	53.88
CIA Upper disp	377.0	0.0026890	35	0.9969	0.9969	0.0003	0.9964	0.9975	0.8956	0.8955	0.0105	0.8750	0.9162	39.60	60.40
The Project Lower disp	74.1	0.0005288	50	0.9996	0.9996	0.0002	0.9991	1.0001	0.9785	0.9786	0.0136	0.9523	1.0054	48.18	51.60
The Project Upper disp	159.3	0.0011363	50	0.9991	0.9991	0.0003	0.9986	0.9996	0.9547	0.9548	0.0134	0.9287	0.9817	45.94	53.62
CIA Lower disp	147.4	0.0010511	50	0.9992	0.9992	0.0003	0.9987	0.9997	0.9579	0.9579	0.0134	0.9314	0.9848	46.28	53.16
CIA Upper disp	377.0	0.0026890	50	0.9978	0.9978	0.0003	0.9973	0.9983	0.8958	0.8956	0.0126	0.8704	0.9202	40.98	58.94

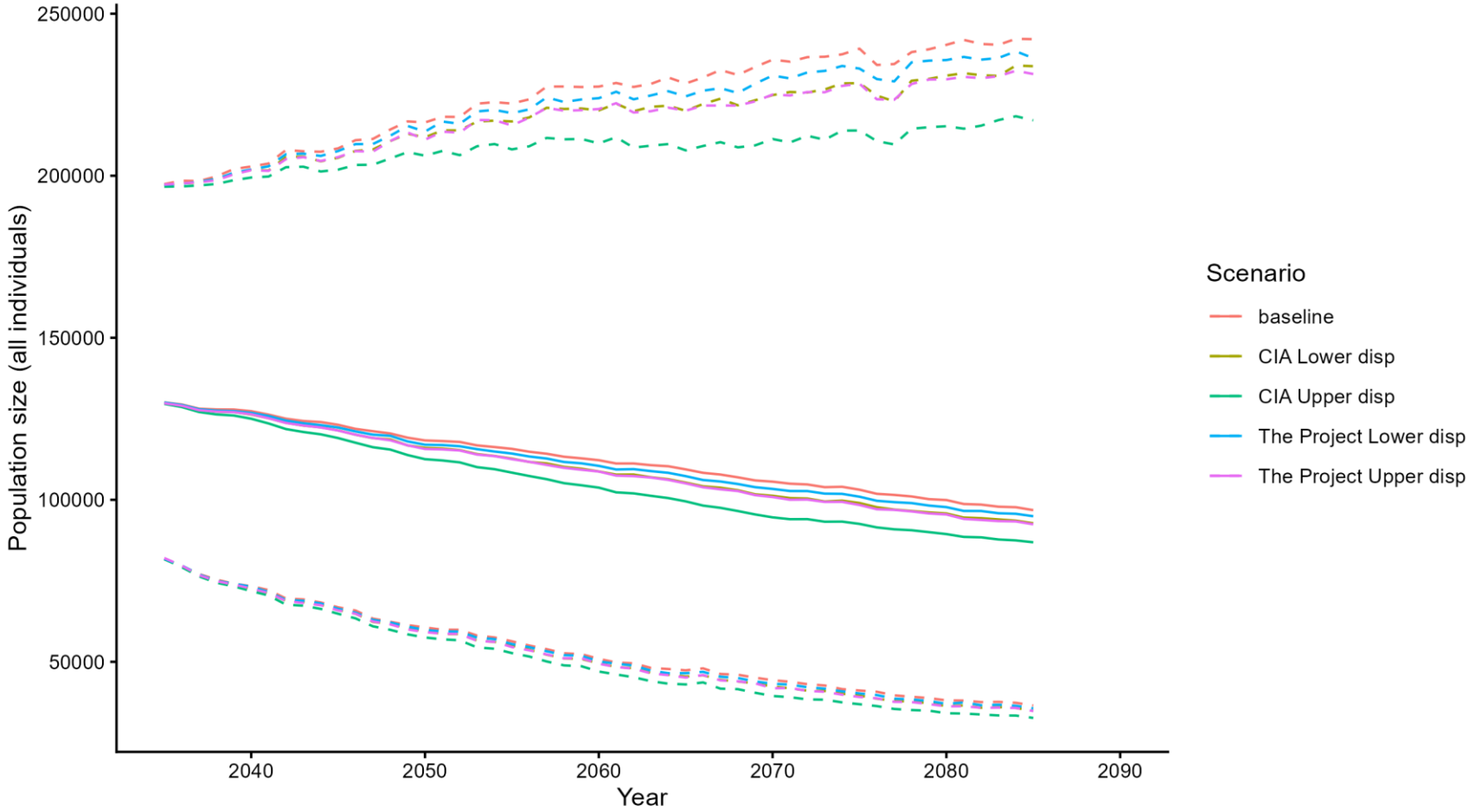


Figure 10: Razorbill - Regional population PVA outputs for Project alone and cumulative offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 27:Razorbill - Regional population PVA inputs for Project alone and cumulative offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Regional Pop Minches and W Scot rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.000528831
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	0.00113625
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	140198	Scenario C name	CIA Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.519	Scenario C Impact on adult survival rate per pair mean	0.001051108
Productivity rate per pair standard deviation	0.052	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	CIA Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.002689035
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 28: Razorbill - Regional population PVA outputs for Project alone and cumulative offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	74.1	0.0005288	25	0.9994	0.9994	0.0003	0.9988	0.9999	0.9844	0.9845	0.0088	0.9674	1.0018	48.22	51.80
The Project Upper disp	159.3	0.0011363	25	0.9987	0.9987	0.0003	0.9981	0.9993	0.9671	0.9671	0.0087	0.9500	0.9846	45.66	54.18
CIA Lower disp	147.4	0.0010511	25	0.9988	0.9988	0.0003	0.9983	0.9993	0.9696	0.9694	0.0087	0.9522	0.9871	45.84	53.76
CIA Upper disp	377.0	0.0026890	25	0.9969	0.9969	0.0003	0.9964	0.9975	0.9233	0.9233	0.0085	0.9066	0.9398	39.70	60.56
The Project Lower disp	74.1	0.0005288	35	0.9994	0.9994	0.0002	0.9989	0.9998	0.9786	0.9786	0.0096	0.9597	0.9978	47.46	52.58
The Project Upper disp	159.3	0.0011363	35	0.9987	0.9987	0.0002	0.9982	0.9992	0.9546	0.9546	0.0096	0.9360	0.9735	45.08	55.40
CIA Lower disp	147.4	0.0010511	35	0.9988	0.9988	0.0002	0.9983	0.9992	0.9579	0.9578	0.0095	0.9394	0.9775	45.20	54.94
CIA Upper disp	377.0	0.0026890	35	0.9969	0.9969	0.0002	0.9964	0.9974	0.8954	0.8953	0.0092	0.8776	0.9134	38.52	63.02
The Project Lower disp	74.1	0.0005288	50	0.9996	0.9996	0.0002	0.9992	1.0000	0.9783	0.9786	0.0109	0.9577	1.0005	47.88	52.26
The Project Upper disp	159.3	0.0011363	50	0.9991	0.9991	0.0002	0.9987	0.9995	0.9546	0.9547	0.0107	0.9342	0.9767	45.66	54.72
CIA Lower disp	147.4	0.0010511	50	0.9992	0.9992	0.0002	0.9988	0.9995	0.9578	0.9579	0.0106	0.9373	0.9788	45.76	54.38
CIA Upper disp	377.0	0.0026890	50	0.9978	0.9978	0.0002	0.9974	0.9982	0.8954	0.8953	0.0103	0.8752	0.9156	39.44	61.02

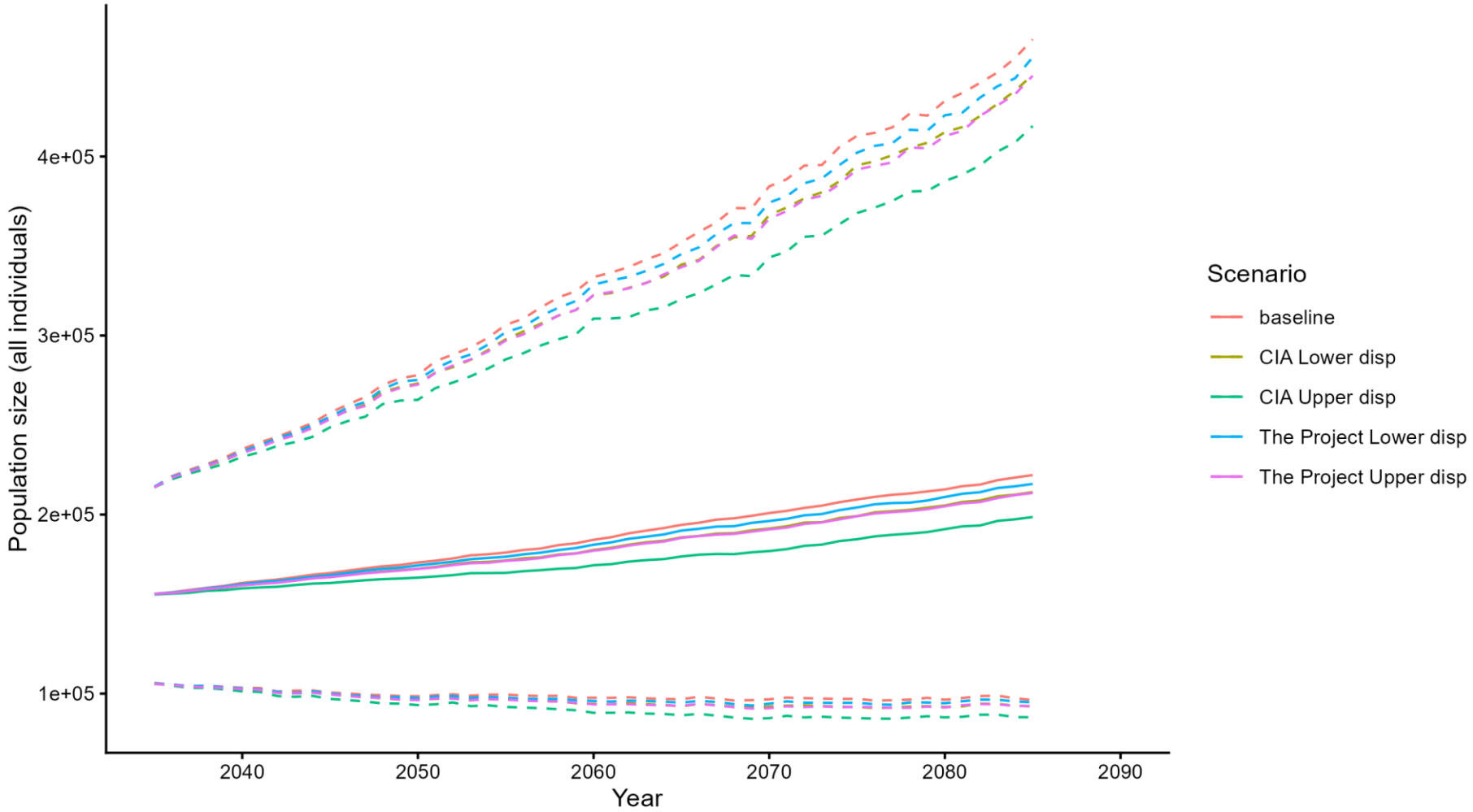


Figure 11: Razorbill - Regional population PVA outputs for Project alone and cumulative offshore windfarms using Local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.1.7 Great black-backed gull

Table 29: Great black-backed gull - Regional population PVA inputs for Project alone and cumulative offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Great black-backed gull Regional Pop CEH National rates	Number of scenarios of impact	2
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project WCS CRM
Species	Great black-backed gull	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0002456471
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	3	Scenario B name	CIA WCS CRM
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	0.0006420655
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	3273	Scenario C name	
Year	2021	Scenario C Impact on productivity rate per pair mean	
Productivity rate per pair mean	0.93	Scenario C Impact on adult survival rate per pair mean	
Productivity rate per pair standard deviation	0.433	Scenario C Impact on immature survival rate mean	
Adult survival rate Mean	0.93	Scenario D name	
Adult survival rate standard deviation	0.05	Scenario D Impact on productivity rate per pair mean	
Immatures survival rates 0 to 1 mean	0.93	Scenario D Impact on adult survival rate	
Immatures survival rates 0 to 1 standard deviation	0.05	Scenario D Impact on immature survival rate mean	
Immatures survival rates 1 to 2 mean	0.93	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.05	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.93	Scenario E Impact on adult survival rate	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.05	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.93	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.05	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.93	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.05	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 30: Great black-backed gull - Regional population PVA outputs for Project alone and cumulative offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project WCS CRM	0.8	0.0002456	25	0.9997	0.9997	0.0005	0.9988	1.0007	0.9930	0.9932	0.0247	0.9462	1.0419	49.24	51.04
CIA WCS CRM	2.1	0.0006421	25	0.9993	0.9993	0.0004	0.9984	1.0002	0.9815	0.9820	0.0242	0.9361	1.0311	48.08	52.06
The Project WCS CRM	0.8	0.0002456	35	0.9997	0.9997	0.0003	0.9991	1.0004	0.9906	0.9906	0.0247	0.9432	1.0395	48.68	51.14
CIA WCS CRM	2.1	0.0006421	35	0.9993	0.9993	0.0003	0.9987	0.9999	0.9746	0.9752	0.0242	0.9298	1.0239	47.20	52.60
The Project WCS CRM	0.8	0.0002456	50	0.9998	0.9998	0.0002	0.9994	1.0003	0.9905	0.9906	0.0247	0.9435	1.0397	49.12	50.92
CIA WCS CRM	2.1	0.0006421	50	0.9995	0.9995	0.0002	0.9991	1.0000	0.9746	0.9752	0.0242	0.9301	1.0243	47.50	52.68

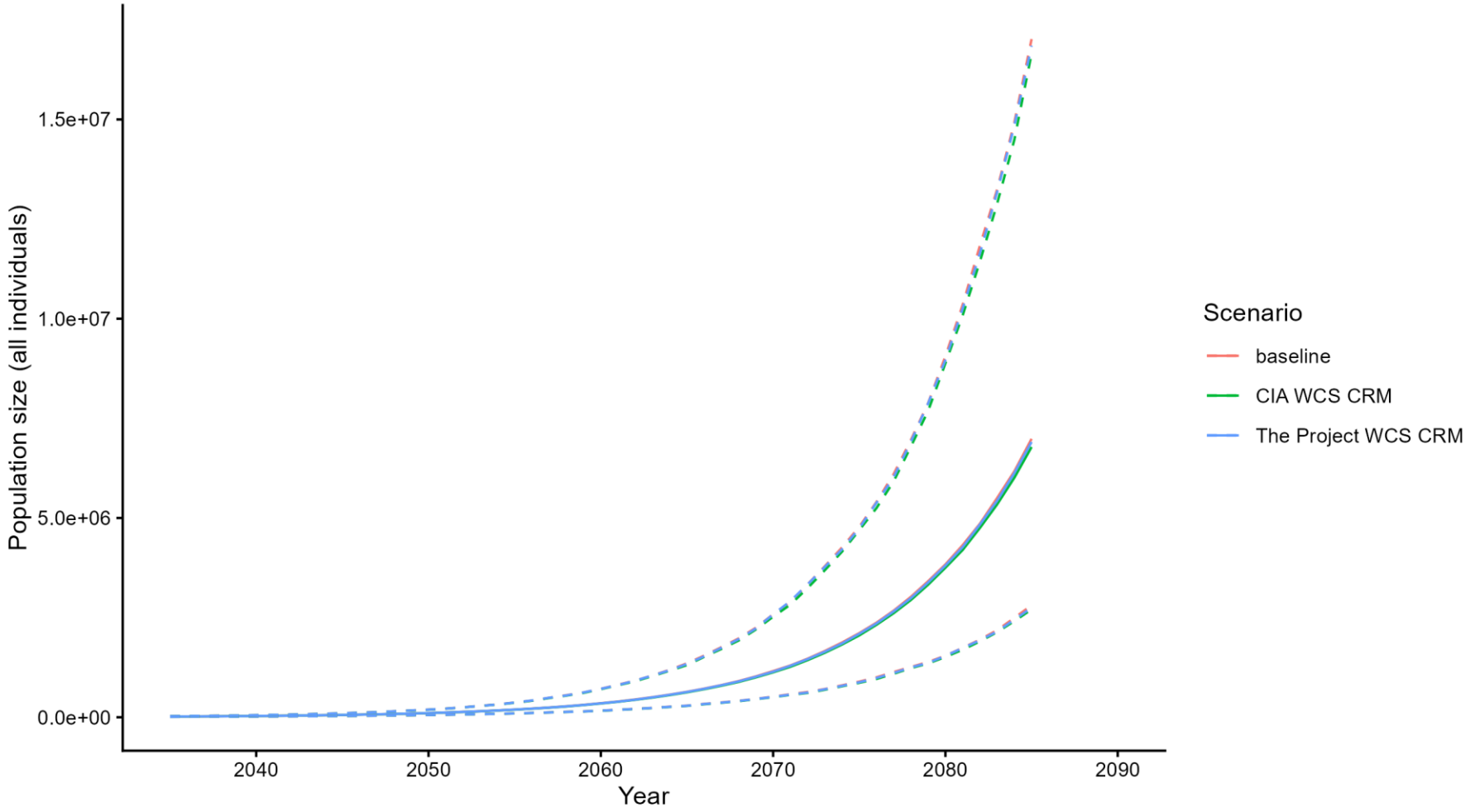


Figure 12: Great black-backed gull - Regional population PVA outputs for Project alone and cumulative offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 31: Great black-backed gull - Regional population PVA inputs for Project alone and cumulative offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Great black-backed gull Regional Pop Minches and W Scot rates	Number of scenarios of impact	2
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project WCS CRM
Species	Great black-backed gull	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0002456471
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	3	Scenario B name	CIA WCS CRM
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	0.0006420655
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	3273	Scenario C name	
Year	2021	Scenario C Impact on productivity rate per pair mean	
Productivity rate per pair mean	0.869	Scenario C Impact on adult survival rate per pair mean	
Productivity rate per pair standard deviation	0.43	Scenario C Impact on immature survival rate mean	
Adult survival rate Mean	0.93	Scenario D name	
Adult survival rate standard deviation	0.05	Scenario D Impact on productivity rate per pair mean	
Immatures survival rates 0 to 1 mean	0.93	Scenario D Impact on adult survival rate	
Immatures survival rates 0 to 1 standard deviation	0.05	Scenario D Impact on immature survival rate mean	
Immatures survival rates 1 to 2 mean	0.93	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.05	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.93	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.05	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.93	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.05	Scenario F Impact on productivity rate per pair mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 4 to 5 mean	0.93	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.05	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 32: Great black-backed gull - Regional population PVA outputs for Project alone and cumulative offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project WCS CRM	0.8	0.0002456	25	0.9997	0.9997	0.0005	0.9988	1.0007	0.9931	0.9931	0.0255	0.9429	1.0433	49.34	50.82
CIA WCS CRM	2.1	0.0006421	25	0.9993	0.9993	0.0005	0.9984	1.0003	0.9821	0.9823	0.0256	0.9325	1.0344	48.18	51.86
The Project WCS CRM	0.8	0.0002456	35	0.9997	0.9997	0.0004	0.9990	1.0004	0.9901	0.9904	0.0256	0.9403	1.0412	48.98	50.84
CIA WCS CRM	2.1	0.0006421	35	0.9993	0.9993	0.0004	0.9986	1.0000	0.9754	0.9755	0.0256	0.9262	1.0271	47.34	52.64
The Project WCS CRM	0.8	0.0002456	50	0.9998	0.9998	0.0003	0.9993	1.0003	0.9901	0.9904	0.0256	0.9398	1.0412	49.20	51.00
CIA WCS CRM	2.1	0.0006421	50	0.9995	0.9995	0.0003	0.9990	1.0000	0.9752	0.9755	0.0256	0.9260	1.0275	47.62	52.52

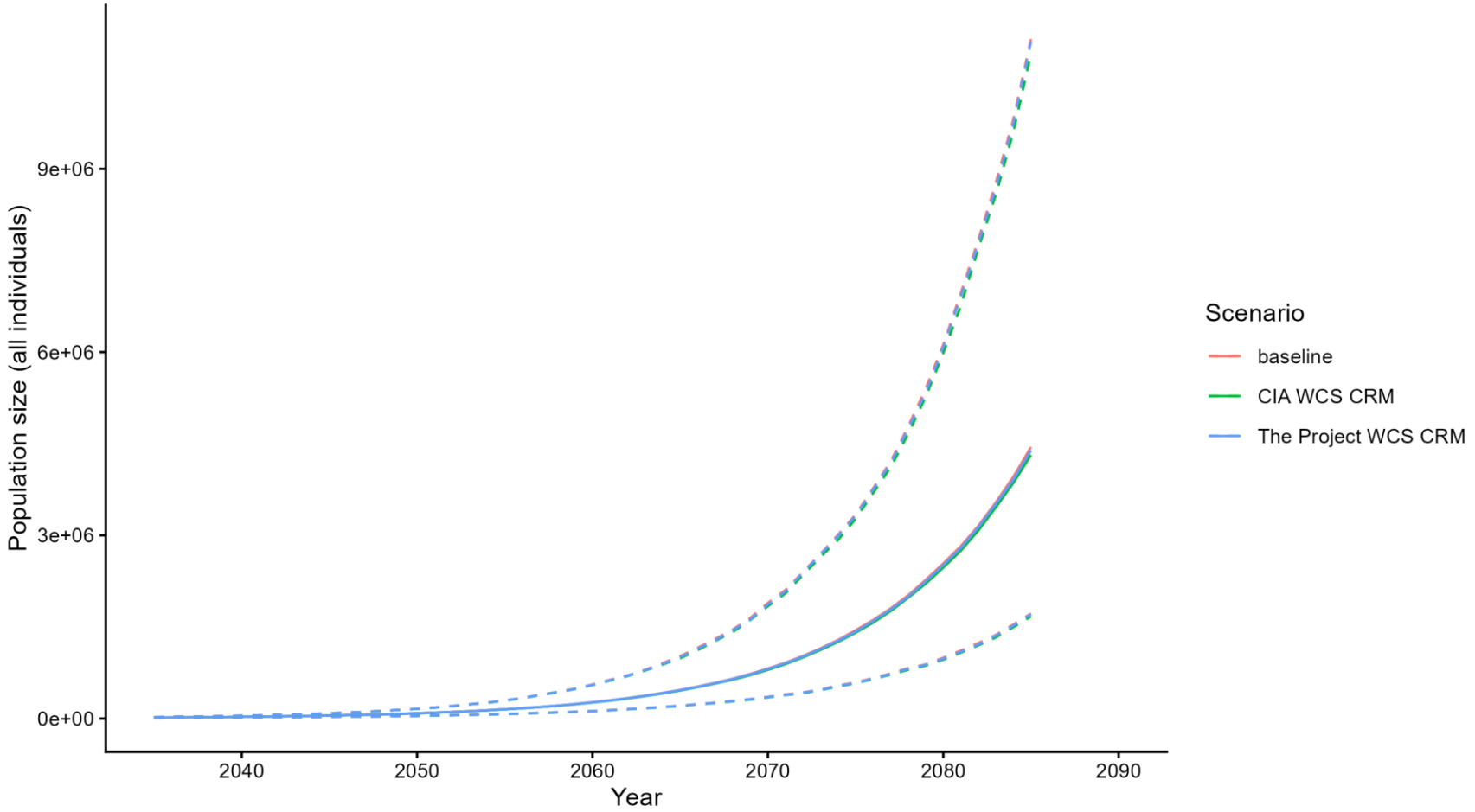


Figure 13: Great black-backed gull - Regional population PVA outputs for Project alone and cumulative offshore windfarms using Local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.1.8 Herring gull

Table 33: Herring gull - Regional population PVA inputs for Project alone. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Herring gull Regional Pop CEH National rates	Number of scenarios of impact	1
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project WCS CRM
Species	Herring gull	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0003848369
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	3	Scenario B name	CIA WCS CRM
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	0
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	20840	Scenario C name	
Year	2021	Scenario C Impact on productivity rate per pair mean	
Productivity rate per pair mean	0.553	Scenario C Impact on adult survival rate per pair mean	
Productivity rate per pair standard deviation	0.41	Scenario C Impact on immature survival rate mean	
Adult survival rate Mean	0.834	Scenario D name	
Adult survival rate standard deviation	0.079	Scenario D Impact on productivity rate per pair mean	
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	
Immatures survival rates 0 to 1 standard deviation	0.079	Scenario D Impact on immature survival rate mean	
Immatures survival rates 1 to 2 mean	0.834	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.079	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.834	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.079	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.834	Scenario F name	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 standard deviation	0.079	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.834	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.079	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 34: Herring gull - Regional population PVA outputs for Project alone. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project WCS CRM	8	0.0003848	25	0.9995	0.9995	0.0020	0.9957	1.0034	0.9873	0.9894	0.0545	0.8856	1.1050	49.18	50.52
The Project WCS CRM	8	0.0003848	35	0.9995	0.9995	0.0019	0.9956	1.0034	0.9821	0.9853	0.0723	0.8496	1.1335	48.66	51.24
The Project WCS CRM	8	0.0003848	50	0.9997	0.9997	0.0021	0.9955	1.0039	0.9836	0.9886	0.1090	0.7900	1.2199	48.82	51.40

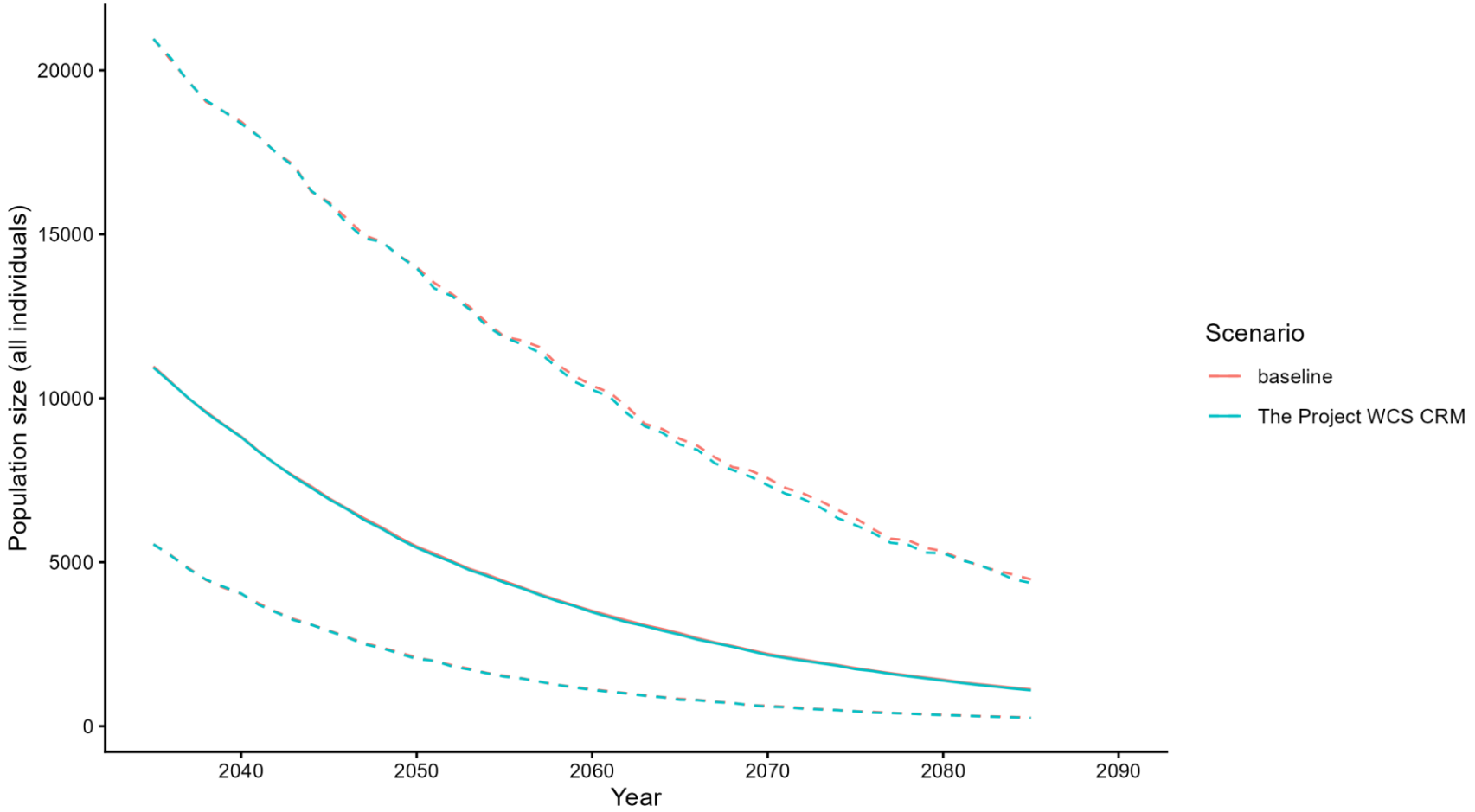


Figure 14: Herring gull - Regional population PVA outputs for Project alone using 'CEH Scotland' productivity rate. Baseline = unimpacted population. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 35: Herring gull - Regional population PVA inputs for Project alone. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Herring gull Regional Pop Minches and W Scot rates	Number of scenarios of impact	1
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project WCS CRM
Species	Herring gull	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0003848369
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	3	Scenario B name	CIA WCS CRM
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	0
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	20840	Scenario C name	
Year	2021	Scenario C Impact on productivity rate per pair mean	
Productivity rate per pair mean	0.437	Scenario C Impact on adult survival rate per pair mean	
Productivity rate per pair standard deviation	0.329	Scenario C Impact on immature survival rate mean	
Adult survival rate Mean	0.834	Scenario D name	
Adult survival rate standard deviation	0.079	Scenario D Impact on productivity rate per pair mean	
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	
Immatures survival rates 0 to 1 standard deviation	0.079	Scenario D Impact on immature survival rate mean	
Immatures survival rates 1 to 2 mean	0.834	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.079	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.834	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.079	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.834	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.079	Scenario F Impact on productivity rate per pair mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 4 to 5 mean	0.834	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.079	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 36: Herring gull - Regional population PVA outputs for Project alone. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project WCS CRM	8	0.0003848	25	0.9995	0.9995	0.0025	0.9946	1.0047	0.9874	0.9905	0.0692	0.8634	1.1359	49.26	50.92
The Project WCS CRM	8	0.0003848	35	0.9995	0.9995	0.0027	0.9941	1.0049	0.9814	0.9865	0.0987	0.8039	1.2000	49.12	50.96
The Project WCS CRM	8	0.0003848	50	0.9996	0.9996	0.0033	0.9929	1.0061	0.9803	0.9933	0.1737	0.6896	1.3710	48.94	50.88

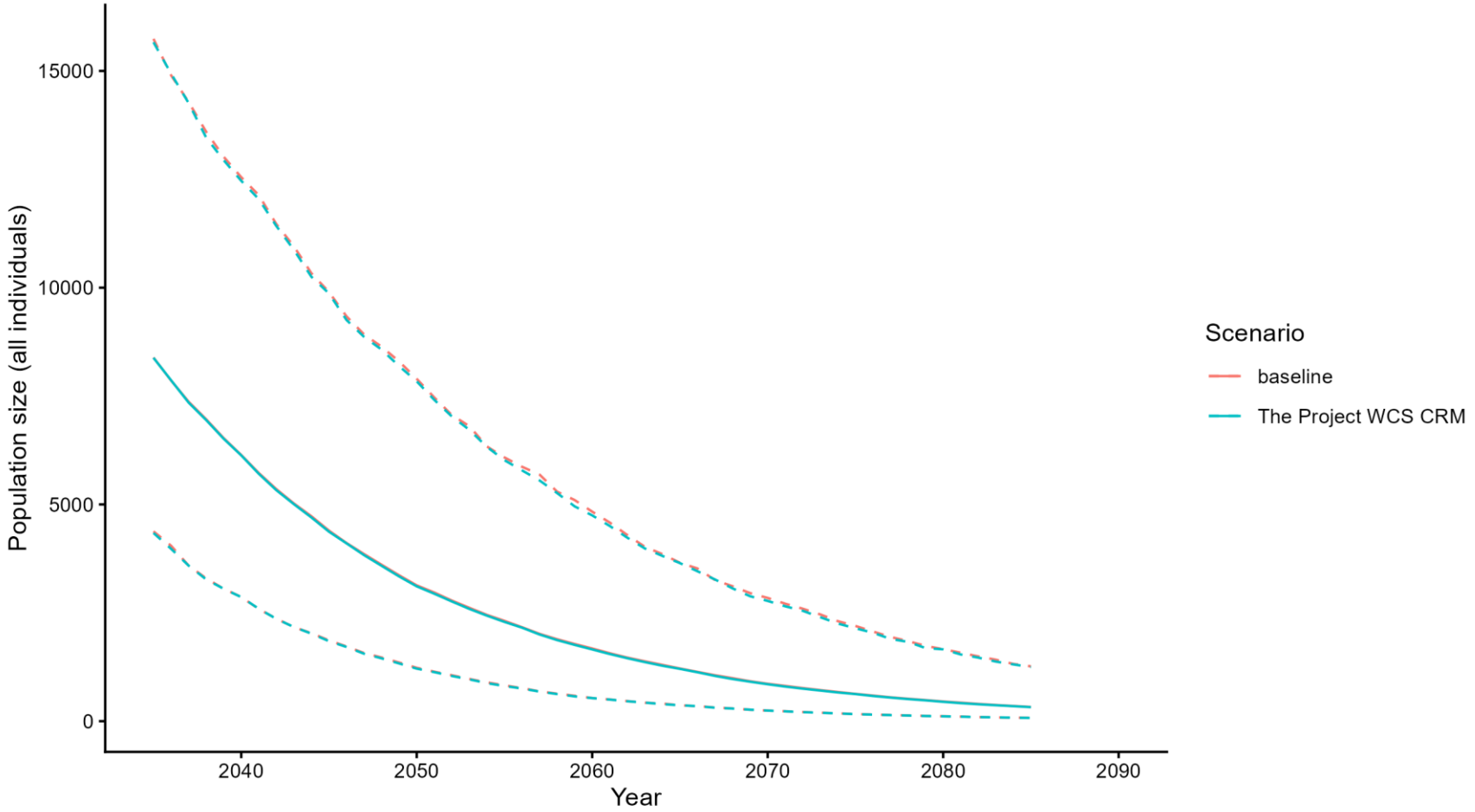


Figure 15: Herring gull - Regional population PVA outputs for Project alone using Local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.1.9 Puffin

Table 37: Puffin - Regional population PVA inputs for Project alone and cumulative offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Puffin Regional Pop CEH National rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Atlantic puffin	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	2.733483e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	5.599767e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	903609	Scenario C name	CIA Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.415	Scenario C Impact on adult survival rate per pair mean	0.0001858105
Productivity rate per pair standard deviation	0.212	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.907	Scenario D name	CIA Upper disp
Adult survival rate standard deviation	0.083	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.892	Scenario D Impact on adult survival rate	0.0003431794
Immatures survival rates 0 to 1 standard deviation	0.083	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.892	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.083	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.892	Scenario E Impact on adult survival rate	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.083	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.76	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.093	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.805	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.083	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 38: Puffin - Regional population PVA outputs for Project alone and cumulative offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	24.7	0.0000273	25	1.0000	1.0000	0.0001	0.9997	1.0002	0.9993	0.9992	0.0040	0.9914	1.0071	49.88	50.08
The Project Upper disp	50.6	0.0000560	25	0.9999	0.9999	0.0001	0.9997	1.0002	0.9982	0.9983	0.0039	0.9906	1.0062	49.86	50.12
CIA Lower disp	167.9	0.0001858	25	0.9998	0.9998	0.0001	0.9995	1.0000	0.9945	0.9945	0.0039	0.9866	1.0020	49.48	50.46
CIA Upper disp	310.1	0.0003432	25	0.9996	0.9996	0.0001	0.9994	0.9999	0.9899	0.9898	0.0039	0.9819	0.9978	49.02	50.80
The Project Lower disp	24.7	0.0000273	35	1.0000	1.0000	0.0001	0.9997	1.0002	0.9989	0.9989	0.0045	0.9899	1.0079	50.02	49.96
The Project Upper disp	50.6	0.0000560	35	0.9999	0.9999	0.0001	0.9997	1.0002	0.9976	0.9977	0.0044	0.9890	1.0066	49.78	50.18
CIA Lower disp	167.9	0.0001858	35	0.9998	0.9998	0.0001	0.9996	1.0000	0.9925	0.9924	0.0045	0.9834	1.0011	49.52	50.60
CIA Upper disp	310.1	0.0003432	35	0.9996	0.9996	0.0001	0.9994	0.9998	0.9861	0.9860	0.0045	0.9768	0.9949	49.18	50.96
The Project Lower disp	24.7	0.0000273	50	1.0000	1.0000	0.0001	0.9998	1.0002	0.9990	0.9989	0.0054	0.9880	1.0098	49.80	50.06
The Project Upper disp	50.6	0.0000560	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9977	0.9977	0.0053	0.9867	1.0080	49.72	50.12
CIA Lower disp	167.9	0.0001858	50	0.9999	0.9999	0.0001	0.9997	1.0000	0.9925	0.9924	0.0054	0.9816	1.0031	49.58	50.56
CIA Upper disp	310.1	0.0003432	50	0.9997	0.9997	0.0001	0.9995	0.9999	0.9860	0.9860	0.0053	0.9755	0.9964	49.24	51.04

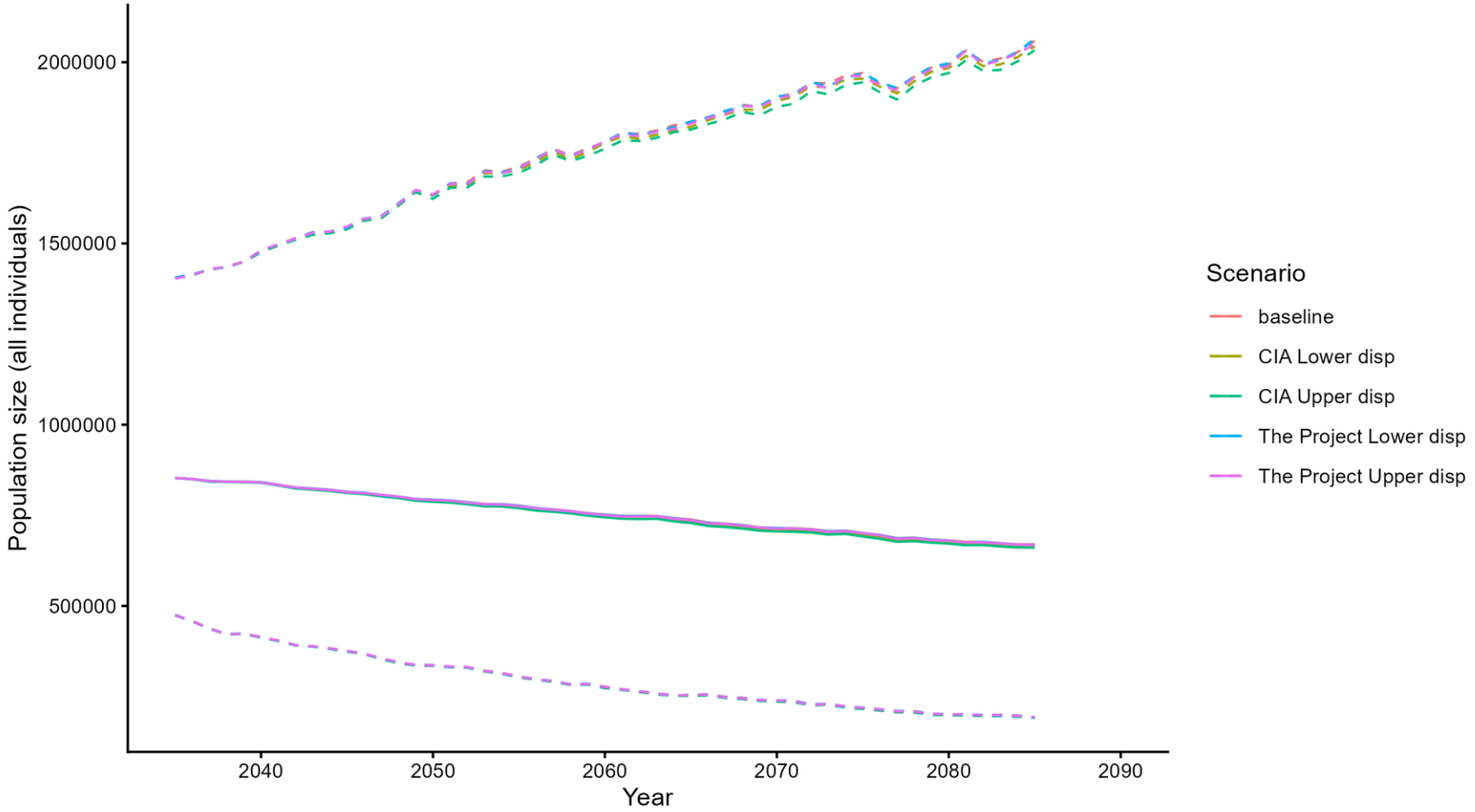


Figure 16: Puffin - Regional population PVA outputs for Project alone and cumulative offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 39: Puffin - Regional population PVA inputs for Project alone and cumulative offshore windfarms. Local 'Western Scotland and East Ireland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Puffin Regional Pop W Scotland E Ireland rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Atlantic puffin	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	2.733483e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	5.599767e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	903609	Scenario C name	CIA Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.501	Scenario C Impact on adult survival rate per pair mean	0.0001858105
Productivity rate per pair standard deviation	0.274	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.907	Scenario D name	CIA Upper disp
Adult survival rate standard deviation	0.083	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.892	Scenario D Impact on adult survival rate	0.0003431794
Immatures survival rates 0 to 1 standard deviation	0.083	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.892	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.083	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.892	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.083	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.76	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.093	Scenario F Impact on productivity rate per pair mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 4 to 5 mean	0.805	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.083	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 40: Puffin - Regional population PVA outputs for Project alone and cumulative offshore windfarms. Local 'Western Scotland and East Ireland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	24.7	0.0000273	25	1.0000	1.0000	0.0001	0.9998	1.0002	0.9992	0.9993	0.0034	0.9925	1.0061	49.92	50.08
The Project Upper disp	50.6	0.0000560	25	0.9999	0.9999	0.0001	0.9997	1.0001	0.9985	0.9984	0.0035	0.9915	1.0053	49.84	50.18
CIA Lower disp	167.9	0.0001858	25	0.9998	0.9998	0.0001	0.9996	1.0000	0.9946	0.9946	0.0034	0.9877	1.0014	49.26	50.42
CIA Upper disp	310.1	0.0003432	25	0.9996	0.9996	0.0001	0.9994	0.9998	0.9900	0.9900	0.0035	0.9830	0.9969	48.92	50.96
The Project Lower disp	24.7	0.0000273	35	1.0000	1.0000	0.0001	0.9998	1.0001	0.9989	0.9990	0.0038	0.9916	1.0065	49.90	50.10
The Project Upper disp	50.6	0.0000560	35	0.9999	0.9999	0.0001	0.9998	1.0001	0.9978	0.9978	0.0038	0.9901	1.0054	49.90	50.12
CIA Lower disp	167.9	0.0001858	35	0.9998	0.9998	0.0001	0.9996	1.0000	0.9926	0.9926	0.0038	0.9849	1.0000	49.50	50.62
CIA Upper disp	310.1	0.0003432	35	0.9996	0.9996	0.0001	0.9994	0.9998	0.9862	0.9861	0.0039	0.9784	0.9938	48.86	51.00
The Project Lower disp	24.7	0.0000273	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9989	0.9990	0.0043	0.9904	1.0076	49.94	50.08
The Project Upper disp	50.6	0.0000560	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9978	0.9978	0.0043	0.9892	1.0062	49.90	50.08
CIA Lower disp	167.9	0.0001858	50	0.9999	0.9999	0.0001	0.9997	1.0000	0.9926	0.9925	0.0043	0.9839	1.0010	49.48	50.52
CIA Upper disp	310.1	0.0003432	50	0.9997	0.9997	0.0001	0.9996	0.9999	0.9862	0.9862	0.0043	0.9774	0.9949	49.10	50.94

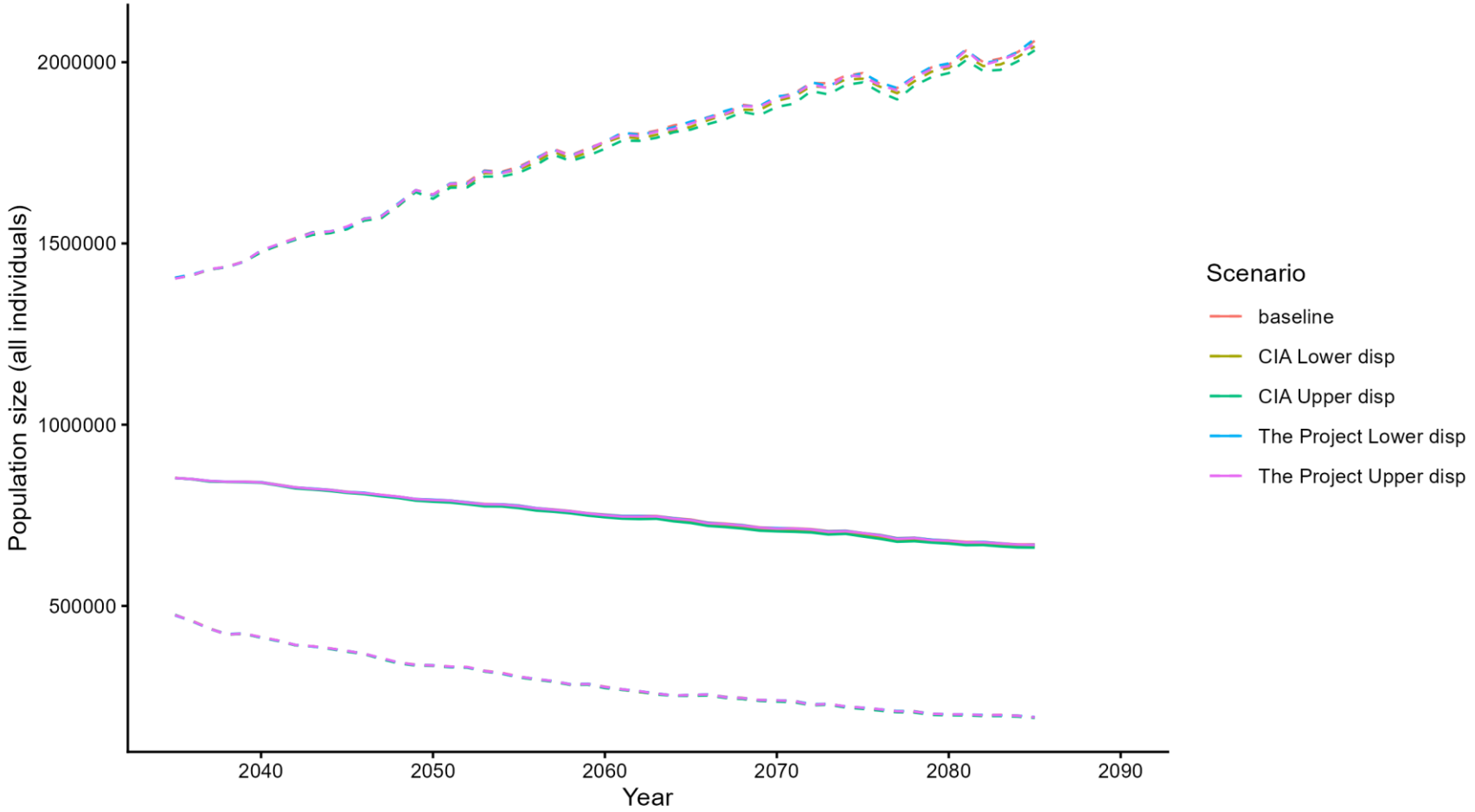


Figure 17: Puffin - Regional population PVA outputs for Project alone and cumulative offshore windfarms using Local 'Western Scotland and East Ireland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

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Table 41: Fulmar - Regional population PVA inputs for Project alone and cumulative offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Fulmar Regional Pop CEH National rates	Number of scenarios of impact	7
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Northern Fulmar	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	9	Scenario A Impact on adult survival rate	6.510592e-07
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	1.767161e-06
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	1075171	Scenario C name	CIA Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.391	Scenario C Impact on adult survival rate per pair mean	1.488135e-05
Productivity rate per pair standard deviation	0.131	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.936	Scenario D name	CIA Upper disp
Adult survival rate standard deviation	0.055	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.845	Scenario D Impact on adult survival rate	4.445804e-05
Immatures survival rates 0 to 1 standard deviation	0.055	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.845	Scenario E name	CIA WCS CRM
Immatures survival rates 1 to 2 standard deviation	0.055	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.845	Scenario E Impact on adult survival rate	3.348305e-07
Immatures survival rates 2 to 3 standard deviation	0.055	Scenario E Impact on immature survival rate mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.845	Scenario F name	CIA WCS CRM plus lower disp
Immatures survival rates 3 to 4 standard deviation	0.055	Scenario F Impact on productivity rate per pair mean	0
Immatures survival rates 4 to 5 mean	0.845	Scenario F Impact on adult survival rate	1.525339e-05
Immatures survival rates 4 to 5 standard deviation	0.055	Scenario F Impact on immature survival rate mean	0
Immatures survival rates 5 to 6 mean	0.845	Scenario G name	CIA WCS CRM plus upper disp
Immatures survival rates 5 to 6 standard deviation	0.055	Scenario G Impact on productivity rate per pair mean	0
Immatures survival rates 6 to 7 mean	0.845	Scenario G Impact on adult survival rate	4.483008e-05
Immatures survival rates 6 to 7 standard deviation	0.055	Scenario G Impact on immature survival rate mean	0
Immatures survival rates 7 to 8 mean	0.845		
Immatures survival rates 7 to 8 standard deviation	0.055		
Immatures survival rates 8 to 9 mean	0.936		
Immatures survival rates 8 to 9 standard deviation	0.055		
Units for output	whole.population		

Table 42: Fulmar - Regional population PVA outputs for Project alone and cumulative offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.7	0.0000007	25	1.0000	1.0000	0.0001	0.9998	1.0002	1.0000	1.0000	0.0033	0.9935	1.0062	49.94	50.08
The Project Upper disp	1.9	0.0000018	25	1.0000	1.0000	0.0001	0.9998	1.0002	0.9999	0.9999	0.0033	0.9934	1.0063	49.78	50.10
CIA Lower disp	16.0	0.0000149	25	1.0000	1.0000	0.0001	0.9998	1.0002	0.9995	0.9996	0.0033	0.9933	1.0061	49.80	50.30
CIA Upper disp	47.8	0.0000445	25	1.0000	1.0000	0.0001	0.9997	1.0002	0.9987	0.9987	0.0033	0.9923	1.0053	49.76	50.28
CIA WCS CRM	0.4	0.0000003	25	1.0000	1.0000	0.0001	0.9998	1.0002	1.0000	1.0000	0.0034	0.9932	1.0066	49.80	50.14
CIA WCS CRM plus lower disp	16.4	0.0000153	25	1.0000	1.0000	0.0001	0.9998	1.0002	0.9996	0.9996	0.0033	0.9930	1.0061	49.84	50.10
CIA WCS CRM plus upper disp	48.2	0.0000448	25	0.9999	0.9999	0.0001	0.9997	1.0002	0.9986	0.9987	0.0033	0.9922	1.0052	49.84	50.14
The Project Lower disp	0.7	0.0000007	35	1.0000	1.0000	0.0001	0.9998	1.0002	0.9999	1.0000	0.0039	0.9926	1.0076	50.00	50.00
The Project Upper disp	1.9	0.0000018	35	1.0000	1.0000	0.0001	0.9998	1.0002	1.0000	1.0000	0.0039	0.9924	1.0076	49.96	50.08
CIA Lower disp	16.0	0.0000149	35	1.0000	1.0000	0.0001	0.9998	1.0002	0.9993	0.9994	0.0039	0.9921	1.0072	49.96	50.14
CIA Upper disp	47.8	0.0000445	35	1.0000	1.0000	0.0001	0.9998	1.0001	0.9983	0.9983	0.0038	0.9909	1.0058	49.82	50.24
CIA WCS CRM	0.4	0.0000003	35	1.0000	1.0000	0.0001	0.9998	1.0002	1.0000	1.0000	0.0039	0.9922	1.0078	50.00	50.00
CIA WCS CRM plus lower disp	16.4	0.0000153	35	1.0000	1.0000	0.0001	0.9998	1.0002	0.9994	0.9994	0.0039	0.9917	1.0071	49.96	50.04
CIA WCS CRM plus upper disp	48.2	0.0000448	35	0.9999	0.9999	0.0001	0.9998	1.0001	0.9982	0.9982	0.0038	0.9908	1.0056	49.78	50.22
The Project Lower disp	0.7	0.0000007	50	1.0000	1.0000	0.0001	0.9998	1.0002	1.0000	1.0000	0.0046	0.9909	1.0091	50.06	49.86
The Project Upper disp	1.9	0.0000018	50	1.0000	1.0000	0.0001	0.9998	1.0002	1.0000	1.0000	0.0046	0.9910	1.0092	49.96	50.04
CIA Lower disp	16.0	0.0000149	50	1.0000	1.0000	0.0001	0.9998	1.0002	0.9993	0.9995	0.0046	0.9905	1.0085	49.88	50.04
CIA Upper disp	47.8	0.0000445	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9982	0.9983	0.0046	0.9896	1.0073	49.80	50.18

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
CIA WCS CRM	0.4	0.0000003	50	1.0000	1.0000	0.0001	0.9998	1.0002	1.0001	1.0000	0.0046	0.9909	1.0093	50.02	49.98
CIA WCS CRM plus lower disp	16.4	0.0000153	50	1.0000	1.0000	0.0001	0.9998	1.0002	0.9995	0.9995	0.0047	0.9900	1.0087	50.04	49.90
CIA WCS CRM plus upper disp	48.2	0.0000448	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9982	0.9982	0.0046	0.9891	1.0072	49.72	50.22

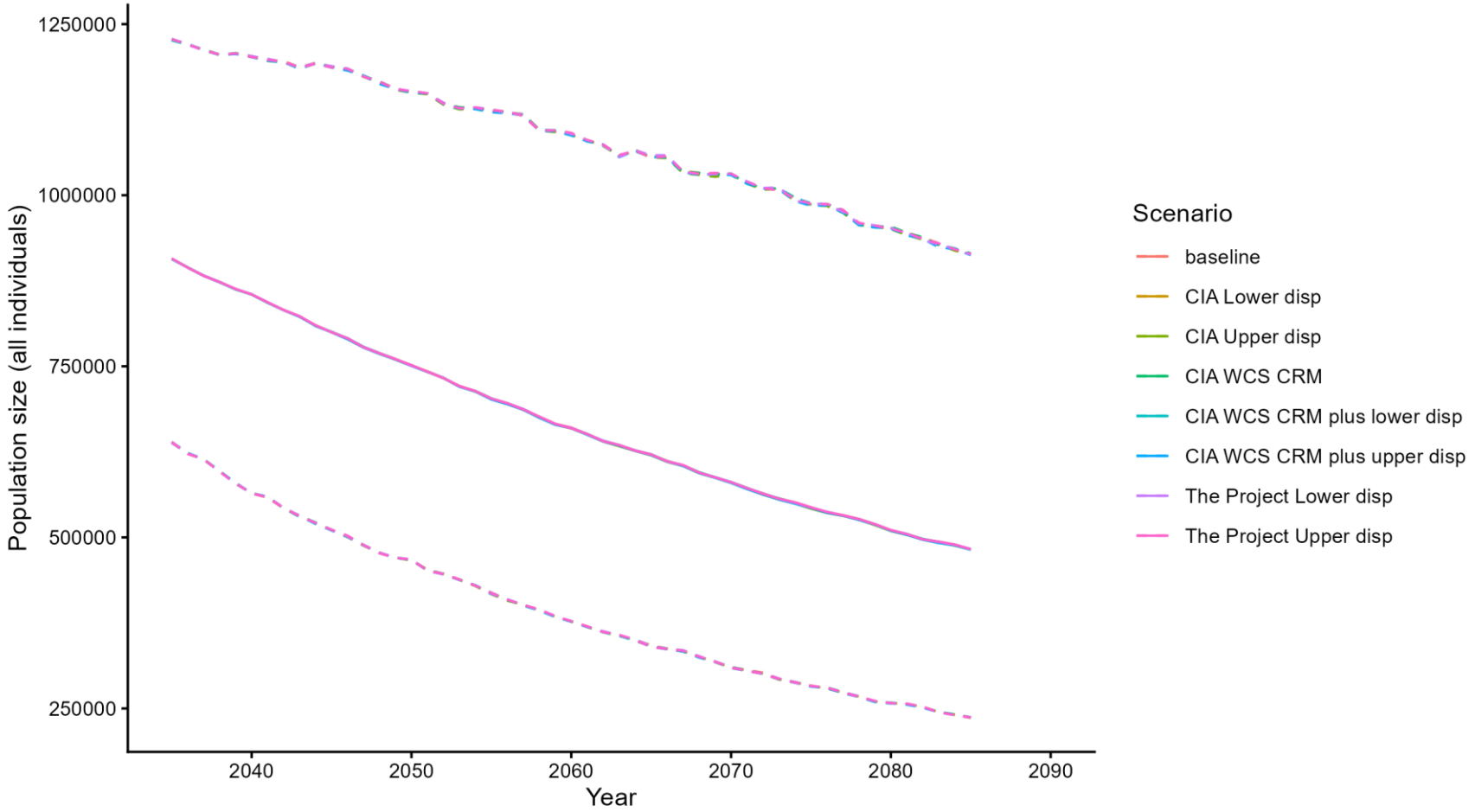


Figure 18: Fulmar - Regional population PVA outputs for Project alone and cumulative offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 43: Fulmar - Regional population PVA inputs for Project alone and cumulative offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Fulmar Regional Pop Minches and W Scot rates	Number of scenarios of impact	7
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Northern Fulmar	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	9	Scenario A Impact on adult survival rate	6.510592e-07
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	1.767161e-06
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	1075171	Scenario C name	CIA Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.463	Scenario C Impact on adult survival rate per pair mean	1.488135e-05
Productivity rate per pair standard deviation	0.0924	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.936	Scenario D name	CIA Upper disp
Adult survival rate standard deviation	0.055	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.845	Scenario D Impact on adult survival rate	4.445804e-05
Immatures survival rates 0 to 1 standard deviation	0.055	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.845	Scenario E name	CIA WCS CRM
Immatures survival rates 1 to 2 standard deviation	0.055	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.845	Scenario E Impact on adult survival rate	3.348305e-07
Immatures survival rates 2 to 3 standard deviation	0.055	Scenario E Impact on immature survival rate mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.845	Scenario F name	CIA WCS CRM plus lower disp
Immatures survival rates 3 to 4 standard deviation	0.055	Scenario F Impact on productivity rate per pair mean	0
Immatures survival rates 4 to 5 mean	0.845	Scenario F Impact on adult survival rate	1.525339e-05
Immatures survival rates 4 to 5 standard deviation	0.055	Scenario F Impact on immature survival rate mean	0
Immatures survival rates 5 to 6 mean	0.845	Scenario G name	CIA WCS CRM plus upper disp
Immatures survival rates 5 to 6 standard deviation	0.055	Scenario G Impact on productivity rate per pair mean	0
Immatures survival rates 6 to 7 mean	0.845	Scenario G Impact on adult survival rate	4.483008e-05
Immatures survival rates 6 to 7 standard deviation	0.055	Scenario G Impact on immature survival rate mean	0
Immatures survival rates 7 to 8 mean	0.845		
Immatures survival rates 7 to 8 standard deviation	0.055		
Immatures survival rates 8 to 9 mean	0.936		
Immatures survival rates 8 to 9 standard deviation	0.055		
Units for output	whole.population		

Table 44: Fulmar - Regional population PVA outputs for Project alone and cumulative offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.7	0.0000007	25	1.0000	1.0000	0.0001	0.9998	1.0002	1.0000	1.0000	0.0032	0.9939	1.0063	49.96	50.04
The Project Upper disp	1.9	0.0000018	25	1.0000	1.0000	0.0001	0.9998	1.0002	1.0000	0.9999	0.0032	0.9937	1.0060	49.92	50.22
CIA Lower disp	16.0	0.0000149	25	1.0000	1.0000	0.0001	0.9998	1.0002	0.9995	0.9995	0.0032	0.9934	1.0057	49.92	50.06
CIA Upper disp	47.8	0.0000445	25	1.0000	1.0000	0.0001	0.9997	1.0002	0.9987	0.9987	0.0032	0.9926	1.0050	49.86	50.20
CIA WCS CRM	0.4	0.0000003	25	1.0000	1.0000	0.0001	0.9998	1.0002	1.0001	1.0001	0.0032	0.9939	1.0063	49.92	50.12
CIA WCS CRM plus lower disp	16.4	0.0000153	25	1.0000	1.0000	0.0001	0.9998	1.0002	0.9996	0.9996	0.0031	0.9935	1.0056	50.00	50.00
CIA WCS CRM plus upper disp	48.2	0.0000448	25	0.9999	0.9999	0.0001	0.9997	1.0002	0.9987	0.9986	0.0032	0.9924	1.0049	49.86	50.38
The Project Lower disp	0.7	0.0000007	35	1.0000	1.0000	0.0001	0.9998	1.0002	1.0000	1.0000	0.0036	0.9930	1.0070	50.02	49.98
The Project Upper disp	1.9	0.0000018	35	1.0000	1.0000	0.0001	0.9998	1.0002	1.0000	0.9999	0.0036	0.9929	1.0068	49.98	50.02
CIA Lower disp	16.0	0.0000149	35	1.0000	1.0000	0.0001	0.9998	1.0002	0.9994	0.9993	0.0036	0.9923	1.0063	50.04	49.98
CIA Upper disp	47.8	0.0000445	35	1.0000	1.0000	0.0001	0.9998	1.0001	0.9982	0.9982	0.0036	0.9912	1.0053	49.82	50.20
CIA WCS CRM	0.4	0.0000003	35	1.0000	1.0000	0.0001	0.9998	1.0002	1.0001	1.0001	0.0036	0.9930	1.0072	50.16	49.90
CIA WCS CRM plus lower disp	16.4	0.0000153	35	1.0000	1.0000	0.0001	0.9998	1.0002	0.9994	0.9994	0.0036	0.9924	1.0065	49.98	50.02
CIA WCS CRM plus upper disp	48.2	0.0000448	35	0.9999	0.9999	0.0001	0.9998	1.0001	0.9981	0.9981	0.0036	0.9910	1.0052	49.76	50.22
The Project Lower disp	0.7	0.0000007	50	1.0000	1.0000	0.0001	0.9999	1.0001	1.0000	1.0000	0.0042	0.9917	1.0082	49.90	50.18
The Project Upper disp	1.9	0.0000018	50	1.0000	1.0000	0.0001	0.9999	1.0001	1.0000	0.9999	0.0042	0.9916	1.0081	50.00	50.00
CIA Lower disp	16.0	0.0000149	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9994	0.9993	0.0042	0.9910	1.0073	49.90	50.16
CIA Upper disp	47.8	0.0000445	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9983	0.9983	0.0042	0.9901	1.0065	49.66	50.42

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
CIA WCS CRM	0.4	0.0000003	50	1.0000	1.0000	0.0001	0.9999	1.0001	1.0000	1.0001	0.0042	0.9918	1.0085	49.96	50.08
CIA WCS CRM plus lower disp	16.4	0.0000153	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9994	0.9994	0.0042	0.9911	1.0076	49.92	50.18
CIA WCS CRM plus upper disp	48.2	0.0000448	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9981	0.9981	0.0042	0.9897	1.0065	49.68	50.34

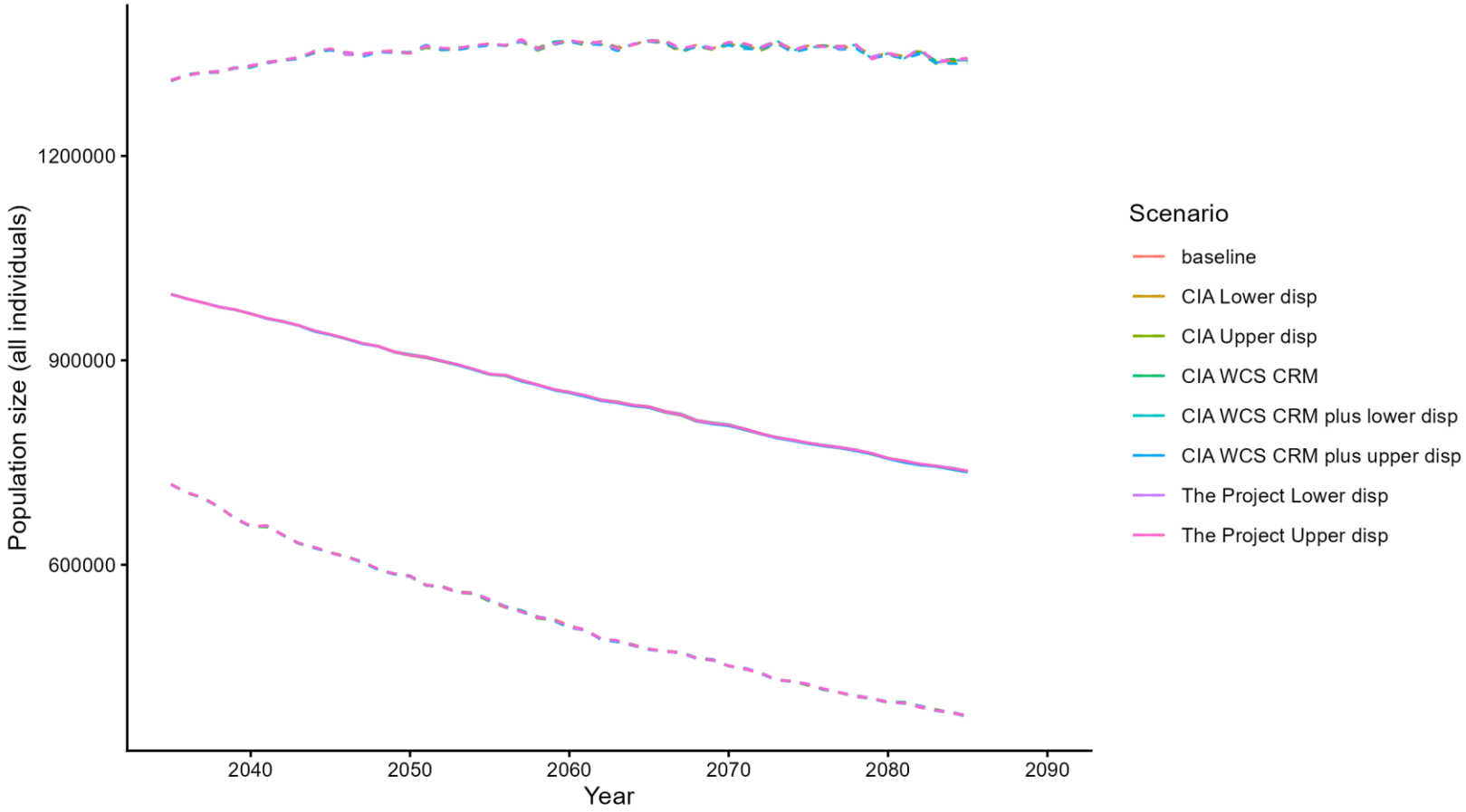


Figure 19: Fulmar - Regional population PVA outputs for Project alone and cumulative offshore windfarms using Local 'Irish Sea' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.1.11 Gannet

Table 45: Gannet - Regional population PVA inputs for Project alone and cumulative offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Gannet Regional Pop CEH National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Northern Gannet	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	8.750464e-06
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	2.574716e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	566327	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.697	Scenario C Impact on adult survival rate per pair mean	2.496895e-05
Productivity rate per pair standard deviation	0.086	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.919	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.042	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.424	Scenario D Impact on adult survival rate	3.371942e-05
Immatures survival rates 0 to 1 standard deviation	0.045	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.829	Scenario E name	The Project WCS CRM plus Upper disp

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 1 to 2 standard deviation	0.026	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.891	Scenario E Impact on adult survival rate	5.071611e-05
Immatures survival rates 2 to 3 standard deviation	0.019	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	CIA Lower disp
Immatures survival rates 3 to 4 standard deviation	0.019	Scenario F Impact on productivity rate per pair mean	0
Immatures survival rates 4 to 5 mean	0.919	Scenario F Impact on adult survival rate	0.0001376362
Immatures survival rates 4 to 5 standard deviation	0.042	Scenario F Impact on immature survival rate mean	0
Units for output	whole.population	Scenario G name	CIA Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0004120768
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	CIA WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0003959147
		Scenario H Impact on immature survival rate mean	0.0005335509
		Scenario I name	CIA WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0005335509
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	CIA WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0008079915
		Scenario J Impact on immature survival rate mean	0

Table 46: Gannet - Regional population PVA outputs for Project alone and cumulative offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	5.0	0.0000088	25	1.0000	1.0000	0.0001	0.9997	1.0003	0.9997	0.9996	0.0043	0.9915	1.0080	50.02	49.88
The Project Upper disp	14.6	0.0000257	25	1.0000	1.0000	0.0001	0.9997	1.0002	0.9993	0.9992	0.0042	0.9911	1.0074	50.00	49.98
The Project WCS CRM	14.1	0.0000250	25	1.0000	1.0000	0.0001	0.9997	1.0002	0.9993	0.9993	0.0043	0.9908	1.0076	49.94	50.10
The Project WCS CRM plus lower disp	19.1	0.0000337	25	1.0000	1.0000	0.0001	0.9997	1.0002	0.9990	0.9991	0.0042	0.9909	1.0072	50.00	50.02
The Project WCS CRM plus Upper disp	28.7	0.0000507	25	0.9999	0.9999	0.0001	0.9997	1.0002	0.9983	0.9984	0.0042	0.9902	1.0065	49.74	50.36
CIA Lower disp	77.9	0.0001376	25	0.9998	0.9998	0.0001	0.9996	1.0001	0.9957	0.9958	0.0043	0.9874	1.0042	49.38	50.78
CIA Upper disp	233.4	0.0004121	25	0.9995	0.9995	0.0001	0.9993	0.9998	0.9874	0.9874	0.0043	0.9790	0.9958	47.90	52.12
CIA WCS CRM	224.2	0.0003959	25	0.9995	0.9995	0.0001	0.9993	0.9998	0.9878	0.9878	0.0042	0.9799	0.9961	47.72	52.22
CIA WCS CRM plus lower disp	302.2	0.0005336	25	0.9994	0.9994	0.0001	0.9991	0.9996	0.9838	0.9837	0.0042	0.9753	0.9919	47.20	52.92
CIA WCS CRM plus upper disp	457.6	0.0008080	25	0.9990	0.9990	0.0001	0.9988	0.9993	0.9755	0.9755	0.0041	0.9675	0.9836	45.74	54.34
The Project Lower disp	5.0	0.0000088	35	1.0000	1.0000	0.0001	0.9998	1.0002	0.9996	0.9995	0.0047	0.9903	1.0086	49.94	50.08
The Project Upper disp	14.6	0.0000257	35	1.0000	1.0000	0.0001	0.9998	1.0002	0.9990	0.9989	0.0047	0.9898	1.0079	49.94	50.12
The Project WCS CRM	14.1	0.0000250	35	1.0000	1.0000	0.0001	0.9998	1.0002	0.9990	0.9990	0.0048	0.9896	1.0085	49.90	50.10
The Project WCS CRM plus lower disp	19.1	0.0000337	35	1.0000	1.0000	0.0001	0.9997	1.0002	0.9987	0.9987	0.0047	0.9894	1.0079	49.76	50.34
The Project WCS CRM plus Upper disp	28.7	0.0000507	35	0.9999	0.9999	0.0001	0.9997	1.0002	0.9977	0.9977	0.0047	0.9886	1.0072	49.74	50.38
CIA Lower disp	77.9	0.0001376	35	0.9998	0.9998	0.0001	0.9996	1.0001	0.9941	0.9941	0.0047	0.9848	1.0035	48.92	51.02
CIA Upper disp	233.4	0.0004121	35	0.9995	0.9995	0.0001	0.9993	0.9997	0.9826	0.9826	0.0047	0.9733	0.9918	47.10	53.36

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
CIA WCS CRM	224.2	0.0003959	35	0.9995	0.9995	0.0001	0.9993	0.9997	0.9832	0.9832	0.0046	0.9743	0.9925	47.14	53.28
CIA WCS CRM plus lower disp	302.2	0.0005336	35	0.9994	0.9994	0.0001	0.9991	0.9996	0.9775	0.9775	0.0046	0.9681	0.9865	46.18	54.06
CIA WCS CRM plus upper disp	457.6	0.0008080	35	0.9990	0.9990	0.0001	0.9988	0.9993	0.9661	0.9661	0.0045	0.9572	0.9750	44.36	56.02
The Project Lower disp	5.0	0.0000088	50	1.0000	1.0000	0.0001	0.9998	1.0002	0.9995	0.9995	0.0053	0.9891	1.0097	49.92	50.04
The Project Upper disp	14.6	0.0000257	50	1.0000	1.0000	0.0001	0.9998	1.0002	0.9990	0.9990	0.0052	0.9886	1.0091	49.84	50.04
The Project WCS CRM	14.1	0.0000250	50	1.0000	1.0000	0.0001	0.9998	1.0002	0.9990	0.9990	0.0053	0.9886	1.0094	49.84	50.14
The Project WCS CRM plus lower disp	19.1	0.0000337	50	1.0000	1.0000	0.0001	0.9998	1.0002	0.9987	0.9987	0.0053	0.9884	1.0092	49.92	50.08
The Project WCS CRM plus Upper disp	28.7	0.0000507	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9978	0.9978	0.0053	0.9877	1.0082	49.70	50.34
CIA Lower disp	77.9	0.0001376	50	0.9999	0.9999	0.0001	0.9997	1.0001	0.9942	0.9941	0.0053	0.9837	1.0044	49.14	51.04
CIA Upper disp	233.4	0.0004121	50	0.9997	0.9997	0.0001	0.9995	0.9998	0.9826	0.9826	0.0052	0.9725	0.9929	47.16	52.50
CIA WCS CRM	224.2	0.0003959	50	0.9997	0.9997	0.0001	0.9995	0.9998	0.9831	0.9832	0.0052	0.9733	0.9934	47.16	52.68
CIA WCS CRM plus lower disp	302.2	0.0005336	50	0.9996	0.9996	0.0001	0.9994	0.9997	0.9776	0.9775	0.0051	0.9672	0.9875	46.30	53.50
CIA WCS CRM plus upper disp	457.6	0.0008080	50	0.9993	0.9993	0.0001	0.9991	0.9995	0.9662	0.9662	0.0051	0.9560	0.9759	44.64	54.84

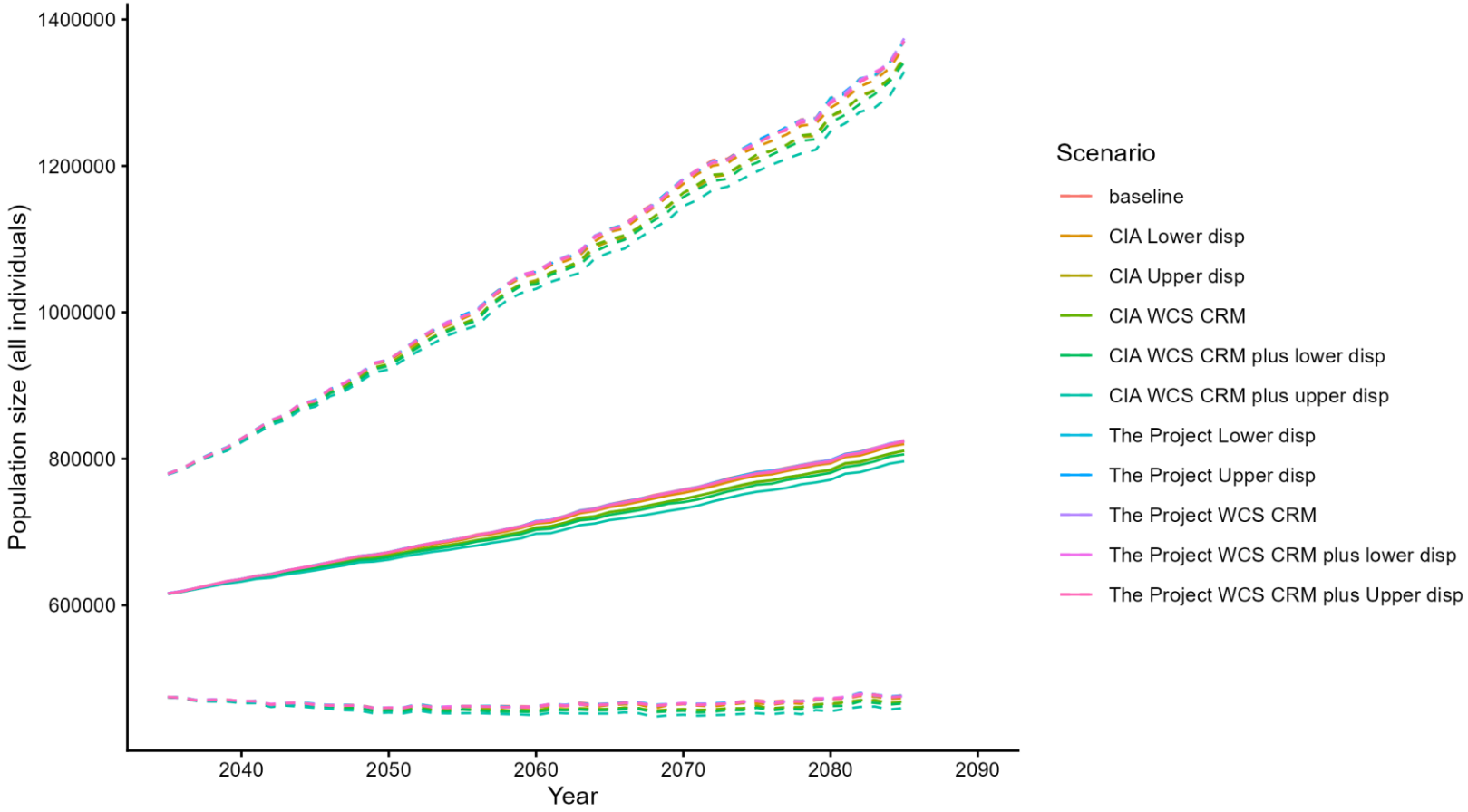


Figure 20: Gannet - Regional population PVA outputs for Project alone and cumulative offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 47: Gannet - Regional population PVA inputs for Project alone and cumulative offshore windfarms. Local 'Irish Sea' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Gannet Regional Pop Irish Sea rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Northern Gannet	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	8.750464e-06
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	all.individuals	Scenario B Impact on adult survival rate	2.574716e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	566327	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.764	Scenario C Impact on adult survival rate per pair mean	2.496895e-05
Productivity rate per pair standard deviation	0.094	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.919	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.042	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.424	Scenario D Impact on adult survival rate	3.371942e-05
Immatures survival rates 0 to 1 standard deviation	0.045	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.829	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.026	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.891	Scenario E Impact on adult survival rate	5.071611e-05
Immatures survival rates 2 to 3 standard deviation	0.019	Scenario E Impact on immature survival rate mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	CIA Lower disp
Immatures survival rates 3 to 4 standard deviation	0.019	Scenario F Impact on productivity rate per pair mean	0
Immatures survival rates 4 to 5 mean	0.919	Scenario F Impact on adult survival rate	0.0001376362
Immatures survival rates 4 to 5 standard deviation	0.042	Scenario F Impact on immature survival rate mean	0
Units for output	whole.population	Scenario G name	CIA Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0004120768
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	CIA WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0003959147
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	CIA WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0005335509
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	CIA WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0008079915
		Scenario J Impact on immature survival rate mean	0

Table 48: Gannet - Regional population PVA outputs for Project alone and cumulative offshore windfarms. Local 'Irish Sea' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	5.0	0.0000088	25	1.0000	1.0000	0.0001	0.9997	1.0002	0.9997	0.9997	0.0041	0.9916	1.0079	50.06	49.94
The Project Upper disp	14.6	0.0000257	25	1.0000	1.0000	0.0001	0.9997	1.0002	0.9993	0.9993	0.0040	0.9913	1.0072	50.02	49.96
The Project WCS CRM	14.1	0.0000250	25	1.0000	1.0000	0.0001	0.9997	1.0002	0.9992	0.9993	0.0040	0.9915	1.0071	50.10	49.92
The Project WCS CRM plus lower disp	19.1	0.0000337	25	1.0000	1.0000	0.0001	0.9997	1.0002	0.9990	0.9990	0.0041	0.9909	1.0071	50.02	49.98
The Project WCS CRM plus Upper disp	28.7	0.0000507	25	0.9999	0.9999	0.0001	0.9997	1.0002	0.9984	0.9984	0.0040	0.9908	1.0065	49.94	50.12
CIA Lower disp	77.9	0.0001376	25	0.9998	0.9998	0.0001	0.9996	1.0001	0.9957	0.9958	0.0040	0.9881	1.0038	49.06	50.60
CIA Upper disp	233.4	0.0004121	25	0.9995	0.9995	0.0001	0.9993	0.9998	0.9874	0.9874	0.0040	0.9794	0.9951	47.66	52.02
CIA WCS CRM	224.2	0.0003959	25	0.9995	0.9995	0.0001	0.9993	0.9998	0.9878	0.9879	0.0041	0.9797	0.9958	47.62	51.96
CIA WCS CRM plus lower disp	302.2	0.0005336	25	0.9994	0.9994	0.0001	0.9991	0.9996	0.9837	0.9837	0.0040	0.9759	0.9914	46.78	52.90
CIA WCS CRM plus upper disp	457.6	0.0008080	25	0.9990	0.9990	0.0001	0.9988	0.9993	0.9754	0.9754	0.0040	0.9675	0.9832	45.68	54.46
The Project Lower disp	5.0	0.0000088	35	1.0000	1.0000	0.0001	0.9998	1.0002	0.9996	0.9996	0.0044	0.9909	1.0084	50.18	49.82
The Project Upper disp	14.6	0.0000257	35	1.0000	1.0000	0.0001	0.9998	1.0002	0.9990	0.9990	0.0044	0.9903	1.0076	50.04	49.96
The Project WCS CRM	14.1	0.0000250	35	1.0000	1.0000	0.0001	0.9998	1.0002	0.9989	0.9990	0.0044	0.9906	1.0076	49.98	50.02
The Project WCS CRM plus lower disp	19.1	0.0000337	35	1.0000	1.0000	0.0001	0.9998	1.0002	0.9986	0.9986	0.0045	0.9898	1.0074	49.74	50.12
The Project WCS CRM plus Upper disp	28.7	0.0000507	35	0.9999	0.9999	0.0001	0.9997	1.0001	0.9977	0.9978	0.0043	0.9893	1.0065	49.74	50.24
CIA Lower disp	77.9	0.0001376	35	0.9998	0.9998	0.0001	0.9996	1.0000	0.9941	0.9941	0.0044	0.9858	1.0029	48.94	50.98

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
CIA Upper disp	233.4	0.0004121	35	0.9995	0.9995	0.0001	0.9993	0.9997	0.9826	0.9826	0.0043	0.9739	0.9909	47.06	52.98
CIA WCS CRM	224.2	0.0003959	35	0.9995	0.9995	0.0001	0.9993	0.9997	0.9833	0.9833	0.0044	0.9747	0.9920	46.98	52.80
CIA WCS CRM plus lower disp	302.2	0.0005336	35	0.9994	0.9994	0.0001	0.9992	0.9996	0.9775	0.9775	0.0043	0.9689	0.9858	46.16	53.86
CIA WCS CRM plus upper disp	457.6	0.0008080	35	0.9990	0.9990	0.0001	0.9988	0.9992	0.9662	0.9661	0.0043	0.9576	0.9745	44.26	55.96
The Project Lower disp	5.0	0.0000088	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9997	0.9996	0.0048	0.9899	1.0090	50.00	50.02
The Project Upper disp	14.6	0.0000257	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9988	0.9990	0.0048	0.9898	1.0085	49.86	50.06
The Project WCS CRM	14.1	0.0000250	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9990	0.9990	0.0048	0.9895	1.0088	49.68	50.18
The Project WCS CRM plus lower disp	19.1	0.0000337	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9986	0.9986	0.0050	0.9889	1.0087	49.58	50.30
The Project WCS CRM plus Upper disp	28.7	0.0000507	50	1.0000	1.0000	0.0001	0.9998	1.0001	0.9977	0.9978	0.0048	0.9884	1.0072	49.60	50.42
CIA Lower disp	77.9	0.0001376	50	0.9999	0.9999	0.0001	0.9997	1.0000	0.9941	0.9941	0.0049	0.9847	1.0036	49.16	50.96
CIA Upper disp	233.4	0.0004121	50	0.9997	0.9997	0.0001	0.9995	0.9998	0.9826	0.9826	0.0048	0.9731	0.9918	47.22	52.72
CIA WCS CRM	224.2	0.0003959	50	0.9997	0.9997	0.0001	0.9995	0.9998	0.9833	0.9833	0.0048	0.9739	0.9927	47.26	52.80
CIA WCS CRM plus lower disp	302.2	0.0005336	50	0.9996	0.9996	0.0001	0.9994	0.9997	0.9775	0.9775	0.0048	0.9680	0.9867	46.24	53.54
CIA WCS CRM plus upper disp	457.6	0.0008080	50	0.9993	0.9993	0.0001	0.9992	0.9995	0.9662	0.9661	0.0048	0.9566	0.9753	44.60	54.94

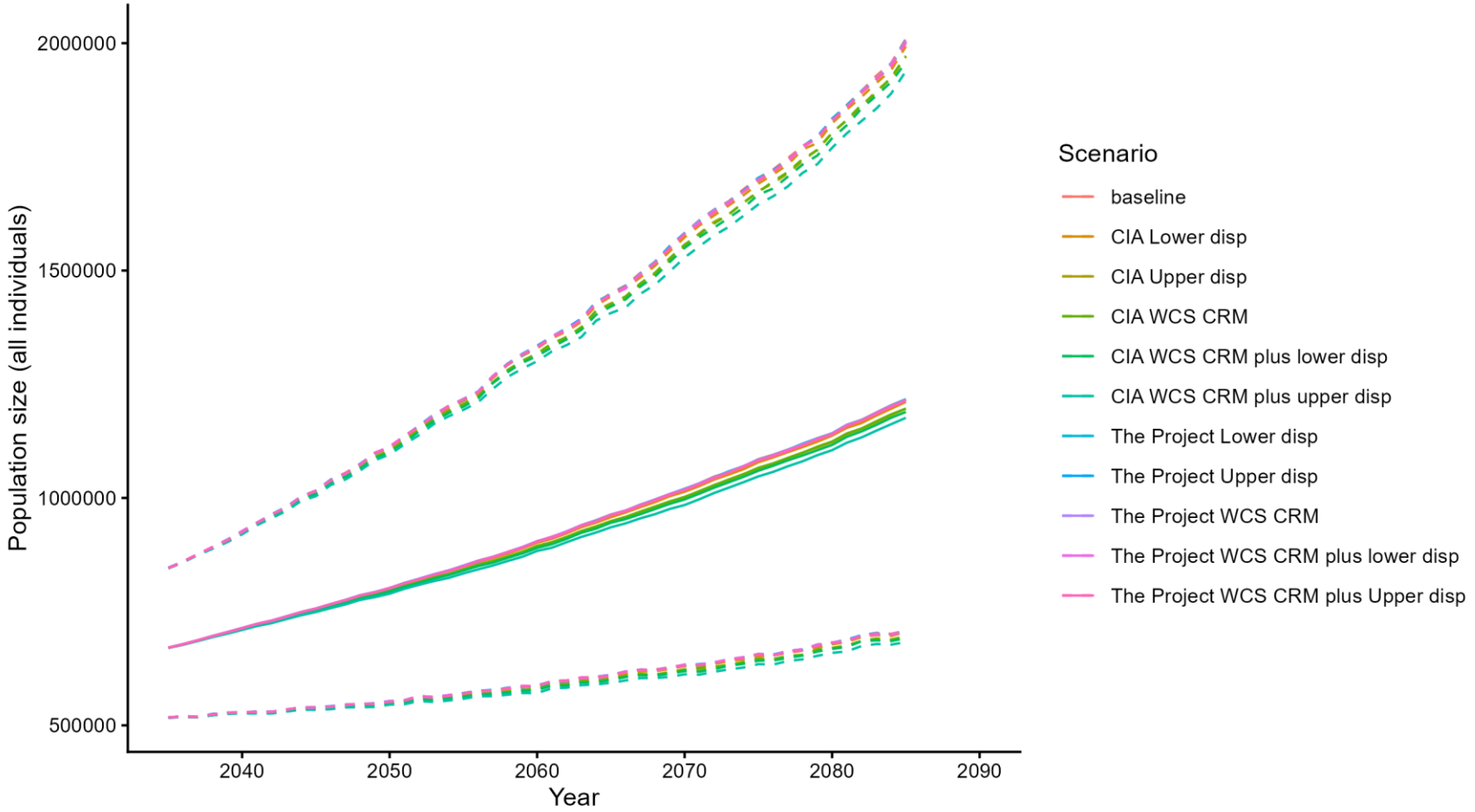


Figure 21: Gannet - Regional population PVA outputs for Project alone and cumulative offshore windfarms using Local 'Irish Sea' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence interval.

5.2 PVAs run for SPA populations – Project alone and in-combination offshore windfarms

5.2.1 Kittiwake: Ailsa Craig SPA

Table 49: Kittiwake – Ailsa Craig SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Ailsa Craig SPA	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	3.533624e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0001055869
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	824	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.69	Scenario C Impact on adult survival rate per pair mean	0.0002184969
Productivity rate per pair standard deviation	0.296	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0002538332
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0003240838
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	4.854369e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0001456311
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.00282767
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.002876214
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.002973301
		Scenario J Impact on immature survival rate mean	0

Table 50: Kittiwake – Ailsa Craig SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.0	0.0000353	25	0.9999	0.9999	0.0029	0.9941	1.0057	0.9965	1.0023	0.0968	0.8299	1.2040	49.58	50.58
The Project Upper disp	0.1	0.0001056	25	0.9998	0.9998	0.0030	0.9939	1.0058	0.9935	0.9983	0.0966	0.8208	1.2074	49.60	50.34
The Project WCS CRM	0.2	0.0002185	25	0.9997	0.9997	0.0029	0.9939	1.0054	0.9914	0.9969	0.0971	0.8202	1.2034	49.62	50.38
The Project WCS CRM plus lower disp	0.2	0.0002538	25	0.9997	0.9996	0.0029	0.9937	1.0054	0.9895	0.9947	0.0967	0.8149	1.2038	48.96	51.22
The Project WCS CRM plus Upper disp	0.3	0.0003241	25	0.9996	0.9996	0.0029	0.9939	1.0054	0.9894	0.9941	0.0970	0.8192	1.1971	48.96	51.12
In-comb Lower disp	0.0	0.0000485	25	0.9999	0.9999	0.0030	0.9941	1.0057	0.9962	1.0012	0.0958	0.8307	1.2031	49.76	50.36
In-comb Upper disp	0.1	0.0001456	25	0.9998	0.9998	0.0029	0.9940	1.0057	0.9930	0.9974	0.0957	0.8251	1.2036	49.56	50.76
In-comb WCS CRM	2.3	0.0028277	25	0.9966	0.9966	0.0029	0.9907	1.0023	0.9136	0.9185	0.0891	0.7592	1.1055	42.44	57.08
In-comb WCS CRM plus lower disp	2.4	0.0028762	25	0.9966	0.9966	0.0029	0.9908	1.0024	0.9139	0.9186	0.0884	0.7586	1.1078	42.68	57.16
In-comb WCS CRM plus upper disp	2.5	0.0029733	25	0.9964	0.9964	0.0029	0.9903	1.0022	0.9105	0.9146	0.0883	0.7537	1.1021	42.24	57.48
The Project Lower disp	0.0	0.0000353	35	0.9999	1.0000	0.0024	0.9953	1.0048	0.9950	1.0031	0.1057	0.8174	1.2343	49.46	50.56
The Project Upper disp	0.1	0.0001056	35	0.9998	0.9998	0.0025	0.9950	1.0049	0.9900	0.9973	0.1054	0.8066	1.2192	48.80	50.78
The Project WCS CRM	0.2	0.0002185	35	0.9997	0.9998	0.0024	0.9948	1.0046	0.9913	0.9964	0.1063	0.8026	1.2228	48.92	50.90
The Project WCS CRM plus lower disp	0.2	0.0002538	35	0.9996	0.9997	0.0024	0.9948	1.0046	0.9869	0.9927	0.1056	0.8039	1.2205	48.14	51.26
The Project WCS CRM plus Upper disp	0.3	0.0003241	35	0.9996	0.9996	0.0024	0.9949	1.0046	0.9843	0.9911	0.1056	0.7979	1.2184	47.78	51.72
In-comb Lower disp	0.0	0.0000485	35	0.9999	0.9999	0.0024	0.9950	1.0048	0.9965	1.0019	0.1050	0.8133	1.2253	49.24	50.56

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb Upper disp	0.1	0.0001456	35	0.9998	0.9998	0.0024	0.9951	1.0047	0.9914	0.9974	0.1049	0.8040	1.2209	48.78	51.06
In-comb WCS CRM	2.3	0.0028277	35	0.9967	0.9966	0.0024	0.9917	1.0015	0.8844	0.8894	0.0937	0.7204	1.0892	41.00	59.58
In-comb WCS CRM plus lower disp	2.4	0.0028762	35	0.9965	0.9966	0.0024	0.9918	1.0013	0.8824	0.8881	0.0931	0.7219	1.0838	40.80	59.48
In-comb WCS CRM plus upper disp	2.5	0.0029733	35	0.9964	0.9964	0.0024	0.9915	1.0012	0.8786	0.8834	0.0936	0.7129	1.0820	40.18	60.02
The Project Lower disp	0.0	0.0000353	50	0.9999	1.0000	0.0020	0.9962	1.0039	0.9977	1.0042	0.1182	0.7981	1.2671	49.86	50.12
The Project Upper disp	0.1	0.0001056	50	0.9999	0.9999	0.0020	0.9960	1.0039	0.9927	0.9994	0.1162	0.7916	1.2515	49.72	50.24
The Project WCS CRM	0.2	0.0002185	50	0.9998	0.9998	0.0020	0.9960	1.0038	0.9926	0.9983	0.1176	0.7891	1.2462	49.54	50.68
The Project WCS CRM plus lower disp	0.2	0.0002538	50	0.9997	0.9998	0.0020	0.9958	1.0037	0.9876	0.9940	0.1167	0.7861	1.2412	48.82	50.80
The Project WCS CRM plus Upper disp	0.3	0.0003241	50	0.9997	0.9997	0.0020	0.9959	1.0037	0.9835	0.9930	0.1174	0.7854	1.2459	48.68	51.18
In-comb Lower disp	0.0	0.0000485	50	0.9999	1.0000	0.0020	0.9961	1.0039	0.9950	1.0034	0.1167	0.7944	1.2605	50.12	49.96
In-comb Upper disp	0.1	0.0001456	50	0.9999	0.9999	0.0020	0.9960	1.0038	0.9910	0.9998	0.1162	0.7896	1.2514	49.90	50.08
In-comb WCS CRM	2.3	0.0028277	50	0.9976	0.9976	0.0020	0.9937	1.0015	0.8854	0.8907	0.1040	0.7030	1.1179	42.48	57.58
In-comb WCS CRM plus lower disp	2.4	0.0028762	50	0.9976	0.9976	0.0020	0.9936	1.0015	0.8826	0.8902	0.1045	0.7072	1.1170	42.34	57.52
In-comb WCS CRM plus upper disp	2.5	0.0029733	50	0.9975	0.9975	0.0020	0.9935	1.0014	0.8781	0.8848	0.1042	0.6964	1.1057	41.88	57.50

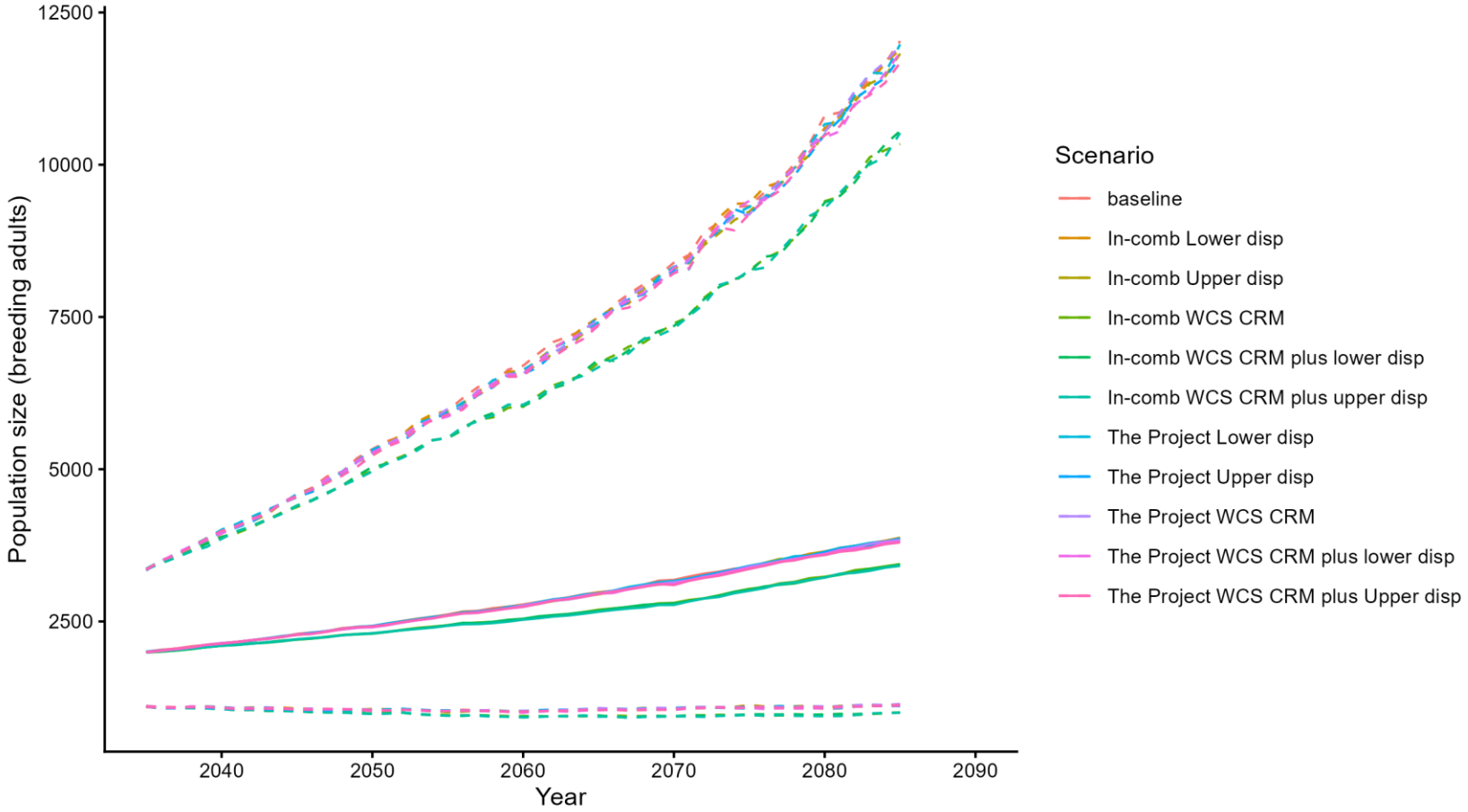


Figure 22: Kittiwake – Ailsa Craig population PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH National' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 51: Kittiwake – Ailsa Craig SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'site specific' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Ailsa Craig SPA site-specific rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	3.533624e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0001055869
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	824	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.496	Scenario C Impact on adult survival rate per pair mean	0.0002184969
Productivity rate per pair standard deviation	0.295	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0002538332
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0003240838
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	4.854369e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0001456311
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.00282767
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.002876214
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.002973301
		Scenario J Impact on immature survival rate mean	0

Table 52: Kittiwake – Ailsa Craig SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'site specific' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.0	0.0000353	25	1.0001	1.0001	0.0048	0.9907	1.0098	1.0034	1.0131	0.1443	0.7541	1.3310	50.16	49.90
The Project Upper disp	0.1	0.0001056	25	0.9999	1.0000	0.0049	0.9901	1.0097	0.9966	1.0091	0.1466	0.7505	1.3295	49.72	50.30
The Project WCS CRM	0.2	0.0002185	25	0.9998	0.9998	0.0049	0.9902	1.0099	0.9916	1.0028	0.1439	0.7513	1.3188	49.18	50.76
The Project WCS CRM plus lower disp	0.2	0.0002538	25	0.9997	0.9997	0.0048	0.9904	1.0096	0.9890	1.0021	0.1428	0.7555	1.3249	49.32	50.66
The Project WCS CRM plus Upper disp	0.3	0.0003241	25	0.9998	0.9997	0.0049	0.9901	1.0094	0.9920	1.0002	0.1431	0.7469	1.3083	49.72	50.46
In-comb Lower disp	0.0	0.0000485	25	1.0001	1.0001	0.0048	0.9905	1.0099	1.0009	1.0111	0.1444	0.7447	1.3214	50.54	49.58
In-comb Upper disp	0.1	0.0001456	25	0.9999	0.9999	0.0049	0.9900	1.0095	0.9980	1.0078	0.1466	0.7530	1.3254	49.50	50.70
In-comb WCS CRM	2.3	0.0028277	25	0.9968	0.9967	0.0048	0.9870	1.0063	0.9179	0.9269	0.1328	0.6928	1.2222	43.66	56.14
In-comb WCS CRM plus lower disp	2.4	0.0028762	25	0.9967	0.9967	0.0049	0.9867	1.0065	0.9179	0.9268	0.1373	0.6835	1.2283	43.66	56.20
In-comb WCS CRM plus upper disp	2.5	0.0029733	25	0.9964	0.9964	0.0050	0.9864	1.0062	0.9106	0.9198	0.1333	0.6852	1.2072	42.98	56.60
The Project Lower disp	0.0	0.0000353	35	1.0001	1.0001	0.0043	0.9916	1.0089	1.0033	1.0181	0.1757	0.7129	1.4194	50.42	49.50
The Project Upper disp	0.1	0.0001056	35	0.9999	1.0000	0.0044	0.9914	1.0092	0.9988	1.0162	0.1804	0.7110	1.4132	50.80	49.10
The Project WCS CRM	0.2	0.0002185	35	0.9997	0.9997	0.0045	0.9909	1.0089	0.9894	1.0044	0.1751	0.7057	1.3941	50.06	50.08
The Project WCS CRM plus lower disp	0.2	0.0002538	35	0.9997	0.9997	0.0044	0.9909	1.0085	0.9908	1.0045	0.1745	0.7032	1.3883	49.76	50.48
The Project WCS CRM plus Upper disp	0.3	0.0003241	35	0.9997	0.9997	0.0044	0.9911	1.0086	0.9862	1.0020	0.1751	0.7045	1.3887	49.44	50.68
In-comb Lower disp	0.0	0.0000485	35	1.0000	1.0001	0.0045	0.9912	1.0091	1.0043	1.0176	0.1768	0.7114	1.4134	50.80	49.08

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb Upper disp	0.1	0.0001456	35	1.0000	0.9999	0.0044	0.9909	1.0088	1.0000	1.0127	0.1775	0.7066	1.4059	50.24	49.90
In-comb WCS CRM	2.3	0.0028277	35	0.9967	0.9967	0.0045	0.9879	1.0059	0.8885	0.9026	0.1629	0.6295	1.2632	42.90	56.94
In-comb WCS CRM plus lower disp	2.4	0.0028762	35	0.9966	0.9966	0.0046	0.9874	1.0055	0.8851	0.8993	0.1636	0.6137	1.2598	42.42	56.88
In-comb WCS CRM plus upper disp	2.5	0.0029733	35	0.9965	0.9965	0.0046	0.9874	1.0058	0.8813	0.8932	0.1601	0.6186	1.2462	41.86	58.26
The Project Lower disp	0.0	0.0000353	50	1.0000	1.0000	0.0042	0.9915	1.0084	0.9960	1.0261	0.2346	0.6358	1.5662	50.12	50.16
The Project Upper disp	0.1	0.0001056	50	1.0000	1.0000	0.0043	0.9917	1.0088	0.9990	1.0282	0.2546	0.6412	1.5763	49.76	50.44
The Project WCS CRM	0.2	0.0002185	50	0.9999	0.9998	0.0043	0.9909	1.0082	0.9895	1.0165	0.2400	0.6209	1.5422	49.50	50.90
The Project WCS CRM plus lower disp	0.2	0.0002538	50	0.9998	0.9998	0.0043	0.9913	1.0084	0.9897	1.0158	0.2446	0.6277	1.5514	49.76	50.52
The Project WCS CRM plus Upper disp	0.3	0.0003241	50	0.9999	0.9998	0.0043	0.9913	1.0083	0.9916	1.0150	0.2415	0.6272	1.5534	49.96	50.32
In-comb Lower disp	0.0	0.0000485	50	1.0001	1.0001	0.0043	0.9912	1.0086	1.0038	1.0297	0.2560	0.6232	1.5844	50.12	50.06
In-comb Upper disp	0.1	0.0001456	50	1.0001	1.0000	0.0043	0.9913	1.0081	1.0000	1.0247	0.2424	0.6263	1.5299	49.86	50.30
In-comb WCS CRM	2.3	0.0028277	50	0.9977	0.9976	0.0043	0.9888	1.0062	0.8900	0.9096	0.2172	0.5551	1.3991	42.84	56.42
In-comb WCS CRM plus lower disp	2.4	0.0028762	50	0.9976	0.9976	0.0044	0.9887	1.0061	0.8832	0.9069	0.2259	0.5480	1.3888	43.14	56.40
In-comb WCS CRM plus upper disp	2.5	0.0029733	50	0.9975	0.9974	0.0044	0.9883	1.0063	0.8803	0.9007	0.2190	0.5431	1.4064	42.56	57.04

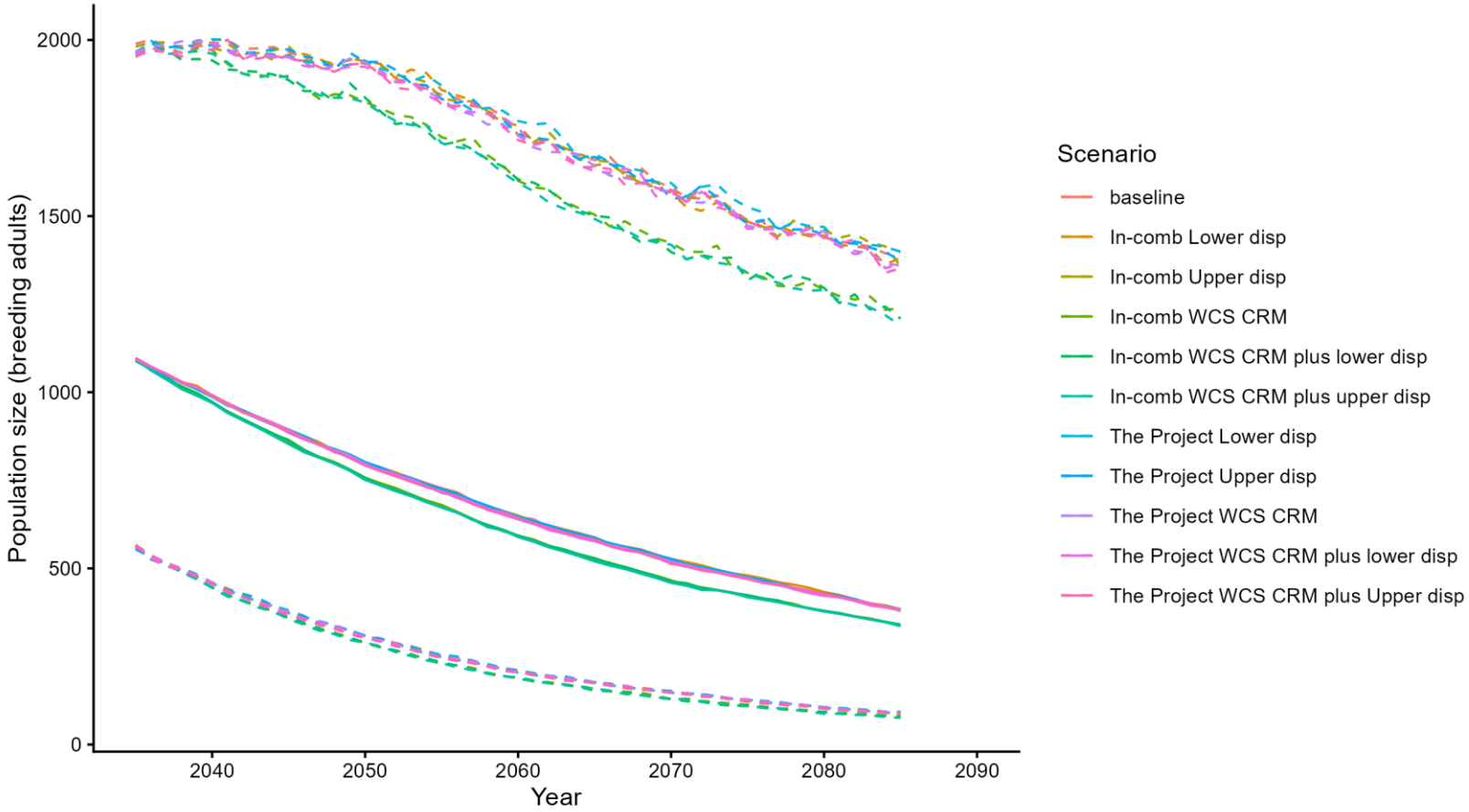


Figure 23: Kittiwake – Ailsa Craig SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'site specific' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.2.2 Kittiwake: Canna and Sanday SPA

Table 53: Kittiwake – Canna and Sanday SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Canna and Sanday SPA CEH National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	2.110735e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	6.30008e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	2956	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.69	Scenario C Impact on adult survival rate per pair mean	0.0001625575
Productivity rate per pair standard deviation	0.296	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0001836648
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0002255583
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	2.368065e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	6.7659e-05
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0001657645
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0001894452
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0002334235
		Scenario J Impact on immature survival rate mean	0

Table 54: Kittiwake – Canna and Sanday SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.1	0.0000211	25	0.9999	1.0000	0.0015	0.9970	1.0030	0.9986	1.0006	0.0502	0.9054	1.1040	49.82	50.16
The Project Upper disp	0.2	0.0000630	25	0.9999	0.9999	0.0015	0.9970	1.0029	0.9979	0.9993	0.0502	0.9060	1.1019	49.66	50.24
The Project WCS CRM	0.5	0.0001626	25	0.9998	0.9998	0.0015	0.9969	1.0028	0.9936	0.9963	0.0500	0.9022	1.0997	49.60	50.24
The Project WCS CRM plus lower disp	0.5	0.0001837	25	0.9998	0.9998	0.0015	0.9968	1.0028	0.9950	0.9960	0.0499	0.8997	1.0985	49.32	50.68
The Project WCS CRM plus Upper disp	0.7	0.0002256	25	0.9997	0.9997	0.0015	0.9967	1.0027	0.9926	0.9940	0.0494	0.8968	1.0934	49.18	50.78
In-comb Lower disp	0.1	0.0000237	25	1.0000	1.0000	0.0015	0.9970	1.0030	0.9995	1.0001	0.0493	0.9057	1.0996	50.18	49.78
In-comb Upper disp	0.2	0.0000677	25	0.9999	0.9999	0.0015	0.9969	1.0030	0.9975	0.9996	0.0501	0.9026	1.1018	50.14	49.90
In-comb WCS CRM	0.5	0.0001658	25	0.9998	0.9998	0.0015	0.9969	1.0028	0.9948	0.9966	0.0492	0.9037	1.0991	49.48	50.32
In-comb WCS CRM plus lower disp	0.6	0.0001894	25	0.9998	0.9998	0.0015	0.9968	1.0027	0.9940	0.9951	0.0494	0.9020	1.0991	49.44	50.40
In-comb WCS CRM plus upper disp	0.7	0.0002334	25	0.9997	0.9997	0.0015	0.9966	1.0028	0.9923	0.9938	0.0497	0.8978	1.0944	48.96	50.74
The Project Lower disp	0.1	0.0000211	35	1.0000	1.0000	0.0013	0.9975	1.0025	0.9992	1.0002	0.0547	0.8964	1.1158	50.06	49.96
The Project Upper disp	0.2	0.0000630	35	0.9999	0.9999	0.0013	0.9975	1.0024	0.9964	0.9983	0.0549	0.8956	1.1122	50.02	49.98
The Project WCS CRM	0.5	0.0001626	35	0.9998	0.9998	0.0012	0.9974	1.0023	0.9907	0.9940	0.0550	0.8916	1.1110	49.34	50.56
The Project WCS CRM plus lower disp	0.5	0.0001837	35	0.9998	0.9998	0.0013	0.9972	1.0023	0.9919	0.9934	0.0544	0.8890	1.1071	49.66	50.52
The Project WCS CRM plus Upper disp	0.7	0.0002256	35	0.9997	0.9997	0.0013	0.9972	1.0022	0.9897	0.9911	0.0540	0.8868	1.1003	49.16	50.74
In-comb Lower disp	0.1	0.0000237	35	1.0000	1.0000	0.0012	0.9976	1.0024	0.9994	0.9995	0.0536	0.8979	1.1098	50.30	49.72

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb Upper disp	0.2	0.0000677	35	0.9999	0.9999	0.0012	0.9975	1.0023	0.9968	0.9984	0.0546	0.8939	1.1105	49.70	50.44
In-comb WCS CRM	0.5	0.0001658	35	0.9998	0.9998	0.0012	0.9974	1.0023	0.9924	0.9947	0.0537	0.8961	1.1078	49.66	50.42
In-comb WCS CRM plus lower disp	0.6	0.0001894	35	0.9998	0.9998	0.0012	0.9973	1.0021	0.9899	0.9924	0.0534	0.8932	1.1014	49.68	50.28
In-comb WCS CRM plus upper disp	0.7	0.0002334	35	0.9997	0.9997	0.0013	0.9972	1.0022	0.9886	0.9909	0.0543	0.8872	1.1032	49.36	50.76
The Project Lower disp	0.1	0.0000211	50	1.0000	1.0000	0.0010	0.9980	1.0021	0.9991	1.0011	0.0602	0.8886	1.1246	49.78	50.28
The Project Upper disp	0.2	0.0000630	50	0.9999	0.9999	0.0010	0.9979	1.0020	0.9964	0.9990	0.0612	0.8889	1.1266	49.74	50.56
The Project WCS CRM	0.5	0.0001626	50	0.9999	0.9999	0.0010	0.9979	1.0019	0.9909	0.9943	0.0604	0.8844	1.1277	49.34	50.62
The Project WCS CRM plus lower disp	0.5	0.0001837	50	0.9998	0.9998	0.0010	0.9978	1.0019	0.9921	0.9937	0.0600	0.8795	1.1181	49.58	50.58
The Project WCS CRM plus Upper disp	0.7	0.0002256	50	0.9998	0.9998	0.0010	0.9978	1.0018	0.9904	0.9918	0.0601	0.8790	1.1141	49.30	50.68
In-comb Lower disp	0.1	0.0000237	50	1.0000	1.0000	0.0010	0.9979	1.0020	0.9988	1.0002	0.0603	0.8866	1.1265	49.88	50.28
In-comb Upper disp	0.2	0.0000677	50	0.9999	0.9999	0.0010	0.9979	1.0020	0.9974	0.9987	0.0606	0.8852	1.1291	49.66	50.46
In-comb WCS CRM	0.5	0.0001658	50	0.9999	0.9999	0.0010	0.9978	1.0019	0.9933	0.9954	0.0601	0.8819	1.1194	49.66	50.52
In-comb WCS CRM plus lower disp	0.6	0.0001894	50	0.9998	0.9998	0.0010	0.9978	1.0018	0.9913	0.9930	0.0597	0.8826	1.1165	49.48	50.66
In-comb WCS CRM plus upper disp	0.7	0.0002334	50	0.9998	0.9998	0.0010	0.9977	1.0018	0.9887	0.9912	0.0603	0.8774	1.1134	49.02	50.80

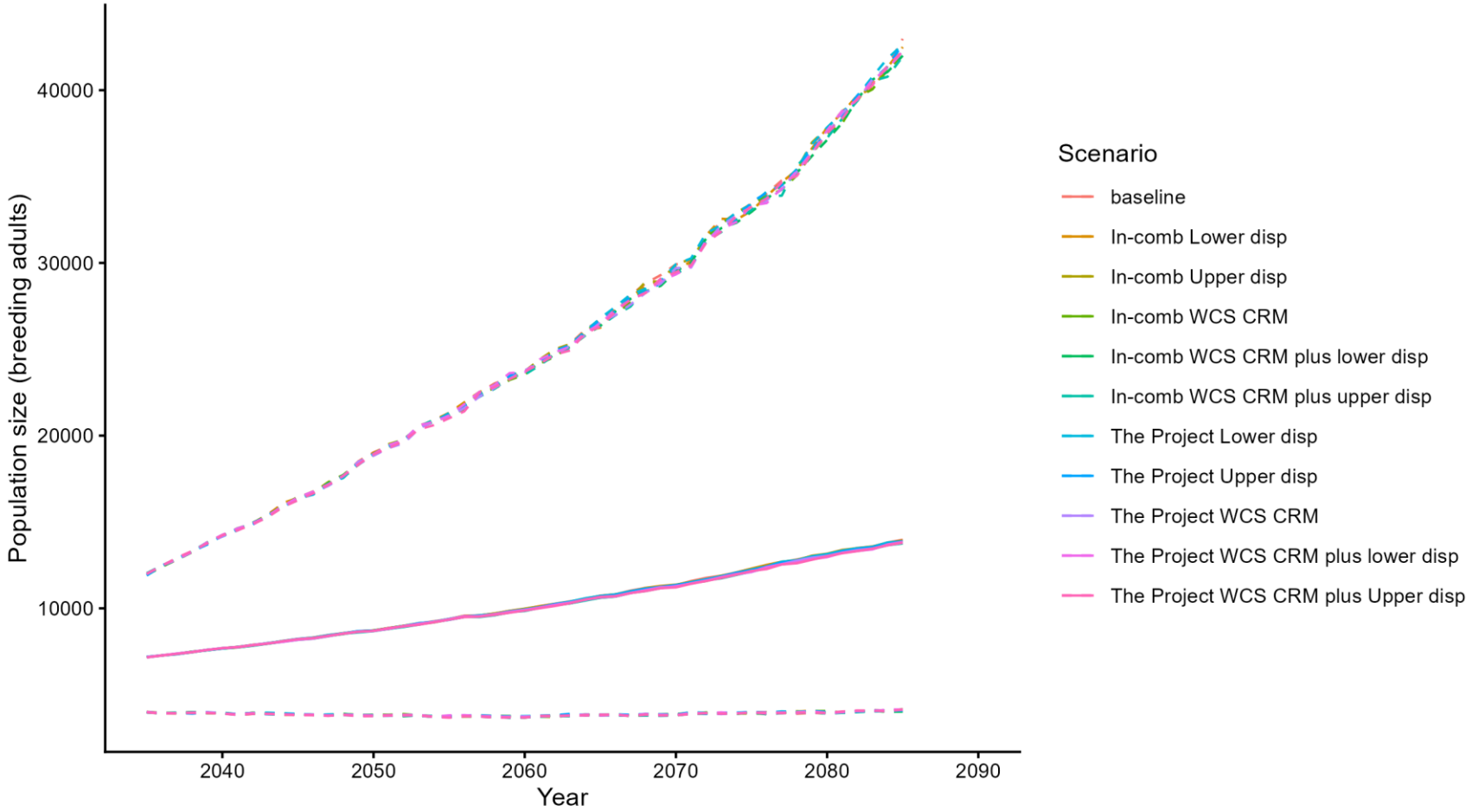


Figure 24: Kittiwake – Canna and Sanday population PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH National' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 55: Kittiwake – Canna and Sanday SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'site specific' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Canna and Sanday SPA site-specific rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	2.110735e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	6.30008e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	2956	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.6625	Scenario C Impact on adult survival rate per pair mean	0.0001625575
Productivity rate per pair standard deviation	0.296	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0001836648
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0002255583
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	2.368065e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	6.7659e-05
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0001657645
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0001894452
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0002334235
		Scenario J Impact on immature survival rate mean	0

Table 56: Kittiwake – Canna and Sanday SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'site specific' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.1	0.0000211	25	1.0000	1.0000	0.0016	0.9967	1.0032	0.9991	1.0004	0.0525	0.9004	1.1093	49.94	50.06
The Project Upper disp	0.2	0.0000630	25	1.0000	0.9999	0.0016	0.9967	1.0031	0.9990	0.9988	0.0518	0.9012	1.1053	49.90	50.22
The Project WCS CRM	0.5	0.0001626	25	0.9998	0.9998	0.0016	0.9966	1.0032	0.9943	0.9961	0.0520	0.8955	1.1063	49.44	50.62
The Project WCS CRM plus lower disp	0.5	0.0001837	25	0.9998	0.9998	0.0016	0.9966	1.0029	0.9944	0.9957	0.0519	0.8965	1.1001	49.52	50.46
The Project WCS CRM plus Upper disp	0.7	0.0002256	25	0.9997	0.9997	0.0016	0.9965	1.0030	0.9925	0.9938	0.0526	0.8950	1.1025	49.42	50.62
In-comb Lower disp	0.1	0.0000237	25	1.0000	1.0000	0.0016	0.9968	1.0031	0.9996	1.0002	0.0522	0.9003	1.1048	49.54	50.54
In-comb Upper disp	0.2	0.0000677	25	1.0000	1.0000	0.0016	0.9968	1.0031	0.9983	0.9996	0.0526	0.9006	1.1095	49.68	50.40
In-comb WCS CRM	0.5	0.0001658	25	0.9998	0.9998	0.0016	0.9967	1.0030	0.9946	0.9959	0.0523	0.8952	1.1018	49.24	50.64
In-comb WCS CRM plus lower disp	0.6	0.0001894	25	0.9998	0.9998	0.0016	0.9965	1.0030	0.9950	0.9957	0.0526	0.8947	1.1032	49.20	50.80
In-comb WCS CRM plus upper disp	0.7	0.0002334	25	0.9997	0.9997	0.0016	0.9965	1.0030	0.9929	0.9938	0.0521	0.8923	1.0971	49.16	50.62
The Project Lower disp	0.1	0.0000211	35	1.0000	1.0000	0.0014	0.9973	1.0027	0.9995	1.0001	0.0580	0.8917	1.1196	49.36	50.46
The Project Upper disp	0.2	0.0000630	35	0.9999	0.9999	0.0014	0.9972	1.0026	0.9975	0.9981	0.0572	0.8887	1.1135	49.22	50.82
The Project WCS CRM	0.5	0.0001626	35	0.9998	0.9998	0.0014	0.9971	1.0025	0.9923	0.9941	0.0576	0.8865	1.1133	49.10	50.88
The Project WCS CRM plus lower disp	0.5	0.0001837	35	0.9998	0.9998	0.0013	0.9971	1.0024	0.9923	0.9935	0.0570	0.8857	1.1114	49.30	50.70
The Project WCS CRM plus Upper disp	0.7	0.0002256	35	0.9997	0.9997	0.0014	0.9970	1.0025	0.9898	0.9909	0.0582	0.8803	1.1135	48.90	51.10
In-comb Lower disp	0.1	0.0000237	35	1.0000	1.0000	0.0014	0.9973	1.0026	1.0001	1.0004	0.0576	0.8879	1.1178	49.54	50.36

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb Upper disp	0.2	0.0000677	35	0.9999	0.9999	0.0013	0.9972	1.0026	0.9957	0.9987	0.0579	0.8904	1.1215	49.66	50.24
In-comb WCS CRM	0.5	0.0001658	35	0.9998	0.9998	0.0014	0.9971	1.0025	0.9927	0.9943	0.0576	0.8833	1.1098	49.30	50.68
In-comb WCS CRM plus lower disp	0.6	0.0001894	35	0.9998	0.9998	0.0014	0.9970	1.0025	0.9916	0.9934	0.0580	0.8832	1.1135	49.26	50.62
In-comb WCS CRM plus upper disp	0.7	0.0002334	35	0.9997	0.9997	0.0014	0.9970	1.0023	0.9907	0.9910	0.0566	0.8810	1.1038	48.88	50.90
The Project Lower disp	0.1	0.0000211	50	1.0000	1.0000	0.0011	0.9978	1.0021	0.9985	1.0003	0.0647	0.8821	1.1329	50.06	49.96
The Project Upper disp	0.2	0.0000630	50	1.0000	0.9999	0.0011	0.9977	1.0021	0.9975	0.9986	0.0638	0.8773	1.1282	49.80	50.22
The Project WCS CRM	0.5	0.0001626	50	0.9999	0.9999	0.0011	0.9977	1.0021	0.9931	0.9950	0.0643	0.8748	1.1283	49.48	50.62
The Project WCS CRM plus lower disp	0.5	0.0001837	50	0.9999	0.9998	0.0011	0.9976	1.0020	0.9923	0.9941	0.0638	0.8725	1.1235	49.20	50.58
The Project WCS CRM plus Upper disp	0.7	0.0002256	50	0.9998	0.9998	0.0011	0.9975	1.0021	0.9901	0.9917	0.0652	0.8681	1.1268	49.48	50.44
In-comb Lower disp	0.1	0.0000237	50	1.0000	1.0000	0.0011	0.9977	1.0022	1.0013	1.0012	0.0645	0.8750	1.1300	50.02	49.96
In-comb Upper disp	0.2	0.0000677	50	1.0000	0.9999	0.0011	0.9978	1.0021	0.9965	0.9988	0.0648	0.8758	1.1347	49.88	50.14
In-comb WCS CRM	0.5	0.0001658	50	0.9999	0.9999	0.0011	0.9976	1.0021	0.9933	0.9949	0.0640	0.8723	1.1249	49.66	50.40
In-comb WCS CRM plus lower disp	0.6	0.0001894	50	0.9998	0.9998	0.0011	0.9975	1.0021	0.9919	0.9936	0.0644	0.8708	1.1253	49.46	50.42
In-comb WCS CRM plus upper disp	0.7	0.0002334	50	0.9998	0.9998	0.0011	0.9975	1.0019	0.9898	0.9915	0.0639	0.8672	1.1208	49.60	50.56

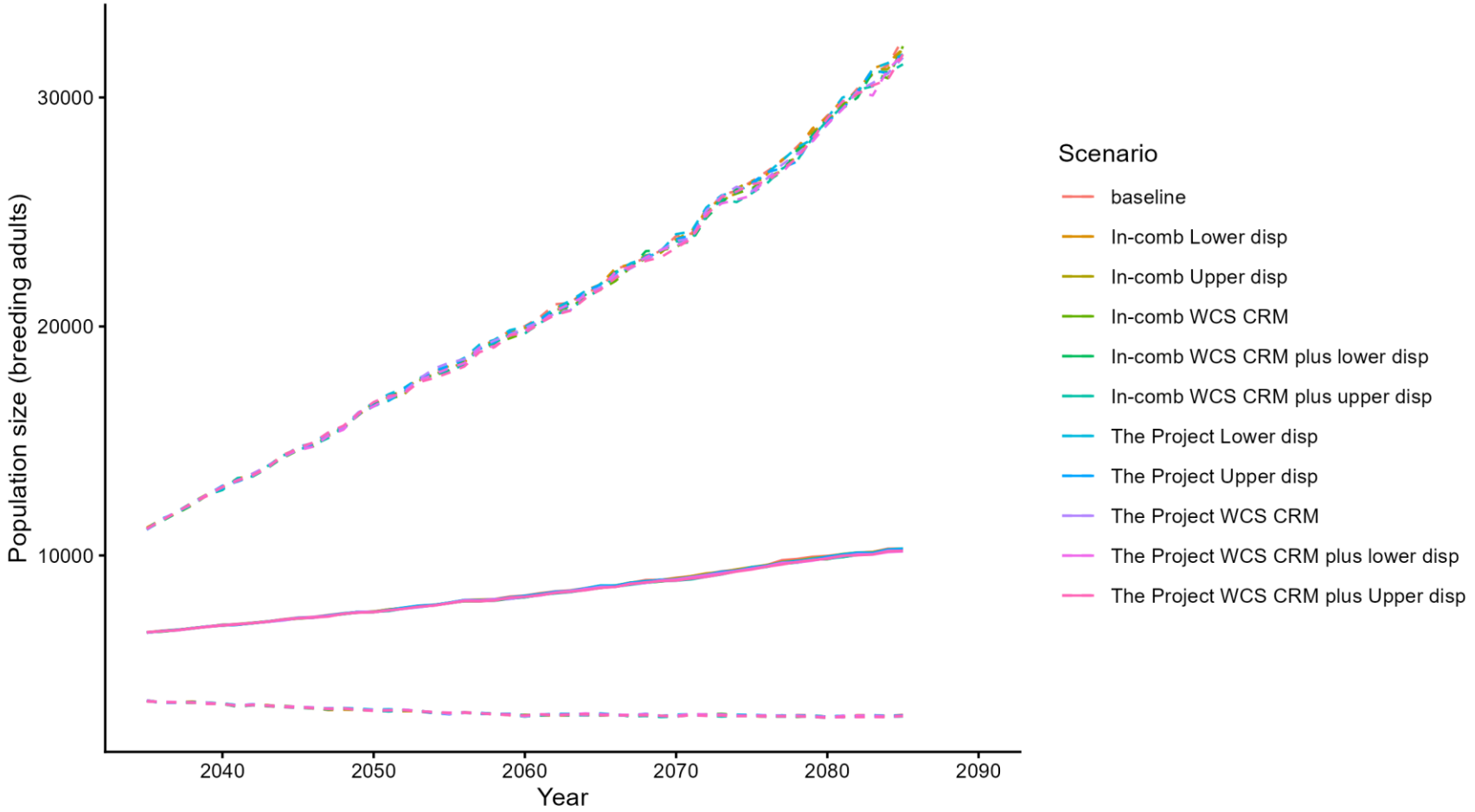


Figure 25: Kittiwake – Canna and Sanday SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'site specific' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.2.3 Kittiwake: Cape Wrath SPA

Table 57: Kittiwake – Cape Wrath SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Cape Wrath SPA CEH National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	7.473408e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.000223621
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	6460	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.69	Scenario C Impact on adult survival rate per pair mean	0.000318218
Productivity rate per pair standard deviation	0.296	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0003929521
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.000541839
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	0.0001393189
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0004024768
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.001393189
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.001532508
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.001795666
		Scenario J Impact on immature survival rate mean	0

Table 58: Kittiwake – Cape Wrath SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.5	0.0000747	25	0.9999	0.9999	0.0010	0.9979	1.0019	0.9986	0.9992	0.0342	0.9331	1.0693	49.92	50.08
The Project Upper disp	1.4	0.0002236	25	0.9997	0.9997	0.0010	0.9977	1.0018	0.9937	0.9940	0.0339	0.9288	1.0608	49.62	50.32
The Project WCS CRM	2.1	0.0003182	25	0.9996	0.9996	0.0010	0.9976	1.0016	0.9899	0.9904	0.0334	0.9259	1.0557	49.10	50.60
The Project WCS CRM plus lower disp	2.5	0.0003930	25	0.9995	0.9995	0.0010	0.9974	1.0016	0.9870	0.9884	0.0340	0.9220	1.0562	49.04	50.84
The Project WCS CRM plus Upper disp	3.5	0.0005418	25	0.9994	0.9994	0.0010	0.9974	1.0014	0.9838	0.9839	0.0337	0.9200	1.0545	48.86	51.02
In-comb Lower disp	0.9	0.0001393	25	0.9998	0.9998	0.0010	0.9978	1.0019	0.9959	0.9961	0.0342	0.9310	1.0664	49.76	50.36
In-comb Upper disp	2.6	0.0004025	25	0.9995	0.9995	0.0010	0.9975	1.0016	0.9873	0.9881	0.0335	0.9245	1.0578	49.54	50.68
In-comb WCS CRM	9.0	0.0013932	25	0.9983	0.9983	0.0010	0.9962	1.0004	0.9586	0.9583	0.0327	0.8939	1.0233	46.30	53.32
In-comb WCS CRM plus lower disp	9.9	0.0015325	25	0.9982	0.9982	0.0010	0.9961	1.0002	0.9539	0.9547	0.0326	0.8914	1.0209	46.16	53.38
In-comb WCS CRM plus upper disp	11.6	0.0017957	25	0.9979	0.9979	0.0010	0.9958	0.9999	0.9465	0.9465	0.0328	0.8826	1.0115	45.32	54.56
The Project Lower disp	0.5	0.0000747	35	0.9999	0.9999	0.0009	0.9983	1.0016	0.9973	0.9984	0.0372	0.9297	1.0751	49.76	50.48
The Project Upper disp	1.4	0.0002236	35	0.9997	0.9997	0.0009	0.9980	1.0014	0.9907	0.9915	0.0371	0.9194	1.0659	49.18	50.94
The Project WCS CRM	2.1	0.0003182	35	0.9996	0.9996	0.0009	0.9979	1.0013	0.9866	0.9870	0.0362	0.9155	1.0601	49.04	51.00
The Project WCS CRM plus lower disp	2.5	0.0003930	35	0.9995	0.9995	0.0009	0.9978	1.0013	0.9827	0.9840	0.0370	0.9118	1.0568	48.80	51.72
The Project WCS CRM plus Upper disp	3.5	0.0005418	35	0.9994	0.9994	0.0009	0.9977	1.0011	0.9767	0.9778	0.0368	0.9081	1.0546	48.34	51.92
In-comb Lower disp	0.9	0.0001393	35	0.9998	0.9998	0.0009	0.9981	1.0015	0.9948	0.9947	0.0372	0.9240	1.0684	49.64	50.40
In-comb Upper disp	2.6	0.0004025	35	0.9995	0.9995	0.0009	0.9978	1.0012	0.9833	0.9837	0.0363	0.9155	1.0587	48.70	51.62

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb WCS CRM	9.0	0.0013932	35	0.9983	0.9983	0.0009	0.9967	1.0000	0.9425	0.9427	0.0352	0.8758	1.0141	45.58	54.60
In-comb WCS CRM plus lower disp	9.9	0.0015325	35	0.9982	0.9982	0.0009	0.9965	0.9999	0.9375	0.9380	0.0350	0.8712	1.0091	45.02	55.16
In-comb WCS CRM plus upper disp	11.6	0.0017957	35	0.9979	0.9979	0.0009	0.9962	0.9995	0.9261	0.9268	0.0348	0.8589	0.9970	44.34	56.14
The Project Lower disp	0.5	0.0000747	50	0.9999	0.9999	0.0007	0.9986	1.0014	0.9974	0.9985	0.0414	0.9209	1.0855	49.78	50.08
The Project Upper disp	1.4	0.0002236	50	0.9998	0.9998	0.0007	0.9984	1.0012	0.9908	0.9918	0.0408	0.9120	1.0747	49.24	50.72
The Project WCS CRM	2.1	0.0003182	50	0.9997	0.9997	0.0007	0.9983	1.0011	0.9858	0.9870	0.0398	0.9104	1.0679	48.98	50.82
The Project WCS CRM plus lower disp	2.5	0.0003930	50	0.9997	0.9997	0.0007	0.9983	1.0011	0.9830	0.9842	0.0409	0.9053	1.0645	48.92	51.10
The Project WCS CRM plus Upper disp	3.5	0.0005418	50	0.9995	0.9996	0.0007	0.9981	1.0010	0.9768	0.9779	0.0407	0.8999	1.0612	48.72	51.26
In-comb Lower disp	0.9	0.0001393	50	0.9999	0.9999	0.0007	0.9985	1.0013	0.9934	0.9946	0.0413	0.9141	1.0807	49.44	50.34
In-comb Upper disp	2.6	0.0004025	50	0.9997	0.9997	0.0007	0.9983	1.0011	0.9833	0.9840	0.0401	0.9083	1.0661	48.92	51.14
In-comb WCS CRM	9.0	0.0013932	50	0.9988	0.9988	0.0007	0.9974	1.0002	0.9425	0.9430	0.0390	0.8681	1.0221	46.08	53.32
In-comb WCS CRM plus lower disp	9.9	0.0015325	50	0.9987	0.9987	0.0007	0.9973	1.0001	0.9366	0.9379	0.0387	0.8638	1.0153	45.16	53.78
In-comb WCS CRM plus upper disp	11.6	0.0017957	50	0.9985	0.9985	0.0007	0.9971	0.9999	0.9261	0.9270	0.0387	0.8538	1.0057	44.46	54.82

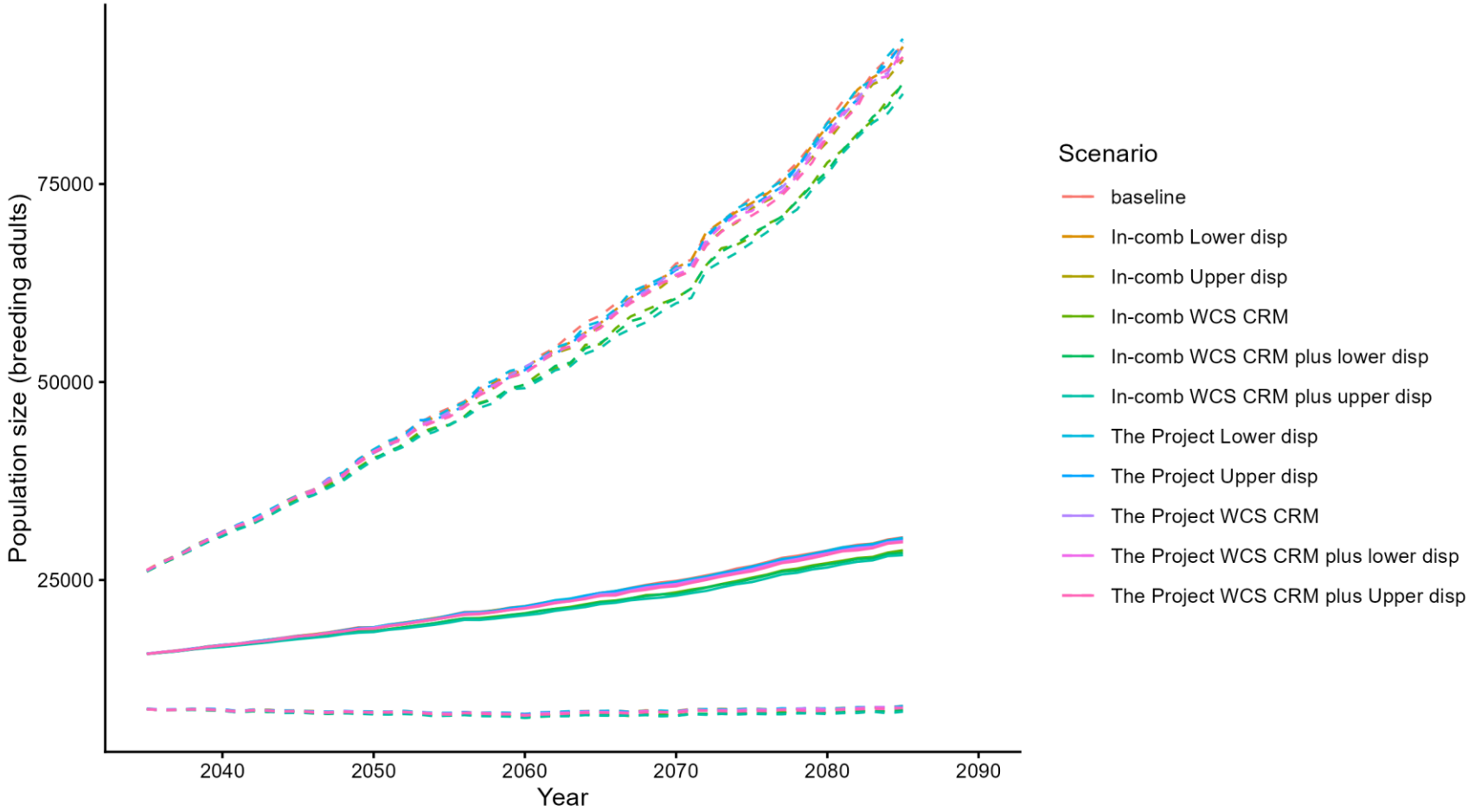


Figure 26: Kittiwake – Cape Wrath population PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH National' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 59: Kittiwake – Cape Wrath SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland rates' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Cape Wrath SPA Minches and W Scot rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	7.473408e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.000223621
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	6460	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.785	Scenario C Impact on adult survival rate per pair mean	0.000318218
Productivity rate per pair standard deviation	0.414	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0003929521
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.000541839
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	0.0001393189
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0004024768
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.001393189
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.001532508
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.001795666
		Scenario J Impact on immature survival rate mean	0

Table 60: Kittiwake – Cape Wrath SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.5	0.0000747	25	0.9999	0.9999	0.0008	0.9982	1.0016	0.9978	0.9982	0.0294	0.9398	1.0559	49.84	50.40
The Project Upper disp	1.4	0.0002236	25	0.9997	0.9997	0.0009	0.9980	1.0014	0.9935	0.9934	0.0296	0.9352	1.0536	49.32	50.74
The Project WCS CRM	2.1	0.0003182	25	0.9996	0.9996	0.0008	0.9979	1.0013	0.9899	0.9905	0.0289	0.9355	1.0492	49.06	50.94
The Project WCS CRM plus lower disp	2.5	0.0003930	25	0.9995	0.9995	0.0009	0.9978	1.0012	0.9877	0.9882	0.0292	0.9320	1.0480	48.78	51.24
The Project WCS CRM plus Upper disp	3.5	0.0005418	25	0.9994	0.9994	0.0009	0.9977	1.0010	0.9833	0.9837	0.0286	0.9297	1.0418	48.90	51.00
In-comb Lower disp	0.9	0.0001393	25	0.9998	0.9998	0.0008	0.9982	1.0016	0.9959	0.9964	0.0291	0.9396	1.0547	49.74	50.54
In-comb Upper disp	2.6	0.0004025	25	0.9995	0.9995	0.0009	0.9978	1.0012	0.9878	0.9877	0.0290	0.9310	1.0464	49.04	51.10
In-comb WCS CRM	9.0	0.0013932	25	0.9983	0.9983	0.0009	0.9966	1.0001	0.9572	0.9576	0.0279	0.9041	1.0140	47.04	53.54
In-comb WCS CRM plus lower disp	9.9	0.0015325	25	0.9982	0.9982	0.0008	0.9965	0.9999	0.9531	0.9536	0.0280	0.8989	1.0094	46.54	53.66
In-comb WCS CRM plus upper disp	11.6	0.0017957	25	0.9979	0.9979	0.0009	0.9962	0.9996	0.9468	0.9466	0.0279	0.8921	1.0028	45.86	54.18
The Project Lower disp	0.5	0.0000747	35	0.9999	0.9999	0.0007	0.9986	1.0013	0.9970	0.9973	0.0315	0.9363	1.0613	49.96	50.02
The Project Upper disp	1.4	0.0002236	35	0.9997	0.9997	0.0007	0.9984	1.0011	0.9901	0.9907	0.0311	0.9311	1.0539	49.40	50.44
The Project WCS CRM	2.1	0.0003182	35	0.9996	0.9996	0.0007	0.9983	1.0010	0.9858	0.9867	0.0310	0.9269	1.0515	49.06	50.78
The Project WCS CRM plus lower disp	2.5	0.0003930	35	0.9995	0.9995	0.0007	0.9981	1.0009	0.9833	0.9836	0.0310	0.9217	1.0464	48.98	51.08
The Project WCS CRM plus Upper disp	3.5	0.0005418	35	0.9994	0.9994	0.0007	0.9980	1.0007	0.9769	0.9774	0.0304	0.9183	1.0388	48.30	51.52
In-comb Lower disp	0.9	0.0001393	35	0.9998	0.9998	0.0007	0.9985	1.0013	0.9941	0.9950	0.0310	0.9356	1.0573	49.44	50.58
In-comb Upper disp	2.6	0.0004025	35	0.9995	0.9995	0.0007	0.9982	1.0009	0.9831	0.9831	0.0310	0.9234	1.0447	48.92	51.26

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb WCS CRM	9.0	0.0013932	35	0.9983	0.9983	0.0007	0.9970	0.9997	0.9414	0.9419	0.0293	0.8861	1.0005	46.18	54.20
In-comb WCS CRM plus lower disp	9.9	0.0015325	35	0.9982	0.9982	0.0007	0.9968	0.9995	0.9356	0.9364	0.0295	0.8783	0.9952	45.66	54.42
In-comb WCS CRM plus upper disp	11.6	0.0017957	35	0.9979	0.9979	0.0007	0.9965	0.9993	0.9265	0.9267	0.0291	0.8698	0.9863	45.08	54.88
The Project Lower disp	0.5	0.0000747	50	0.9999	0.9999	0.0005	0.9989	1.0010	0.9968	0.9975	0.0336	0.9326	1.0650	49.46	50.36
The Project Upper disp	1.4	0.0002236	50	0.9998	0.9998	0.0005	0.9988	1.0009	0.9900	0.9909	0.0331	0.9270	1.0596	49.28	50.62
The Project WCS CRM	2.1	0.0003182	50	0.9997	0.9997	0.0005	0.9987	1.0008	0.9861	0.9866	0.0331	0.9228	1.0555	49.18	51.02
The Project WCS CRM plus lower disp	2.5	0.0003930	50	0.9997	0.9997	0.0005	0.9986	1.0007	0.9830	0.9836	0.0333	0.9192	1.0518	49.24	50.86
The Project WCS CRM plus Upper disp	3.5	0.0005418	50	0.9995	0.9995	0.0005	0.9985	1.0006	0.9766	0.9774	0.0327	0.9149	1.0444	48.58	51.66
In-comb Lower disp	0.9	0.0001393	50	0.9999	0.9999	0.0005	0.9988	1.0010	0.9942	0.9950	0.0334	0.9304	1.0621	49.54	50.38
In-comb Upper disp	2.6	0.0004025	50	0.9997	0.9997	0.0005	0.9986	1.0007	0.9830	0.9832	0.0330	0.9192	1.0482	48.94	51.14
In-comb WCS CRM	9.0	0.0013932	50	0.9988	0.9988	0.0005	0.9977	0.9999	0.9412	0.9419	0.0314	0.8817	1.0054	46.62	53.48
In-comb WCS CRM plus lower disp	9.9	0.0015325	50	0.9987	0.9987	0.0005	0.9976	0.9998	0.9359	0.9365	0.0316	0.8755	1.0025	45.92	53.92
In-comb WCS CRM plus upper disp	11.6	0.0017957	50	0.9985	0.9985	0.0005	0.9974	0.9996	0.9266	0.9269	0.0314	0.8645	0.9899	45.64	54.46

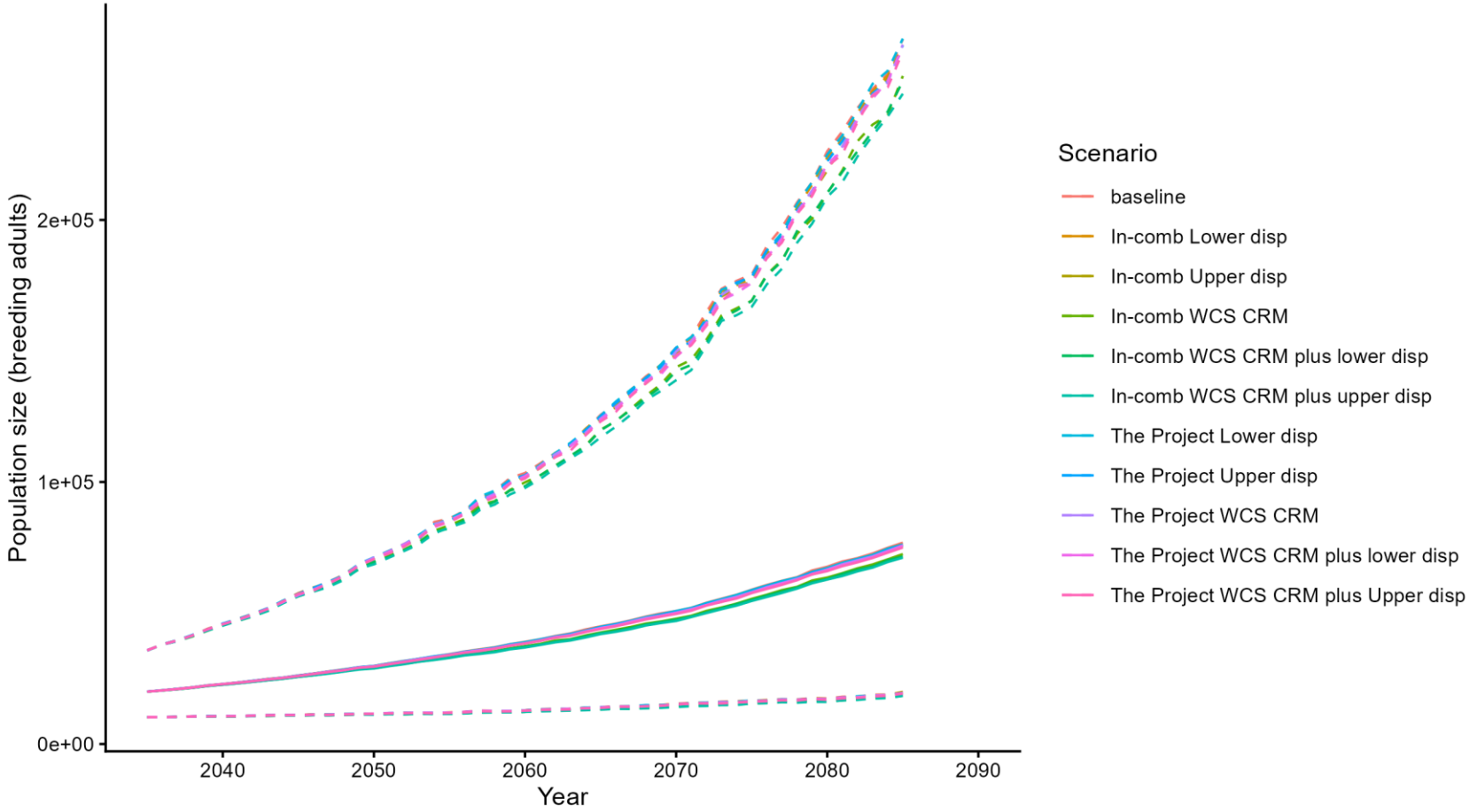


Figure 27: Kittiwake – Cape Wrath population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.2.4 Kittiwake: Flannan Isles SPA

Table 61: Kittiwake – Flannan Isles SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Flannan Isles SPA CEH National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	4.113302e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0001230536
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	1632	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.69	Scenario C Impact on adult survival rate per pair mean	0.000186937
Productivity rate per pair standard deviation	0.296	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.00022807
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0003099906
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	4.289216e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0001286765
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.000189951
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0002328431
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0003247549
		Scenario J Impact on immature survival rate mean	0

Table 62: Kittiwake – Flannan Isles SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.1	0.0000411	25	0.9999	0.9999	0.0020	0.9959	1.0040	0.9977	1.0009	0.0665	0.8772	1.1425	49.82	50.24
The Project Upper disp	0.2	0.0001231	25	0.9999	0.9999	0.0020	0.9958	1.0039	0.9982	0.9995	0.0660	0.8802	1.1357	49.92	50.08
The Project WCS CRM	0.3	0.0001869	25	0.9998	0.9998	0.0021	0.9956	1.0040	0.9947	0.9966	0.0672	0.8702	1.1347	49.90	50.22
The Project WCS CRM plus lower disp	0.4	0.0002281	25	0.9997	0.9997	0.0020	0.9956	1.0036	0.9938	0.9961	0.0667	0.8698	1.1336	49.88	50.28
The Project WCS CRM plus Upper disp	0.5	0.0003100	25	0.9996	0.9996	0.0020	0.9956	1.0037	0.9915	0.9935	0.0669	0.8668	1.1337	49.42	50.78
In-comb Lower disp	0.1	0.0000429	25	1.0000	1.0000	0.0021	0.9959	1.0041	0.9989	1.0017	0.0678	0.8758	1.1421	49.90	50.10
In-comb Upper disp	0.2	0.0001287	25	0.9999	0.9998	0.0020	0.9958	1.0039	0.9957	0.9980	0.0665	0.8709	1.1351	49.86	50.12
In-comb WCS CRM	0.3	0.0001900	25	0.9997	0.9997	0.0021	0.9957	1.0038	0.9935	0.9965	0.0671	0.8758	1.1363	49.82	50.34
In-comb WCS CRM plus lower disp	0.4	0.0002328	25	0.9997	0.9997	0.0020	0.9956	1.0037	0.9933	0.9952	0.0658	0.8719	1.1320	49.74	50.38
In-comb WCS CRM plus upper disp	0.5	0.0003248	25	0.9996	0.9996	0.0020	0.9957	1.0036	0.9903	0.9927	0.0670	0.8722	1.1310	49.36	50.76
The Project Lower disp	0.1	0.0000411	35	0.9999	1.0000	0.0017	0.9966	1.0034	0.9978	1.0012	0.0736	0.8635	1.1549	49.92	50.04
The Project Upper disp	0.2	0.0001231	35	0.9998	0.9999	0.0017	0.9966	1.0033	0.9955	0.9989	0.0726	0.8662	1.1541	49.90	50.14
The Project WCS CRM	0.3	0.0001869	35	0.9998	0.9998	0.0017	0.9963	1.0032	0.9928	0.9944	0.0732	0.8565	1.1478	49.92	50.12
The Project WCS CRM plus lower disp	0.4	0.0002281	35	0.9997	0.9997	0.0017	0.9963	1.0031	0.9915	0.9938	0.0736	0.8564	1.1461	49.74	50.32
The Project WCS CRM plus Upper disp	0.5	0.0003100	35	0.9997	0.9996	0.0017	0.9963	1.0030	0.9887	0.9904	0.0731	0.8505	1.1424	49.32	50.78
In-comb Lower disp	0.1	0.0000429	35	0.9999	1.0000	0.0017	0.9966	1.0033	0.9984	1.0019	0.0743	0.8624	1.1575	50.18	49.82
In-comb Upper disp	0.2	0.0001287	35	0.9999	0.9999	0.0017	0.9965	1.0031	0.9956	0.9975	0.0736	0.8603	1.1500	49.92	50.14

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb WCS CRM	0.3	0.0001900	35	0.9997	0.9998	0.0017	0.9964	1.0031	0.9915	0.9949	0.0733	0.8603	1.1490	49.90	50.14
In-comb WCS CRM plus lower disp	0.4	0.0002328	35	0.9997	0.9997	0.0017	0.9963	1.0030	0.9914	0.9934	0.0718	0.8572	1.1405	49.88	50.20
In-comb WCS CRM plus upper disp	0.5	0.0003248	35	0.9996	0.9996	0.0017	0.9964	1.0030	0.9874	0.9894	0.0738	0.8557	1.1437	49.04	50.80
The Project Lower disp	0.1	0.0000411	50	1.0000	1.0000	0.0014	0.9971	1.0027	0.9977	1.0015	0.0814	0.8476	1.1772	49.68	50.60
The Project Upper disp	0.2	0.0001231	50	0.9999	0.9999	0.0014	0.9972	1.0027	0.9963	0.9999	0.0807	0.8513	1.1677	49.62	50.58
The Project WCS CRM	0.3	0.0001869	50	0.9999	0.9999	0.0014	0.9970	1.0026	0.9944	0.9957	0.0818	0.8377	1.1654	49.44	50.84
The Project WCS CRM plus lower disp	0.4	0.0002281	50	0.9998	0.9998	0.0014	0.9970	1.0026	0.9904	0.9946	0.0820	0.8406	1.1689	49.34	50.58
The Project WCS CRM plus Upper disp	0.5	0.0003100	50	0.9998	0.9998	0.0014	0.9971	1.0024	0.9875	0.9913	0.0809	0.8396	1.1613	49.30	51.16
In-comb Lower disp	0.1	0.0000429	50	1.0000	1.0000	0.0014	0.9973	1.0027	0.9996	1.0027	0.0816	0.8498	1.1718	49.64	50.44
In-comb Upper disp	0.2	0.0001287	50	0.9999	0.9999	0.0014	0.9971	1.0026	0.9954	0.9981	0.0813	0.8495	1.1701	49.62	50.56
In-comb WCS CRM	0.3	0.0001900	50	0.9998	0.9998	0.0014	0.9970	1.0026	0.9920	0.9957	0.0829	0.8417	1.1714	49.74	50.60
In-comb WCS CRM plus lower disp	0.4	0.0002328	50	0.9998	0.9998	0.0014	0.9970	1.0025	0.9912	0.9942	0.0801	0.8448	1.1628	49.42	50.80
In-comb WCS CRM plus upper disp	0.5	0.0003248	50	0.9997	0.9997	0.0014	0.9970	1.0025	0.9864	0.9905	0.0818	0.8422	1.1613	49.08	51.16

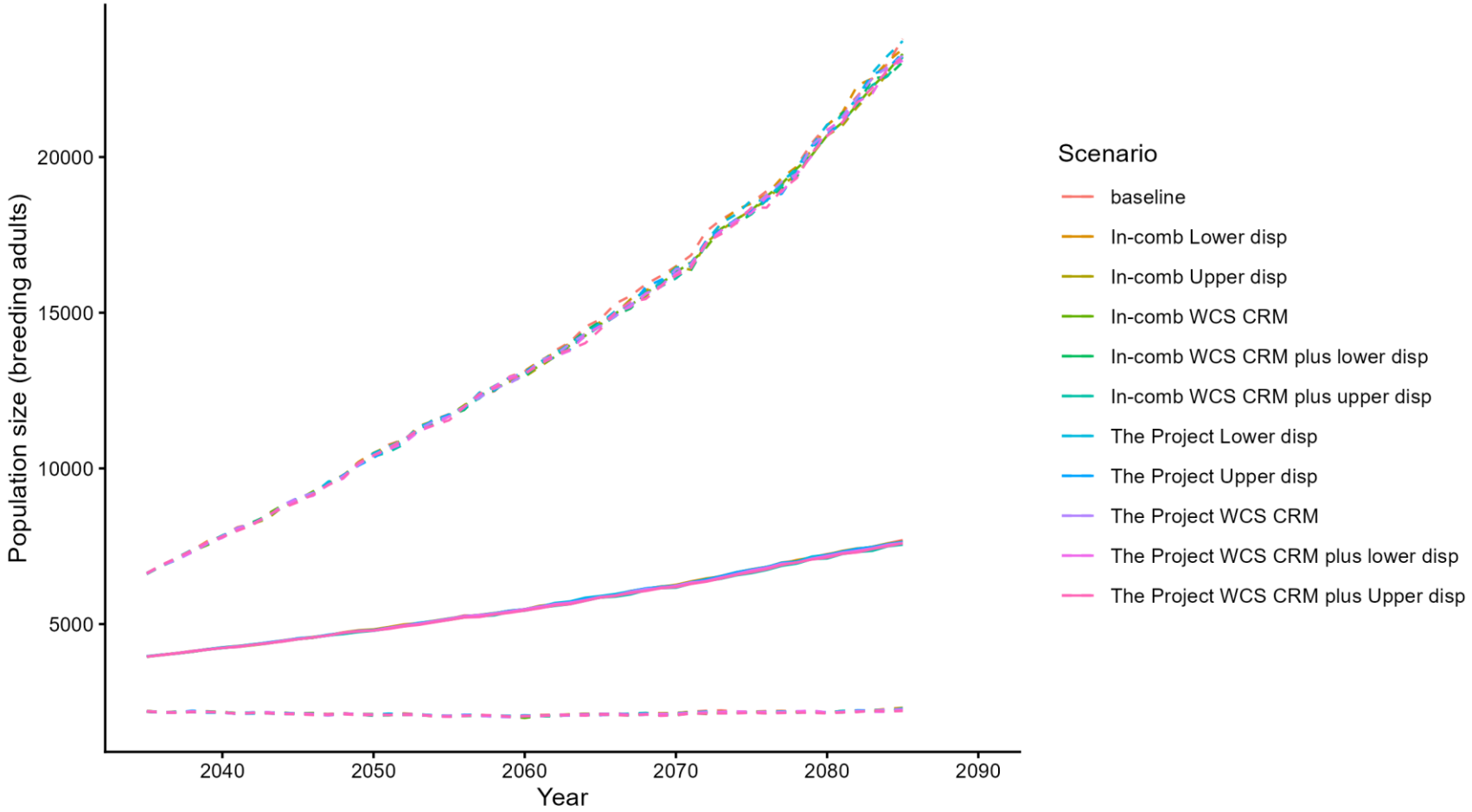


Figure 28: Kittiwake – Flannan Isles SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH National' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 63: Kittiwake – Flannan Isles SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Flannan Isles SPA Minches and W Scot	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	4.113302e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0001230536
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	1632	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.785	Scenario C Impact on adult survival rate per pair mean	0.000186937
Productivity rate per pair standard deviation	0.414	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.00022807
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0003099906
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	4.289216e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0001286765
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.000189951
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0002328431
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0003247549
		Scenario J Impact on immature survival rate mean	0

Table 64: Kittiwake – Flannan Isles SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.1	0.0000411	25	0.9999	1.0000	0.0017	0.9967	1.0034	0.9979	0.9996	0.0579	0.8910	1.1180	49.54	50.24
The Project Upper disp	0.2	0.0001231	25	0.9998	0.9999	0.0017	0.9965	1.0033	0.9956	0.9968	0.0576	0.8878	1.1147	49.54	50.20
The Project WCS CRM	0.3	0.0001869	25	0.9998	0.9998	0.0017	0.9965	1.0031	0.9937	0.9958	0.0580	0.8898	1.1147	49.56	50.20
The Project WCS CRM plus lower disp	0.4	0.0002281	25	0.9997	0.9997	0.0017	0.9965	1.0032	0.9916	0.9934	0.0572	0.8859	1.1140	49.54	50.24
The Project WCS CRM plus Upper disp	0.5	0.0003100	25	0.9996	0.9996	0.0017	0.9963	1.0030	0.9893	0.9911	0.0574	0.8834	1.1055	48.96	51.02
In-comb Lower disp	0.1	0.0000429	25	0.9999	0.9999	0.0017	0.9966	1.0032	0.9966	0.9986	0.0576	0.8907	1.1137	50.28	49.62
In-comb Upper disp	0.2	0.0001287	25	0.9998	0.9998	0.0017	0.9966	1.0031	0.9938	0.9960	0.0576	0.8873	1.1156	49.52	50.42
In-comb WCS CRM	0.3	0.0001900	25	0.9998	0.9998	0.0017	0.9965	1.0033	0.9937	0.9955	0.0584	0.8877	1.1194	49.18	50.60
In-comb WCS CRM plus lower disp	0.4	0.0002328	25	0.9997	0.9997	0.0017	0.9964	1.0032	0.9923	0.9942	0.0586	0.8838	1.1140	49.36	50.62
In-comb WCS CRM plus upper disp	0.5	0.0003248	25	0.9996	0.9996	0.0017	0.9963	1.0031	0.9895	0.9921	0.0577	0.8852	1.1115	49.22	50.62
The Project Lower disp	0.1	0.0000411	35	0.9999	1.0000	0.0014	0.9973	1.0027	0.9977	0.9995	0.0618	0.8856	1.1299	49.46	50.54
The Project Upper disp	0.2	0.0001231	35	0.9998	0.9999	0.0014	0.9972	1.0026	0.9937	0.9955	0.0619	0.8808	1.1232	49.14	50.80
The Project WCS CRM	0.3	0.0001869	35	0.9998	0.9998	0.0013	0.9972	1.0025	0.9917	0.9938	0.0614	0.8817	1.1210	49.42	50.58
The Project WCS CRM plus lower disp	0.4	0.0002281	35	0.9997	0.9997	0.0013	0.9970	1.0024	0.9895	0.9914	0.0613	0.8759	1.1200	48.94	50.88
The Project WCS CRM plus Upper disp	0.5	0.0003100	35	0.9996	0.9996	0.0013	0.9970	1.0024	0.9847	0.9874	0.0610	0.8727	1.1139	48.72	51.04
In-comb Lower disp	0.1	0.0000429	35	0.9999	0.9999	0.0014	0.9972	1.0025	0.9951	0.9979	0.0613	0.8858	1.1263	49.14	50.82
In-comb Upper disp	0.2	0.0001287	35	0.9998	0.9998	0.0013	0.9972	1.0024	0.9923	0.9945	0.0610	0.8796	1.1228	49.70	50.32

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb WCS CRM	0.3	0.0001900	35	0.9997	0.9998	0.0014	0.9971	1.0025	0.9899	0.9931	0.0623	0.8745	1.1256	49.30	50.72
In-comb WCS CRM plus lower disp	0.4	0.0002328	35	0.9997	0.9997	0.0014	0.9970	1.0025	0.9897	0.9916	0.0623	0.8722	1.1188	49.42	50.66
In-comb WCS CRM plus upper disp	0.5	0.0003248	35	0.9996	0.9996	0.0014	0.9969	1.0023	0.9867	0.9887	0.0614	0.8753	1.1174	48.74	51.34
The Project Lower disp	0.1	0.0000411	50	0.9999	1.0000	0.0011	0.9979	1.0021	0.9964	0.9989	0.0658	0.8765	1.1368	49.80	50.26
The Project Upper disp	0.2	0.0001231	50	0.9999	0.9999	0.0011	0.9978	1.0021	0.9941	0.9956	0.0661	0.8696	1.1301	49.54	50.54
The Project WCS CRM	0.3	0.0001869	50	0.9998	0.9998	0.0011	0.9978	1.0019	0.9907	0.9934	0.0659	0.8725	1.1326	49.44	50.68
The Project WCS CRM plus lower disp	0.4	0.0002281	50	0.9998	0.9998	0.0011	0.9977	1.0020	0.9896	0.9914	0.0658	0.8673	1.1312	49.64	50.36
The Project WCS CRM plus Upper disp	0.5	0.0003100	50	0.9997	0.9997	0.0011	0.9976	1.0018	0.9849	0.9873	0.0653	0.8636	1.1233	49.40	50.54
In-comb Lower disp	0.1	0.0000429	50	0.9999	0.9999	0.0011	0.9978	1.0020	0.9958	0.9976	0.0658	0.8737	1.1351	49.80	50.20
In-comb Upper disp	0.2	0.0001287	50	0.9999	0.9999	0.0011	0.9978	1.0020	0.9918	0.9943	0.0655	0.8734	1.1335	49.70	50.32
In-comb WCS CRM	0.3	0.0001900	50	0.9998	0.9998	0.0011	0.9977	1.0020	0.9906	0.9926	0.0668	0.8690	1.1310	49.32	50.72
In-comb WCS CRM plus lower disp	0.4	0.0002328	50	0.9998	0.9998	0.0011	0.9977	1.0019	0.9891	0.9914	0.0666	0.8623	1.1266	49.54	50.66
In-comb WCS CRM plus upper disp	0.5	0.0003248	50	0.9997	0.9997	0.0011	0.9976	1.0019	0.9857	0.9887	0.0658	0.8644	1.1299	49.22	50.82

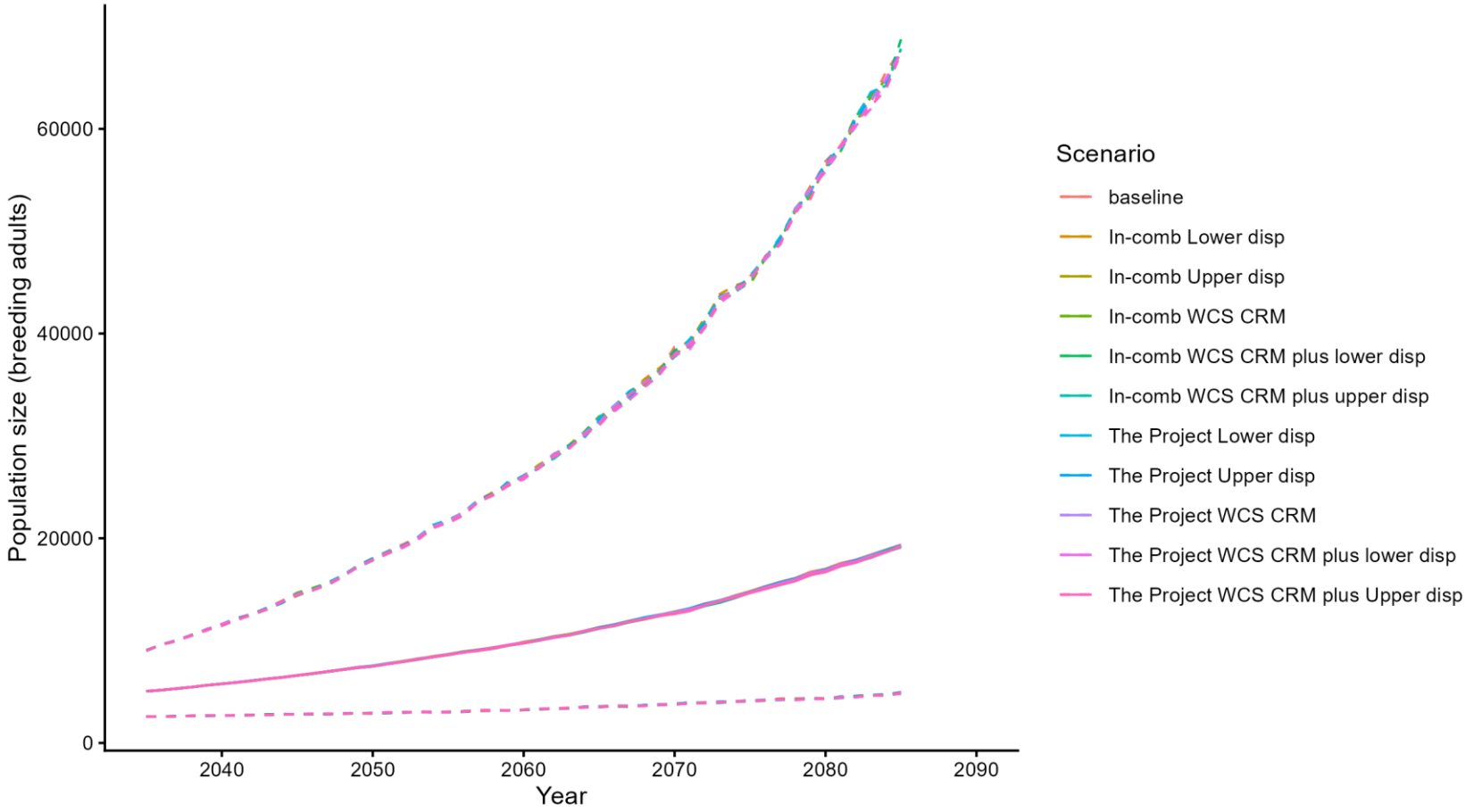


Figure 29: Kittiwake – Flannan Isles SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.2.5 Kittiwake: Handa SPA

Table 65: Kittiwake – Handa population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Handa SPA CEH National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	1.063314e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	3.179528e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	9178	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.69	Scenario C Impact on adult survival rate per pair mean	5.519375e-05
Productivity rate per pair standard deviation	0.296	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	6.582689e-05
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	8.698903e-05
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	2.179124e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	5.44781e-05
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0001089562
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0001198518
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0001634343
		Scenario J Impact on immature survival rate mean	0

Table 66: Kittiwake – Handa SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.1	0.0000106	25	1.0000	1.0000	0.0009	0.9983	1.0017	0.9998	1.0004	0.0285	0.9449	1.0574	50.12	49.78
The Project Upper disp	0.3	0.0000318	25	1.0000	1.0000	0.0008	0.9983	1.0016	0.9991	0.9996	0.0281	0.9441	1.0538	50.14	49.92
The Project WCS CRM	0.5	0.0000552	25	1.0000	0.9999	0.0009	0.9982	1.0016	0.9989	0.9984	0.0279	0.9424	1.0541	49.80	50.08
The Project WCS CRM plus lower disp	0.6	0.0000658	25	0.9999	0.9999	0.0009	0.9983	1.0016	0.9981	0.9982	0.0285	0.9421	1.0553	50.12	49.90
The Project WCS CRM plus Upper disp	0.8	0.0000870	25	0.9999	0.9999	0.0008	0.9982	1.0015	0.9975	0.9975	0.0278	0.9432	1.0542	49.82	50.24
In-comb Lower disp	0.2	0.0000218	25	1.0000	1.0000	0.0008	0.9983	1.0017	0.9995	1.0001	0.0279	0.9459	1.0564	50.56	49.50
In-comb Upper disp	0.5	0.0000545	25	0.9999	0.9999	0.0009	0.9982	1.0016	0.9979	0.9985	0.0278	0.9437	1.0542	50.18	49.84
In-comb WCS CRM	1.0	0.0001090	25	0.9998	0.9999	0.0009	0.9982	1.0015	0.9970	0.9970	0.0277	0.9430	1.0524	50.08	49.92
In-comb WCS CRM plus lower disp	1.1	0.0001199	25	0.9999	0.9999	0.0009	0.9982	1.0016	0.9961	0.9965	0.0277	0.9426	1.0516	49.90	50.08
In-comb WCS CRM plus upper disp	1.5	0.0001634	25	0.9998	0.9998	0.0009	0.9981	1.0015	0.9950	0.9954	0.0280	0.9415	1.0498	49.80	50.16
The Project Lower disp	0.1	0.0000106	35	1.0000	1.0000	0.0007	0.9986	1.0014	0.9994	1.0001	0.0312	0.9392	1.0616	49.86	50.22
The Project Upper disp	0.3	0.0000318	35	1.0000	1.0000	0.0007	0.9986	1.0014	0.9994	0.9995	0.0309	0.9382	1.0595	49.92	50.06
The Project WCS CRM	0.5	0.0000552	35	0.9999	0.9999	0.0007	0.9985	1.0013	0.9976	0.9979	0.0306	0.9375	1.0594	49.76	50.34
The Project WCS CRM plus lower disp	0.6	0.0000658	35	0.9999	0.9999	0.0007	0.9985	1.0013	0.9973	0.9975	0.0310	0.9366	1.0590	49.86	50.18
The Project WCS CRM plus Upper disp	0.8	0.0000870	35	0.9999	0.9999	0.0007	0.9985	1.0013	0.9965	0.9968	0.0303	0.9373	1.0585	49.66	50.36
In-comb Lower disp	0.2	0.0000218	35	1.0000	1.0000	0.0007	0.9986	1.0014	0.9990	0.9999	0.0305	0.9421	1.0613	49.64	50.58

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb Upper disp	0.5	0.0000545	35	0.9999	0.9999	0.0007	0.9985	1.0013	0.9977	0.9980	0.0304	0.9375	1.0570	49.64	50.34
In-comb WCS CRM	1.0	0.0001090	35	0.9999	0.9999	0.0007	0.9985	1.0013	0.9950	0.9960	0.0305	0.9389	1.0556	49.48	50.38
In-comb WCS CRM plus lower disp	1.1	0.0001199	35	0.9999	0.9999	0.0007	0.9985	1.0013	0.9946	0.9952	0.0304	0.9374	1.0570	49.56	50.36
In-comb WCS CRM plus upper disp	1.5	0.0001634	35	0.9998	0.9998	0.0007	0.9984	1.0012	0.9932	0.9935	0.0307	0.9347	1.0550	49.38	50.72
The Project Lower disp	0.1	0.0000106	50	1.0000	1.0000	0.0006	0.9989	1.0011	1.0001	1.0003	0.0341	0.9327	1.0689	50.12	49.94
The Project Upper disp	0.3	0.0000318	50	1.0000	1.0000	0.0006	0.9988	1.0011	0.9991	0.9992	0.0340	0.9311	1.0660	50.08	49.98
The Project WCS CRM	0.5	0.0000552	50	1.0000	1.0000	0.0006	0.9988	1.0011	0.9977	0.9978	0.0335	0.9318	1.0657	49.86	50.06
The Project WCS CRM plus lower disp	0.6	0.0000658	50	0.9999	1.0000	0.0006	0.9988	1.0011	0.9972	0.9978	0.0341	0.9324	1.0659	49.98	50.04
The Project WCS CRM plus Upper disp	0.8	0.0000870	50	0.9999	0.9999	0.0006	0.9988	1.0010	0.9964	0.9969	0.0332	0.9307	1.0644	49.78	50.22
In-comb Lower disp	0.2	0.0000218	50	1.0000	1.0000	0.0006	0.9989	1.0011	0.9993	0.9998	0.0336	0.9338	1.0662	49.80	50.22
In-comb Upper disp	0.5	0.0000545	50	1.0000	1.0000	0.0006	0.9988	1.0011	0.9981	0.9982	0.0336	0.9314	1.0660	50.16	49.96
In-comb WCS CRM	1.0	0.0001090	50	0.9999	0.9999	0.0006	0.9988	1.0010	0.9949	0.9959	0.0334	0.9310	1.0626	49.72	50.28
In-comb WCS CRM plus lower disp	1.1	0.0001199	50	0.9999	0.9999	0.0006	0.9988	1.0010	0.9951	0.9952	0.0333	0.9307	1.0626	49.98	50.04
In-comb WCS CRM plus upper disp	1.5	0.0001634	50	0.9999	0.9999	0.0006	0.9988	1.0010	0.9933	0.9936	0.0339	0.9282	1.0623	49.50	50.58

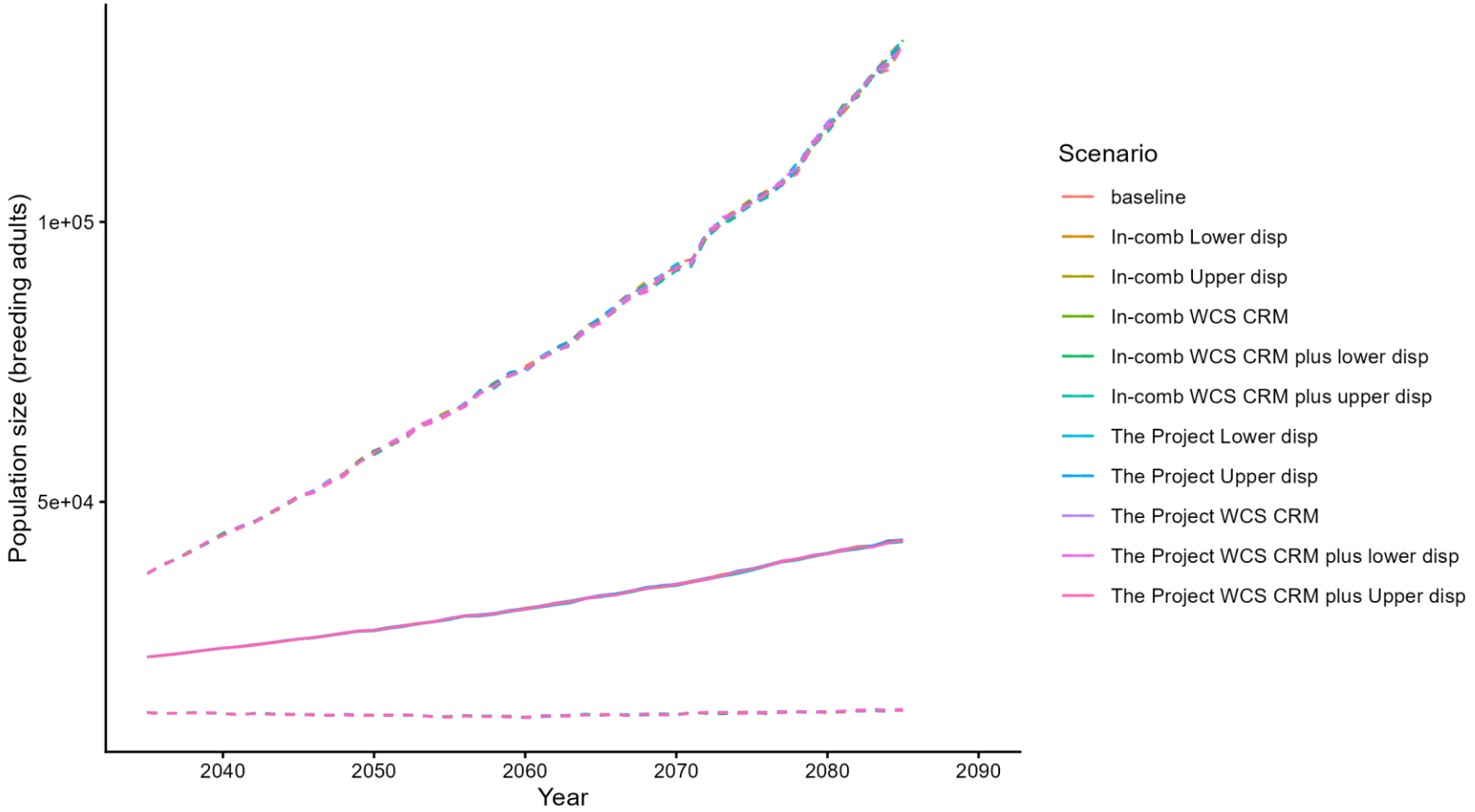


Figure 30: Kittiwake – Handa SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH National' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 67: Kittiwake – Handa SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Handa SPA Minches and W Scot rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	1.063314e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	3.179528e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	9178	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.785	Scenario C Impact on adult survival rate per pair mean	5.519375e-05
Productivity rate per pair standard deviation	0.414	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	6.582689e-05
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	8.698903e-05
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	2.179124e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	5.44781e-05
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0001089562
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0001198518
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0001634343
		Scenario J Impact on immature survival rate mean	0

Table 68: Kittiwake – Handa SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.1	0.0000106	25	1.0000	1.0000	0.0007	0.9986	1.0015	1.0004	1.0004	0.0246	0.9527	1.0500	50.08	49.92
The Project Upper disp	0.3	0.0000318	25	1.0000	1.0000	0.0007	0.9986	1.0014	0.9990	0.9994	0.0242	0.9531	1.0477	49.90	50.26
The Project WCS CRM	0.5	0.0000552	25	0.9999	0.9999	0.0007	0.9985	1.0013	0.9989	0.9987	0.0242	0.9501	1.0458	49.78	50.20
The Project WCS CRM plus lower disp	0.6	0.0000658	25	0.9999	0.9999	0.0007	0.9985	1.0013	0.9978	0.9982	0.0244	0.9498	1.0467	49.94	50.10
The Project WCS CRM plus Upper disp	0.8	0.0000870	25	0.9999	0.9999	0.0007	0.9985	1.0013	0.9979	0.9977	0.0243	0.9505	1.0448	49.88	50.34
In-comb Lower disp	0.2	0.0000218	25	1.0000	1.0000	0.0007	0.9986	1.0014	0.9995	0.9996	0.0245	0.9517	1.0485	49.94	50.08
In-comb Upper disp	0.5	0.0000545	25	0.9999	0.9999	0.0007	0.9985	1.0014	0.9980	0.9983	0.0244	0.9515	1.0472	49.92	50.04
In-comb WCS CRM	1.0	0.0001090	25	0.9999	0.9999	0.0007	0.9985	1.0013	0.9960	0.9968	0.0242	0.9507	1.0457	49.92	50.22
In-comb WCS CRM plus lower disp	1.1	0.0001199	25	0.9999	0.9999	0.0007	0.9984	1.0013	0.9965	0.9967	0.0241	0.9496	1.0435	49.76	50.26
In-comb WCS CRM plus upper disp	1.5	0.0001634	25	0.9998	0.9998	0.0007	0.9984	1.0012	0.9950	0.9950	0.0243	0.9475	1.0425	49.38	50.52
The Project Lower disp	0.1	0.0000106	35	1.0000	1.0000	0.0006	0.9989	1.0011	0.9997	1.0002	0.0263	0.9503	1.0550	49.82	50.06
The Project Upper disp	0.3	0.0000318	35	1.0000	1.0000	0.0006	0.9988	1.0011	0.9990	0.9991	0.0258	0.9494	1.0509	49.82	50.02
The Project WCS CRM	0.5	0.0000552	35	0.9999	0.9999	0.0006	0.9988	1.0010	0.9981	0.9982	0.0259	0.9476	1.0480	49.86	50.10
The Project WCS CRM plus lower disp	0.6	0.0000658	35	0.9999	0.9999	0.0006	0.9988	1.0011	0.9972	0.9975	0.0261	0.9461	1.0492	49.94	50.06
The Project WCS CRM plus Upper disp	0.8	0.0000870	35	0.9999	0.9999	0.0006	0.9987	1.0010	0.9969	0.9966	0.0262	0.9447	1.0479	49.62	50.24
In-comb Lower disp	0.2	0.0000218	35	1.0000	1.0000	0.0006	0.9988	1.0012	0.9995	0.9995	0.0261	0.9480	1.0510	49.90	50.04

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb Upper disp	0.5	0.0000545	35	0.9999	0.9999	0.0006	0.9988	1.0011	0.9975	0.9977	0.0261	0.9484	1.0514	49.78	50.22
In-comb WCS CRM	1.0	0.0001090	35	0.9999	0.9999	0.0006	0.9987	1.0010	0.9950	0.9956	0.0257	0.9468	1.0478	49.66	50.28
In-comb WCS CRM plus lower disp	1.1	0.0001199	35	0.9999	0.9999	0.0006	0.9987	1.0010	0.9952	0.9952	0.0258	0.9446	1.0464	49.66	50.34
In-comb WCS CRM plus upper disp	1.5	0.0001634	35	0.9998	0.9998	0.0006	0.9986	1.0009	0.9929	0.9933	0.0259	0.9430	1.0454	49.56	50.40
The Project Lower disp	0.1	0.0000106	50	1.0000	1.0000	0.0005	0.9991	1.0009	0.9999	1.0003	0.0283	0.9479	1.0589	49.86	50.02
The Project Upper disp	0.3	0.0000318	50	1.0000	1.0000	0.0004	0.9991	1.0009	0.9986	0.9991	0.0276	0.9469	1.0547	50.16	49.86
The Project WCS CRM	0.5	0.0000552	50	1.0000	1.0000	0.0004	0.9991	1.0008	0.9983	0.9982	0.0277	0.9436	1.0520	49.94	50.04
The Project WCS CRM plus lower disp	0.6	0.0000658	50	0.9999	0.9999	0.0004	0.9991	1.0008	0.9975	0.9975	0.0278	0.9438	1.0529	50.18	49.88
The Project WCS CRM plus Upper disp	0.8	0.0000870	50	0.9999	0.9999	0.0005	0.9990	1.0008	0.9969	0.9966	0.0279	0.9409	1.0513	49.96	50.04
In-comb Lower disp	0.2	0.0000218	50	1.0000	1.0000	0.0004	0.9991	1.0009	0.9991	0.9994	0.0277	0.9442	1.0548	50.02	49.98
In-comb Upper disp	0.5	0.0000545	50	1.0000	1.0000	0.0005	0.9991	1.0008	0.9976	0.9977	0.0279	0.9433	1.0549	50.14	49.90
In-comb WCS CRM	1.0	0.0001090	50	0.9999	0.9999	0.0004	0.9990	1.0008	0.9950	0.9957	0.0275	0.9439	1.0515	49.78	50.10
In-comb WCS CRM plus lower disp	1.1	0.0001199	50	0.9999	0.9999	0.0004	0.9990	1.0008	0.9954	0.9953	0.0276	0.9406	1.0505	49.76	50.12
In-comb WCS CRM plus upper disp	1.5	0.0001634	50	0.9999	0.9999	0.0005	0.9990	1.0008	0.9926	0.9932	0.0276	0.9409	1.0492	49.86	50.10

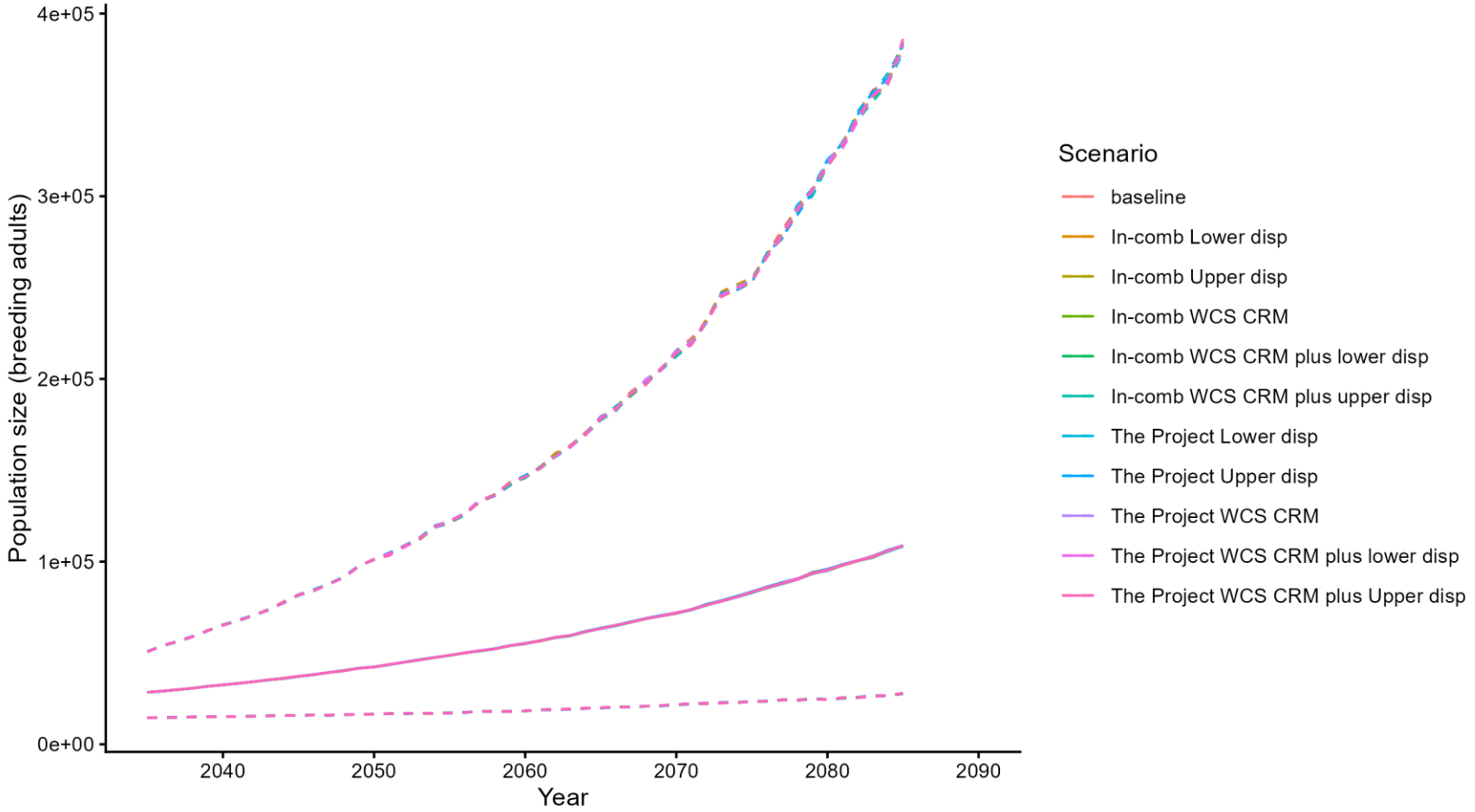


Figure 31: Kittiwake – Handa SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.2.6 Kittiwake: Mingulay and Berneray SPA

Table 69: Kittiwake – Mingulay and Berneray SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Mingulay and Berneray SPA CEH National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	3.512167e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0001049054
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	4088	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.69	Scenario C Impact on adult survival rate per pair mean	0.0002358076
Productivity rate per pair standard deviation	0.296	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0002709293
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.000340713
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	3.669276e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0001076321
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0002372798
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0002739726
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0003449119
		Scenario J Impact on immature survival rate mean	0

Table 70: Kittiwake – Mingulay and Berneray SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.1	0.0000351	25	1.0000	1.0000	0.0013	0.9974	1.0025	0.9997	0.9998	0.0425	0.9169	1.0860	49.70	50.10
The Project Upper disp	0.4	0.0001049	25	0.9999	0.9999	0.0013	0.9972	1.0024	0.9962	0.9970	0.0423	0.9144	1.0827	49.52	50.42
The Project WCS CRM	1.0	0.0002358	25	0.9997	0.9997	0.0013	0.9972	1.0022	0.9930	0.9939	0.0426	0.9126	1.0790	49.56	50.42
The Project WCS CRM plus lower disp	1.1	0.0002709	25	0.9997	0.9997	0.0013	0.9971	1.0022	0.9910	0.9914	0.0421	0.9084	1.0768	49.30	50.72
The Project WCS CRM plus Upper disp	1.4	0.0003407	25	0.9996	0.9996	0.0013	0.9970	1.0021	0.9897	0.9902	0.0424	0.9087	1.0729	49.28	50.88
In-comb Lower disp	0.1	0.0000367	25	1.0000	0.9999	0.0013	0.9974	1.0025	0.9993	0.9992	0.0423	0.9180	1.0847	50.26	49.82
In-comb Upper disp	0.4	0.0001076	25	0.9999	0.9999	0.0013	0.9973	1.0024	0.9969	0.9975	0.0428	0.9127	1.0832	49.84	50.08
In-comb WCS CRM	1.0	0.0002373	25	0.9997	0.9997	0.0013	0.9971	1.0023	0.9924	0.9935	0.0425	0.9126	1.0776	49.52	50.46
In-comb WCS CRM plus lower disp	1.1	0.0002740	25	0.9997	0.9997	0.0013	0.9970	1.0022	0.9921	0.9925	0.0424	0.9119	1.0780	49.52	50.56
In-comb WCS CRM plus upper disp	1.4	0.0003449	25	0.9996	0.9996	0.0013	0.9970	1.0021	0.9901	0.9901	0.0421	0.9088	1.0732	49.16	50.92
The Project Lower disp	0.1	0.0000351	35	1.0000	1.0000	0.0011	0.9978	1.0021	0.9986	0.9993	0.0468	0.9081	1.0927	49.74	50.16
The Project Upper disp	0.4	0.0001049	35	0.9999	0.9999	0.0011	0.9977	1.0020	0.9951	0.9961	0.0467	0.9068	1.0909	49.38	50.58
The Project WCS CRM	1.0	0.0002358	35	0.9997	0.9997	0.0011	0.9975	1.0019	0.9908	0.9914	0.0467	0.9012	1.0862	49.26	50.84
The Project WCS CRM plus lower disp	1.1	0.0002709	35	0.9997	0.9997	0.0011	0.9975	1.0018	0.9890	0.9890	0.0463	0.8999	1.0805	49.16	50.72
The Project WCS CRM plus Upper disp	1.4	0.0003407	35	0.9996	0.9996	0.0011	0.9975	1.0017	0.9858	0.9868	0.0462	0.8985	1.0781	49.02	50.96
In-comb Lower disp	0.1	0.0000367	35	0.9999	1.0000	0.0011	0.9978	1.0020	0.9986	0.9991	0.0463	0.9095	1.0939	49.50	50.30

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb Upper disp	0.4	0.0001076	35	0.9999	0.9999	0.0011	0.9977	1.0020	0.9967	0.9968	0.0467	0.9065	1.0905	49.72	50.18
In-comb WCS CRM	1.0	0.0002373	35	0.9997	0.9997	0.0011	0.9976	1.0018	0.9899	0.9910	0.0460	0.9018	1.0824	49.20	50.70
In-comb WCS CRM plus lower disp	1.1	0.0002740	35	0.9997	0.9997	0.0011	0.9975	1.0018	0.9881	0.9894	0.0464	0.9016	1.0849	49.16	50.80
In-comb WCS CRM plus upper disp	1.4	0.0003449	35	0.9996	0.9996	0.0011	0.9974	1.0017	0.9856	0.9861	0.0452	0.8963	1.0775	48.76	51.22
The Project Lower disp	0.1	0.0000351	50	1.0000	1.0000	0.0009	0.9982	1.0017	0.9991	0.9999	0.0517	0.9003	1.1072	49.58	50.28
The Project Upper disp	0.4	0.0001049	50	0.9999	0.9999	0.0009	0.9981	1.0017	0.9954	0.9965	0.0516	0.8979	1.1015	49.30	50.80
The Project WCS CRM	1.0	0.0002358	50	0.9998	0.9998	0.0009	0.9981	1.0016	0.9905	0.9917	0.0515	0.8941	1.0992	49.24	50.72
The Project WCS CRM plus lower disp	1.1	0.0002709	50	0.9998	0.9998	0.0009	0.9980	1.0015	0.9887	0.9894	0.0509	0.8934	1.0931	49.24	50.66
The Project WCS CRM plus Upper disp	1.4	0.0003407	50	0.9997	0.9997	0.0009	0.9980	1.0015	0.9871	0.9874	0.0507	0.8909	1.0904	48.76	51.12
In-comb Lower disp	0.1	0.0000367	50	1.0000	1.0000	0.0009	0.9983	1.0017	0.9988	0.9998	0.0508	0.9039	1.1053	49.60	50.22
In-comb Upper disp	0.4	0.0001076	50	0.9999	0.9999	0.0009	0.9982	1.0016	0.9961	0.9970	0.0508	0.8996	1.1012	49.48	50.56
In-comb WCS CRM	1.0	0.0002373	50	0.9998	0.9998	0.0009	0.9981	1.0015	0.9899	0.9911	0.0505	0.8934	1.0925	49.14	50.62
In-comb WCS CRM plus lower disp	1.1	0.0002740	50	0.9998	0.9998	0.0009	0.9980	1.0016	0.9884	0.9901	0.0516	0.8908	1.0994	49.26	50.64
In-comb WCS CRM plus upper disp	1.4	0.0003449	50	0.9997	0.9997	0.0009	0.9980	1.0014	0.9857	0.9867	0.0503	0.8910	1.0898	48.94	50.98

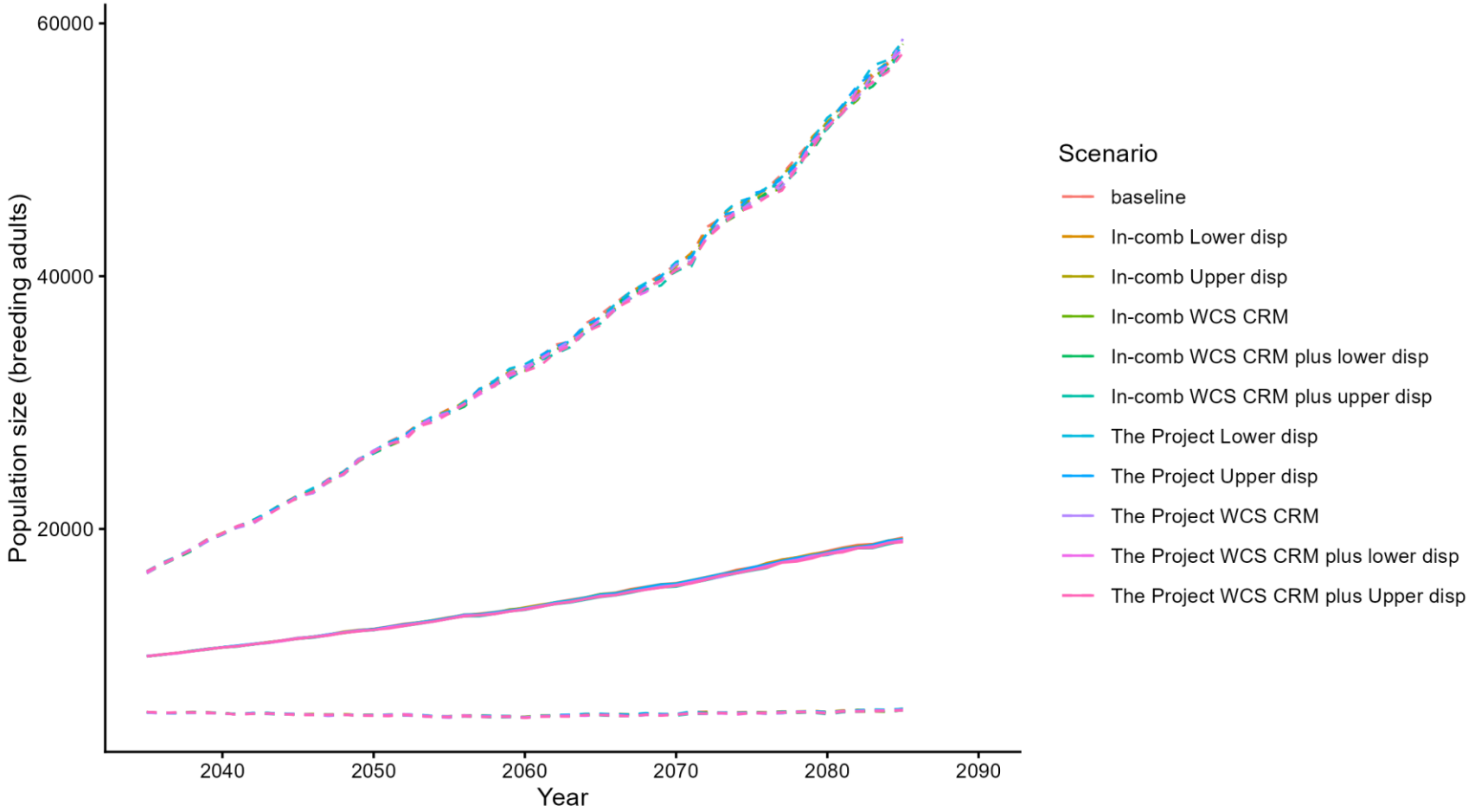


Figure 32: Kittiwake – Mingulay and Berneray SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH National' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 71: Kittiwake – Mingulay and Berneray SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Mingulay and Berneray SPA Minches and W Scot rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	3.512167e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0001049054
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	4088	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.785	Scenario C Impact on adult survival rate per pair mean	0.0002358076
Productivity rate per pair standard deviation	0.414	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0002709293
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.000340713

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	3.669276e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0001076321
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0002372798
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0002739726
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0003449119
		Scenario J Impact on immature survival rate mean	0

Table 72: Kittiwake – Mingulay and Berneray SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.1	0.0000351	25	1.0000	1.0000	0.0011	0.9979	1.0021	0.9986	0.9997	0.0369	0.9282	1.0721	49.82	50.14
The Project Upper disp	0.4	0.0001049	25	0.9999	0.9999	0.0011	0.9978	1.0020	0.9971	0.9975	0.0367	0.9245	1.0712	49.92	50.08
The Project WCS CRM	1.0	0.0002358	25	0.9997	0.9997	0.0011	0.9976	1.0018	0.9931	0.9939	0.0368	0.9231	1.0708	49.40	50.60
The Project WCS CRM plus lower disp	1.1	0.0002709	25	0.9997	0.9997	0.0011	0.9976	1.0018	0.9926	0.9926	0.0364	0.9236	1.0653	49.30	50.74
The Project WCS CRM plus Upper disp	1.4	0.0003407	25	0.9996	0.9996	0.0011	0.9975	1.0017	0.9910	0.9910	0.0362	0.9230	1.0655	49.16	50.80
In-comb Lower disp	0.1	0.0000367	25	1.0000	1.0000	0.0010	0.9979	1.0020	0.9994	1.0001	0.0361	0.9301	1.0724	49.86	50.08
In-comb Upper disp	0.4	0.0001076	25	0.9999	0.9999	0.0010	0.9977	1.0019	0.9965	0.9970	0.0360	0.9273	1.0694	49.58	50.28
In-comb WCS CRM	1.0	0.0002373	25	0.9997	0.9997	0.0011	0.9976	1.0019	0.9934	0.9941	0.0368	0.9235	1.0687	49.54	50.40
In-comb WCS CRM plus lower disp	1.1	0.0002740	25	0.9997	0.9997	0.0011	0.9976	1.0018	0.9919	0.9929	0.0365	0.9227	1.0657	49.60	50.52
In-comb WCS CRM plus upper disp	1.4	0.0003449	25	0.9996	0.9996	0.0011	0.9975	1.0018	0.9894	0.9903	0.0364	0.9172	1.0643	49.40	50.66
The Project Lower disp	0.1	0.0000351	35	1.0000	1.0000	0.0009	0.9982	1.0017	0.9983	0.9992	0.0396	0.9236	1.0797	49.98	50.02
The Project Upper disp	0.4	0.0001049	35	0.9999	0.9999	0.0009	0.9981	1.0015	0.9959	0.9962	0.0392	0.9197	1.0744	50.00	50.02
The Project WCS CRM	1.0	0.0002358	35	0.9997	0.9997	0.0009	0.9980	1.0015	0.9910	0.9913	0.0392	0.9164	1.0741	49.64	50.40
The Project WCS CRM plus lower disp	1.1	0.0002709	35	0.9997	0.9997	0.0009	0.9980	1.0014	0.9892	0.9895	0.0389	0.9151	1.0661	49.50	50.60
The Project WCS CRM plus Upper disp	1.4	0.0003407	35	0.9996	0.9996	0.0009	0.9979	1.0014	0.9862	0.9873	0.0387	0.9120	1.0662	48.94	51.08
In-comb Lower disp	0.1	0.0000367	35	1.0000	1.0000	0.0008	0.9983	1.0016	0.9996	0.9999	0.0387	0.9245	1.0783	50.10	49.84

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb Upper disp	0.4	0.0001076	35	0.9999	0.9999	0.0008	0.9982	1.0015	0.9950	0.9960	0.0385	0.9219	1.0739	49.74	50.18
In-comb WCS CRM	1.0	0.0002373	35	0.9997	0.9997	0.0009	0.9980	1.0014	0.9907	0.9916	0.0390	0.9167	1.0713	49.58	50.64
In-comb WCS CRM plus lower disp	1.1	0.0002740	35	0.9997	0.9997	0.0009	0.9980	1.0014	0.9892	0.9900	0.0389	0.9155	1.0694	49.36	50.70
In-comb WCS CRM plus upper disp	1.4	0.0003449	35	0.9996	0.9996	0.0009	0.9979	1.0014	0.9861	0.9866	0.0390	0.9101	1.0656	49.14	50.66
The Project Lower disp	0.1	0.0000351	50	1.0000	1.0000	0.0007	0.9986	1.0013	0.9984	0.9992	0.0423	0.9189	1.0854	49.82	50.10
The Project Upper disp	0.4	0.0001049	50	0.9999	0.9999	0.0007	0.9985	1.0013	0.9953	0.9964	0.0420	0.9141	1.0801	49.82	50.08
The Project WCS CRM	1.0	0.0002358	50	0.9998	0.9998	0.0007	0.9984	1.0012	0.9907	0.9916	0.0424	0.9099	1.0801	49.54	50.30
The Project WCS CRM plus lower disp	1.1	0.0002709	50	0.9998	0.9998	0.0007	0.9984	1.0011	0.9887	0.9896	0.0413	0.9088	1.0718	49.46	50.60
The Project WCS CRM plus Upper disp	1.4	0.0003407	50	0.9997	0.9997	0.0007	0.9984	1.0011	0.9873	0.9876	0.0416	0.9094	1.0729	49.48	50.60
In-comb Lower disp	0.1	0.0000367	50	1.0000	1.0000	0.0007	0.9986	1.0013	0.9992	0.9998	0.0413	0.9191	1.0842	49.86	50.10
In-comb Upper disp	0.4	0.0001076	50	0.9999	0.9999	0.0007	0.9986	1.0012	0.9957	0.9963	0.0412	0.9169	1.0802	49.58	50.28
In-comb WCS CRM	1.0	0.0002373	50	0.9998	0.9998	0.0007	0.9985	1.0012	0.9915	0.9919	0.0418	0.9122	1.0767	49.50	50.54
In-comb WCS CRM plus lower disp	1.1	0.0002740	50	0.9998	0.9998	0.0007	0.9984	1.0011	0.9893	0.9902	0.0416	0.9107	1.0756	49.58	50.38
In-comb WCS CRM plus upper disp	1.4	0.0003449	50	0.9997	0.9997	0.0007	0.9984	1.0011	0.9866	0.9870	0.0422	0.9043	1.0731	49.50	50.58

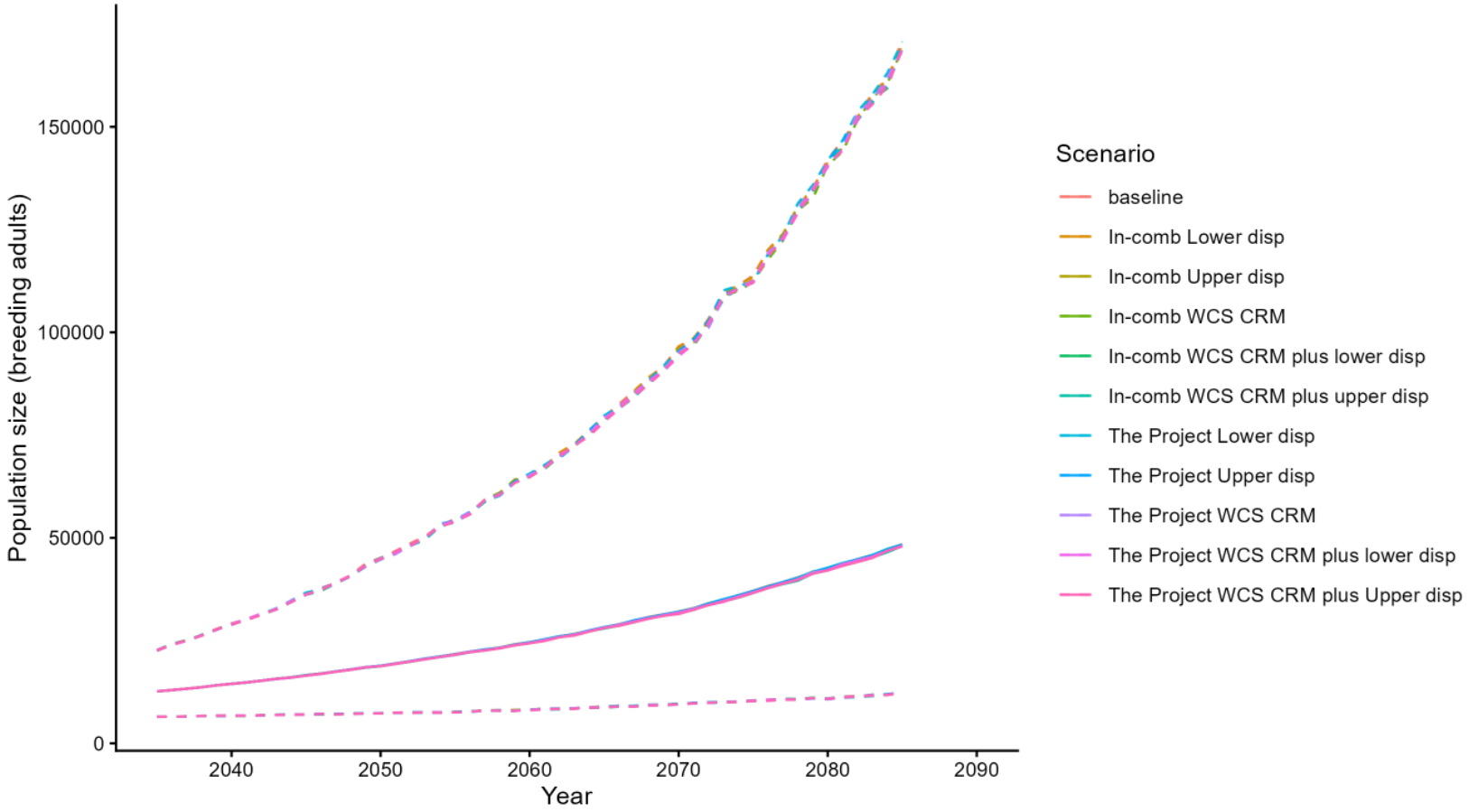


Figure 33: Kittiwake – Mingulay and Berneray SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.2.7 Kittiwake: North Colonsay and Western Cliffs SPA

Table 73: Kittiwake – North Colonsay and Western Cliffs SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake N Colonsay and W Cliffs SPA CEH National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	0.0001132238
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0003371186
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	9852	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.69	Scenario C Impact on adult survival rate per pair mean	0.001255844
Productivity rate per pair standard deviation	0.296	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.001369068
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.001592963
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	0.0001136825
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0003369874
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.001324604
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.001438287
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.001661592
		Scenario J Impact on immature survival rate mean	0

Table 74: Kittiwake – North Colonsay and Western Cliffs SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	1.1	0.0001132	25	0.9999	0.9999	0.0008	0.9982	1.0016	0.9963	0.9974	0.0275	0.9449	1.0543	49.76	50.18
The Project Upper disp	3.3	0.0003371	25	0.9996	0.9996	0.0008	0.9979	1.0013	0.9897	0.9903	0.0269	0.9379	1.0442	49.26	50.66
The Project WCS CRM	12.4	0.0012558	25	0.9985	0.9985	0.0008	0.9969	1.0001	0.9623	0.9625	0.0260	0.9112	1.0145	46.70	52.96
The Project WCS CRM plus lower disp	13.5	0.0013691	25	0.9984	0.9984	0.0008	0.9967	1.0000	0.9592	0.9592	0.0260	0.9079	1.0109	46.64	53.44
The Project WCS CRM plus Upper disp	15.7	0.0015930	25	0.9981	0.9981	0.0008	0.9964	0.9998	0.9524	0.9524	0.0260	0.9015	1.0051	45.80	53.88
In-comb Lower disp	1.1	0.0001137	25	0.9998	0.9999	0.0008	0.9982	1.0015	0.9961	0.9967	0.0273	0.9448	1.0528	49.54	50.42
In-comb Upper disp	3.3	0.0003370	25	0.9996	0.9996	0.0008	0.9979	1.0013	0.9898	0.9905	0.0273	0.9392	1.0457	49.16	50.56
In-comb WCS CRM	13.1	0.0013246	25	0.9984	0.9984	0.0008	0.9968	1.0001	0.9600	0.9607	0.0261	0.9103	1.0142	46.82	52.90
In-comb WCS CRM plus lower disp	14.2	0.0014383	25	0.9983	0.9983	0.0008	0.9966	0.9999	0.9569	0.9568	0.0259	0.9060	1.0097	46.16	53.28
In-comb WCS CRM plus upper disp	16.4	0.0016616	25	0.9980	0.9980	0.0008	0.9964	0.9997	0.9502	0.9506	0.0261	0.9004	1.0045	45.72	53.98
The Project Lower disp	1.1	0.0001132	35	0.9999	0.9999	0.0007	0.9985	1.0013	0.9950	0.9960	0.0299	0.9383	1.0573	49.50	50.46
The Project Upper disp	3.3	0.0003371	35	0.9996	0.9996	0.0007	0.9983	1.0010	0.9860	0.9863	0.0293	0.9302	1.0445	48.60	51.20
The Project WCS CRM	12.4	0.0012558	35	0.9985	0.9985	0.0007	0.9972	0.9998	0.9478	0.9482	0.0283	0.8922	1.0048	45.74	54.00
The Project WCS CRM plus lower disp	13.5	0.0013691	35	0.9984	0.9984	0.0007	0.9970	0.9998	0.9434	0.9437	0.0281	0.8881	1.0002	45.12	54.54
The Project WCS CRM plus Upper disp	15.7	0.0015930	35	0.9981	0.9981	0.0007	0.9967	0.9995	0.9339	0.9347	0.0278	0.8798	0.9907	44.66	55.08
In-comb Lower disp	1.1	0.0001137	35	0.9999	0.9999	0.0007	0.9985	1.0013	0.9948	0.9955	0.0298	0.9384	1.0571	49.32	50.46
In-comb Upper disp	3.3	0.0003370	35	0.9996	0.9996	0.0007	0.9983	1.0010	0.9854	0.9866	0.0293	0.9297	1.0474	48.82	50.96

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb WCS CRM	13.1	0.0013246	35	0.9984	0.9984	0.0007	0.9970	0.9998	0.9452	0.9456	0.0282	0.8911	1.0026	45.54	54.40
In-comb WCS CRM plus lower disp	14.2	0.0014383	35	0.9983	0.9983	0.0007	0.9969	0.9996	0.9402	0.9406	0.0281	0.8856	0.9977	45.00	54.90
In-comb WCS CRM plus upper disp	16.4	0.0016616	35	0.9980	0.9980	0.0007	0.9966	0.9994	0.9311	0.9320	0.0279	0.8786	0.9884	44.48	55.42
The Project Lower disp	1.1	0.0001132	50	0.9999	0.9999	0.0006	0.9988	1.0010	0.9949	0.9957	0.0330	0.9310	1.0639	49.80	50.30
The Project Upper disp	3.3	0.0003371	50	0.9997	0.9997	0.0006	0.9986	1.0008	0.9853	0.9861	0.0323	0.9254	1.0518	49.06	50.90
The Project WCS CRM	12.4	0.0012558	50	0.9989	0.9989	0.0006	0.9978	1.0001	0.9477	0.9480	0.0316	0.8871	1.0106	46.34	53.56
The Project WCS CRM plus lower disp	13.5	0.0013691	50	0.9988	0.9989	0.0006	0.9977	1.0000	0.9433	0.9437	0.0311	0.8823	1.0066	46.08	53.82
The Project WCS CRM plus Upper disp	15.7	0.0015930	50	0.9987	0.9987	0.0006	0.9975	0.9998	0.9344	0.9346	0.0310	0.8753	0.9974	45.48	54.06
In-comb Lower disp	1.1	0.0001137	50	0.9999	0.9999	0.0006	0.9988	1.0010	0.9945	0.9952	0.0328	0.9308	1.0618	49.46	50.50
In-comb Upper disp	3.3	0.0003370	50	0.9997	0.9997	0.0006	0.9986	1.0008	0.9851	0.9865	0.0327	0.9229	1.0541	48.94	51.22
In-comb WCS CRM	13.1	0.0013246	50	0.9989	0.9989	0.0006	0.9978	1.0000	0.9448	0.9456	0.0311	0.8864	1.0078	46.38	53.72
In-comb WCS CRM plus lower disp	14.2	0.0014383	50	0.9988	0.9988	0.0006	0.9977	0.9999	0.9406	0.9406	0.0312	0.8809	1.0053	45.92	54.02
In-comb WCS CRM plus upper disp	16.4	0.0016616	50	0.9986	0.9986	0.0006	0.9975	0.9998	0.9310	0.9321	0.0309	0.8736	0.9960	45.48	54.36

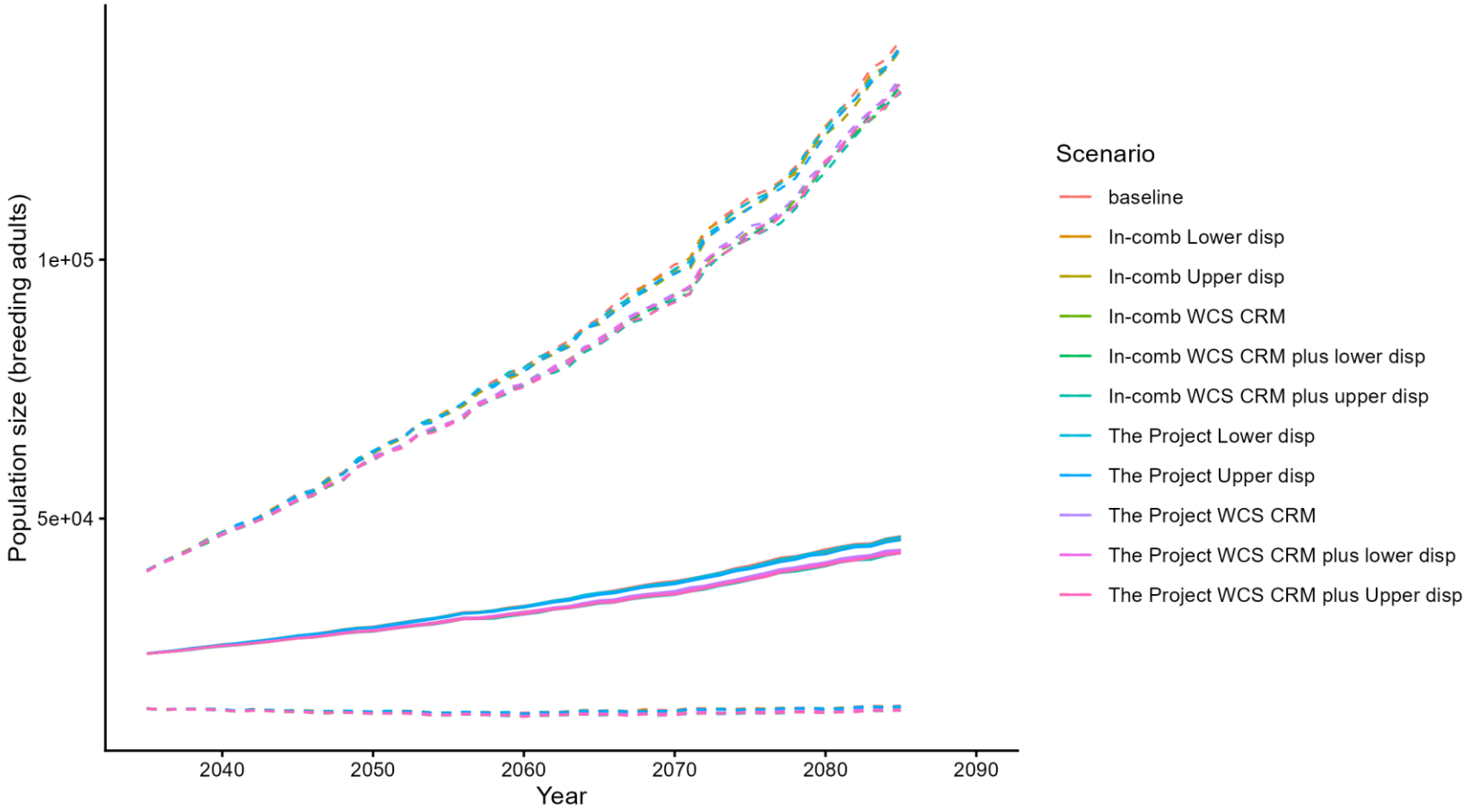


Figure 34: Kittiwake – North Colonsay and Western Cliffs SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH National' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 75: Kittiwake – North Colonsay and Western Cliffs SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake N Colonsay and W Cliffs SPA Minches and W Scot rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	0.0001132238
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0003371186
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	9852	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.785	Scenario C Impact on adult survival rate per pair mean	0.001255844
Productivity rate per pair standard deviation	0.414	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.001369068
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.001592963

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	0.0001136825
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0003369874
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.001324604
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.001438287
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.001661592
		Scenario J Impact on immature survival rate mean	0

Table 76: Kittiwake – North Colonsay and Western Cliffs SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	1.1	0.0001132	25	0.9999	0.9999	0.0007	0.9985	1.0012	0.9963	0.9967	0.0234	0.9518	1.0427	49.72	50.20
The Project Upper disp	3.3	0.0003371	25	0.9996	0.9996	0.0007	0.9983	1.0010	0.9891	0.9894	0.0232	0.9444	1.0366	49.08	50.94
The Project WCS CRM	12.4	0.0012558	25	0.9985	0.9985	0.0007	0.9972	0.9999	0.9621	0.9625	0.0225	0.9188	1.0072	47.28	52.86
The Project WCS CRM plus lower disp	13.5	0.0013691	25	0.9984	0.9984	0.0007	0.9970	0.9997	0.9583	0.9588	0.0224	0.9155	1.0042	46.58	53.04
The Project WCS CRM plus Upper disp	15.7	0.0015930	25	0.9981	0.9981	0.0007	0.9967	0.9995	0.9522	0.9523	0.0225	0.9081	0.9979	46.10	53.62
In-comb Lower disp	1.1	0.0001137	25	0.9999	0.9999	0.0007	0.9985	1.0012	0.9965	0.9968	0.0232	0.9509	1.0437	49.76	50.26
In-comb Upper disp	3.3	0.0003370	25	0.9996	0.9996	0.0007	0.9983	1.0010	0.9894	0.9897	0.0231	0.9446	1.0352	49.28	50.78
In-comb WCS CRM	13.1	0.0013246	25	0.9985	0.9984	0.0007	0.9971	0.9998	0.9603	0.9609	0.0225	0.9172	1.0060	46.98	53.00
In-comb WCS CRM plus lower disp	14.2	0.0014383	25	0.9983	0.9983	0.0007	0.9969	0.9997	0.9571	0.9572	0.0227	0.9119	1.0017	46.52	53.04
In-comb WCS CRM plus upper disp	16.4	0.0016616	25	0.9980	0.9980	0.0007	0.9967	0.9994	0.9498	0.9502	0.0228	0.9060	0.9970	45.90	53.64
The Project Lower disp	1.1	0.0001132	35	0.9999	0.9999	0.0005	0.9988	1.0009	0.9953	0.9954	0.0250	0.9458	1.0446	49.58	50.42
The Project Upper disp	3.3	0.0003371	35	0.9996	0.9996	0.0005	0.9985	1.0007	0.9850	0.9856	0.0246	0.9377	1.0353	49.02	51.40
The Project WCS CRM	12.4	0.0012558	35	0.9985	0.9985	0.0006	0.9974	0.9996	0.9476	0.9483	0.0236	0.9015	0.9952	46.42	53.68
The Project WCS CRM plus lower disp	13.5	0.0013691	35	0.9984	0.9984	0.0005	0.9973	0.9995	0.9429	0.9433	0.0234	0.8987	0.9902	46.18	53.88
The Project WCS CRM plus Upper disp	15.7	0.0015930	35	0.9981	0.9981	0.0006	0.9970	0.9992	0.9341	0.9344	0.0234	0.8891	0.9817	45.42	54.60
In-comb Lower disp	1.1	0.0001137	35	0.9999	0.9999	0.0005	0.9988	1.0009	0.9952	0.9955	0.0245	0.9452	1.0448	49.38	50.60
In-comb Upper disp	3.3	0.0003370	35	0.9996	0.9996	0.0005	0.9985	1.0007	0.9858	0.9858	0.0246	0.9363	1.0345	48.86	51.18

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb WCS CRM	13.1	0.0013246	35	0.9984	0.9984	0.0005	0.9974	0.9996	0.9453	0.9459	0.0236	0.8995	0.9925	46.20	53.66
In-comb WCS CRM plus lower disp	14.2	0.0014383	35	0.9983	0.9983	0.0006	0.9972	0.9994	0.9415	0.9411	0.0237	0.8946	0.9889	45.76	54.30
In-comb WCS CRM plus upper disp	16.4	0.0016616	35	0.9980	0.9980	0.0006	0.9969	0.9992	0.9315	0.9317	0.0240	0.8857	0.9795	45.18	54.84
The Project Lower disp	1.1	0.0001132	50	0.9999	0.9999	0.0004	0.9991	1.0008	0.9953	0.9955	0.0266	0.9439	1.0482	49.70	50.28
The Project Upper disp	3.3	0.0003371	50	0.9997	0.9997	0.0004	0.9989	1.0006	0.9852	0.9856	0.0262	0.9344	1.0395	49.18	50.80
The Project WCS CRM	12.4	0.0012558	50	0.9990	0.9990	0.0004	0.9981	0.9998	0.9478	0.9485	0.0255	0.8988	1.0001	46.84	53.16
The Project WCS CRM plus lower disp	13.5	0.0013691	50	0.9989	0.9989	0.0004	0.9980	0.9997	0.9429	0.9433	0.0249	0.8948	0.9928	46.74	53.40
The Project WCS CRM plus Upper disp	15.7	0.0015930	50	0.9987	0.9987	0.0004	0.9978	0.9995	0.9346	0.9347	0.0250	0.8856	0.9852	46.22	54.02
In-comb Lower disp	1.1	0.0001137	50	0.9999	0.9999	0.0004	0.9991	1.0007	0.9955	0.9956	0.0263	0.9437	1.0472	49.44	50.66
In-comb Upper disp	3.3	0.0003370	50	0.9997	0.9997	0.0004	0.9989	1.0006	0.9859	0.9858	0.0261	0.9332	1.0381	49.18	50.90
In-comb WCS CRM	13.1	0.0013246	50	0.9989	0.9989	0.0004	0.9981	0.9998	0.9456	0.9460	0.0251	0.8964	0.9956	46.74	53.34
In-comb WCS CRM plus lower disp	14.2	0.0014383	50	0.9988	0.9988	0.0004	0.9979	0.9996	0.9412	0.9412	0.0253	0.8916	0.9924	46.60	53.52
In-comb WCS CRM plus upper disp	16.4	0.0016616	50	0.9986	0.9986	0.0004	0.9977	0.9995	0.9318	0.9317	0.0255	0.8816	0.9821	46.00	54.16

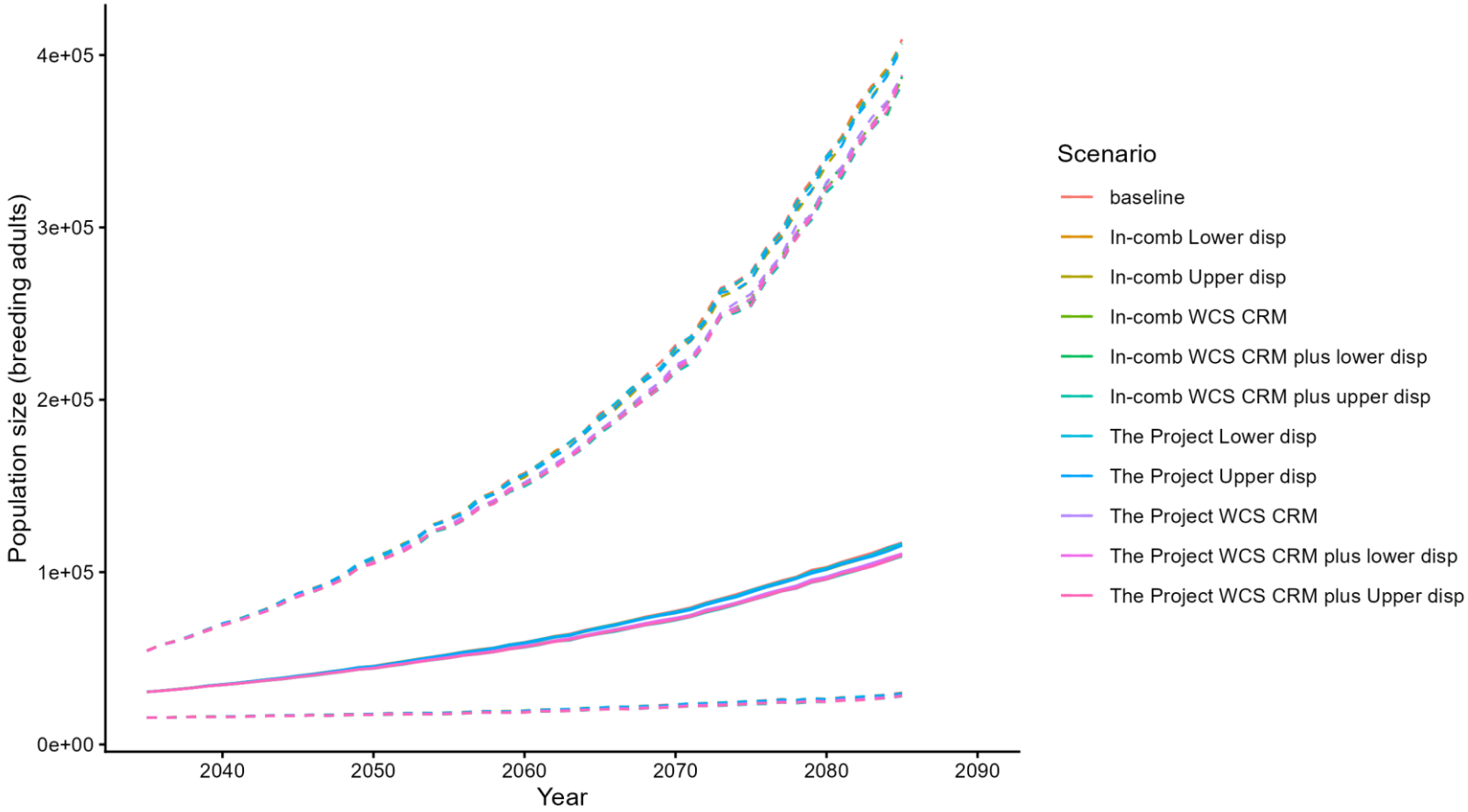


Figure 35: Kittiwake – North Colonsay and Western Cliffs SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.2.8 Kittiwake: North Rona and Sula Sgeir SPA

Table 77: Kittiwake – North Rona and Sula Sgeir SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake N Rona and Sula Sgeir SPA CEH National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	4.106802e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0001228846
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	1424	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.69	Scenario C Impact on adult survival rate per pair mean	0.0001748678
Productivity rate per pair standard deviation	0.296	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0002159358
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0002977525
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	4.91573e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.000133427
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0002036517
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0002457865
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0003370787
		Scenario J Impact on immature survival rate mean	0

Table 78: Kittiwake – North Rona and Sula Sgeir SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.1	0.0000411	25	1.0000	1.0000	0.0022	0.9956	1.0044	0.9992	1.0019	0.0725	0.8661	1.1540	49.60	50.38
The Project Upper disp	0.2	0.0001229	25	0.9999	0.9999	0.0022	0.9956	1.0042	0.9961	0.9991	0.0713	0.8673	1.1462	49.04	51.00
The Project WCS CRM	0.2	0.0001749	25	0.9998	0.9998	0.0021	0.9956	1.0040	0.9940	0.9978	0.0717	0.8702	1.1508	49.10	50.64
The Project WCS CRM plus lower disp	0.3	0.0002159	25	0.9997	0.9998	0.0022	0.9954	1.0041	0.9948	0.9965	0.0706	0.8639	1.1399	48.98	50.76
The Project WCS CRM plus Upper disp	0.4	0.0002978	25	0.9997	0.9996	0.0022	0.9952	1.0040	0.9907	0.9934	0.0718	0.8587	1.1394	48.64	51.22
In-comb Lower disp	0.1	0.0000492	25	0.9999	0.9999	0.0022	0.9956	1.0042	0.9985	1.0010	0.0724	0.8664	1.1515	49.16	50.78
In-comb Upper disp	0.2	0.0001334	25	0.9998	0.9998	0.0022	0.9954	1.0041	0.9960	0.9983	0.0721	0.8619	1.1476	49.70	50.42
In-comb WCS CRM	0.3	0.0002037	25	0.9998	0.9998	0.0022	0.9955	1.0041	0.9948	0.9973	0.0713	0.8641	1.1448	49.40	50.58
In-comb WCS CRM plus lower disp	0.3	0.0002458	25	0.9998	0.9997	0.0022	0.9952	1.0040	0.9942	0.9954	0.0713	0.8588	1.1411	49.06	50.78
In-comb WCS CRM plus upper disp	0.5	0.0003371	25	0.9996	0.9996	0.0022	0.9950	1.0039	0.9903	0.9925	0.0708	0.8596	1.1427	48.64	51.38
The Project Lower disp	0.1	0.0000411	35	1.0000	1.0000	0.0018	0.9963	1.0036	0.9982	1.0016	0.0796	0.8475	1.1679	49.68	50.30
The Project Upper disp	0.2	0.0001229	35	0.9998	0.9999	0.0018	0.9963	1.0035	0.9937	0.9979	0.0788	0.8521	1.1640	49.80	50.08
The Project WCS CRM	0.2	0.0001749	35	0.9998	0.9998	0.0018	0.9963	1.0033	0.9923	0.9960	0.0784	0.8543	1.1607	49.68	50.30
The Project WCS CRM plus lower disp	0.3	0.0002159	35	0.9997	0.9997	0.0018	0.9962	1.0033	0.9922	0.9944	0.0777	0.8500	1.1521	49.22	50.80
The Project WCS CRM plus Upper disp	0.4	0.0002978	35	0.9996	0.9996	0.0019	0.9959	1.0033	0.9869	0.9898	0.0791	0.8441	1.1496	48.86	51.20
In-comb Lower disp	0.1	0.0000492	35	1.0000	1.0000	0.0018	0.9964	1.0034	0.9971	1.0011	0.0789	0.8530	1.1685	49.50	50.58
In-comb Upper disp	0.2	0.0001334	35	0.9998	0.9998	0.0018	0.9962	1.0034	0.9945	0.9966	0.0795	0.8497	1.1611	49.38	50.60

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb WCS CRM	0.3	0.0002037	35	0.9998	0.9998	0.0018	0.9962	1.0033	0.9912	0.9948	0.0779	0.8474	1.1564	48.92	51.00
In-comb WCS CRM plus lower disp	0.3	0.0002458	35	0.9997	0.9997	0.0018	0.9961	1.0033	0.9898	0.9926	0.0777	0.8452	1.1502	48.86	51.06
In-comb WCS CRM plus upper disp	0.5	0.0003371	35	0.9996	0.9996	0.0018	0.9959	1.0031	0.9869	0.9888	0.0771	0.8444	1.1509	48.74	51.14
The Project Lower disp	0.1	0.0000411	50	1.0000	1.0000	0.0015	0.9970	1.0029	0.9984	1.0022	0.0881	0.8358	1.1890	49.82	50.14
The Project Upper disp	0.2	0.0001229	50	0.9999	0.9999	0.0015	0.9970	1.0029	0.9936	0.9983	0.0874	0.8417	1.1820	49.82	50.24
The Project WCS CRM	0.2	0.0001749	50	0.9999	0.9998	0.0014	0.9970	1.0027	0.9927	0.9966	0.0858	0.8406	1.1832	50.08	49.82
The Project WCS CRM plus lower disp	0.3	0.0002159	50	0.9998	0.9998	0.0015	0.9969	1.0027	0.9907	0.9944	0.0858	0.8407	1.1784	49.46	50.34
The Project WCS CRM plus Upper disp	0.4	0.0002978	50	0.9997	0.9997	0.0015	0.9968	1.0027	0.9857	0.9904	0.0874	0.8309	1.1762	49.36	50.60
In-comb Lower disp	0.1	0.0000492	50	1.0000	1.0000	0.0015	0.9971	1.0029	0.9975	1.0016	0.0871	0.8376	1.1822	49.82	50.12
In-comb Upper disp	0.2	0.0001334	50	0.9999	0.9999	0.0015	0.9969	1.0027	0.9947	0.9976	0.0876	0.8360	1.1778	49.82	50.16
In-comb WCS CRM	0.3	0.0002037	50	0.9999	0.9998	0.0015	0.9969	1.0028	0.9933	0.9961	0.0858	0.8335	1.1772	48.98	50.70
In-comb WCS CRM plus lower disp	0.3	0.0002458	50	0.9998	0.9998	0.0015	0.9968	1.0026	0.9899	0.9931	0.0860	0.8305	1.1699	49.18	50.46
In-comb WCS CRM plus upper disp	0.5	0.0003371	50	0.9997	0.9997	0.0015	0.9968	1.0026	0.9855	0.9888	0.0851	0.8248	1.1634	49.12	50.68

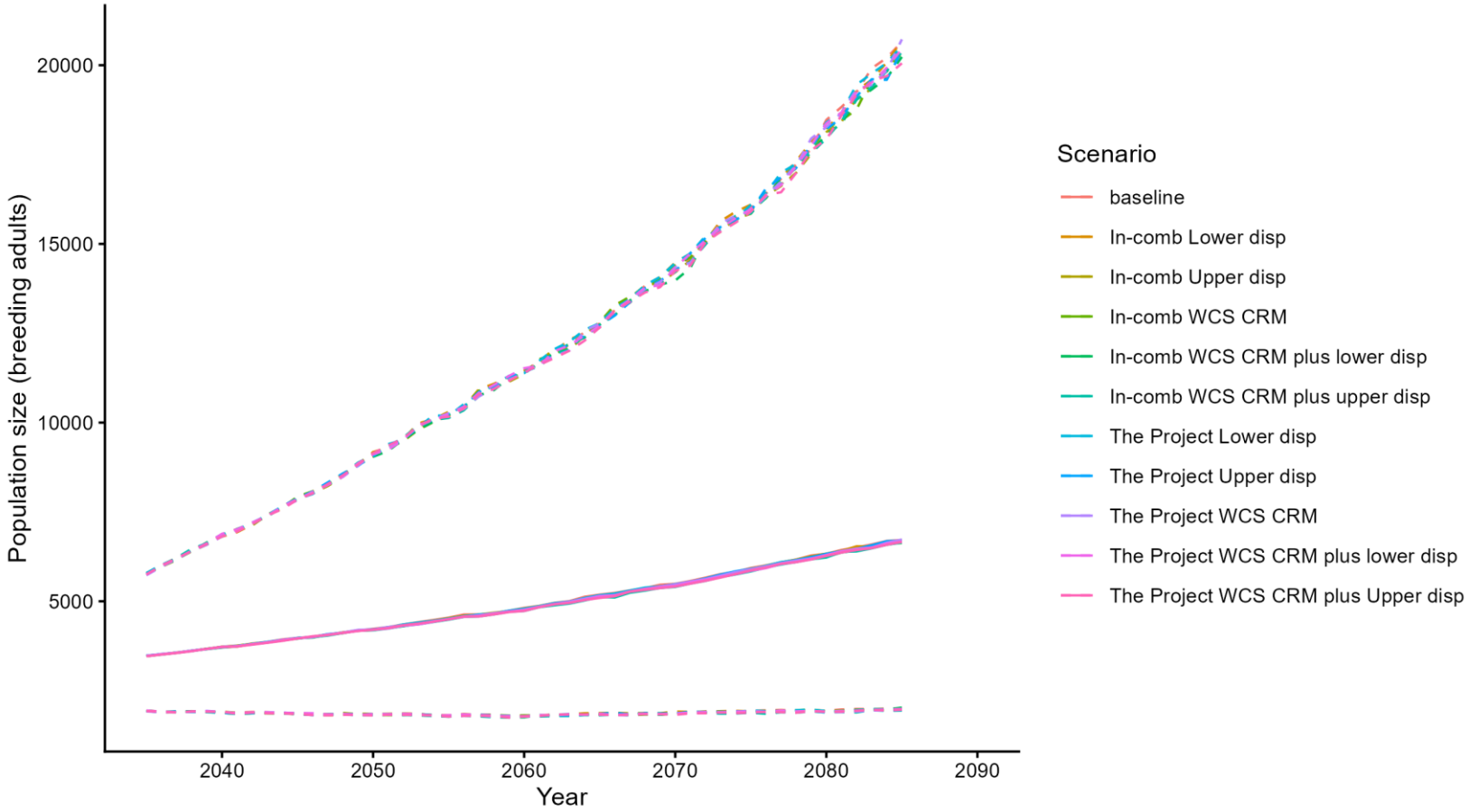


Figure 36: Kittiwake – North Rona and Sula Sgeir SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH National' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 79: Kittiwake – North Rona and Sula Sgeir SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake N Rona and Sula Sgeir SPA Minches and W Scot rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	4.106802e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0001228846
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	1424	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.785	Scenario C Impact on adult survival rate per pair mean	0.0001748678
Productivity rate per pair standard deviation	0.414	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0002159358
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0002977525

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	4.91573e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.000133427
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0002036517
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0002457865
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0003370787
		Scenario J Impact on immature survival rate mean	0

Table 80: Kittiwake – North Rona and Sula Sgeir SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.1	0.0000411	25	1.0000	1.0000	0.0018	0.9965	1.0036	1.0002	1.0009	0.0621	0.8825	1.1282	50.14	49.88
The Project Upper disp	0.2	0.0001229	25	0.9999	0.9999	0.0018	0.9963	1.0035	0.9970	0.9984	0.0630	0.8797	1.1259	49.86	50.10
The Project WCS CRM	0.2	0.0001749	25	0.9998	0.9998	0.0018	0.9962	1.0035	0.9938	0.9970	0.0624	0.8823	1.1284	50.14	49.92
The Project WCS CRM plus lower disp	0.3	0.0002159	25	0.9998	0.9998	0.0018	0.9963	1.0034	0.9940	0.9963	0.0615	0.8795	1.1241	49.88	50.06
The Project WCS CRM plus Upper disp	0.4	0.0002978	25	0.9996	0.9996	0.0018	0.9961	1.0032	0.9895	0.9924	0.0615	0.8753	1.1207	49.80	50.16
In-comb Lower disp	0.1	0.0000492	25	0.9999	1.0000	0.0018	0.9965	1.0036	0.9995	1.0016	0.0623	0.8820	1.1312	50.38	49.62
In-comb Upper disp	0.2	0.0001334	25	0.9998	0.9998	0.0018	0.9963	1.0035	0.9950	0.9977	0.0629	0.8790	1.1244	49.84	50.16
In-comb WCS CRM	0.3	0.0002037	25	0.9998	0.9998	0.0018	0.9963	1.0034	0.9939	0.9957	0.0615	0.8788	1.1201	49.82	50.20
In-comb WCS CRM plus lower disp	0.3	0.0002458	25	0.9997	0.9997	0.0018	0.9961	1.0034	0.9930	0.9946	0.0622	0.8780	1.1215	49.38	50.72
In-comb WCS CRM plus upper disp	0.5	0.0003371	25	0.9996	0.9996	0.0018	0.9961	1.0034	0.9903	0.9915	0.0615	0.8761	1.1188	49.48	50.46
The Project Lower disp	0.1	0.0000411	35	1.0000	1.0000	0.0014	0.9972	1.0029	1.0004	1.0010	0.0666	0.8682	1.1389	49.86	50.12
The Project Upper disp	0.2	0.0001229	35	0.9999	0.9999	0.0015	0.9969	1.0028	0.9946	0.9973	0.0672	0.8702	1.1365	49.16	50.70
The Project WCS CRM	0.2	0.0001749	35	0.9998	0.9998	0.0015	0.9970	1.0028	0.9909	0.9950	0.0667	0.8721	1.1307	49.72	50.30
The Project WCS CRM plus lower disp	0.3	0.0002159	35	0.9998	0.9998	0.0015	0.9970	1.0028	0.9908	0.9941	0.0661	0.8712	1.1295	49.28	50.62
The Project WCS CRM plus Upper disp	0.4	0.0002978	35	0.9997	0.9997	0.0014	0.9968	1.0026	0.9871	0.9898	0.0656	0.8659	1.1300	48.94	51.16
In-comb Lower disp	0.1	0.0000492	35	1.0000	1.0000	0.0015	0.9971	1.0029	0.9997	1.0013	0.0667	0.8732	1.1416	49.68	50.26
In-comb Upper disp	0.2	0.0001334	35	0.9998	0.9998	0.0014	0.9970	1.0028	0.9934	0.9964	0.0667	0.8720	1.1327	49.90	50.12

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb WCS CRM	0.3	0.0002037	35	0.9998	0.9998	0.0014	0.9970	1.0026	0.9920	0.9936	0.0654	0.8678	1.1271	48.94	50.98
In-comb WCS CRM plus lower disp	0.3	0.0002458	35	0.9997	0.9997	0.0015	0.9968	1.0027	0.9900	0.9918	0.0662	0.8667	1.1272	49.32	50.52
In-comb WCS CRM plus upper disp	0.5	0.0003371	35	0.9996	0.9996	0.0015	0.9968	1.0026	0.9863	0.9880	0.0660	0.8658	1.1234	49.12	51.04
The Project Lower disp	0.1	0.0000411	50	1.0000	1.0000	0.0011	0.9978	1.0023	1.0013	1.0020	0.0716	0.8637	1.1525	50.34	49.56
The Project Upper disp	0.2	0.0001229	50	0.9999	0.9999	0.0012	0.9976	1.0022	0.9954	0.9979	0.0725	0.8616	1.1464	49.84	50.32
The Project WCS CRM	0.2	0.0001749	50	0.9999	0.9999	0.0011	0.9977	1.0022	0.9914	0.9960	0.0714	0.8644	1.1501	49.84	50.16
The Project WCS CRM plus lower disp	0.3	0.0002159	50	0.9998	0.9999	0.0011	0.9977	1.0021	0.9915	0.9948	0.0704	0.8626	1.1397	49.80	50.20
The Project WCS CRM plus Upper disp	0.4	0.0002978	50	0.9998	0.9998	0.0011	0.9975	1.0020	0.9895	0.9911	0.0702	0.8603	1.1394	49.34	50.70
In-comb Lower disp	0.1	0.0000492	50	1.0000	1.0000	0.0011	0.9978	1.0024	1.0000	1.0022	0.0715	0.8673	1.1518	50.10	49.94
In-comb Upper disp	0.2	0.0001334	50	0.9999	0.9999	0.0011	0.9977	1.0022	0.9938	0.9973	0.0706	0.8681	1.1420	49.90	50.08
In-comb WCS CRM	0.3	0.0002037	50	0.9998	0.9999	0.0011	0.9977	1.0021	0.9928	0.9947	0.0699	0.8635	1.1359	49.72	50.42
In-comb WCS CRM plus lower disp	0.3	0.0002458	50	0.9998	0.9998	0.0012	0.9976	1.0021	0.9897	0.9924	0.0711	0.8580	1.1383	49.64	50.50
In-comb WCS CRM plus upper disp	0.5	0.0003371	50	0.9997	0.9998	0.0012	0.9975	1.0020	0.9872	0.9891	0.0711	0.8558	1.1325	49.36	50.72

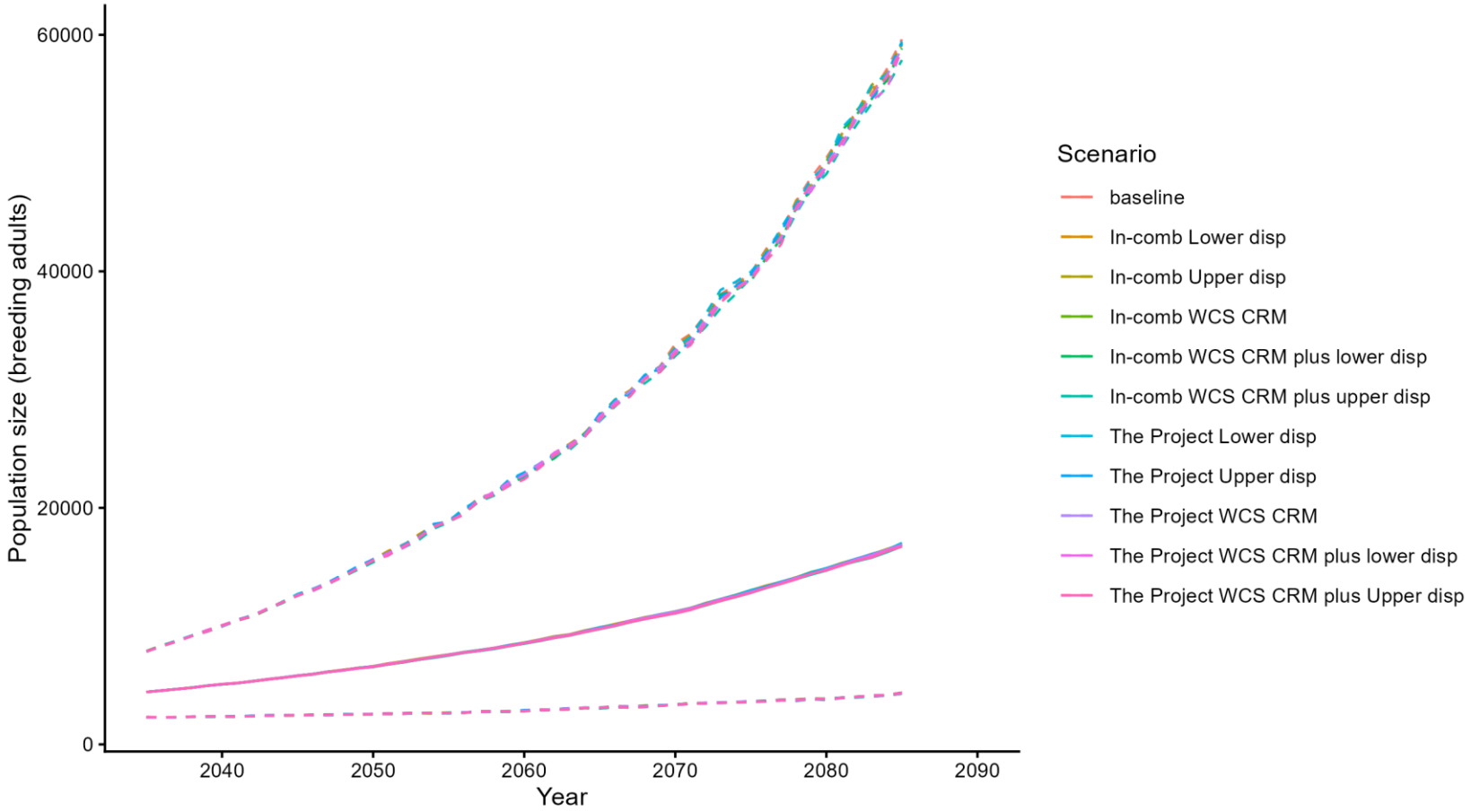


Figure 37: Kittiwake – North Rona and Sula Sgeir SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.2.9 Kittiwake: Rathlin Island SPA

Table 81: Kittiwake – Rathlin Island SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Rathlin Island SPA CEH National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	3.794753e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0001131865
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	19258	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.767	Scenario C Impact on adult survival rate per pair mean	0.0003285682
Productivity rate per pair standard deviation	0.48	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0003665157
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0004417548
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	3.790632e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0001131997
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0003837366
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.000421643
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0004969363
		Scenario J Impact on immature survival rate mean	0

Table 82: Kittiwake – Rathlin Island SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH National' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.7	0.0000379	25	1.0000	1.0000	0.0005	0.9989	1.0010	0.9989	0.9988	0.0175	0.9642	1.0342	49.82	50.08
The Project Upper disp	2.2	0.0001132	25	0.9999	0.9999	0.0005	0.9988	1.0009	0.9967	0.9968	0.0176	0.9626	1.0321	49.46	50.36
The Project WCS CRM	6.3	0.0003286	25	0.9996	0.9996	0.0005	0.9986	1.0006	0.9904	0.9902	0.0172	0.9569	1.0243	49.24	50.74
The Project WCS CRM plus lower disp	7.1	0.0003665	25	0.9996	0.9996	0.0005	0.9985	1.0006	0.9890	0.9892	0.0175	0.9551	1.0251	49.06	50.74
The Project WCS CRM plus Upper disp	8.5	0.0004418	25	0.9995	0.9995	0.0005	0.9984	1.0005	0.9868	0.9868	0.0173	0.9533	1.0215	48.98	51.16
In-comb Lower disp	0.7	0.0000379	25	1.0000	1.0000	0.0005	0.9989	1.0010	0.9988	0.9989	0.0175	0.9644	1.0337	49.82	50.12
In-comb Upper disp	2.2	0.0001132	25	0.9999	0.9999	0.0005	0.9988	1.0009	0.9966	0.9968	0.0175	0.9624	1.0321	49.66	50.32
In-comb WCS CRM	7.4	0.0003837	25	0.9995	0.9995	0.0005	0.9985	1.0006	0.9882	0.9881	0.0173	0.9545	1.0231	49.10	50.80
In-comb WCS CRM plus lower disp	8.1	0.0004216	25	0.9995	0.9995	0.0005	0.9985	1.0006	0.9872	0.9874	0.0173	0.9535	1.0226	49.08	50.82
In-comb WCS CRM plus upper disp	9.6	0.0004969	25	0.9994	0.9994	0.0005	0.9984	1.0004	0.9852	0.9850	0.0171	0.9511	1.0188	48.96	51.34
The Project Lower disp	0.7	0.0000379	35	1.0000	1.0000	0.0004	0.9991	1.0008	0.9985	0.9985	0.0188	0.9617	1.0370	50.02	49.98
The Project Upper disp	2.2	0.0001132	35	0.9999	0.9999	0.0004	0.9990	1.0007	0.9956	0.9955	0.0191	0.9582	1.0340	49.76	50.12
The Project WCS CRM	6.3	0.0003286	35	0.9996	0.9996	0.0004	0.9988	1.0004	0.9864	0.9864	0.0185	0.9507	1.0235	49.16	50.64
The Project WCS CRM plus lower disp	7.1	0.0003665	35	0.9996	0.9996	0.0004	0.9987	1.0004	0.9844	0.9849	0.0187	0.9483	1.0228	49.08	50.66
The Project WCS CRM plus Upper disp	8.5	0.0004418	35	0.9995	0.9995	0.0004	0.9986	1.0003	0.9817	0.9817	0.0185	0.9457	1.0180	49.00	50.90
In-comb Lower disp	0.7	0.0000379	35	1.0000	1.0000	0.0004	0.9991	1.0008	0.9987	0.9986	0.0187	0.9615	1.0358	50.16	49.78
In-comb Upper disp	2.2	0.0001132	35	0.9999	0.9999	0.0004	0.9990	1.0007	0.9953	0.9955	0.0188	0.9583	1.0325	49.76	50.16

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb WCS CRM	7.4	0.0003837	35	0.9995	0.9995	0.0004	0.9987	1.0004	0.9838	0.9837	0.0185	0.9479	1.0205	48.88	50.76
In-comb WCS CRM plus lower disp	8.1	0.0004216	35	0.9995	0.9995	0.0004	0.9987	1.0004	0.9826	0.9826	0.0184	0.9461	1.0201	48.82	50.90
In-comb WCS CRM plus upper disp	9.6	0.0004969	35	0.9994	0.9994	0.0004	0.9985	1.0002	0.9791	0.9792	0.0183	0.9426	1.0149	48.56	51.10
The Project Lower disp	0.7	0.0000379	50	1.0000	1.0000	0.0003	0.9993	1.0006	0.9977	0.9984	0.0204	0.9585	1.0399	49.86	50.16
The Project Upper disp	2.2	0.0001132	50	0.9999	0.9999	0.0003	0.9992	1.0006	0.9952	0.9955	0.0205	0.9551	1.0379	49.86	50.20
The Project WCS CRM	6.3	0.0003286	50	0.9997	0.9997	0.0003	0.9991	1.0004	0.9863	0.9866	0.0199	0.9482	1.0262	49.24	50.72
The Project WCS CRM plus lower disp	7.1	0.0003665	50	0.9997	0.9997	0.0003	0.9990	1.0004	0.9847	0.9850	0.0202	0.9462	1.0262	48.98	50.86
The Project WCS CRM plus Upper disp	8.5	0.0004418	50	0.9996	0.9996	0.0003	0.9990	1.0003	0.9813	0.9818	0.0202	0.9426	1.0213	48.94	50.94
In-comb Lower disp	0.7	0.0000379	50	1.0000	1.0000	0.0003	0.9993	1.0006	0.9986	0.9987	0.0201	0.9589	1.0397	49.86	50.12
In-comb Upper disp	2.2	0.0001132	50	0.9999	0.9999	0.0003	0.9992	1.0006	0.9951	0.9957	0.0203	0.9564	1.0374	49.72	50.28
In-comb WCS CRM	7.4	0.0003837	50	0.9997	0.9997	0.0003	0.9990	1.0004	0.9835	0.9837	0.0201	0.9444	1.0234	48.80	50.98
In-comb WCS CRM plus lower disp	8.1	0.0004216	50	0.9997	0.9997	0.0003	0.9990	1.0003	0.9825	0.9826	0.0199	0.9434	1.0234	48.80	50.94
In-comb WCS CRM plus upper disp	9.6	0.0004969	50	0.9996	0.9996	0.0003	0.9989	1.0003	0.9787	0.9790	0.0198	0.9397	1.0185	48.76	51.14

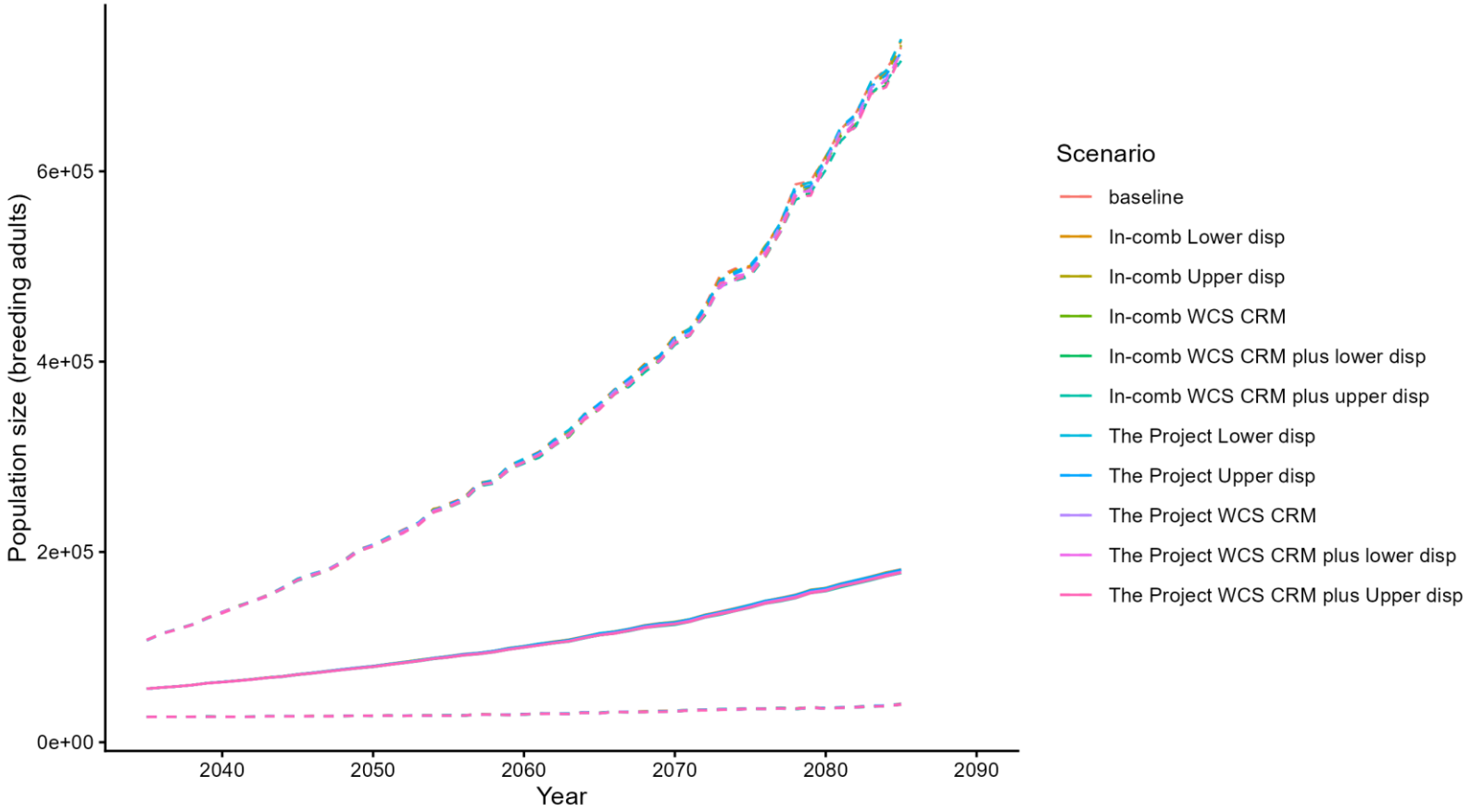


Figure 38: Kittiwake – Rathlin Island SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH National' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 83: Kittiwake – Rathlin Island SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'site specific' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Rathlin Island SPA site-specific rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	3.794753e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0001131865
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	19258	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.785	Scenario C Impact on adult survival rate per pair mean	0.0003285682
Productivity rate per pair standard deviation	0.414	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0003665157
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0004417548
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	3.790632e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0001131997
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0003837366
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.000421643
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0004969363
		Scenario J Impact on immature survival rate mean	0

Table 84: Kittiwake – Rathlin Island SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'site specific' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.7	0.0000379	25	1.0000	1.0000	0.0005	0.9990	1.0009	0.9988	0.9991	0.0168	0.9658	1.0320	49.74	50.16
The Project Upper disp	2.2	0.0001132	25	0.9999	0.9999	0.0005	0.9989	1.0008	0.9965	0.9967	0.0168	0.9643	1.0308	49.58	50.48
The Project WCS CRM	6.3	0.0003286	25	0.9996	0.9996	0.0005	0.9986	1.0006	0.9903	0.9900	0.0169	0.9562	1.0235	49.08	50.96
The Project WCS CRM plus lower disp	7.1	0.0003665	25	0.9996	0.9996	0.0005	0.9986	1.0005	0.9887	0.9889	0.0167	0.9568	1.0223	48.94	51.00
The Project WCS CRM plus Upper disp	8.5	0.0004418	25	0.9995	0.9995	0.0005	0.9985	1.0004	0.9866	0.9866	0.0167	0.9542	1.0196	48.58	51.00
In-comb Lower disp	0.7	0.0000379	25	1.0000	1.0000	0.0005	0.9990	1.0009	0.9991	0.9991	0.0169	0.9655	1.0324	49.84	50.22
In-comb Upper disp	2.2	0.0001132	25	0.9999	0.9999	0.0005	0.9989	1.0008	0.9963	0.9968	0.0167	0.9639	1.0308	49.68	50.36
In-comb WCS CRM	7.4	0.0003837	25	0.9995	0.9995	0.0005	0.9986	1.0005	0.9885	0.9886	0.0166	0.9564	1.0212	48.94	50.86
In-comb WCS CRM plus lower disp	8.1	0.0004216	25	0.9995	0.9995	0.0005	0.9986	1.0005	0.9873	0.9874	0.0164	0.9557	1.0195	48.80	50.94
In-comb WCS CRM plus upper disp	9.6	0.0004969	25	0.9994	0.9994	0.0005	0.9984	1.0004	0.9852	0.9852	0.0166	0.9530	1.0183	48.46	51.10
The Project Lower disp	0.7	0.0000379	35	1.0000	1.0000	0.0004	0.9992	1.0007	0.9985	0.9986	0.0180	0.9632	1.0339	49.72	50.24
The Project Upper disp	2.2	0.0001132	35	0.9999	0.9999	0.0004	0.9991	1.0006	0.9951	0.9953	0.0179	0.9613	1.0324	49.72	50.28
The Project WCS CRM	6.3	0.0003286	35	0.9996	0.9996	0.0004	0.9988	1.0004	0.9862	0.9860	0.0179	0.9518	1.0214	49.16	51.12
The Project WCS CRM plus lower disp	7.1	0.0003665	35	0.9996	0.9996	0.0004	0.9988	1.0003	0.9848	0.9847	0.0176	0.9500	1.0200	48.98	51.10
The Project WCS CRM plus Upper disp	8.5	0.0004418	35	0.9995	0.9995	0.0004	0.9987	1.0002	0.9816	0.9815	0.0177	0.9469	1.0159	48.60	51.48
In-comb Lower disp	0.7	0.0000379	35	1.0000	1.0000	0.0004	0.9992	1.0008	0.9984	0.9988	0.0182	0.9633	1.0355	49.88	50.04
In-comb Upper disp	2.2	0.0001132	35	0.9999	0.9999	0.0004	0.9991	1.0007	0.9953	0.9955	0.0179	0.9609	1.0315	49.68	50.36

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb WCS CRM	7.4	0.0003837	35	0.9995	0.9995	0.0004	0.9988	1.0003	0.9840	0.9841	0.0177	0.9497	1.0188	48.90	51.14
In-comb WCS CRM plus lower disp	8.1	0.0004216	35	0.9995	0.9995	0.0004	0.9987	1.0003	0.9821	0.9824	0.0175	0.9484	1.0172	48.72	51.50
In-comb WCS CRM plus upper disp	9.6	0.0004969	35	0.9994	0.9994	0.0004	0.9986	1.0002	0.9794	0.9795	0.0175	0.9447	1.0142	48.58	51.62
The Project Lower disp	0.7	0.0000379	50	1.0000	1.0000	0.0003	0.9993	1.0006	0.9984	0.9987	0.0192	0.9616	1.0366	49.84	50.10
The Project Upper disp	2.2	0.0001132	50	0.9999	0.9999	0.0003	0.9993	1.0005	0.9954	0.9953	0.0190	0.9576	1.0345	49.72	50.36
The Project WCS CRM	6.3	0.0003286	50	0.9997	0.9997	0.0003	0.9991	1.0003	0.9858	0.9860	0.0191	0.9493	1.0242	49.22	50.94
The Project WCS CRM plus lower disp	7.1	0.0003665	50	0.9997	0.9997	0.0003	0.9991	1.0003	0.9849	0.9847	0.0187	0.9476	1.0219	49.14	50.94
The Project WCS CRM plus Upper disp	8.5	0.0004418	50	0.9996	0.9996	0.0003	0.9990	1.0002	0.9817	0.9815	0.0189	0.9445	1.0176	48.94	50.96
In-comb Lower disp	0.7	0.0000379	50	1.0000	1.0000	0.0003	0.9993	1.0006	0.9987	0.9988	0.0193	0.9611	1.0375	49.80	50.24
In-comb Upper disp	2.2	0.0001132	50	0.9999	0.9999	0.0003	0.9993	1.0005	0.9954	0.9955	0.0191	0.9599	1.0345	49.72	50.20
In-comb WCS CRM	7.4	0.0003837	50	0.9997	0.9997	0.0003	0.9991	1.0003	0.9842	0.9841	0.0189	0.9471	1.0211	49.22	51.02
In-comb WCS CRM plus lower disp	8.1	0.0004216	50	0.9997	0.9996	0.0003	0.9990	1.0002	0.9820	0.9824	0.0186	0.9468	1.0197	49.00	50.96
In-comb WCS CRM plus upper disp	9.6	0.0004969	50	0.9996	0.9996	0.0003	0.9990	1.0002	0.9797	0.9795	0.0187	0.9430	1.0165	48.96	51.24

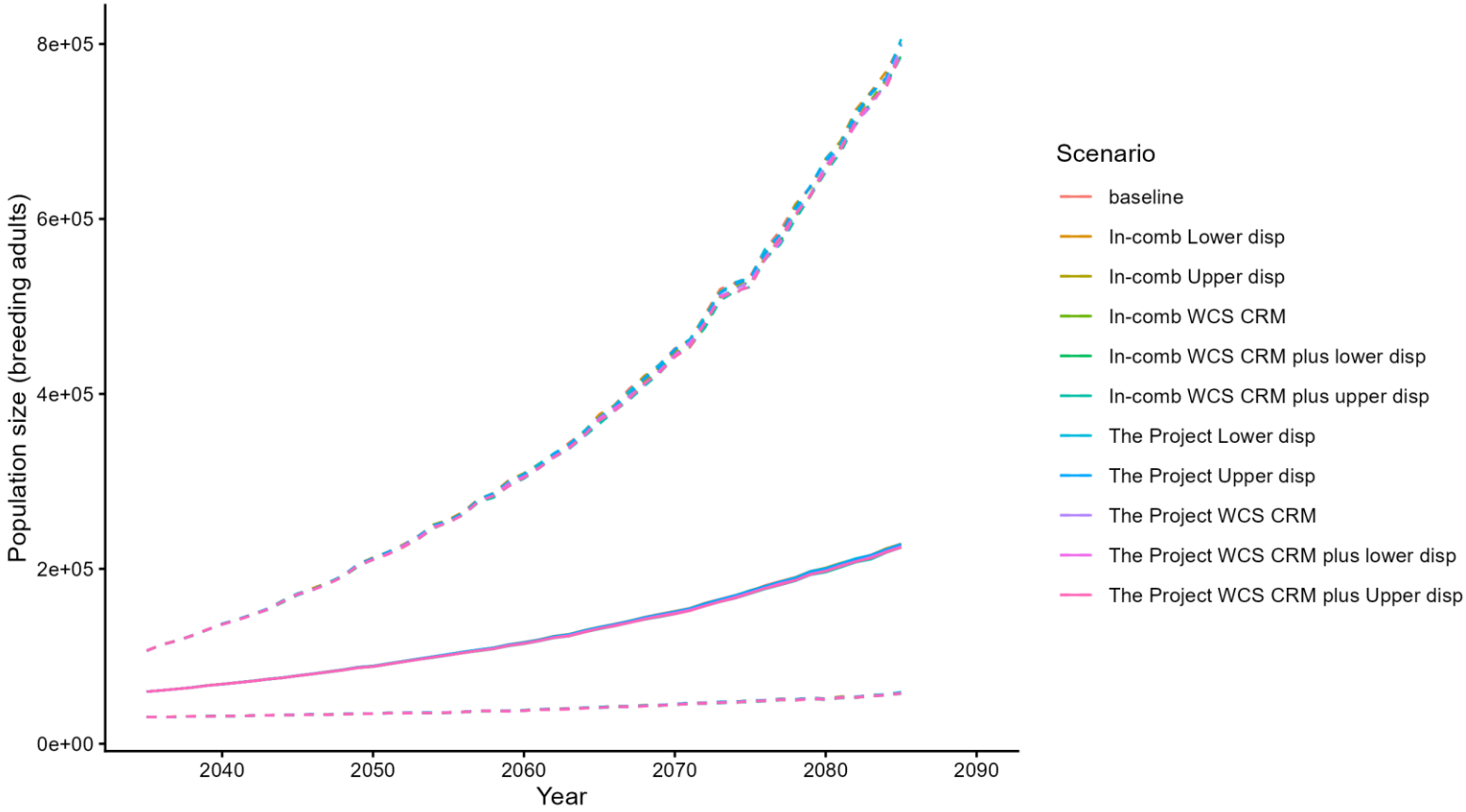


Figure 39: Kittiwake – Rathlin Island SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'site specific' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.2.10 Kittiwake: Rum SPA

Table 85: Kittiwake – Rum SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Rum SPA CEH National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	3.165476e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	9.454041e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	1640	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.69	Scenario C Impact on adult survival rate per pair mean	0.0002169884
Productivity rate per pair standard deviation	0.296	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0002486432
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0003115288
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	3.04878e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	9.756098e-05
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0002256098
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0002560976
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0003170732
		Scenario J Impact on immature survival rate mean	0

Table 86: Kittiwake – Rum SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.1	0.0000317	25	0.9999	0.9999	0.0021	0.9959	1.0040	0.9986	1.0000	0.0677	0.8740	1.1400	49.84	50.28
The Project Upper disp	0.2	0.0000945	25	0.9999	0.9999	0.0020	0.9959	1.0039	0.9971	0.9999	0.0677	0.8721	1.1409	49.80	50.38
The Project WCS CRM	0.4	0.0002170	25	0.9997	0.9997	0.0020	0.9957	1.0037	0.9925	0.9954	0.0664	0.8726	1.1328	49.28	50.94
The Project WCS CRM plus lower disp	0.4	0.0002486	25	0.9997	0.9997	0.0020	0.9956	1.0039	0.9946	0.9959	0.0670	0.8688	1.1338	49.60	50.32
The Project WCS CRM plus Upper disp	0.5	0.0003115	25	0.9996	0.9996	0.0020	0.9956	1.0037	0.9908	0.9929	0.0672	0.8671	1.1298	48.98	50.98
In-comb Lower disp	0.0	0.0000305	25	1.0000	1.0000	0.0021	0.9959	1.0041	1.0003	1.0019	0.0680	0.8753	1.1449	49.82	50.30
In-comb Upper disp	0.2	0.0000976	25	0.9999	0.9999	0.0021	0.9958	1.0040	0.9985	1.0001	0.0672	0.8728	1.1368	49.44	50.70
In-comb WCS CRM	0.4	0.0002256	25	0.9997	0.9997	0.0020	0.9958	1.0037	0.9924	0.9958	0.0668	0.8691	1.1355	49.54	50.84
In-comb WCS CRM plus lower disp	0.4	0.0002561	25	0.9997	0.9997	0.0020	0.9956	1.0037	0.9920	0.9950	0.0664	0.8729	1.1316	49.50	50.52
In-comb WCS CRM plus upper disp	0.5	0.0003171	25	0.9996	0.9996	0.0020	0.9957	1.0035	0.9906	0.9929	0.0674	0.8694	1.1343	49.22	50.86
The Project Lower disp	0.1	0.0000317	35	0.9999	0.9999	0.0017	0.9965	1.0033	0.9971	0.9992	0.0739	0.8612	1.1522	50.12	49.88
The Project Upper disp	0.2	0.0000945	35	0.9999	0.9999	0.0017	0.9965	1.0033	0.9959	0.9994	0.0736	0.8621	1.1489	50.14	49.82
The Project WCS CRM	0.4	0.0002170	35	0.9997	0.9997	0.0017	0.9963	1.0030	0.9913	0.9931	0.0725	0.8593	1.1439	49.62	50.32
The Project WCS CRM plus lower disp	0.4	0.0002486	35	0.9997	0.9997	0.0017	0.9964	1.0031	0.9904	0.9931	0.0727	0.8596	1.1431	49.44	50.48
The Project WCS CRM plus Upper disp	0.5	0.0003115	35	0.9996	0.9996	0.0017	0.9961	1.0029	0.9870	0.9891	0.0731	0.8512	1.1427	49.06	50.96
In-comb Lower disp	0.0	0.0000305	35	1.0000	0.9999	0.0017	0.9965	1.0033	0.9976	1.0013	0.0747	0.8621	1.1558	50.12	49.94

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb Upper disp	0.2	0.0000976	35	0.9999	0.9999	0.0017	0.9965	1.0032	0.9961	0.9993	0.0732	0.8652	1.1547	50.12	49.84
In-comb WCS CRM	0.4	0.0002256	35	0.9997	0.9997	0.0017	0.9963	1.0030	0.9892	0.9929	0.0725	0.8557	1.1438	49.36	50.64
In-comb WCS CRM plus lower disp	0.4	0.0002561	35	0.9997	0.9997	0.0017	0.9964	1.0031	0.9892	0.9922	0.0719	0.8579	1.1431	49.54	50.50
In-comb WCS CRM plus upper disp	0.5	0.0003171	35	0.9996	0.9996	0.0017	0.9962	1.0029	0.9865	0.9891	0.0735	0.8539	1.1468	49.00	50.96
The Project Lower disp	0.1	0.0000317	50	1.0000	1.0000	0.0014	0.9972	1.0027	0.9973	1.0001	0.0814	0.8479	1.1697	49.92	50.10
The Project Upper disp	0.2	0.0000945	50	0.9999	0.9999	0.0014	0.9971	1.0027	0.9970	1.0003	0.0818	0.8489	1.1714	49.82	50.18
The Project WCS CRM	0.4	0.0002170	50	0.9998	0.9998	0.0014	0.9971	1.0025	0.9916	0.9941	0.0809	0.8445	1.1606	49.44	50.66
The Project WCS CRM plus lower disp	0.4	0.0002486	50	0.9998	0.9998	0.0014	0.9971	1.0026	0.9895	0.9935	0.0805	0.8464	1.1656	49.30	50.74
The Project WCS CRM plus Upper disp	0.5	0.0003115	50	0.9997	0.9997	0.0014	0.9970	1.0024	0.9871	0.9902	0.0807	0.8386	1.1597	49.22	51.04
In-comb Lower disp	0.0	0.0000305	50	1.0000	1.0000	0.0014	0.9972	1.0027	0.9982	1.0019	0.0822	0.8512	1.1731	49.86	50.14
In-comb Upper disp	0.2	0.0000976	50	0.9999	0.9999	0.0014	0.9972	1.0026	0.9966	1.0001	0.0810	0.8461	1.1694	49.78	50.42
In-comb WCS CRM	0.4	0.0002256	50	0.9998	0.9998	0.0014	0.9970	1.0026	0.9889	0.9934	0.0816	0.8410	1.1660	49.32	50.80
In-comb WCS CRM plus lower disp	0.4	0.0002561	50	0.9998	0.9998	0.0014	0.9970	1.0024	0.9894	0.9928	0.0798	0.8441	1.1608	49.30	50.76
In-comb WCS CRM plus upper disp	0.5	0.0003171	50	0.9997	0.9997	0.0014	0.9970	1.0024	0.9865	0.9898	0.0810	0.8401	1.1601	48.88	51.00

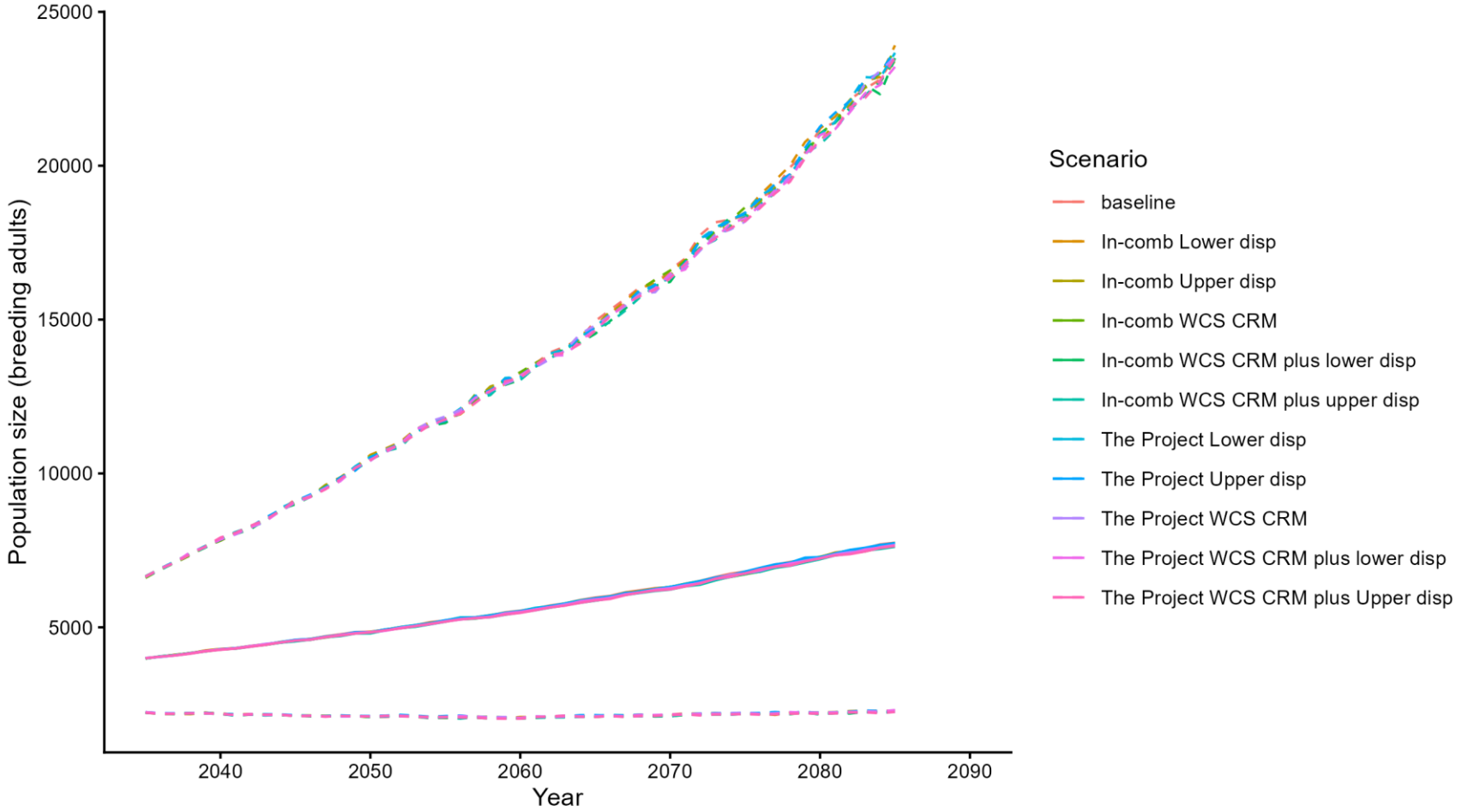


Figure 40: Kittiwake – Rum SPA PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 87: Kittiwake – Rum SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake Rum SPA Minches and W Scot rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	3.165476e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	9.454041e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	1640	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.785	Scenario C Impact on adult survival rate per pair mean	0.0002169884
Productivity rate per pair standard deviation	0.414	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0002486432
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0003115288

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	3.04878e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	9.756098e-05
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0002256098
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0002560976
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0003170732
		Scenario J Impact on immature survival rate mean	0

Table 88: Kittiwake – Rum SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.1	0.0000317	25	1.0000	1.0000	0.0017	0.9968	1.0034	0.9991	1.0018	0.0586	0.8911	1.1212	49.68	50.16
The Project Upper disp	0.2	0.0000945	25	0.9999	0.9999	0.0017	0.9966	1.0032	0.9990	0.9992	0.0583	0.8873	1.1186	49.90	50.04
The Project WCS CRM	0.4	0.0002170	25	0.9997	0.9997	0.0017	0.9964	1.0031	0.9930	0.9957	0.0579	0.8841	1.1124	49.50	50.46
The Project WCS CRM plus lower disp	0.4	0.0002486	25	0.9997	0.9997	0.0017	0.9964	1.0030	0.9941	0.9954	0.0572	0.8879	1.1135	49.46	50.74
The Project WCS CRM plus Upper disp	0.5	0.0003115	25	0.9996	0.9996	0.0017	0.9963	1.0030	0.9898	0.9924	0.0573	0.8855	1.1130	48.84	50.70
In-comb Lower disp	0.0	0.0000305	25	1.0000	1.0000	0.0017	0.9966	1.0033	1.0006	1.0017	0.0583	0.8922	1.1207	49.82	50.20
In-comb Upper disp	0.2	0.0000976	25	0.9999	0.9999	0.0017	0.9964	1.0032	0.9976	0.9995	0.0581	0.8903	1.1173	49.80	50.14
In-comb WCS CRM	0.4	0.0002256	25	0.9997	0.9997	0.0017	0.9963	1.0030	0.9926	0.9946	0.0578	0.8852	1.1150	49.54	50.50
In-comb WCS CRM plus lower disp	0.4	0.0002561	25	0.9997	0.9997	0.0017	0.9964	1.0030	0.9927	0.9944	0.0580	0.8881	1.1143	49.46	50.82
In-comb WCS CRM plus upper disp	0.5	0.0003171	25	0.9996	0.9996	0.0017	0.9963	1.0028	0.9894	0.9925	0.0584	0.8809	1.1131	49.46	50.60
The Project Lower disp	0.1	0.0000317	35	1.0000	1.0000	0.0013	0.9974	1.0027	0.9991	1.0017	0.0626	0.8861	1.1289	49.86	50.08
The Project Upper disp	0.2	0.0000945	35	0.9999	0.9999	0.0013	0.9971	1.0026	0.9973	0.9987	0.0624	0.8778	1.1290	49.74	50.42
The Project WCS CRM	0.4	0.0002170	35	0.9997	0.9997	0.0014	0.9970	1.0025	0.9912	0.9935	0.0618	0.8760	1.1226	49.50	50.74
The Project WCS CRM plus lower disp	0.4	0.0002486	35	0.9997	0.9997	0.0013	0.9971	1.0023	0.9918	0.9927	0.0605	0.8790	1.1189	49.30	50.82
The Project WCS CRM plus Upper disp	0.5	0.0003115	35	0.9996	0.9996	0.0014	0.9970	1.0023	0.9869	0.9892	0.0615	0.8742	1.1205	48.84	51.38
In-comb Lower disp	0.0	0.0000305	35	1.0000	1.0000	0.0013	0.9972	1.0026	1.0000	1.0014	0.0621	0.8858	1.1327	49.74	50.20

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb Upper disp	0.2	0.0000976	35	0.9999	0.9999	0.0014	0.9971	1.0027	0.9964	0.9985	0.0624	0.8801	1.1265	49.52	50.52
In-comb WCS CRM	0.4	0.0002256	35	0.9997	0.9997	0.0014	0.9970	1.0024	0.9905	0.9927	0.0619	0.8763	1.1233	49.74	50.26
In-comb WCS CRM plus lower disp	0.4	0.0002561	35	0.9997	0.9997	0.0014	0.9969	1.0024	0.9890	0.9916	0.0619	0.8749	1.1208	48.68	51.20
In-comb WCS CRM plus upper disp	0.5	0.0003171	35	0.9996	0.9996	0.0013	0.9970	1.0022	0.9860	0.9889	0.0617	0.8715	1.1204	48.84	51.16
The Project Lower disp	0.1	0.0000317	50	1.0000	1.0000	0.0010	0.9979	1.0022	0.9998	1.0017	0.0664	0.8762	1.1373	49.76	50.24
The Project Upper disp	0.2	0.0000945	50	0.9999	0.9999	0.0010	0.9977	1.0020	0.9978	0.9988	0.0661	0.8721	1.1367	49.76	50.28
The Project WCS CRM	0.4	0.0002170	50	0.9998	0.9998	0.0011	0.9976	1.0019	0.9904	0.9931	0.0660	0.8691	1.1298	49.30	50.42
The Project WCS CRM plus lower disp	0.4	0.0002486	50	0.9998	0.9998	0.0010	0.9976	1.0018	0.9918	0.9925	0.0642	0.8681	1.1266	49.54	50.54
The Project WCS CRM plus Upper disp	0.5	0.0003115	50	0.9997	0.9997	0.0011	0.9977	1.0018	0.9870	0.9890	0.0653	0.8665	1.1269	49.12	50.80
In-comb Lower disp	0.0	0.0000305	50	1.0000	1.0000	0.0010	0.9979	1.0021	0.9997	1.0013	0.0659	0.8776	1.1408	49.88	50.16
In-comb Upper disp	0.2	0.0000976	50	0.9999	0.9999	0.0011	0.9977	1.0021	0.9958	0.9983	0.0663	0.8745	1.1364	49.74	50.42
In-comb WCS CRM	0.4	0.0002256	50	0.9998	0.9998	0.0011	0.9977	1.0019	0.9902	0.9925	0.0663	0.8688	1.1339	49.22	50.56
In-comb WCS CRM plus lower disp	0.4	0.0002561	50	0.9998	0.9998	0.0011	0.9977	1.0019	0.9885	0.9915	0.0658	0.8677	1.1257	49.20	50.58
In-comb WCS CRM plus upper disp	0.5	0.0003171	50	0.9997	0.9997	0.0010	0.9977	1.0018	0.9864	0.9890	0.0646	0.8670	1.1246	49.36	50.62

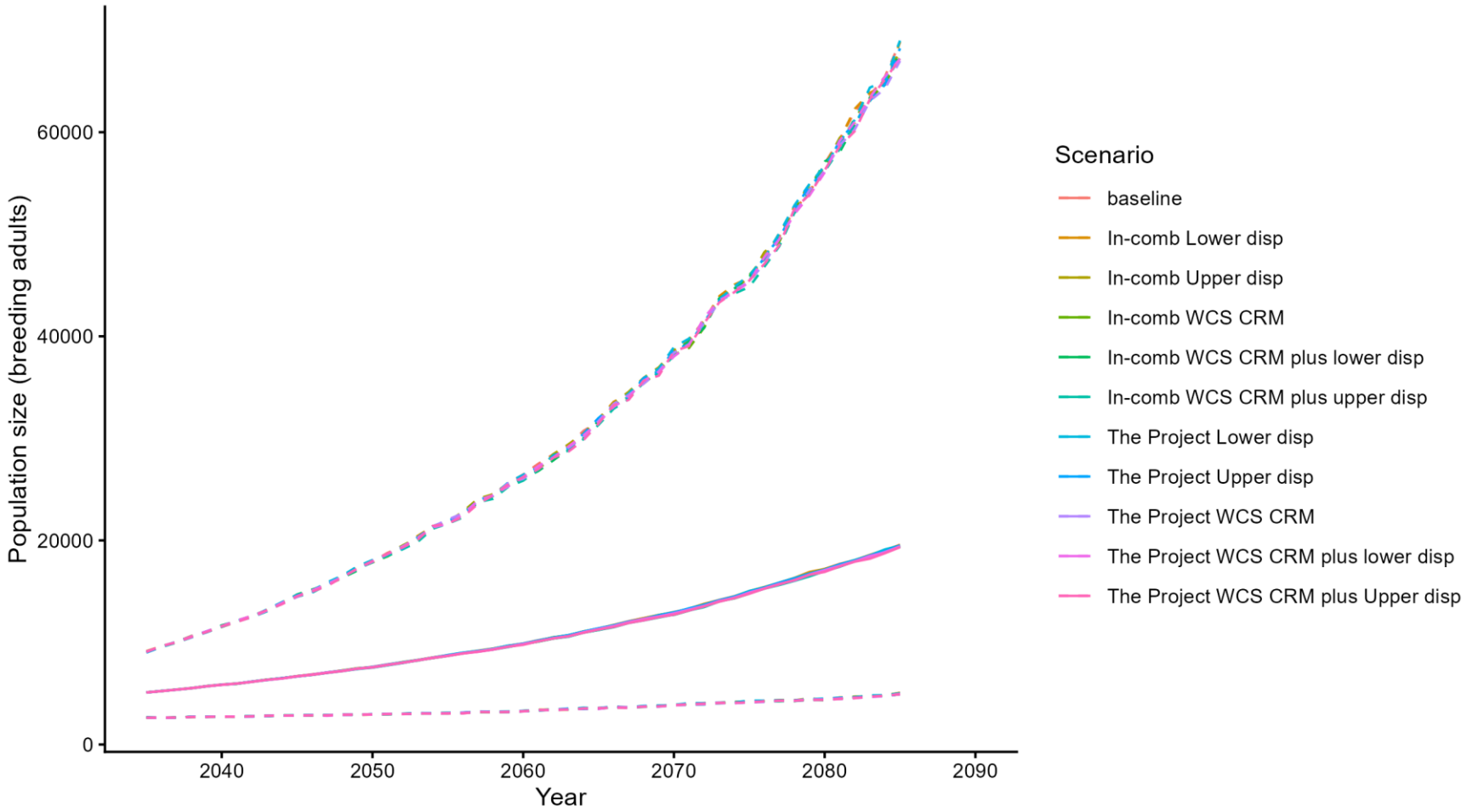


Figure 41: Kittiwake – Rum SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.2.11 Kittiwake: St Kilda SPA

Table 89: Kittiwake – St Kilda SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake St Kilda SPA CEH National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	2.855312e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	8.540623e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	1658	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.69	Scenario C Impact on adult survival rate per pair mean	0.0001359513
Productivity rate per pair standard deviation	0.296	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0001645044
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0002213576
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	3.015682e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	8.443908e-05
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0001387214
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0001628468
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0002231604
		Scenario J Impact on immature survival rate mean	0

Table 90: Kittiwake – St Kilda SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.0	0.0000286	25	1.0000	1.0000	0.0020	0.9960	1.0039	0.9995	1.0015	0.0665	0.8772	1.1385	49.96	50.06
The Project Upper disp	0.1	0.0000854	25	0.9999	0.9999	0.0021	0.9959	1.0040	0.9984	1.0003	0.0677	0.8737	1.1401	49.62	50.34
The Project WCS CRM	0.2	0.0001360	25	0.9998	0.9998	0.0020	0.9959	1.0039	0.9959	0.9988	0.0668	0.8777	1.1396	49.60	50.66
The Project WCS CRM plus lower disp	0.3	0.0001645	25	0.9998	0.9998	0.0020	0.9958	1.0040	0.9955	0.9981	0.0672	0.8760	1.1408	49.20	50.80
The Project WCS CRM plus Upper disp	0.4	0.0002214	25	0.9997	0.9997	0.0021	0.9957	1.0038	0.9941	0.9958	0.0677	0.8698	1.1360	49.58	50.38
In-comb Lower disp	0.0	0.0000302	25	1.0000	1.0000	0.0020	0.9959	1.0039	0.9989	1.0013	0.0670	0.8783	1.1437	49.68	50.40
In-comb Upper disp	0.1	0.0000844	25	0.9998	0.9999	0.0021	0.9958	1.0039	0.9968	0.9991	0.0670	0.8751	1.1335	49.50	50.64
In-comb WCS CRM	0.2	0.0001387	25	0.9998	0.9999	0.0020	0.9958	1.0039	0.9960	0.9983	0.0670	0.8724	1.1373	49.62	50.38
In-comb WCS CRM plus lower disp	0.3	0.0001628	25	0.9998	0.9998	0.0020	0.9959	1.0039	0.9965	0.9973	0.0658	0.8763	1.1292	49.68	50.32
In-comb WCS CRM plus upper disp	0.4	0.0002232	25	0.9998	0.9998	0.0020	0.9959	1.0039	0.9932	0.9965	0.0666	0.8703	1.1321	49.48	50.58
The Project Lower disp	0.0	0.0000286	35	1.0000	1.0000	0.0017	0.9967	1.0032	0.9986	1.0012	0.0729	0.8649	1.1516	50.26	49.86
The Project Upper disp	0.1	0.0000854	35	0.9999	0.9999	0.0017	0.9966	1.0032	0.9970	0.9996	0.0741	0.8605	1.1526	49.84	50.20
The Project WCS CRM	0.2	0.0001360	35	0.9999	0.9999	0.0017	0.9965	1.0032	0.9936	0.9982	0.0734	0.8646	1.1478	49.38	50.36
The Project WCS CRM plus lower disp	0.3	0.0001645	35	0.9998	0.9998	0.0017	0.9965	1.0033	0.9937	0.9959	0.0733	0.8614	1.1485	49.20	50.40
The Project WCS CRM plus Upper disp	0.4	0.0002214	35	0.9997	0.9997	0.0017	0.9964	1.0030	0.9907	0.9934	0.0737	0.8543	1.1456	49.34	50.62
In-comb Lower disp	0.0	0.0000302	35	1.0000	1.0000	0.0017	0.9967	1.0033	0.9998	1.0014	0.0730	0.8656	1.1535	50.02	50.00

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb Upper disp	0.1	0.0000844	35	0.9998	0.9999	0.0017	0.9965	1.0032	0.9957	0.9980	0.0731	0.8648	1.1486	50.02	49.96
In-comb WCS CRM	0.2	0.0001387	35	0.9998	0.9998	0.0017	0.9966	1.0032	0.9948	0.9969	0.0732	0.8631	1.1487	50.04	49.98
In-comb WCS CRM plus lower disp	0.3	0.0001628	35	0.9998	0.9998	0.0017	0.9965	1.0032	0.9937	0.9954	0.0719	0.8602	1.1400	49.84	50.10
In-comb WCS CRM plus upper disp	0.4	0.0002232	35	0.9997	0.9998	0.0017	0.9965	1.0032	0.9897	0.9941	0.0723	0.8604	1.1435	49.12	50.46
The Project Lower disp	0.0	0.0000286	50	1.0000	1.0000	0.0013	0.9973	1.0026	0.9993	1.0020	0.0803	0.8521	1.1687	49.78	50.10
The Project Upper disp	0.1	0.0000854	50	0.9999	0.9999	0.0014	0.9972	1.0027	0.9972	1.0006	0.0817	0.8471	1.1690	50.00	49.98
The Project WCS CRM	0.2	0.0001360	50	0.9999	0.9999	0.0014	0.9972	1.0027	0.9954	0.9996	0.0819	0.8470	1.1717	49.68	50.26
The Project WCS CRM plus lower disp	0.3	0.0001645	50	0.9999	0.9999	0.0014	0.9972	1.0026	0.9950	0.9977	0.0819	0.8483	1.1670	49.74	50.28
The Project WCS CRM plus Upper disp	0.4	0.0002214	50	0.9998	0.9998	0.0014	0.9971	1.0026	0.9909	0.9947	0.0810	0.8434	1.1682	49.46	50.62
In-comb Lower disp	0.0	0.0000302	50	1.0000	1.0000	0.0014	0.9973	1.0028	0.9991	1.0025	0.0813	0.8537	1.1759	50.08	49.92
In-comb Upper disp	0.1	0.0000844	50	0.9999	0.9999	0.0014	0.9971	1.0027	0.9973	0.9992	0.0817	0.8504	1.1712	50.12	49.80
In-comb WCS CRM	0.2	0.0001387	50	0.9999	0.9999	0.0014	0.9972	1.0025	0.9949	0.9981	0.0809	0.8468	1.1699	50.06	49.96
In-comb WCS CRM plus lower disp	0.3	0.0001628	50	0.9999	0.9999	0.0014	0.9971	1.0027	0.9940	0.9967	0.0808	0.8480	1.1700	49.54	50.58
In-comb WCS CRM plus upper disp	0.4	0.0002232	50	0.9998	0.9998	0.0014	0.9971	1.0025	0.9910	0.9947	0.0805	0.8457	1.1635	49.76	50.28

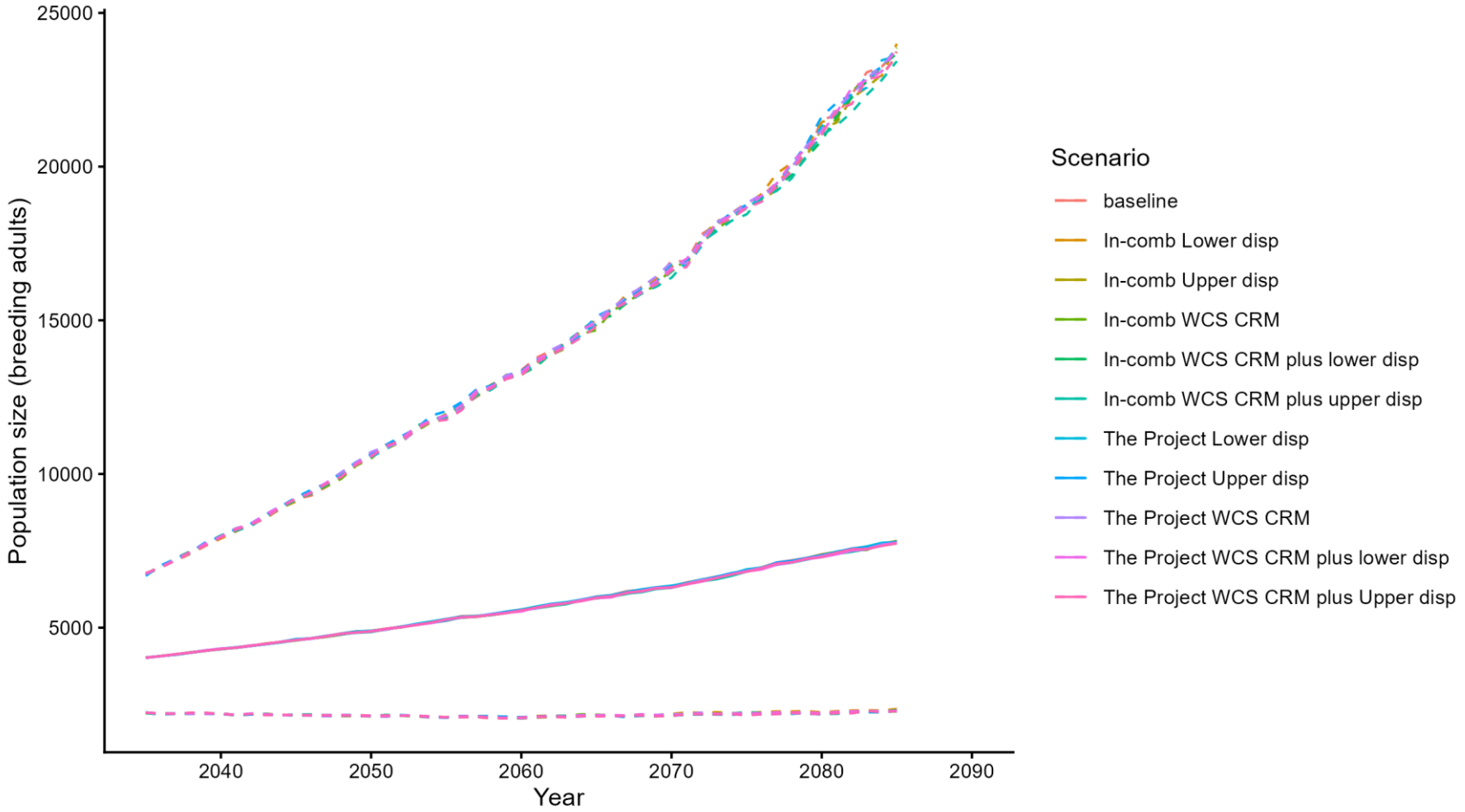


Figure 42: Kittiwake – St Kilda SPA PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 91: Kittiwake – St Kilda SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'site specific' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Kittiwake St Kilda SPA site-specific rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Black-legged kittiwake	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	4	Scenario A Impact on adult survival rate	2.855312e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	2	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	8.540623e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	1658	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.358	Scenario C Impact on adult survival rate per pair mean	0.0001359513
Productivity rate per pair standard deviation	0.232	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.854	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.077	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.79	Scenario D Impact on adult survival rate	0.0001645044
Immatures survival rates 0 to 1 standard deviation	0.077	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.854	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.077	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.854	Scenario E Impact on adult survival rate	0.0002213576

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.077	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.854	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.077	Scenario F Impact on productivity rate per pair mean	0
Units for output	whole.population	Scenario F Impact on adult survival rate	3.015682e-05
		Scenario F Impact on immature survival rate mean	0
		Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	8.443908e-05
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0001387214
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0001628468
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0002231604
		Scenario J Impact on immature survival rate mean	0

Table 92: Kittiwake – St Kilda SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'site specific' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.0	0.0000286	25	1.0001	1.0000	0.0053	0.9893	1.0106	1.0027	1.0124	0.1528	0.7453	1.3502	49.60	50.46
The Project Upper disp	0.1	0.0000854	25	1.0001	1.0000	0.0054	0.9896	1.0108	1.0000	1.0116	0.1526	0.7519	1.3572	49.60	50.42
The Project WCS CRM	0.2	0.0001360	25	0.9998	0.9999	0.0053	0.9895	1.0104	0.9960	1.0082	0.1518	0.7398	1.3376	50.18	49.96
The Project WCS CRM plus lower disp	0.3	0.0001645	25	0.9998	0.9999	0.0052	0.9897	1.0106	0.9945	1.0069	0.1503	0.7474	1.3368	49.60	50.50
The Project WCS CRM plus Upper disp	0.4	0.0002214	25	0.9997	0.9998	0.0054	0.9888	1.0105	0.9937	1.0066	0.1556	0.7374	1.3394	49.60	50.40
In-comb Lower disp	0.0	0.0000302	25	1.0001	1.0001	0.0053	0.9894	1.0106	1.0029	1.0127	0.1520	0.7454	1.3429	50.00	50.14
In-comb Upper disp	0.1	0.0000844	25	1.0000	1.0000	0.0053	0.9895	1.0108	1.0000	1.0118	0.1531	0.7408	1.3516	50.32	49.70
In-comb WCS CRM	0.2	0.0001387	25	0.9998	0.9998	0.0055	0.9889	1.0106	0.9930	1.0054	0.1557	0.7343	1.3378	49.60	50.30
In-comb WCS CRM plus lower disp	0.3	0.0001628	25	0.9998	0.9999	0.0053	0.9893	1.0108	0.9948	1.0093	0.1542	0.7463	1.3438	50.18	49.90
In-comb WCS CRM plus upper disp	0.4	0.0002232	25	0.9997	0.9998	0.0053	0.9894	1.0103	0.9924	1.0041	0.1517	0.7406	1.3417	49.44	50.44
The Project Lower disp	0.0	0.0000286	35	1.0001	1.0001	0.0054	0.9894	1.0109	1.0007	1.0227	0.2108	0.6667	1.5000	50.32	49.84
The Project Upper disp	0.1	0.0000854	35	1.0000	1.0000	0.0055	0.9891	1.0111	1.0000	1.0204	0.2107	0.6666	1.5032	50.52	49.78
The Project WCS CRM	0.2	0.0001360	35	0.9999	0.9999	0.0054	0.9893	1.0105	0.9983	1.0160	0.2092	0.6635	1.4839	49.66	50.22
The Project WCS CRM plus lower disp	0.3	0.0001645	35	0.9997	0.9999	0.0053	0.9893	1.0109	0.9928	1.0143	0.2086	0.6743	1.4944	49.66	50.30
The Project WCS CRM plus Upper disp	0.4	0.0002214	35	0.9998	0.9998	0.0054	0.9891	1.0113	0.9923	1.0149	0.2130	0.6616	1.5119	50.04	50.16
In-comb Lower disp	0.0	0.0000302	35	1.0001	1.0000	0.0054	0.9891	1.0109	1.0000	1.0214	0.2090	0.6654	1.5000	50.32	49.86

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb Upper disp	0.1	0.0000844	35	0.9999	1.0000	0.0054	0.9891	1.0109	1.0000	1.0209	0.2114	0.6655	1.4990	50.04	50.00
In-comb WCS CRM	0.2	0.0001387	35	0.9999	0.9998	0.0056	0.9889	1.0110	0.9920	1.0142	0.2158	0.6583	1.5099	49.26	50.68
In-comb WCS CRM plus lower disp	0.3	0.0001628	35	0.9998	0.9999	0.0054	0.9887	1.0109	0.9921	1.0165	0.2095	0.6598	1.4872	50.32	49.76
In-comb WCS CRM plus upper disp	0.4	0.0002232	35	0.9998	0.9998	0.0055	0.9890	1.0106	0.9884	1.0116	0.2105	0.6644	1.4780	49.66	50.52
The Project Lower disp	0.0	0.0000286	50	1.0002	1.0001	0.0062	0.9878	1.0125	1.0086	1.0613	0.5614	0.5267	1.9187	51.26	49.40
The Project Upper disp	0.1	0.0000854	50	1.0000	0.9998	0.0155	0.9867	1.0126	1.0000	1.0545	0.3907	0.5161	1.9167	50.92	49.56
The Project WCS CRM	0.2	0.0001360	50	0.9999	0.9999	0.0063	0.9874	1.0124	0.9976	1.0487	0.4121	0.5172	1.8890	50.92	49.68
The Project WCS CRM plus lower disp	0.3	0.0001645	50	0.9998	0.9999	0.0062	0.9878	1.0125	0.9860	1.0483	0.5094	0.5280	1.9091	50.92	49.68
The Project WCS CRM plus Upper disp	0.4	0.0002214	50	0.9999	0.9996	0.0155	0.9870	1.0123	0.9965	1.0474	0.3776	0.5079	1.9071	50.92	49.74
In-comb Lower disp	0.0	0.0000302	50	1.0001	1.0001	0.0063	0.9874	1.0127	1.0000	1.0612	0.4809	0.5274	1.9075	51.26	49.38
In-comb Upper disp	0.1	0.0000844	50	1.0000	0.9999	0.0155	0.9881	1.0123	1.0000	1.0598	0.3917	0.5370	1.8981	50.92	49.44
In-comb WCS CRM	0.2	0.0001387	50	0.9999	0.9997	0.0155	0.9870	1.0124	0.9920	1.0517	0.5097	0.5113	1.8968	50.92	49.42
In-comb WCS CRM plus lower disp	0.3	0.0001628	50	1.0001	1.0000	0.0062	0.9876	1.0127	1.0000	1.0561	0.3877	0.5211	1.9164	51.26	49.42
In-comb WCS CRM plus upper disp	0.4	0.0002232	50	0.9999	0.9999	0.0062	0.9875	1.0119	0.9960	1.0492	0.4970	0.5274	1.8698	49.92	50.50

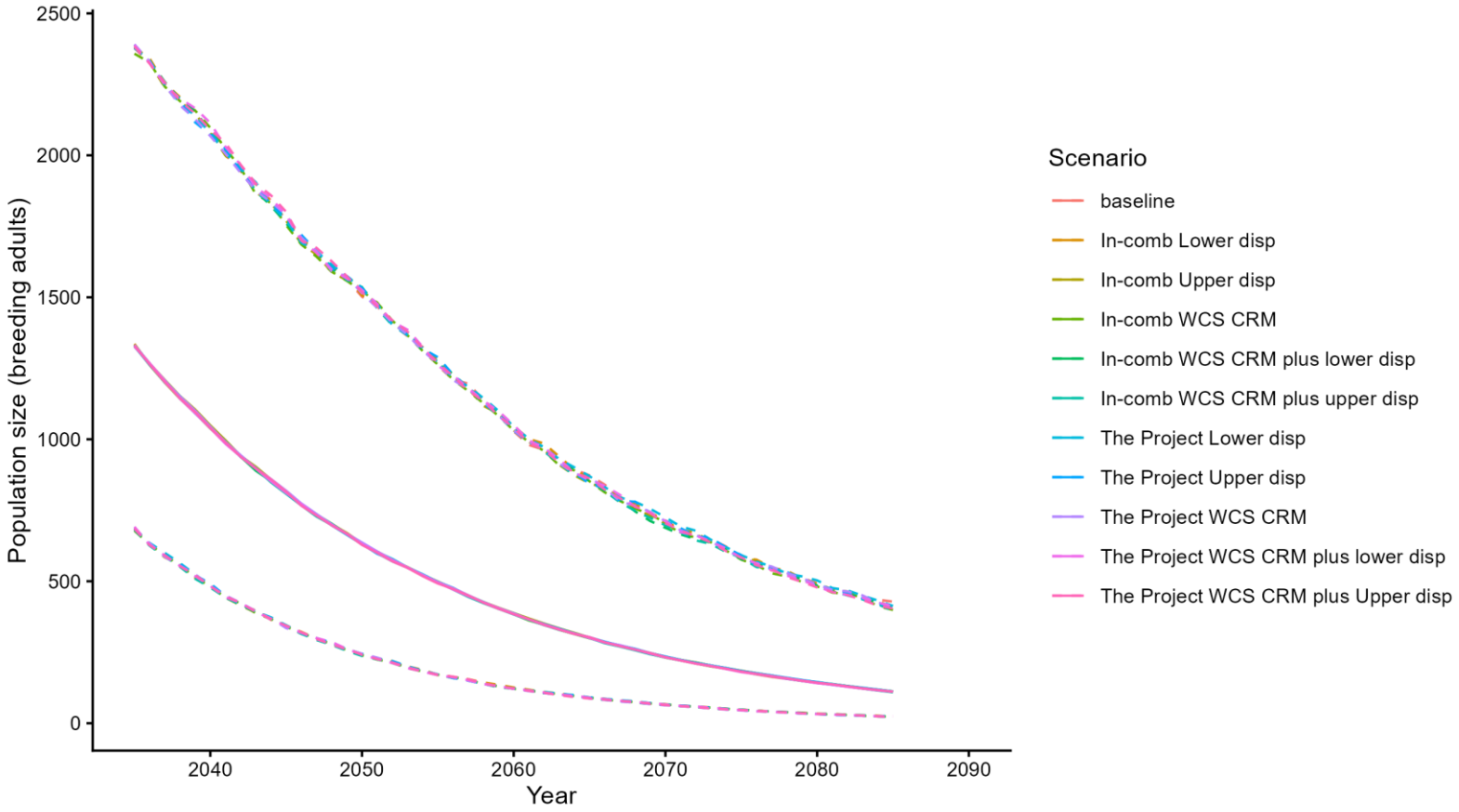


Figure 43: Kittiwake – St Kilda SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'site specific' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.2.12 Great black-backed gull: North Rona and Sula Sgeir SPA

Table 93: Great black-backed gull – North Rona and Sula Sgeir SPA population PVA inputs for Project alone. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Great black-backed gull N Rona and Sula Sgeirr SPA CEH National rates	Number of scenarios of impact	1
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project WCS CRM
Species	Great black-backed gull	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0007142857
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	3	Scenario B name	
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	
Initial population size	98	Scenario C name	
Year	2021	Scenario C Impact on productivity rate per pair mean	
Productivity rate per pair mean	0.93	Scenario C Impact on adult survival rate per pair mean	
Productivity rate per pair standard deviation	0.433	Scenario C Impact on immature survival rate mean	
Adult survival rate Mean	0.93	Scenario D name	
Adult survival rate standard deviation	0.01	Scenario D Impact on productivity rate per pair mean	
Immatures survival rates 0 to 1 mean	0.93	Scenario D Impact on adult survival rate	
Immatures survival rates 0 to 1 standard deviation	0.01	Scenario D Impact on immature survival rate mean	
Immatures survival rates 1 to 2 mean	0.93	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.01	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.93	Scenario E Impact on adult survival rate	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.01	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.93	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.01	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.93	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.01	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 94: Great black-backed gull – North Rona and Sula Sgeir SPA population PVA outputs for Project alone. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project WCS CRM	0.1	0.0007143	25	0.9992	0.9992	0.0017	0.9960	1.0025	0.9795	0.9845	0.0905	0.8170	1.1813	47.68	52.82
The Project WCS CRM	0.1	0.0007143	35	0.9992	0.9992	0.0012	0.9968	1.0016	0.9718	0.9770	0.0904	0.8107	1.1728	46.64	53.20
The Project WCS CRM	0.1	0.0007143	50	0.9995	0.9995	0.0009	0.9977	1.0012	0.9725	0.9770	0.0905	0.8129	1.1728	47.12	52.90

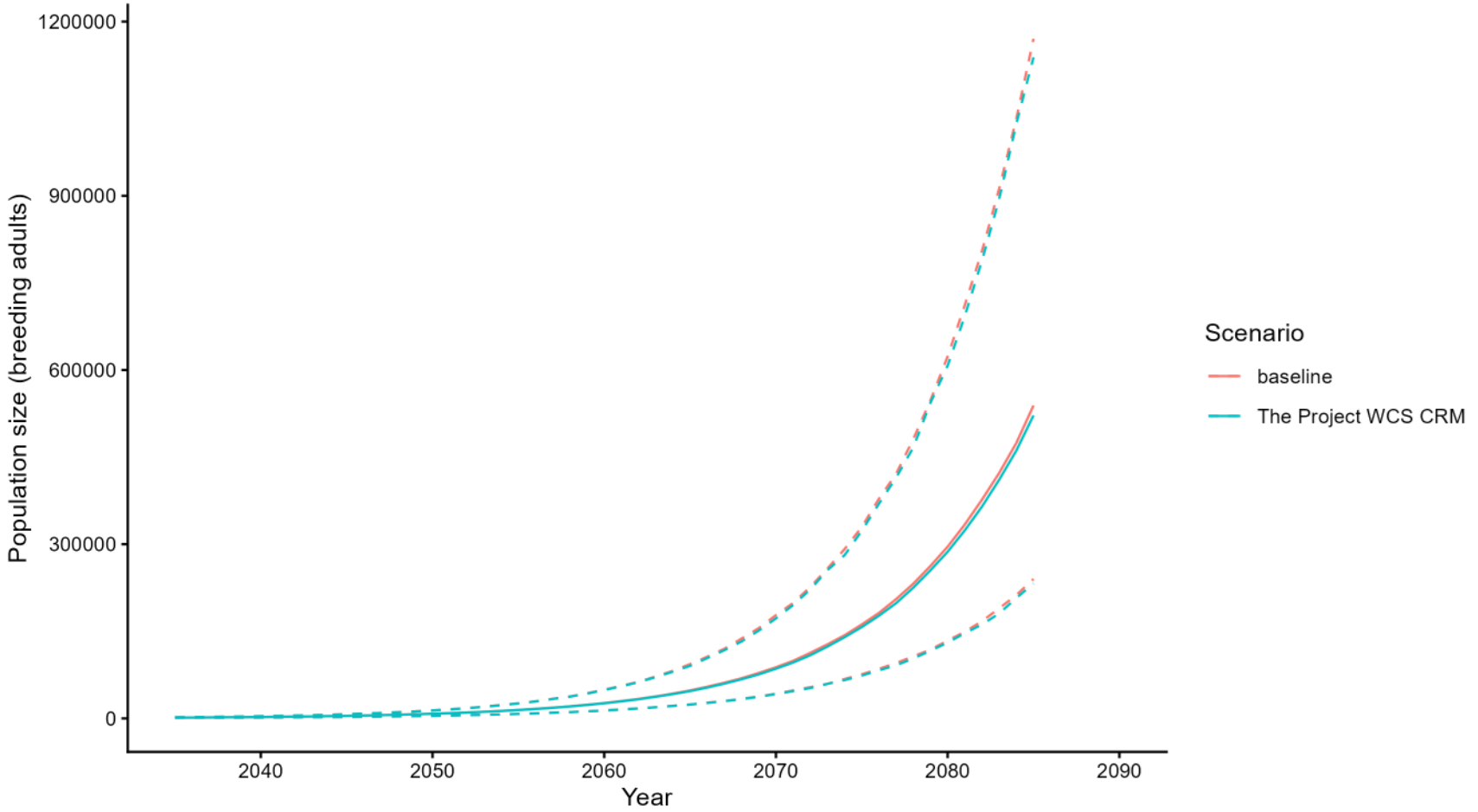


Figure 44: Great black-backed gull – North Rona and Sula Sgeir SPA PVA outputs for Project alone using 'CEH Scotland' productivity rate. Baseline = unimpacted population. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 95: Great black-backed gull – North Rona and Sula Sgeir SPA population PVA inputs for Project alone. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Great black-backed gull N Rona and Sula Sgeirr SPA Minches and W Scot rates	Number of scenarios of impact	1
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project WCS CRM
Species	Great black-backed gull	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0007142857
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	3	Scenario B name	
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	
Initial population size	98	Scenario C name	
Year	2021	Scenario C Impact on productivity rate per pair mean	
Productivity rate per pair mean	0.87	Scenario C Impact on adult survival rate per pair mean	
Productivity rate per pair standard deviation	0.43	Scenario C Impact on immature survival rate mean	
Adult survival rate Mean	0.93	Scenario D name	
Adult survival rate standard deviation	0.01	Scenario D Impact on productivity rate per pair mean	
Immatures survival rates 0 to 1 mean	0.93	Scenario D Impact on adult survival rate	
Immatures survival rates 0 to 1 standard deviation	0.01	Scenario D Impact on immature survival rate mean	
Immatures survival rates 1 to 2 mean	0.93	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.01	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.93	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.01	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.93	Scenario F name	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 standard deviation	0.01	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.93	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.01	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 96: Great black-backed gull – North Rona and Sula Sgeir SPA population PVA outputs for Project alone. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project WCS CRM	0.1	0.0007143	25	0.9993	0.9993	0.0017	0.9959	1.0027	0.9810	0.9869	0.0950	0.8161	1.1945	48.08	51.90
The Project WCS CRM	0.1	0.0007143	35	0.9993	0.9993	0.0013	0.9967	1.0018	0.9731	0.9794	0.0946	0.8113	1.1828	47.00	53.04
The Project WCS CRM	0.1	0.0007143	50	0.9995	0.9995	0.0009	0.9977	1.0013	0.9732	0.9793	0.0947	0.8116	1.1850	47.78	51.98

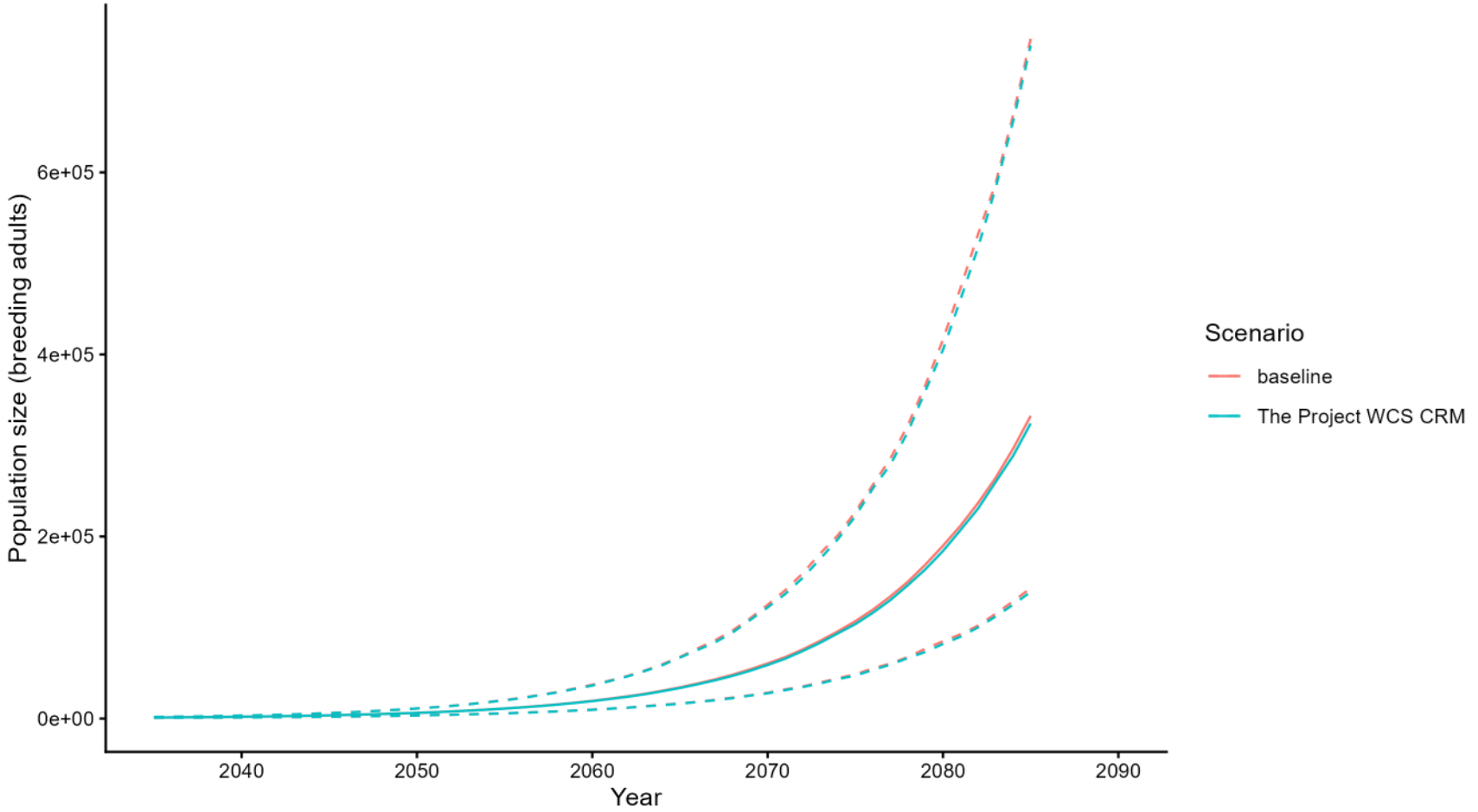


Figure 45: Great black-backed gull – North Rona and Sula Sgeir SPA population PVA outputs for Project using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Solid line = mean population size, dashed line = 95% confidence intervals.

5.2.13 Guillemot: Rathlin Island SPA

Table 97: Guillemot – Rathlin Island SPA population PVA inputs for Project alone. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Guillemot Rathlin Island SPA CEH Scotland rates	Number of scenarios of impact	2
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Common Guillemot	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	6	Scenario A Impact on adult survival rate	0.001152911
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.002529483
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	152095	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.502	Scenario C Impact on adult survival rate per pair mean	0
Productivity rate per pair standard deviation	0.208	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.94	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.025	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.56	Scenario D Impact on adult survival rate	0
Immatures survival rates 0 to 1 standard deviation	0.058	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.792	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.152	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.917	Scenario E Impact on adult survival rate	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.098	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.938	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.107	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.94	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.025	Scenario F Impact on immature survival rate mean	
Immatures survival rates 5 to 6 mean	0.94	Scenario G name	
Immatures survival rates 5 to 6 standard deviation	0.025	Scenario G Impact on productivity rate per pair mean	
Units for output	whole.population	Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 98: Guillemot – Rathlin Island SPA population PVA outputs for Project alone. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	175.4	0.0011529	25	0.9987	0.9987	0.0001	0.9984	0.9990	0.9670	0.9670	0.0046	0.9579	0.9762	43.60	55.82
The Project Upper disp	384.7	0.0025295	25	0.9972	0.9972	0.0001	0.9969	0.9975	0.9292	0.9291	0.0045	0.9204	0.9380	36.44	62.88
The Project Lower disp	175.4	0.0011529	35	0.9987	0.9987	0.0001	0.9985	0.9989	0.9545	0.9546	0.0050	0.9448	0.9645	42.58	57.20
The Project Upper disp	384.7	0.0025295	35	0.9972	0.9972	0.0001	0.9969	0.9974	0.9031	0.9032	0.0047	0.8943	0.9126	33.70	66.26
The Project Lower disp	175.4	0.0011529	50	0.9991	0.9991	0.0001	0.9989	0.9993	0.9545	0.9546	0.0054	0.9440	0.9649	43.90	56.52
The Project Upper disp	384.7	0.0025295	50	0.9980	0.9980	0.0001	0.9978	0.9982	0.9032	0.9032	0.0051	0.8932	0.9132	36.24	64.46

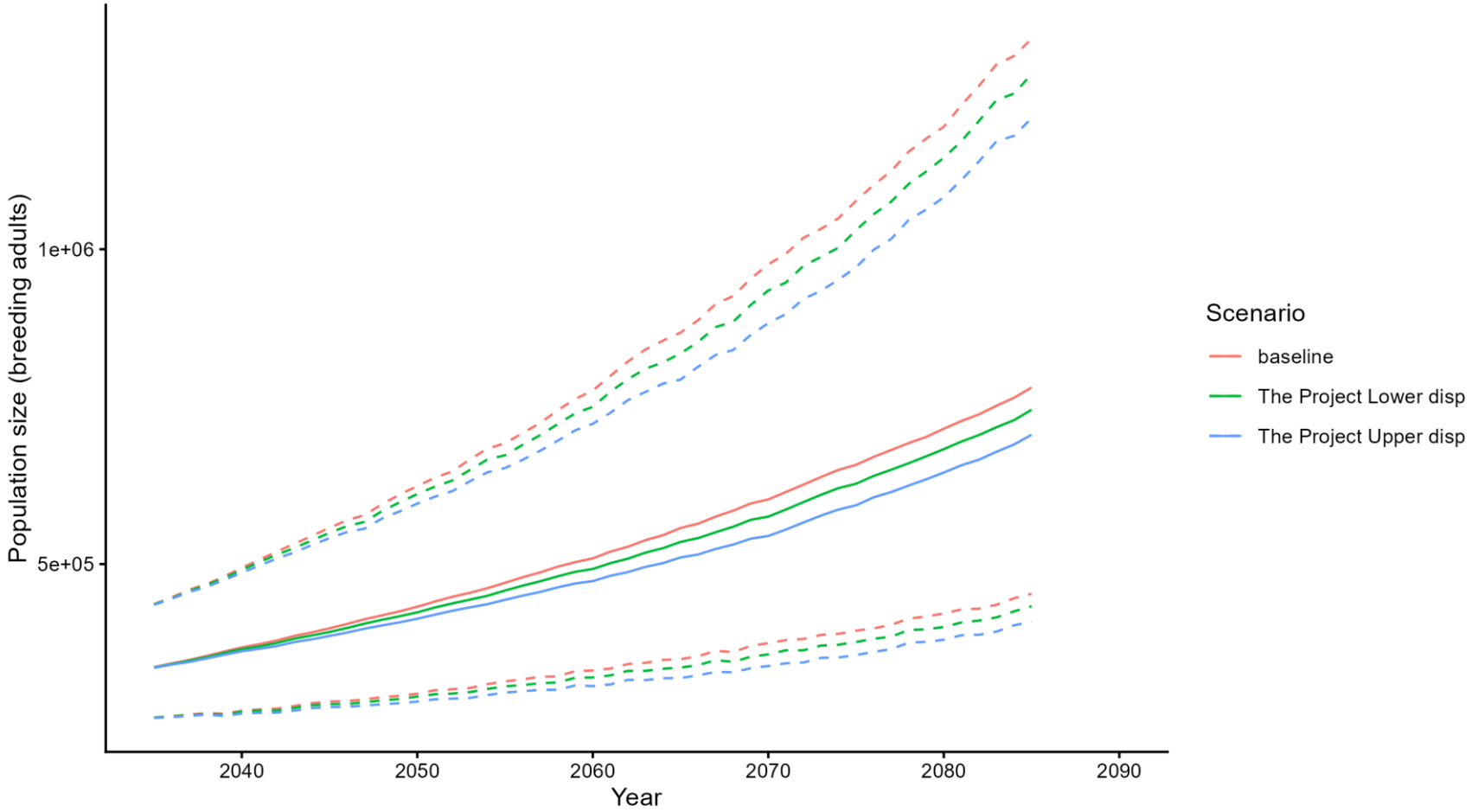


Figure 46: Guillemot – Rathlin Island SPA PVA outputs for Project alone using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 99: Guillemot – Rathlin Island SPA population PVA inputs for Project alone. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Guillemot Rathlin Island SPA Minches and W Scot rates	Number of scenarios of impact	2
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Common Guillemot	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	6	Scenario A Impact on adult survival rate	0.001152911
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.002529483
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	152095	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.583	Scenario C Impact on adult survival rate per pair mean	0
Productivity rate per pair standard deviation	0.147	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.94	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.025	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.56	Scenario D Impact on adult survival rate	0
Immatures survival rates 0 to 1 standard deviation	0.058	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.792	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.152	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.917	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.098	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.938	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.107	Scenario F Impact on productivity rate per pair mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 4 to 5 mean	0.94	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.025	Scenario F Impact on immature survival rate mean	
Immatures survival rates 5 to 6 mean	0.94	Scenario G name	
Immatures survival rates 5 to 6 standard deviation	0.025	Scenario G Impact on productivity rate per pair mean	
Units for output	whole.population	Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 100: Guillemot – Rathlin Island SPA population PVA outputs for Project alone. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	175.4	0.0011529	25	0.9987	0.9987	0.0001	0.9985	0.9990	0.9669	0.9669	0.0042	0.9588	0.9754	43.10	56.92
The Project Upper disp	384.7	0.0025295	25	0.9972	0.9972	0.0001	0.9969	0.9974	0.9288	0.9289	0.0041	0.9208	0.9368	35.26	65.66
The Project Lower disp	175.4	0.0011529	35	0.9987	0.9987	0.0001	0.9985	0.9989	0.9545	0.9545	0.0044	0.9460	0.9634	41.68	59.36
The Project Upper disp	384.7	0.0025295	35	0.9972	0.9972	0.0001	0.9970	0.9974	0.9029	0.9029	0.0042	0.8945	0.9111	31.92	69.28
The Project Lower disp	175.4	0.0011529	50	0.9991	0.9991	0.0001	0.9989	0.9992	0.9545	0.9546	0.0047	0.9455	0.9636	42.04	57.02
The Project Upper disp	384.7	0.0025295	50	0.9980	0.9980	0.0001	0.9978	0.9982	0.9029	0.9029	0.0045	0.8941	0.9118	33.48	66.30

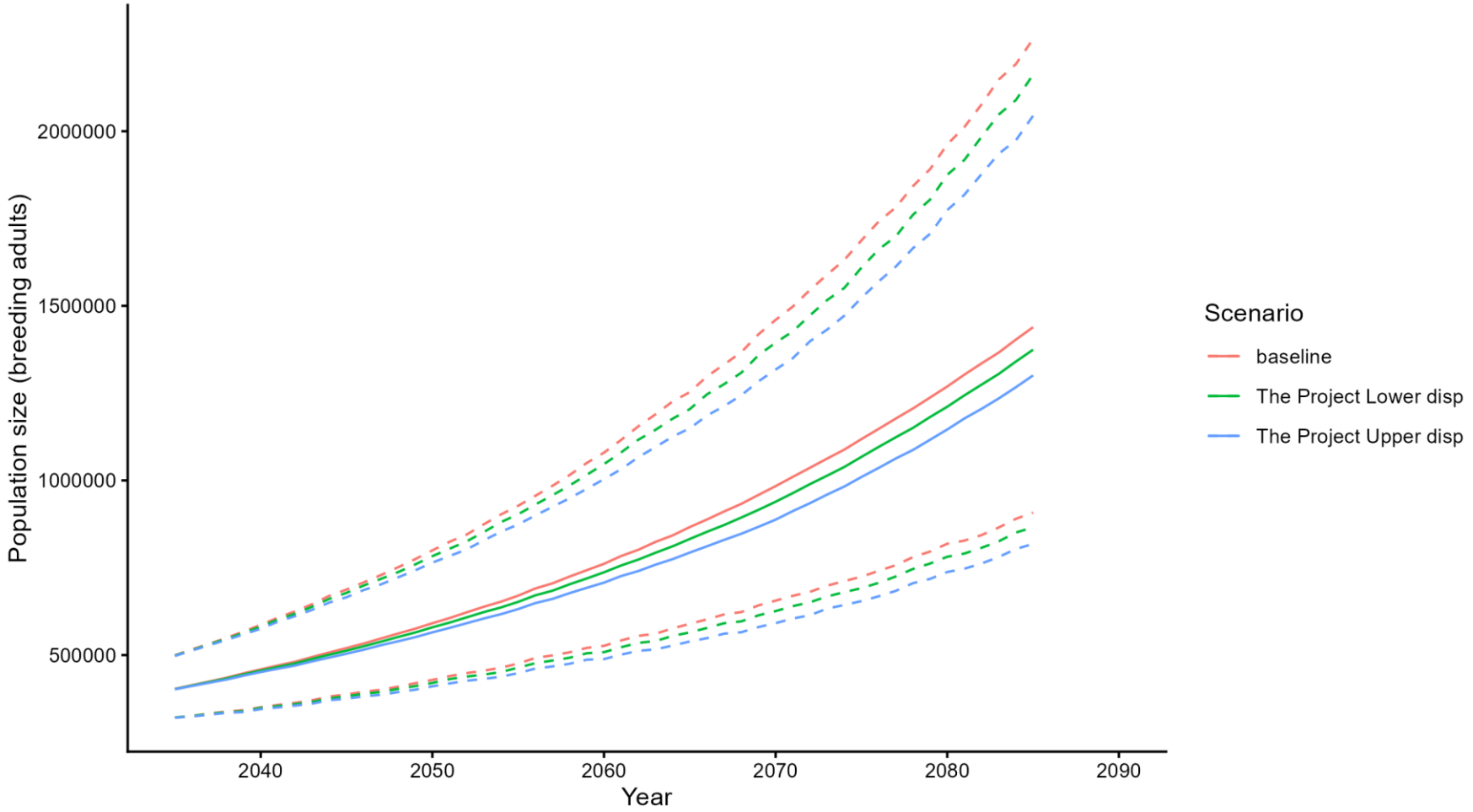


Figure 47: Guillemot – Rathlin Island SPA population PVA outputs for Project alone using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.2.14 Guillemot: North Colonsay and Western Cliffs SPA

Table 101: Guillemot – North Colonsay and Western Cliffs SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Guillemot N Colonsay and W Cliffs SPA CEH Scotland rates	Number of scenarios of impact	2
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Common Guillemot	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	6	Scenario A Impact on adult survival rate	0.00357702
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.006570004
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	33793	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.502	Scenario C Impact on adult survival rate per pair mean	0
Productivity rate per pair standard deviation	0.208	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.94	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.025	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.56	Scenario D Impact on adult survival rate	0
Immatures survival rates 0 to 1 standard deviation	0.058	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.792	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.152	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.917	Scenario E Impact on adult survival rate	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.098	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.938	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.107	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.94	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.025	Scenario F Impact on immature survival rate mean	
Immatures survival rates 5 to 6 mean	0.94	Scenario G name	
Immatures survival rates 5 to 6 standard deviation	0.025	Scenario G Impact on productivity rate per pair mean	
Units for output	whole.population	Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 102: Guillemot – North Colonsay and Western Cliffs SPA population PVA outputs for Project alone. 'CEH Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	120.9	0.003577	25	0.9960	0.9960	0.0003	0.9954	0.9966	0.9012	0.9013	0.0091	0.8835	0.9195	32.04	68.38
The Project Upper disp	222.0	0.006570	25	0.9927	0.9927	0.0003	0.9920	0.9933	0.8257	0.8257	0.0084	0.8093	0.8419	19.44	80.62
The Project Lower disp	120.9	0.003577	35	0.9960	0.9960	0.0003	0.9955	0.9965	0.8656	0.8658	0.0095	0.8474	0.8849	27.92	72.46
The Project Upper disp	222.0	0.006570	35	0.9927	0.9927	0.0003	0.9922	0.9931	0.7670	0.7670	0.0085	0.7506	0.7839	13.86	86.32
The Project Lower disp	120.9	0.003577	50	0.9972	0.9972	0.0002	0.9968	0.9976	0.8656	0.8658	0.0103	0.8461	0.8864	30.10	70.16
The Project Upper disp	222.0	0.006570	50	0.9948	0.9948	0.0002	0.9944	0.9952	0.7670	0.7671	0.0093	0.7490	0.7852	17.04	83.56

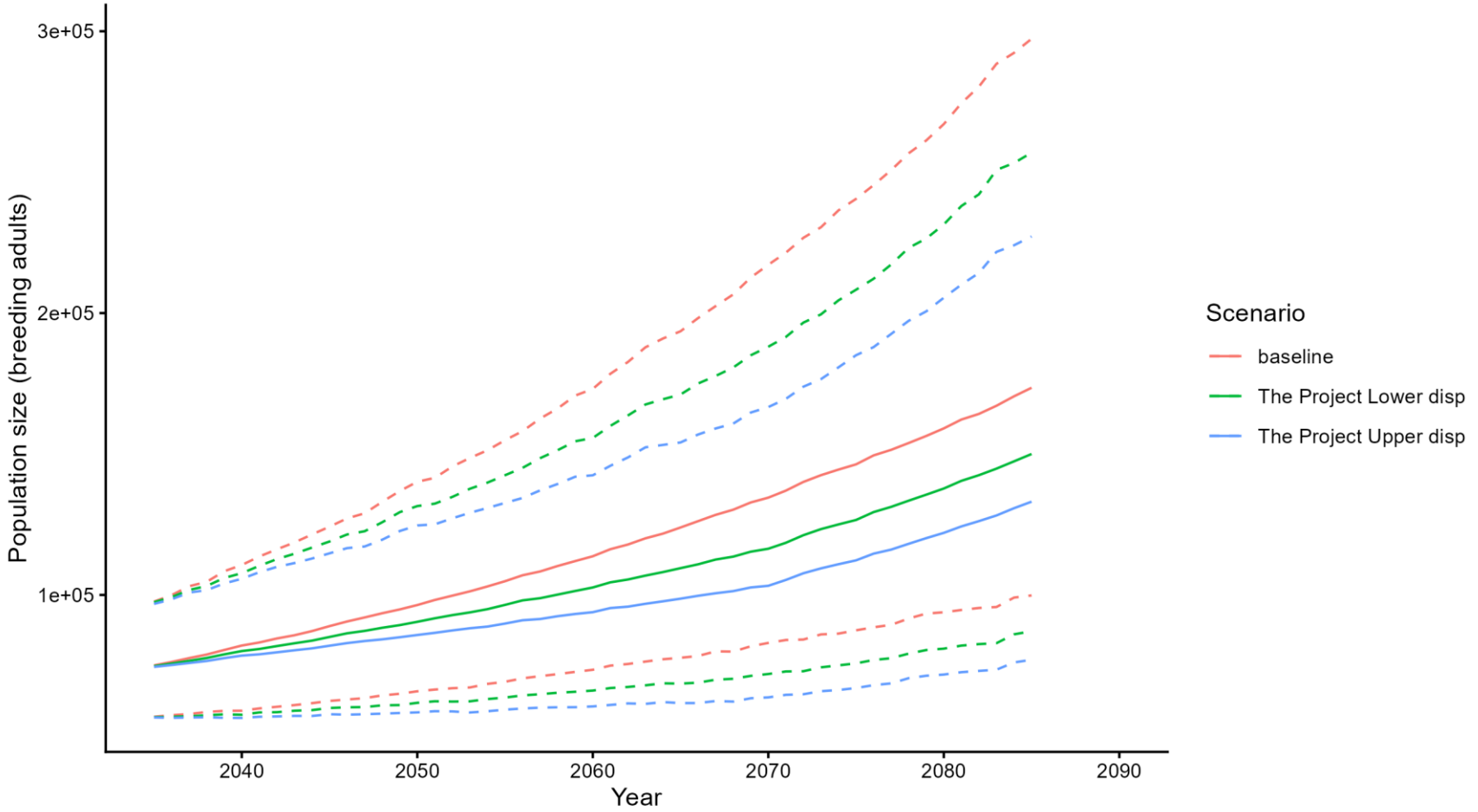


Figure 48: Guillemot – North Colonsay and Western Cliffs SPA PVA outputs for Project alone using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 103:Guillemot – North Colonsay and Western Cliffs SPA population PVA inputs for Project alone. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Guillemot N Colonsay and W Cliffs SPA Minches and W Scot rates	Number of scenarios of impact	2
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Common Guillemot	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	6	Scenario A Impact on adult survival rate	0.00357702
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.006570004
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	33793	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.583	Scenario C Impact on adult survival rate per pair mean	0
Productivity rate per pair standard deviation	0.147	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.94	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.025	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.56	Scenario D Impact on adult survival rate	0
Immatures survival rates 0 to 1 standard deviation	0.058	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.792	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.152	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.917	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.098	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.938	Scenario F name	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 standard deviation	0.107	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.94	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.025	Scenario F Impact on immature survival rate mean	
Immatures survival rates 5 to 6 mean	0.94	Scenario G name	
Immatures survival rates 5 to 6 standard deviation	0.025	Scenario G Impact on productivity rate per pair mean	
Units for output	whole.population	Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 104: Guillemot – North Colonsay and Western Cliffs SPA population PVA outputs for Project alone. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	120.9	0.003577	25	0.9960	0.9960	0.0003	0.9955	0.9965	0.9005	0.9006	0.0083	0.8839	0.9167	29.48	72.14
The Project Upper disp	222.0	0.006570	25	0.9926	0.9926	0.0003	0.9921	0.9932	0.8251	0.8250	0.0078	0.8098	0.8402	15.48	85.24
The Project Lower disp	120.9	0.003577	35	0.9960	0.9960	0.0002	0.9956	0.9964	0.8652	0.8652	0.0086	0.8483	0.8821	25.00	76.00
The Project Upper disp	222.0	0.006570	35	0.9926	0.9926	0.0002	0.9922	0.9931	0.7662	0.7663	0.0078	0.7513	0.7814	9.58	90.90
The Project Lower disp	120.9	0.003577	50	0.9972	0.9972	0.0002	0.9968	0.9975	0.8652	0.8653	0.0091	0.8473	0.8830	27.96	74.04
The Project Upper disp	222.0	0.006570	50	0.9948	0.9948	0.0002	0.9944	0.9951	0.7664	0.7665	0.0083	0.7504	0.7829	12.86	87.68

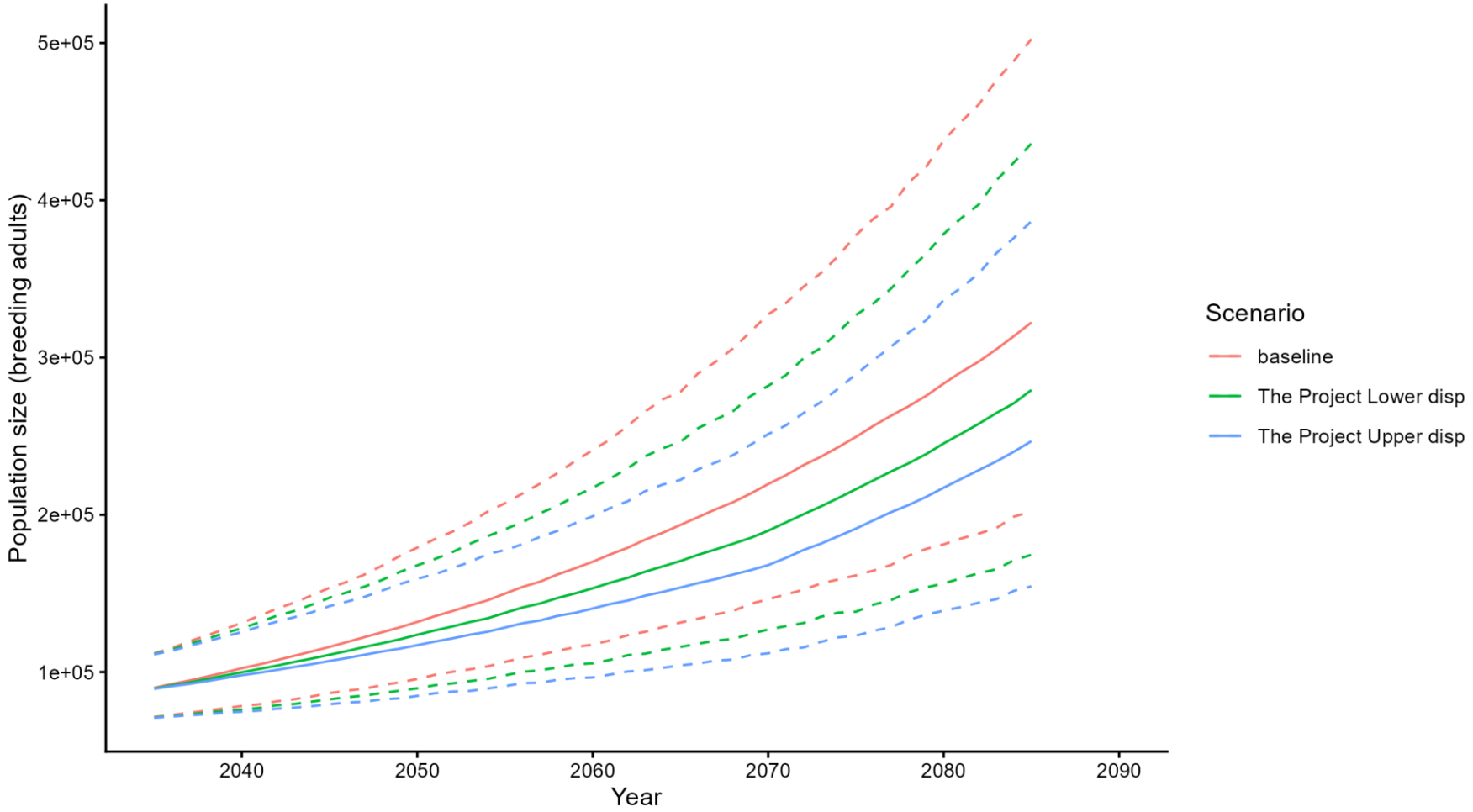


Figure 49: Guillemot – North Colonsay and Western Cliffs SPA population PVA outputs for Project alone using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.2.15 Razorbill: Cape Wrath SPA

Table 105:Razorbill – Cape Wrath SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Cape Wrath SPA CEH Scotland rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0001149702
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0003447719
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	4869	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.44	Scenario C Impact on adult survival rate per pair mean	0.0004723763
Productivity rate per pair standard deviation	0.189	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.0009652906
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 106:Razorbill – Cape Wrath SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.6	0.0001150	25	0.9999	0.9999	0.0013	0.9973	1.0025	0.9956	0.9975	0.0409	0.9196	1.0816	49.80	50.26
The Project Upper disp	1.7	0.0003448	25	0.9996	0.9996	0.0013	0.9970	1.0023	0.9907	0.9915	0.0410	0.9139	1.0770	49.48	50.82
In-comb Lower disp	2.3	0.0004724	25	0.9995	0.9995	0.0013	0.9968	1.0021	0.9872	0.9873	0.0413	0.9093	1.0707	48.86	51.08
In-comb Upper disp	4.7	0.0009653	25	0.9989	0.9989	0.0013	0.9962	1.0015	0.9724	0.9734	0.0400	0.8949	1.0544	47.02	53.10
The Project Lower disp	0.6	0.0001150	35	0.9999	0.9999	0.0012	0.9975	1.0021	0.9951	0.9964	0.0472	0.9035	1.0905	49.82	50.14
The Project Upper disp	1.7	0.0003448	35	0.9996	0.9996	0.0012	0.9974	1.0020	0.9864	0.9877	0.0467	0.8981	1.0850	48.88	51.12
In-comb Lower disp	2.3	0.0004724	35	0.9995	0.9995	0.0012	0.9971	1.0017	0.9816	0.9822	0.0466	0.8935	1.0785	48.28	51.76
In-comb Upper disp	4.7	0.0009653	35	0.9989	0.9989	0.0011	0.9967	1.0011	0.9625	0.9630	0.0447	0.8769	1.0539	46.24	53.70
The Project Lower disp	0.6	0.0001150	50	0.9999	0.9999	0.0010	0.9979	1.0019	0.9953	0.9973	0.0559	0.8900	1.1119	49.72	50.52
The Project Upper disp	1.7	0.0003448	50	0.9997	0.9997	0.0010	0.9978	1.0018	0.9866	0.9887	0.0556	0.8813	1.1045	49.16	50.96
In-comb Lower disp	2.3	0.0004724	50	0.9996	0.9996	0.0010	0.9976	1.0016	0.9814	0.9829	0.0550	0.8794	1.0960	48.76	51.70
In-comb Upper disp	4.7	0.0009653	50	0.9993	0.9992	0.0010	0.9973	1.0012	0.9631	0.9644	0.0527	0.8634	1.0719	46.92	53.42

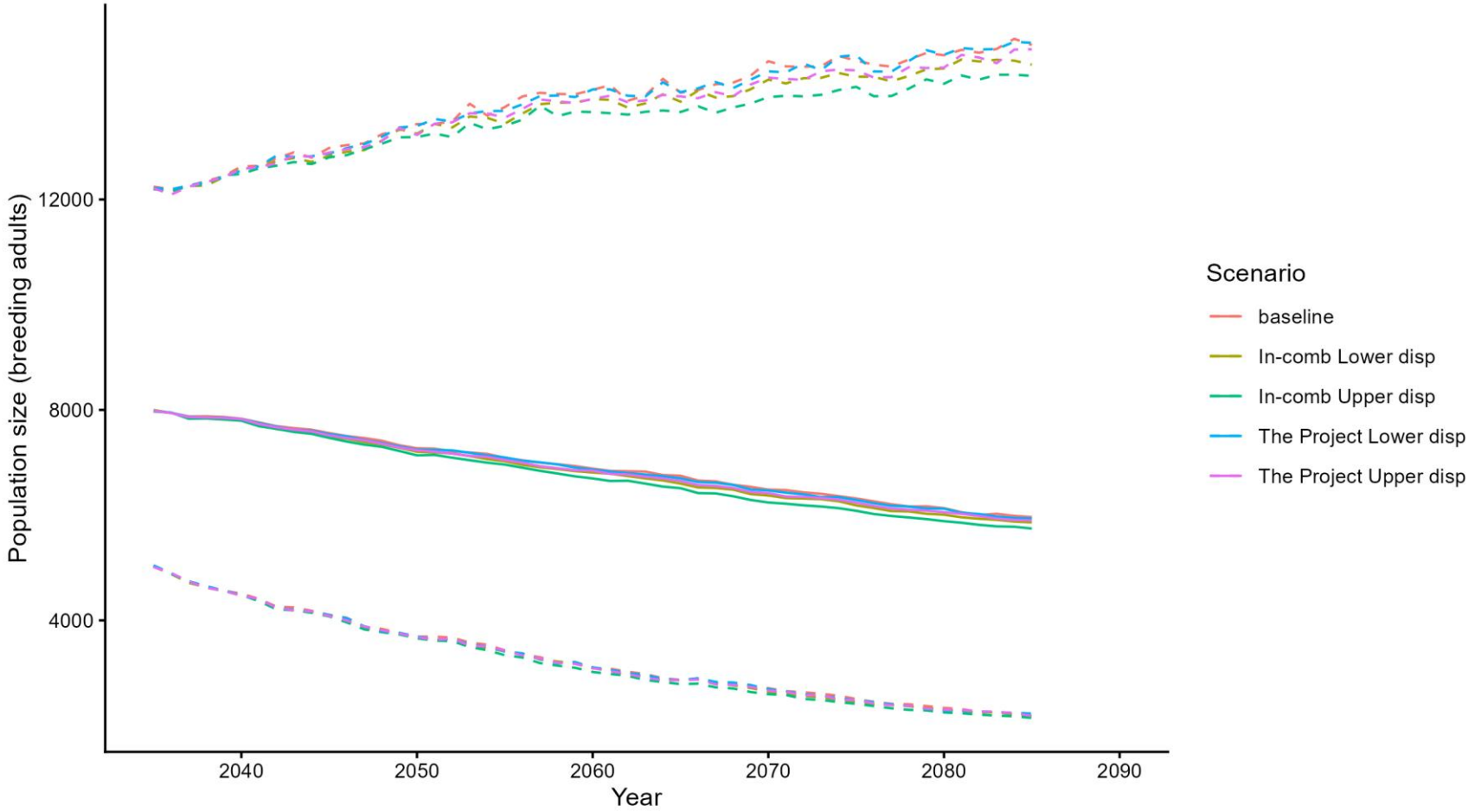


Figure 50: Razorbill – Cape Wrath SPA PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 107:Razorbill – Cape Wrath SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Cape Wrath SPA Minches and W Scot rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0001149702
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0003447719
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	4869	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.519	Scenario C Impact on adult survival rate per pair mean	0.0004723763
Productivity rate per pair standard deviation	0.052	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.0009652906
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 108:Razorbill – Cape Wrath SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.6	0.0001150	25	0.9998	0.9999	0.0011	0.9977	1.0021	0.9956	0.9963	0.0348	0.9303	1.0683	49.62	50.54
The Project Upper disp	1.7	0.0003448	25	0.9996	0.9996	0.0011	0.9974	1.0017	0.9890	0.9893	0.0346	0.9227	1.0591	48.54	51.28
In-comb Lower disp	2.3	0.0004724	25	0.9995	0.9995	0.0011	0.9973	1.0016	0.9856	0.9863	0.0349	0.9210	1.0584	48.40	51.80
In-comb Upper disp	4.7	0.0009653	25	0.9989	0.9989	0.0011	0.9967	1.0010	0.9712	0.9721	0.0342	0.9089	1.0401	46.78	53.84
The Project Lower disp	0.6	0.0001150	35	0.9998	0.9999	0.0009	0.9981	1.0017	0.9942	0.9952	0.0387	0.9213	1.0751	49.64	50.24
The Project Upper disp	1.7	0.0003448	35	0.9996	0.9996	0.0009	0.9978	1.0014	0.9847	0.9857	0.0382	0.9123	1.0626	48.26	51.72
In-comb Lower disp	2.3	0.0004724	35	0.9995	0.9995	0.0009	0.9977	1.0012	0.9801	0.9813	0.0381	0.9098	1.0601	47.86	52.06
In-comb Upper disp	4.7	0.0009653	35	0.9989	0.9989	0.0009	0.9971	1.0006	0.9608	0.9615	0.0374	0.8889	1.0358	45.72	54.42
The Project Lower disp	0.6	0.0001150	50	0.9999	0.9999	0.0008	0.9984	1.0014	0.9939	0.9954	0.0433	0.9116	1.0849	49.06	51.02
The Project Upper disp	1.7	0.0003448	50	0.9997	0.9997	0.0007	0.9983	1.0011	0.9850	0.9860	0.0423	0.9035	1.0715	48.58	51.70
In-comb Lower disp	2.3	0.0004724	50	0.9996	0.9996	0.0007	0.9982	1.0011	0.9806	0.9818	0.0426	0.9008	1.0702	48.46	51.70
In-comb Upper disp	4.7	0.0009653	50	0.9992	0.9992	0.0007	0.9978	1.0007	0.9616	0.9621	0.0418	0.8837	1.0457	46.24	53.92

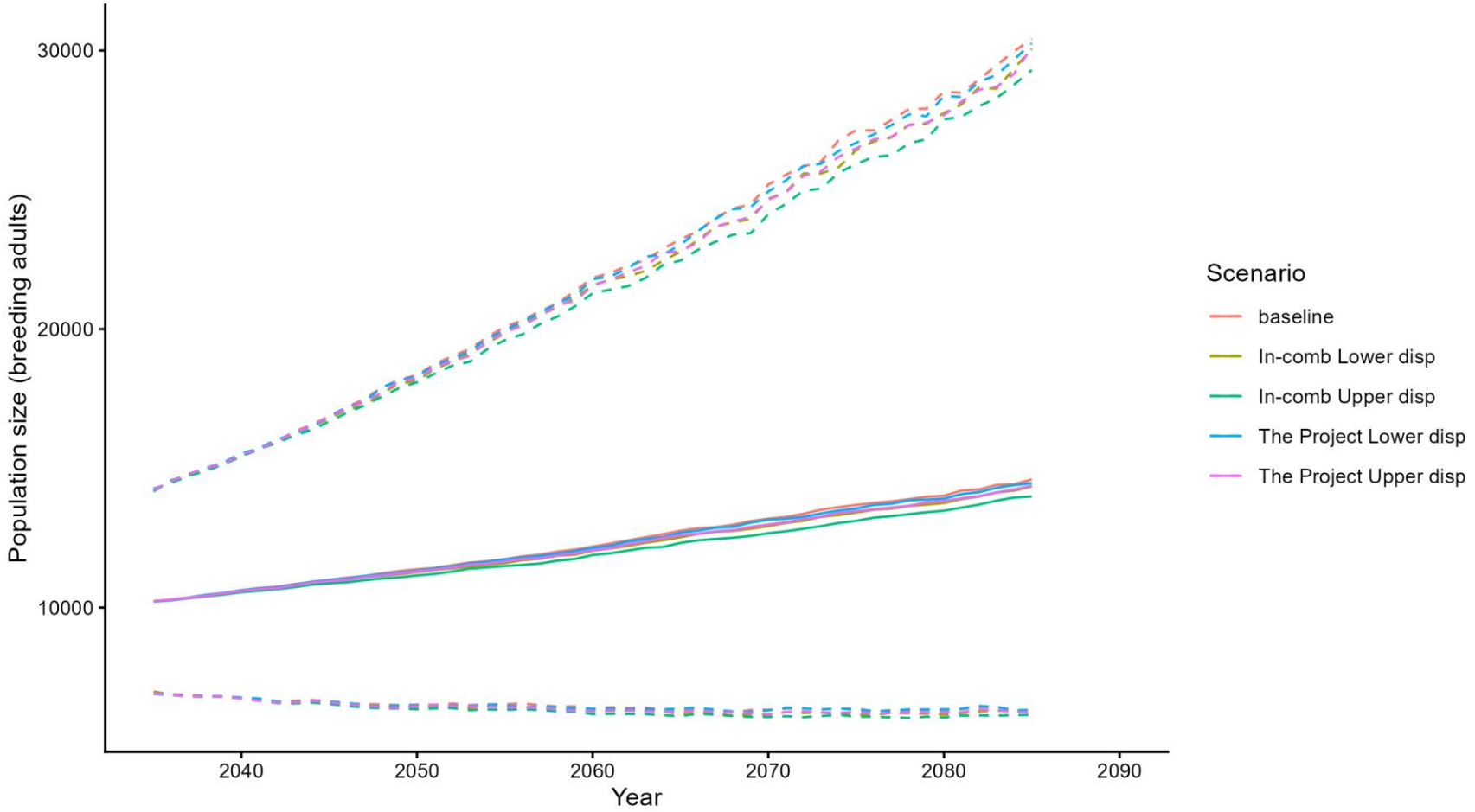


Figure 51: Razorbill – Cape Wrath SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.2.16 Razorbill: Flannan Isles SPA

Table 109: Razorbill – Flannan Isles SPA population PVA inputs for Project alone. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Flannan Islands SPA CEH Scotland rates	Number of scenarios of impact	2
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0001641411
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0004922253
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	1715	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.44	Scenario C Impact on adult survival rate per pair mean	0
Productivity rate per pair standard deviation	0.189	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 110:Razorbill – Flannan Isles SPA population PVA outputs for Project alone. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.3	0.0001641	25	0.9998	0.9998	0.0023	0.9954	1.0045	0.9968	0.9989	0.0709	0.8689	1.1486	49.88	50.22
The Project Upper disp	0.8	0.0004922	25	0.9994	0.9995	0.0022	0.9951	1.0039	0.9863	0.9886	0.0680	0.8599	1.1307	48.52	51.24
The Project Lower disp	0.3	0.0001641	35	0.9998	0.9998	0.0020	0.9961	1.0038	0.9942	0.9980	0.0806	0.8495	1.1728	49.10	50.64
The Project Upper disp	0.8	0.0004922	35	0.9994	0.9994	0.0019	0.9955	1.0033	0.9811	0.9828	0.0780	0.8375	1.1475	47.96	51.98
The Project Lower disp	0.3	0.0001641	50	0.9999	0.9999	0.0017	0.9965	1.0033	0.9939	0.9986	0.0951	0.8212	1.2000	49.56	50.54
The Project Upper disp	0.8	0.0004922	50	0.9996	0.9996	0.0017	0.9962	1.0030	0.9814	0.9842	0.0926	0.8133	1.1783	48.56	51.40

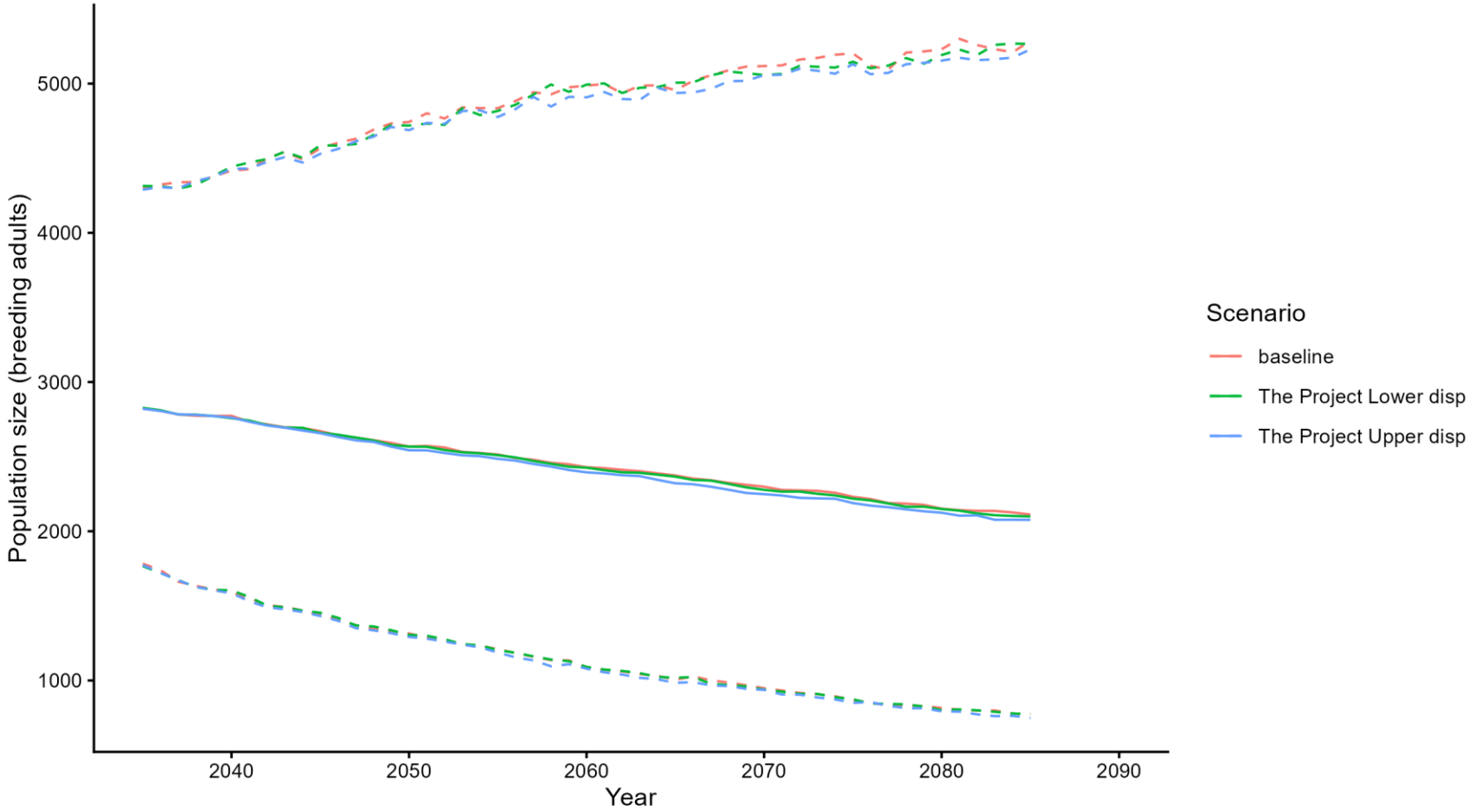


Figure 52: Razorbill – Flannan Isles SPA PVA outputs for Project alone using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 111:Razorbill – Flannan Isles SPA population PVA inputs for Project alone. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Flannan Islands SPA Minches and W Scot rates	Number of scenarios of impact	2
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0001641411
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0004922253
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	1715	Scenario C name	
Year	2021	Scenario C Impact on productivity rate per pair mean	
Productivity rate per pair mean	0.519	Scenario C Impact on adult survival rate per pair mean	
Productivity rate per pair standard deviation	0.052	Scenario C Impact on immature survival rate mean	
Adult survival rate Mean	0.895	Scenario D name	
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 112:Razorbill – Flannan Isles SPA population PVA outputs for Project alone. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.3	0.0001641	25	0.9998	0.9998	0.0018	0.9962	1.0035	0.9950	0.9960	0.0580	0.8853	1.1160	48.66	50.94
The Project Upper disp	0.8	0.0004922	25	0.9994	0.9994	0.0018	0.9959	1.0030	0.9831	0.9854	0.0584	0.8760	1.1046	47.74	52.02
The Project Lower disp	0.3	0.0001641	35	0.9998	0.9998	0.0015	0.9968	1.0028	0.9931	0.9949	0.0639	0.8727	1.1288	49.26	50.66
The Project Upper disp	0.8	0.0004922	35	0.9994	0.9994	0.0015	0.9964	1.0025	0.9775	0.9797	0.0650	0.8588	1.1133	46.98	52.76
The Project Lower disp	0.3	0.0001641	50	0.9999	0.9999	0.0013	0.9974	1.0024	0.9926	0.9958	0.0721	0.8635	1.1497	49.52	50.44
The Project Upper disp	0.8	0.0004922	50	0.9996	0.9996	0.0013	0.9971	1.0020	0.9769	0.9802	0.0727	0.8477	1.1294	47.66	52.60

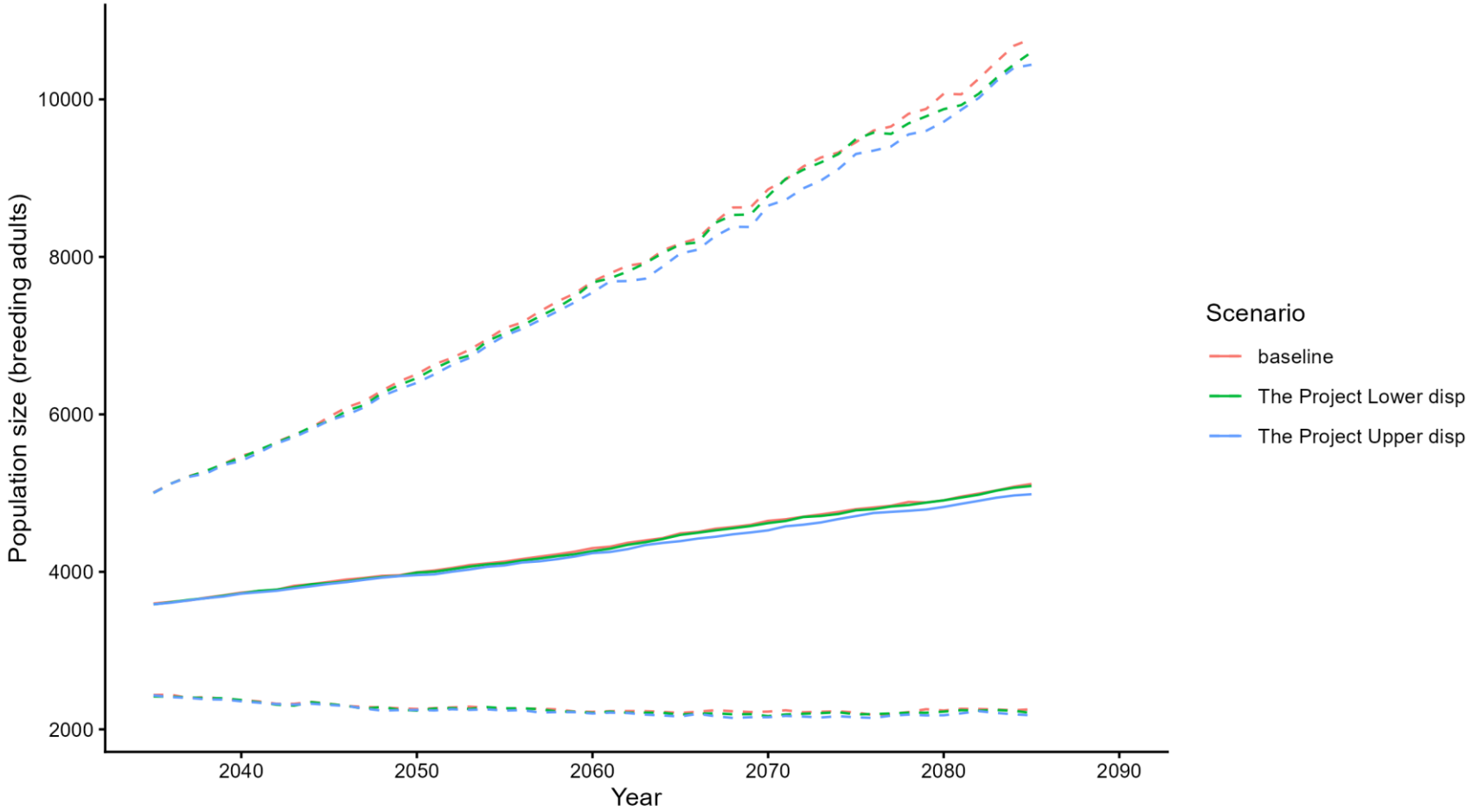


Figure 53: Razorbill – Flannan Isles SPA population PVA outputs for Project alone using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.2.17 Razorbill: Handa SPA

Table 113:Razorbill – Handa SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Handa SPA CEH Scotland rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0001120949
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0003369786
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	12311	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.44	Scenario C Impact on adult survival rate per pair mean	0.000403704
Productivity rate per pair standard deviation	0.189	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.0008553326
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 114:Razorbill – Handa SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	1.4	0.0001121	25	0.9998	0.9999	0.0009	0.9982	1.0016	0.9961	0.9967	0.0261	0.9451	1.0489	49.44	50.58
The Project Upper disp	4.1	0.0003370	25	0.9996	0.9996	0.0008	0.9980	1.0013	0.9898	0.9900	0.0256	0.9402	1.0408	49.04	51.08
In-comb Lower disp	5.0	0.0004037	25	0.9995	0.9995	0.0008	0.9980	1.0012	0.9880	0.9883	0.0252	0.9394	1.0394	48.90	51.52
In-comb Upper disp	10.5	0.0008553	25	0.9990	0.9990	0.0008	0.9973	1.0007	0.9748	0.9751	0.0253	0.9255	1.0245	47.70	52.86
The Project Lower disp	1.4	0.0001121	35	0.9999	0.9999	0.0007	0.9984	1.0013	0.9950	0.9955	0.0299	0.9383	1.0546	50.02	50.00
The Project Upper disp	4.1	0.0003370	35	0.9996	0.9996	0.0007	0.9982	1.0011	0.9864	0.9865	0.0292	0.9298	1.0460	48.50	51.54
In-comb Lower disp	5.0	0.0004037	35	0.9995	0.9995	0.0007	0.9982	1.0010	0.9839	0.9841	0.0288	0.9289	1.0431	48.32	51.38
In-comb Upper disp	10.5	0.0008553	35	0.9990	0.9990	0.0007	0.9975	1.0004	0.9654	0.9657	0.0284	0.9108	1.0232	46.60	53.50
The Project Lower disp	1.4	0.0001121	50	0.9999	0.9999	0.0006	0.9987	1.0012	0.9954	0.9959	0.0349	0.9289	1.0664	49.62	50.26
The Project Upper disp	4.1	0.0003370	50	0.9997	0.9997	0.0006	0.9985	1.0010	0.9864	0.9872	0.0340	0.9204	1.0560	48.96	51.18
In-comb Lower disp	5.0	0.0004037	50	0.9997	0.9997	0.0006	0.9984	1.0009	0.9844	0.9847	0.0342	0.9186	1.0532	48.96	51.08
In-comb Upper disp	10.5	0.0008553	50	0.9993	0.9993	0.0006	0.9980	1.0006	0.9660	0.9663	0.0337	0.9005	1.0350	47.26	52.76

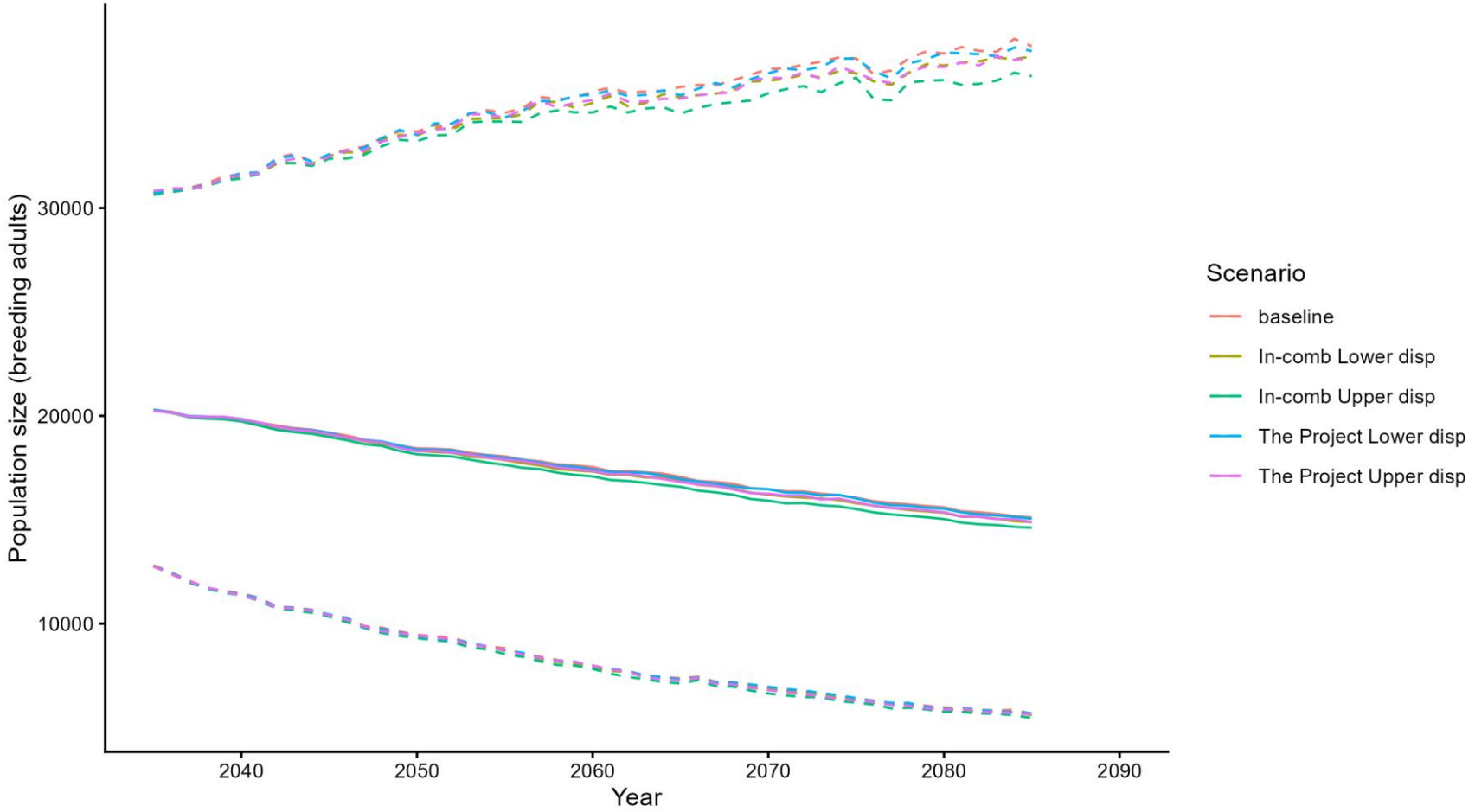


Figure 54: Razorbill – Handa SPA PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 115:Razorbill – Handa SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Handa SPA Minches and W Scot rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0001120949
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0003369786
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	12311	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.519	Scenario C Impact on adult survival rate per pair mean	0.000403704
Productivity rate per pair standard deviation	0.052	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.0008553326
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 116:Razorbill – Handa SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	1.4	0.0001121	25	0.9999	0.9999	0.0007	0.9985	1.0012	0.9969	0.9971	0.0222	0.9541	1.0424	49.52	50.44
The Project Upper disp	4.1	0.0003370	25	0.9996	0.9996	0.0007	0.9982	1.0010	0.9904	0.9905	0.0220	0.9477	1.0346	48.64	51.40
In-comb Lower disp	5.0	0.0004037	25	0.9996	0.9996	0.0007	0.9982	1.0009	0.9884	0.9885	0.0217	0.9459	1.0326	48.26	51.56
In-comb Upper disp	10.5	0.0008553	25	0.9990	0.9990	0.0007	0.9977	1.0004	0.9751	0.9752	0.0220	0.9324	1.0197	46.74	53.28
The Project Lower disp	1.4	0.0001121	35	0.9999	0.9999	0.0006	0.9987	1.0010	0.9955	0.9958	0.0245	0.9484	1.0449	49.60	50.42
The Project Upper disp	4.1	0.0003370	35	0.9996	0.9996	0.0006	0.9985	1.0008	0.9865	0.9870	0.0242	0.9408	1.0361	48.32	51.58
In-comb Lower disp	5.0	0.0004037	35	0.9995	0.9995	0.0006	0.9984	1.0007	0.9837	0.9840	0.0242	0.9369	1.0327	47.90	51.82
In-comb Upper disp	10.5	0.0008553	35	0.9990	0.9990	0.0006	0.9979	1.0002	0.9658	0.9660	0.0241	0.9198	1.0140	45.78	53.86
The Project Lower disp	1.4	0.0001121	50	0.9999	0.9999	0.0005	0.9990	1.0008	0.9955	0.9960	0.0274	0.9434	1.0501	49.80	50.16
The Project Upper disp	4.1	0.0003370	50	0.9997	0.9997	0.0005	0.9988	1.0007	0.9867	0.9872	0.0275	0.9343	1.0428	48.74	51.14
In-comb Lower disp	5.0	0.0004037	50	0.9997	0.9997	0.0005	0.9987	1.0006	0.9835	0.9841	0.0270	0.9307	1.0377	48.52	51.24
In-comb Upper disp	10.5	0.0008553	50	0.9993	0.9993	0.0005	0.9984	1.0003	0.9655	0.9660	0.0271	0.9138	1.0194	46.60	53.44

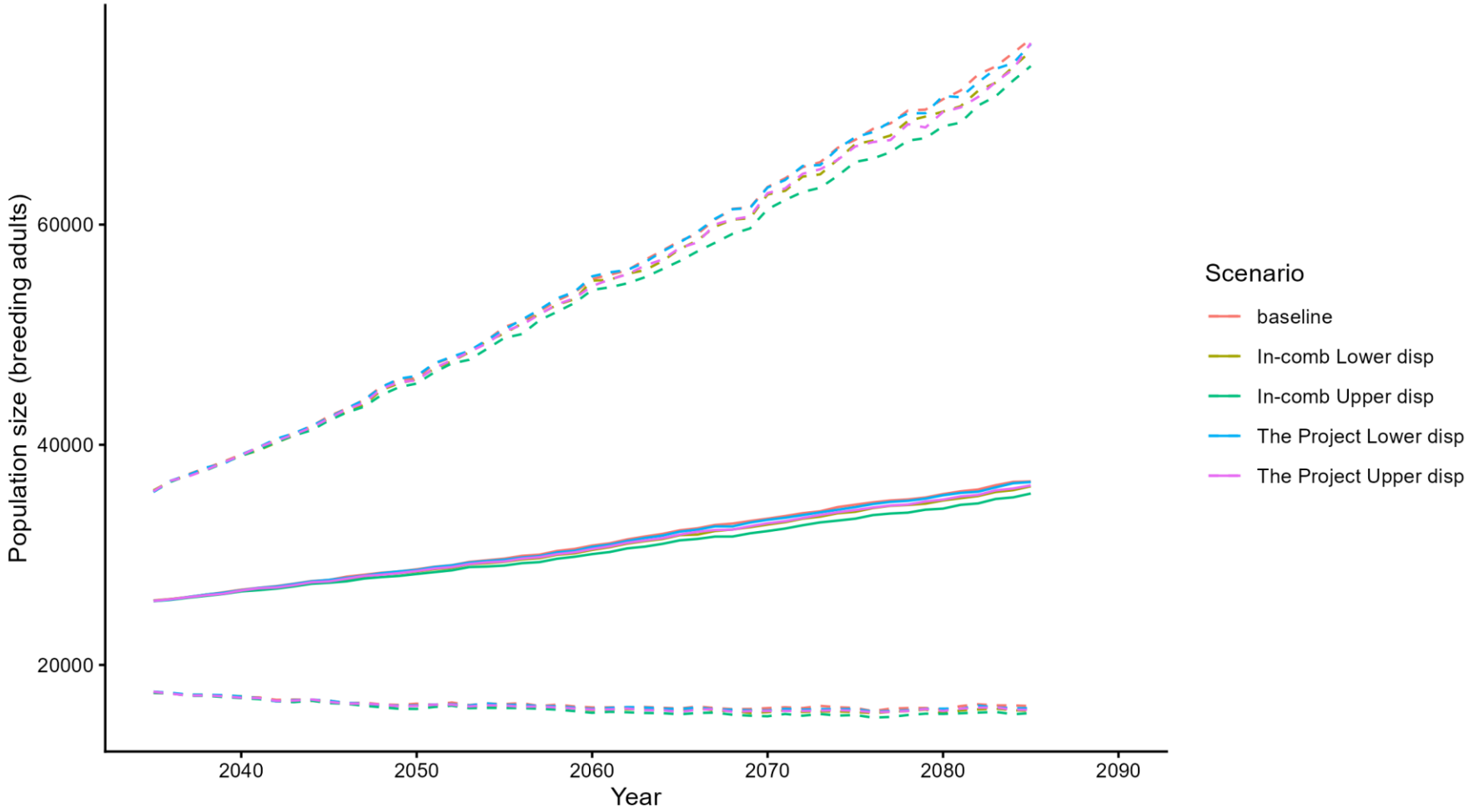


Figure 55: Razorbill – Handa SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.2.18 Razorbill: Mingulay and Berneray SPA

Table 117: Razorbill – Mingulay and Berneray SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Mingulay and Berneray SPA CEH Scotland rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0003019589
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0007071916
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	17718	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.44	Scenario C Impact on adult survival rate per pair mean	0.0006208376
Productivity rate per pair standard deviation	0.189	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.001309403
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 118:Razorbill – Mingulay and Berneray SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	5.4	0.0003020	25	0.9996	0.9996	0.0007	0.9983	1.0010	0.9903	0.9909	0.0216	0.9508	1.0341	49.40	50.80
The Project Upper disp	12.5	0.0007072	25	0.9992	0.9992	0.0007	0.9978	1.0006	0.9787	0.9792	0.0211	0.9385	1.0226	48.18	52.06
In-comb Lower disp	11.0	0.0006208	25	0.9993	0.9993	0.0007	0.9979	1.0007	0.9815	0.9820	0.0211	0.9420	1.0259	48.26	51.74
In-comb Upper disp	23.2	0.0013094	25	0.9985	0.9985	0.0007	0.9971	0.9999	0.9620	0.9621	0.0207	0.9213	1.0030	46.20	53.68
The Project Lower disp	5.4	0.0003020	35	0.9996	0.9996	0.0006	0.9984	1.0008	0.9868	0.9874	0.0245	0.9400	1.0370	48.56	51.36
The Project Upper disp	12.5	0.0007072	35	0.9992	0.9992	0.0006	0.9980	1.0004	0.9709	0.9714	0.0238	0.9249	1.0199	47.38	52.94
In-comb Lower disp	11.0	0.0006208	35	0.9993	0.9993	0.0006	0.9981	1.0005	0.9745	0.9754	0.0241	0.9287	1.0262	47.86	52.58
In-comb Upper disp	23.2	0.0013094	35	0.9985	0.9985	0.0006	0.9973	0.9997	0.9473	0.9480	0.0232	0.9031	0.9938	45.38	55.30
The Project Lower disp	5.4	0.0003020	50	0.9997	0.9997	0.0005	0.9987	1.0008	0.9870	0.9875	0.0289	0.9316	1.0461	48.80	51.06
The Project Upper disp	12.5	0.0007072	50	0.9994	0.9994	0.0005	0.9984	1.0005	0.9711	0.9714	0.0279	0.9174	1.0278	47.54	52.78
In-comb Lower disp	11.0	0.0006208	50	0.9995	0.9995	0.0005	0.9985	1.0006	0.9746	0.9755	0.0287	0.9193	1.0360	47.90	52.30
In-comb Upper disp	23.2	0.0013094	50	0.9990	0.9990	0.0005	0.9979	1.0000	0.9480	0.9483	0.0273	0.8945	1.0030	45.44	54.44

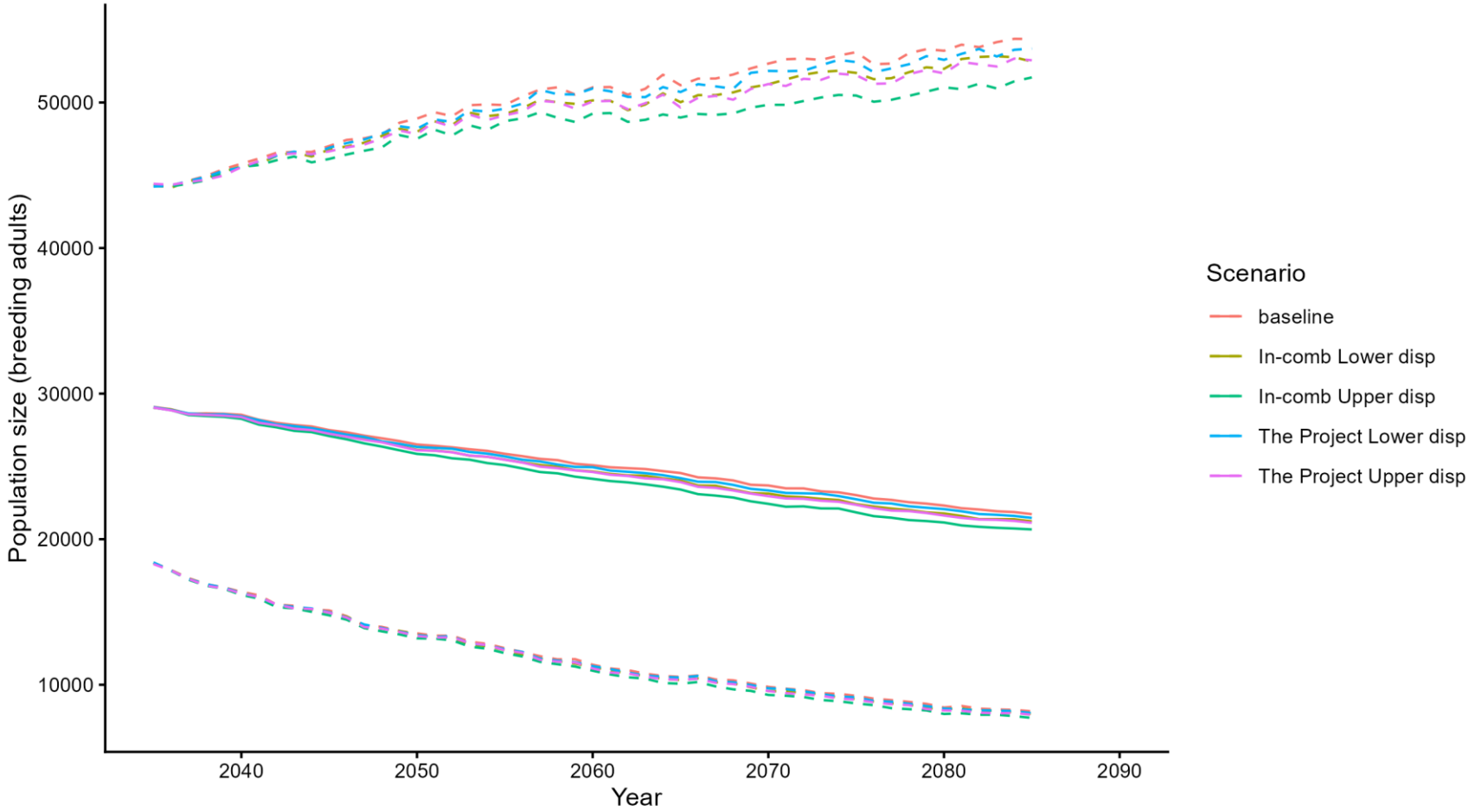


Figure 56: Razorbill – Mingulay and Berneray SPA PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 119:Razorbill – Mingulay and Berneray SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Mingulay and Berneray SPA Minches and W Scot rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0003019589
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0007071916
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	17718	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.519	Scenario C Impact on adult survival rate per pair mean	0.0006208376
Productivity rate per pair standard deviation	0.052	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.001309403
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 120:Razorbill – Mingulay and Berneray SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	5.4	0.0003020	25	0.9997	0.9997	0.0006	0.9985	1.0008	0.9906	0.9910	0.0181	0.9552	1.0274	48.72	51.22
The Project Upper disp	12.5	0.0007072	25	0.9992	0.9992	0.0006	0.9981	1.0003	0.9790	0.9792	0.0180	0.9445	1.0153	47.42	52.76
In-comb Lower disp	11.0	0.0006208	25	0.9993	0.9993	0.0006	0.9982	1.0005	0.9817	0.9822	0.0181	0.9472	1.0177	47.50	52.36
In-comb Upper disp	23.2	0.0013094	25	0.9985	0.9985	0.0006	0.9974	0.9996	0.9617	0.9619	0.0176	0.9279	0.9970	44.76	55.02
The Project Lower disp	5.4	0.0003020	35	0.9996	0.9996	0.0005	0.9987	1.0006	0.9871	0.9874	0.0198	0.9478	1.0263	48.84	51.40
The Project Upper disp	12.5	0.0007072	35	0.9992	0.9992	0.0005	0.9982	1.0001	0.9708	0.9711	0.0200	0.9329	1.0120	46.94	53.06
In-comb Lower disp	11.0	0.0006208	35	0.9993	0.9993	0.0005	0.9984	1.0002	0.9746	0.9750	0.0198	0.9367	1.0147	47.06	52.74
In-comb Upper disp	23.2	0.0013094	35	0.9985	0.9985	0.0005	0.9976	0.9994	0.9469	0.9473	0.0192	0.9098	0.9858	44.26	56.08
The Project Lower disp	5.4	0.0003020	50	0.9997	0.9997	0.0004	0.9990	1.0005	0.9876	0.9874	0.0223	0.9435	1.0312	48.82	51.06
The Project Upper disp	12.5	0.0007072	50	0.9994	0.9994	0.0004	0.9986	1.0002	0.9706	0.9713	0.0224	0.9280	1.0166	46.78	52.80
In-comb Lower disp	11.0	0.0006208	50	0.9995	0.9995	0.0004	0.9987	1.0003	0.9743	0.9752	0.0222	0.9319	1.0192	47.50	52.42
In-comb Upper disp	23.2	0.0013094	50	0.9989	0.9989	0.0004	0.9982	0.9997	0.9475	0.9477	0.0214	0.9060	0.9900	44.82	55.10

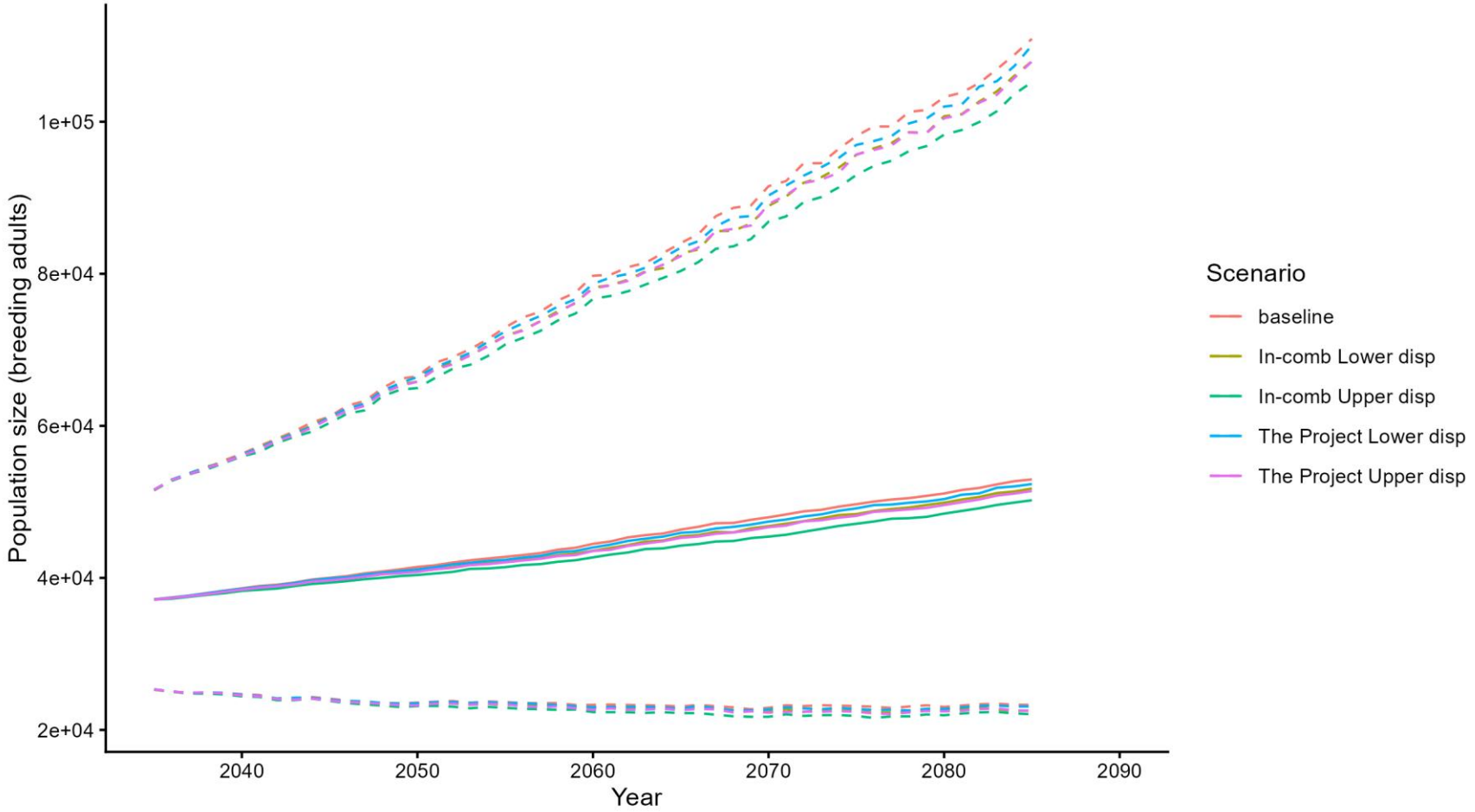


Figure 57: Razorbill – Mingulay and Berneray SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.2.19 Razorbill: North Rona and Sula Sgeir SPA

Table 121:Razorbill – North Rona and Sula Sgeir SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill N Rona and S Sgeir SPA CEH Scotland rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0004910437
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.001472539
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	594	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.44	Scenario C Impact on adult survival rate per pair mean	0.0005050505
Productivity rate per pair standard deviation	0.189	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.001515152
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 122:Razorbill – North Rona and Sula Sgeir SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.3	0.0004910	25	0.9994	0.9994	0.0037	0.9920	1.0067	0.9863	0.9927	0.1159	0.7836	1.2384	48.78	51.14
The Project Upper disp	0.9	0.0014725	25	0.9983	0.9983	0.0039	0.9907	1.0060	0.9569	0.9649	0.1165	0.7590	1.2131	45.56	54.42
In-comb Lower disp	0.3	0.0005051	25	0.9994	0.9994	0.0038	0.9921	1.0068	0.9877	0.9935	0.1173	0.7825	1.2359	48.78	51.28
In-comb Upper disp	0.9	0.0015152	25	0.9982	0.9982	0.0039	0.9905	1.0060	0.9542	0.9626	0.1157	0.7513	1.2078	45.94	53.94
The Project Lower disp	0.3	0.0004910	35	0.9994	0.9994	0.0033	0.9928	1.0059	0.9806	0.9903	0.1336	0.7535	1.2784	49.02	51.44
The Project Upper disp	0.9	0.0014725	35	0.9984	0.9983	0.0034	0.9916	1.0052	0.9433	0.9526	0.1333	0.7180	1.2366	44.92	55.76
In-comb Lower disp	0.3	0.0005051	35	0.9994	0.9994	0.0033	0.9929	1.0062	0.9815	0.9907	0.1353	0.7524	1.2788	48.84	51.78
In-comb Upper disp	0.9	0.0015152	35	0.9983	0.9982	0.0033	0.9919	1.0048	0.9393	0.9495	0.1300	0.7193	1.2296	45.32	55.46
The Project Lower disp	0.3	0.0004910	50	0.9996	0.9996	0.0029	0.9938	1.0054	0.9827	0.9957	0.1619	0.7189	1.3567	48.78	51.48
The Project Upper disp	0.9	0.0014725	50	0.9988	0.9988	0.0030	0.9929	1.0046	0.9418	0.9550	0.1587	0.6836	1.3006	45.50	55.04
In-comb Lower disp	0.3	0.0005051	50	0.9996	0.9996	0.0029	0.9939	1.0053	0.9790	0.9940	0.1608	0.7169	1.3528	48.88	51.36
In-comb Upper disp	0.9	0.0015152	50	0.9988	0.9988	0.0029	0.9931	1.0046	0.9421	0.9555	0.1555	0.6908	1.3081	45.62	54.30

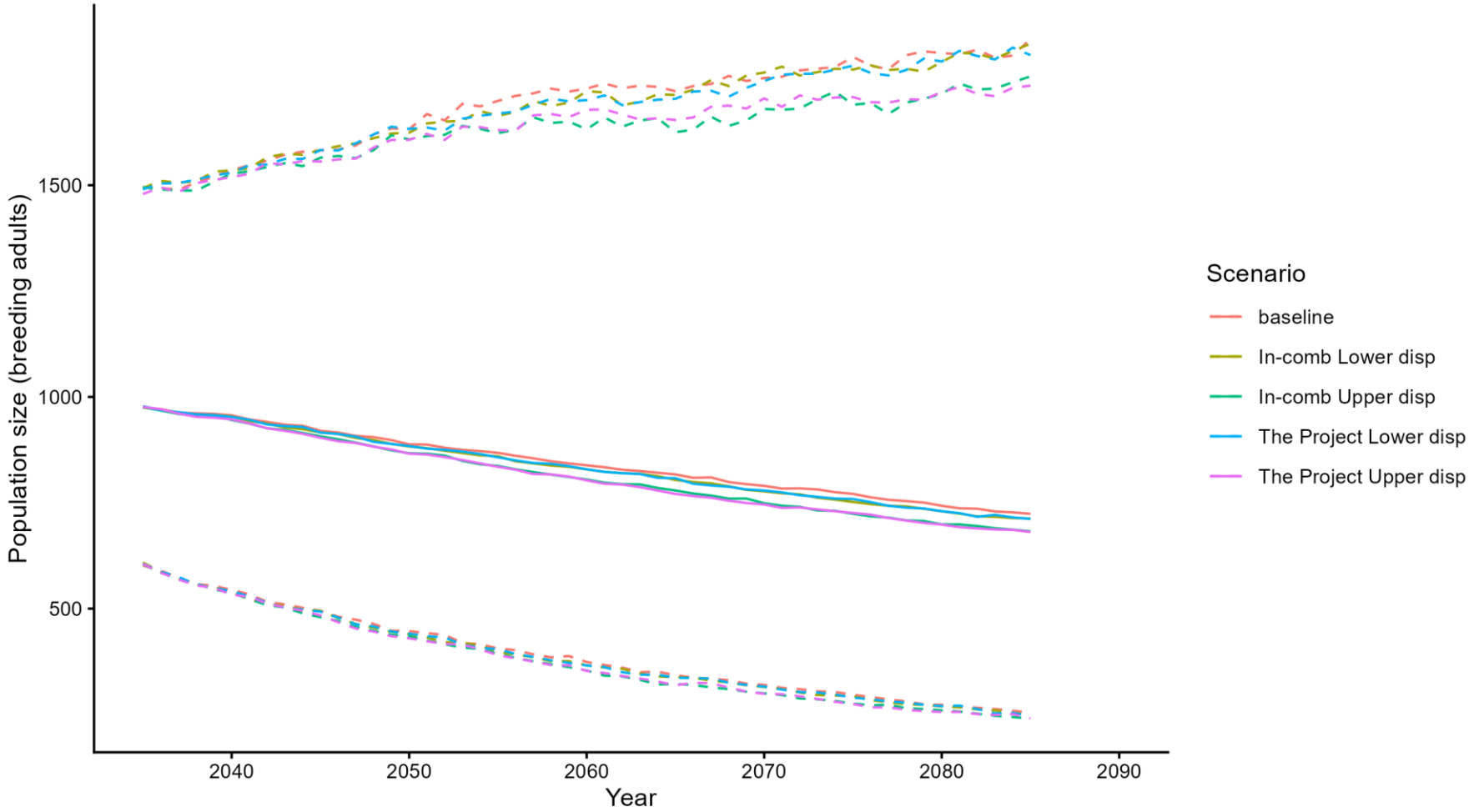


Figure 58: Razorbill – North Rona and Sula Sgeir SPA PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 123:Razorbill – North Rona and Sula Sgeir SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill N Rona and S Sgeir SPA Minches and W Scot rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0004910437
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.001472539
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	594	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.519	Scenario C Impact on adult survival rate per pair mean	0.0005050505
Productivity rate per pair standard deviation	0.052	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.001515152
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 124:Razorbill – North Rona and Sula Sgeir SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.3	0.0004910	25	0.9995	0.9995	0.0031	0.9932	1.0056	0.9875	0.9920	0.1010	0.8061	1.2108	48.56	51.70
The Project Upper disp	0.9	0.0014725	25	0.9984	0.9983	0.0031	0.9921	1.0046	0.9600	0.9627	0.0982	0.7820	1.1641	44.64	55.70
In-comb Lower disp	0.3	0.0005051	25	0.9994	0.9995	0.0031	0.9934	1.0056	0.9867	0.9917	0.1008	0.8080	1.2026	48.74	51.34
In-comb Upper disp	0.9	0.0015152	25	0.9983	0.9983	0.0031	0.9921	1.0044	0.9594	0.9613	0.0977	0.7844	1.1690	44.42	55.42
The Project Lower disp	0.3	0.0004910	35	0.9994	0.9995	0.0026	0.9943	1.0047	0.9799	0.9882	0.1124	0.7912	1.2383	48.74	51.78
The Project Upper disp	0.9	0.0014725	35	0.9983	0.9983	0.0026	0.9931	1.0035	0.9413	0.9473	0.1068	0.7544	1.1732	43.50	56.72
In-comb Lower disp	0.3	0.0005051	35	0.9994	0.9995	0.0026	0.9943	1.0048	0.9819	0.9876	0.1113	0.7875	1.2310	48.62	51.52
In-comb Upper disp	0.9	0.0015152	35	0.9983	0.9983	0.0026	0.9930	1.0034	0.9411	0.9463	0.1066	0.7502	1.1728	43.40	56.80
The Project Lower disp	0.3	0.0004910	50	0.9996	0.9996	0.0021	0.9954	1.0039	0.9806	0.9898	0.1260	0.7692	1.2727	48.06	51.72
The Project Upper disp	0.9	0.0014725	50	0.9989	0.9988	0.0022	0.9945	1.0030	0.9443	0.9496	0.1200	0.7327	1.2129	44.66	55.38
In-comb Lower disp	0.3	0.0005051	50	0.9996	0.9996	0.0021	0.9954	1.0039	0.9836	0.9901	0.1258	0.7634	1.2602	48.32	51.54
In-comb Upper disp	0.9	0.0015152	50	0.9988	0.9988	0.0021	0.9946	1.0030	0.9410	0.9487	0.1204	0.7330	1.2056	44.28	55.36

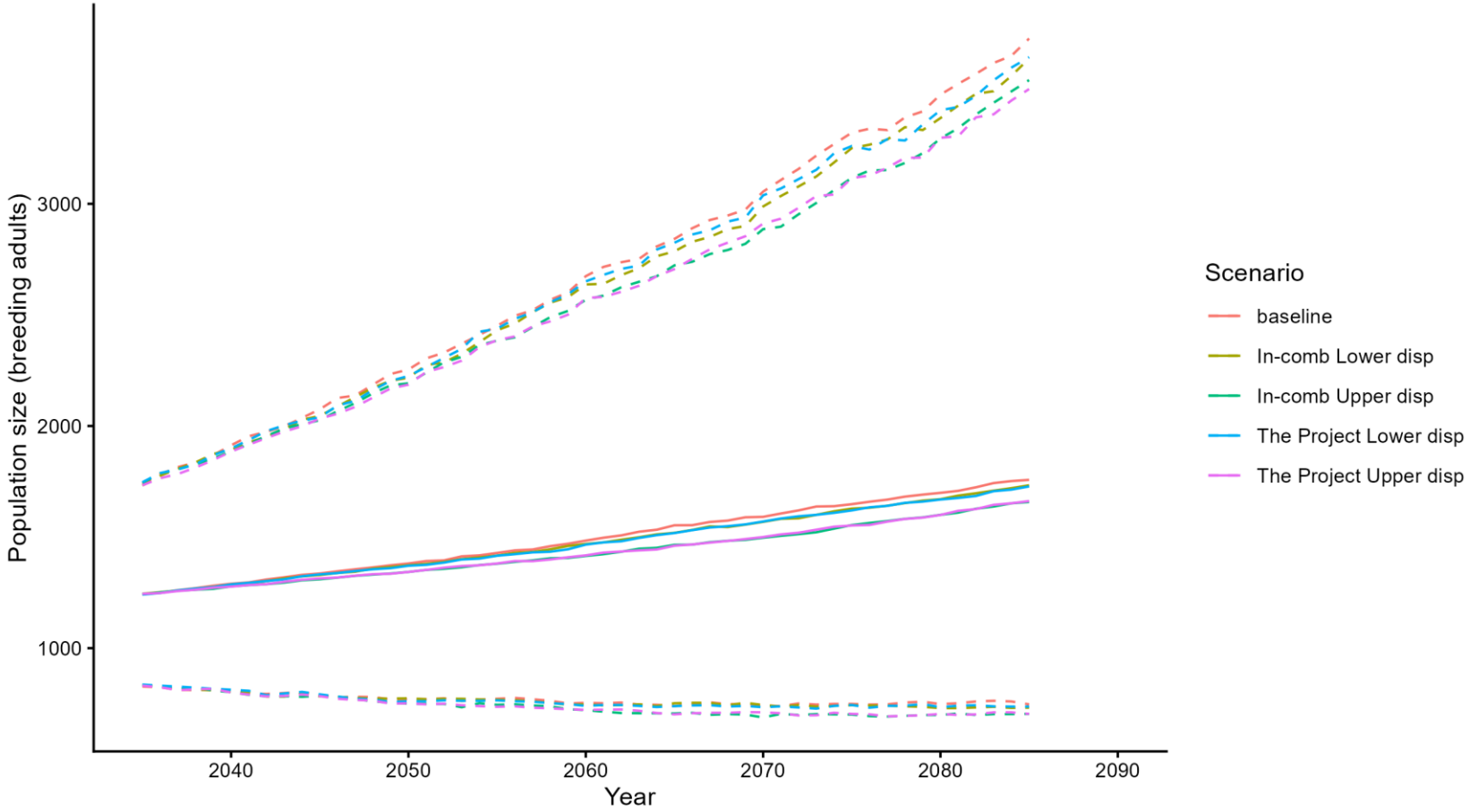


Figure 59: Razorbill – North Rona and Sula Sgeir population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.2.20 Razorbill: Rathlin Island SPA

Table 125:Razorbill – Rathlin SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Rathlin Island SPA CEH Scotland rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0004853332
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0009729572
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	33632	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.44	Scenario C Impact on adult survival rate per pair mean	0.0007433397
Productivity rate per pair standard deviation	0.189	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.001409372
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 126:Razorbill – Rathlin SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	16.3	0.0004853	25	0.9994	0.9994	0.0005	0.9984	1.0005	0.9856	0.9856	0.0157	0.9548	1.0164	48.48	51.64
The Project Upper disp	32.7	0.0009730	25	0.9989	0.9989	0.0005	0.9978	0.9999	0.9712	0.9714	0.0154	0.9409	1.0021	47.04	53.68
In-comb Lower disp	25.0	0.0007433	25	0.9991	0.9991	0.0005	0.9981	1.0001	0.9775	0.9779	0.0154	0.9483	1.0082	47.58	52.72
In-comb Upper disp	47.4	0.0014094	25	0.9984	0.9984	0.0005	0.9974	0.9994	0.9591	0.9590	0.0150	0.9291	0.9877	45.92	54.86
The Project Lower disp	16.3	0.0004853	35	0.9994	0.9994	0.0004	0.9986	1.0003	0.9802	0.9801	0.0176	0.9455	1.0154	47.88	52.08
The Project Upper disp	32.7	0.0009730	35	0.9989	0.9989	0.0004	0.9980	0.9997	0.9605	0.9607	0.0175	0.9272	0.9951	45.90	53.86
In-comb Lower disp	25.0	0.0007433	35	0.9991	0.9991	0.0004	0.9983	1.0000	0.9695	0.9696	0.0174	0.9360	1.0043	46.72	52.80
In-comb Upper disp	47.4	0.0014094	35	0.9984	0.9984	0.0004	0.9975	0.9993	0.9437	0.9438	0.0168	0.9099	0.9773	44.66	55.78
The Project Lower disp	16.3	0.0004853	50	0.9996	0.9996	0.0004	0.9988	1.0003	0.9800	0.9799	0.0206	0.9400	1.0207	48.30	51.60
The Project Upper disp	32.7	0.0009730	50	0.9992	0.9992	0.0004	0.9985	0.9999	0.9606	0.9604	0.0204	0.9216	1.0012	46.54	53.52
In-comb Lower disp	25.0	0.0007433	50	0.9994	0.9994	0.0004	0.9986	1.0001	0.9694	0.9695	0.0206	0.9287	1.0110	47.34	52.44
In-comb Upper disp	47.4	0.0014094	50	0.9989	0.9989	0.0004	0.9981	0.9996	0.9436	0.9436	0.0198	0.9048	0.9834	44.72	54.86

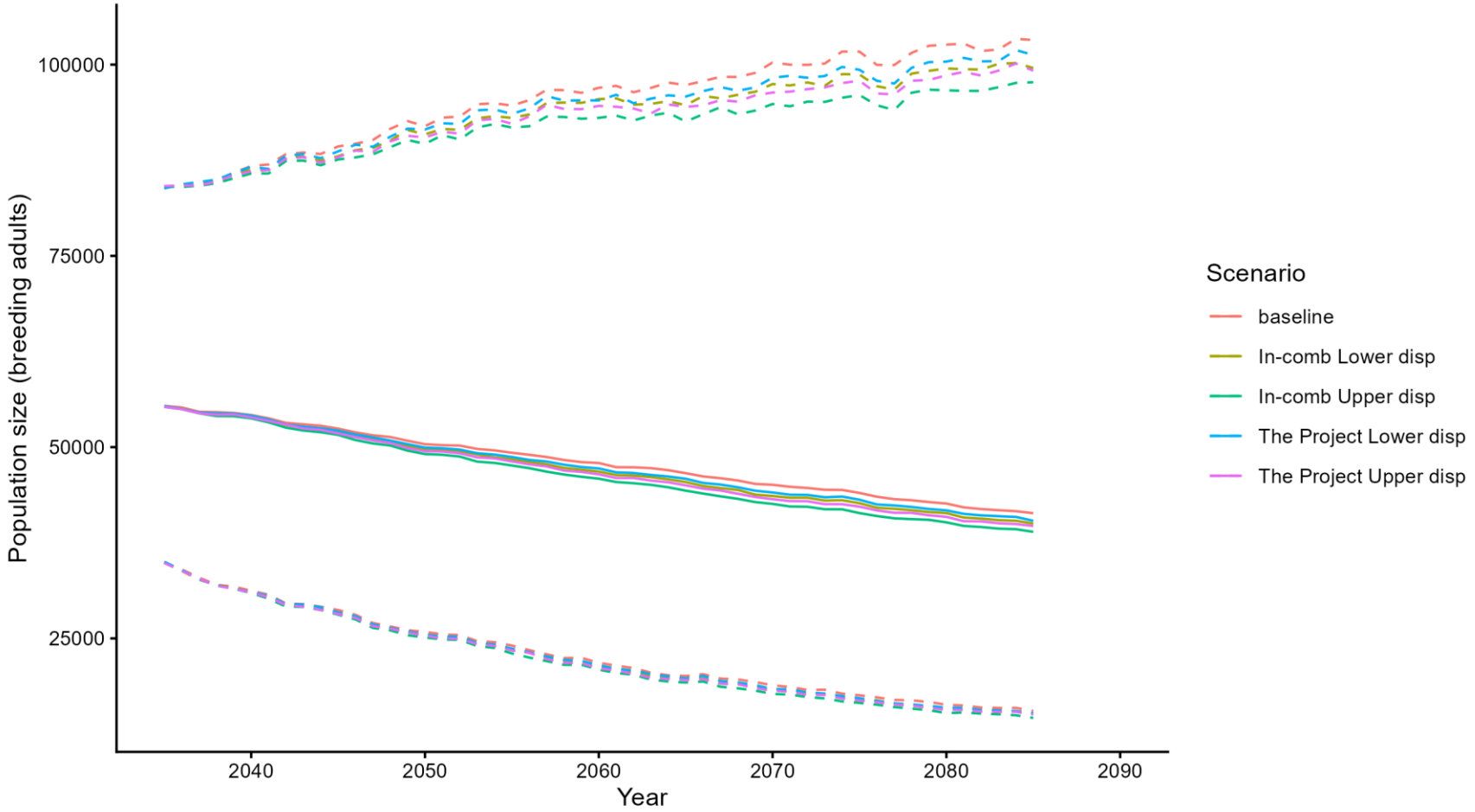


Figure 60: Razorbill – Rathlin Island SPA PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 127:Razorbill – Rathlin Island SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Rathlin Island SPA Minches and W Scot rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0004853332
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0009729572
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	33632	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.519	Scenario C Impact on adult survival rate per pair mean	0.0007433397
Productivity rate per pair standard deviation	0.052	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.001409372
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 128:Razorbill – Rathlin Island SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	16.3	0.0004853	25	0.9994	0.9995	0.0004	0.9986	1.0003	0.9861	0.9860	0.0131	0.9606	1.0123	48.26	51.54
The Project Upper disp	32.7	0.0009730	25	0.9989	0.9989	0.0004	0.9980	0.9997	0.9714	0.9716	0.0132	0.9458	0.9985	46.12	53.52
In-comb Lower disp	25.0	0.0007433	25	0.9992	0.9992	0.0004	0.9983	1.0000	0.9783	0.9783	0.0132	0.9528	1.0044	47.12	52.82
In-comb Upper disp	47.4	0.0014094	25	0.9984	0.9984	0.0004	0.9976	0.9992	0.9592	0.9593	0.0130	0.9345	0.9855	44.42	55.30
The Project Lower disp	16.3	0.0004853	35	0.9994	0.9995	0.0003	0.9988	1.0001	0.9805	0.9807	0.0145	0.9524	1.0101	47.78	52.02
The Project Upper disp	32.7	0.0009730	35	0.9989	0.9989	0.0004	0.9982	0.9996	0.9610	0.9610	0.0145	0.9333	0.9902	45.76	54.58
In-comb Lower disp	25.0	0.0007433	35	0.9992	0.9992	0.0003	0.9985	0.9999	0.9696	0.9702	0.0144	0.9418	0.9994	46.64	53.32
In-comb Upper disp	47.4	0.0014094	35	0.9984	0.9984	0.0004	0.9977	0.9991	0.9439	0.9440	0.0142	0.9169	0.9725	43.70	56.54
The Project Lower disp	16.3	0.0004853	50	0.9996	0.9996	0.0003	0.9991	1.0002	0.9806	0.9807	0.0161	0.9492	1.0134	47.94	52.26
The Project Upper disp	32.7	0.0009730	50	0.9992	0.9992	0.0003	0.9987	0.9998	0.9607	0.9610	0.0161	0.9297	0.9939	46.08	54.18
In-comb Lower disp	25.0	0.0007433	50	0.9994	0.9994	0.0003	0.9988	1.0000	0.9700	0.9702	0.0160	0.9386	1.0025	47.30	53.32
In-comb Upper disp	47.4	0.0014094	50	0.9989	0.9989	0.0003	0.9983	0.9994	0.9438	0.9439	0.0156	0.9130	0.9744	44.46	55.58

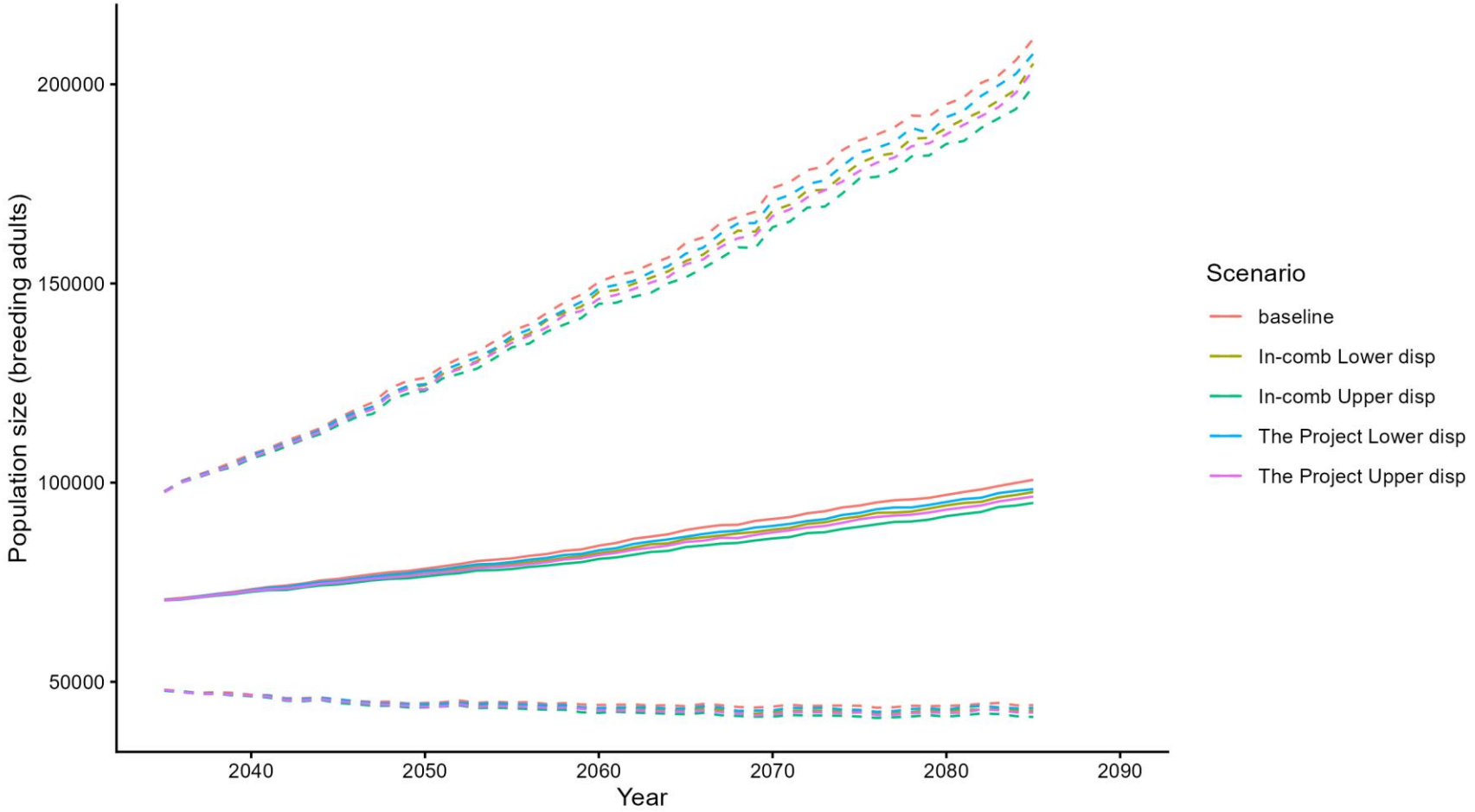


Figure 61: Razorbill – Rathlin Island SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.2.21 Razorbill: Shiant Islands SPA

Table 129:Razorbill – Shiant Islands SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Shiant Islands SPA CEH Scotland rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	9.446968e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0002832951
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	12044	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.44	Scenario C Impact on adult survival rate per pair mean	0.0003238127
Productivity rate per pair standard deviation	0.189	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.0006974427
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 130:Razorbill – Shiant Islands SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	1.1	0.0000945	25	0.9999	0.9999	0.0008	0.9982	1.0016	0.9970	0.9974	0.0259	0.9465	1.0480	49.68	50.28
The Project Upper disp	3.4	0.0002833	25	0.9997	0.9997	0.0008	0.9980	1.0013	0.9915	0.9925	0.0256	0.9428	1.0422	49.14	50.82
In-comb Lower disp	3.9	0.0003238	25	0.9996	0.9996	0.0008	0.9980	1.0013	0.9901	0.9905	0.0258	0.9390	1.0425	49.02	51.00
In-comb Upper disp	8.4	0.0006974	25	0.9992	0.9992	0.0008	0.9975	1.0009	0.9800	0.9801	0.0256	0.9312	1.0321	47.94	52.18
The Project Lower disp	1.1	0.0000945	35	0.9999	0.9999	0.0007	0.9985	1.0014	0.9958	0.9964	0.0296	0.9394	1.0565	49.62	50.76
The Project Upper disp	3.4	0.0002833	35	0.9997	0.9997	0.0007	0.9982	1.0011	0.9890	0.9895	0.0297	0.9316	1.0478	48.90	51.16
In-comb Lower disp	3.9	0.0003238	35	0.9996	0.9996	0.0007	0.9982	1.0011	0.9872	0.9871	0.0291	0.9303	1.0446	48.74	51.62
In-comb Upper disp	8.4	0.0006974	35	0.9992	0.9992	0.0007	0.9978	1.0007	0.9719	0.9723	0.0289	0.9165	1.0303	47.32	53.06
The Project Lower disp	1.1	0.0000945	50	0.9999	0.9999	0.0006	0.9987	1.0012	0.9960	0.9967	0.0352	0.9290	1.0674	49.42	50.66
The Project Upper disp	3.4	0.0002833	50	0.9998	0.9998	0.0006	0.9985	1.0011	0.9894	0.9896	0.0352	0.9213	1.0598	49.00	51.10
In-comb Lower disp	3.9	0.0003238	50	0.9997	0.9997	0.0006	0.9985	1.0010	0.9874	0.9874	0.0346	0.9198	1.0561	49.02	51.34
In-comb Upper disp	8.4	0.0006974	50	0.9994	0.9994	0.0006	0.9982	1.0007	0.9710	0.9722	0.0341	0.9062	1.0409	47.82	52.48

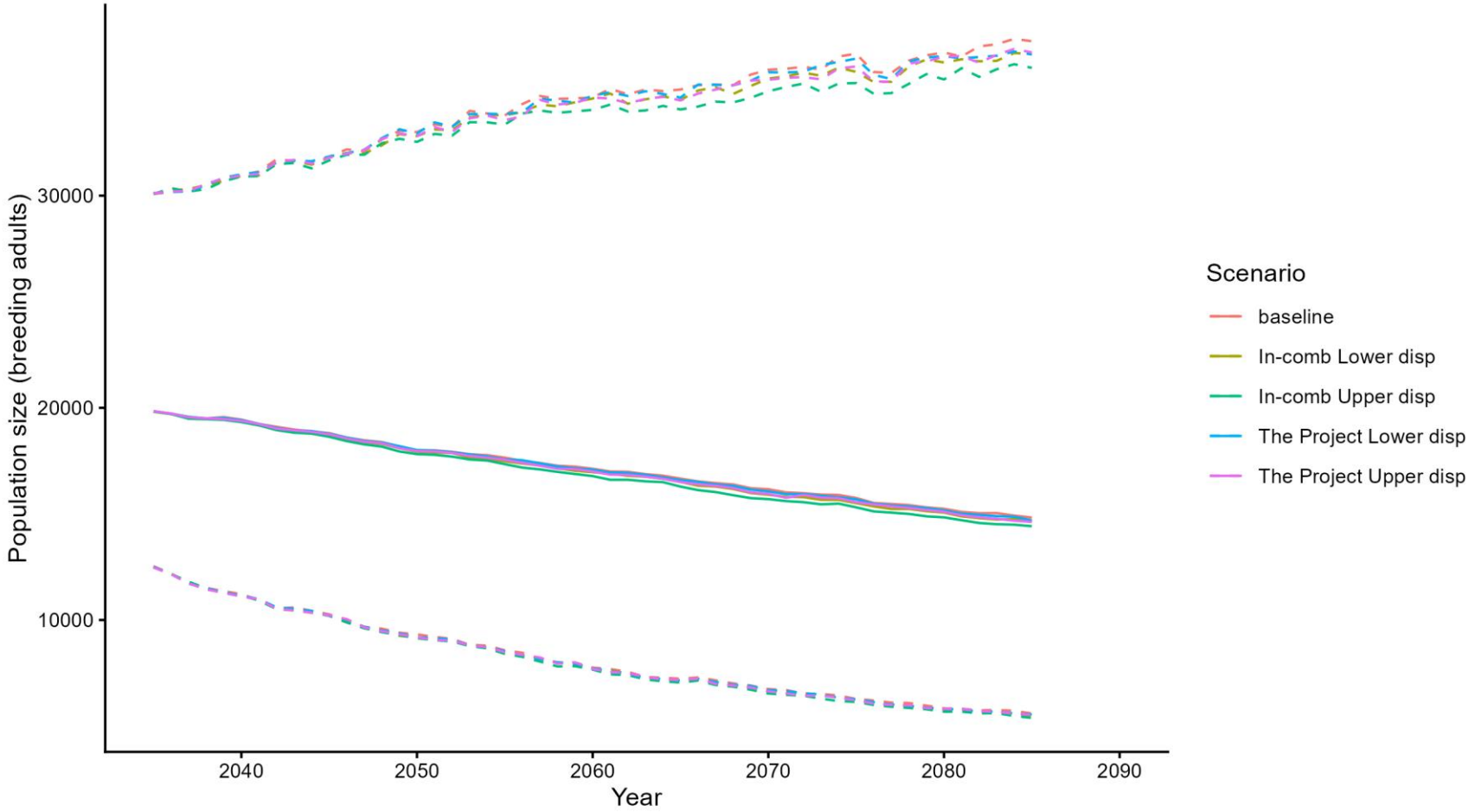


Figure 62: Razorbill – Shiant Islands SPA PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 131:Razorbill – Shiant Islands SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Shiant Islands SPA Minches and W Scot rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	9.446968e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0002832951
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	12044	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.519	Scenario C Impact on adult survival rate per pair mean	0.0003238127
Productivity rate per pair standard deviation	0.052	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.0006974427
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 132:Razorbill – Shiant Islands SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	1.1	0.0000945	25	0.9999	0.9999	0.0007	0.9985	1.0013	0.9968	0.9975	0.0222	0.9544	1.0424	49.32	50.52
The Project Upper disp	3.4	0.0002833	25	0.9997	0.9997	0.0007	0.9984	1.0010	0.9922	0.9925	0.0219	0.9512	1.0361	48.90	51.00
In-comb Lower disp	3.9	0.0003238	25	0.9996	0.9996	0.0007	0.9982	1.0010	0.9908	0.9907	0.0224	0.9465	1.0350	48.68	51.34
In-comb Upper disp	8.4	0.0006974	25	0.9992	0.9992	0.0007	0.9979	1.0005	0.9792	0.9796	0.0218	0.9368	1.0239	47.38	52.64
The Project Lower disp	1.1	0.0000945	35	0.9999	0.9999	0.0006	0.9987	1.0010	0.9959	0.9963	0.0248	0.9496	1.0463	49.24	50.58
The Project Upper disp	3.4	0.0002833	35	0.9997	0.9997	0.0006	0.9986	1.0008	0.9890	0.9892	0.0245	0.9426	1.0392	48.54	51.58
In-comb Lower disp	3.9	0.0003238	35	0.9996	0.9996	0.0006	0.9985	1.0008	0.9865	0.9869	0.0246	0.9389	1.0347	48.00	51.64
In-comb Upper disp	8.4	0.0006974	35	0.9992	0.9992	0.0006	0.9981	1.0003	0.9714	0.9717	0.0239	0.9260	1.0210	46.56	53.56
The Project Lower disp	1.1	0.0000945	50	0.9999	0.9999	0.0005	0.9990	1.0008	0.9961	0.9963	0.0273	0.9443	1.0525	49.64	50.38
The Project Upper disp	3.4	0.0002833	50	0.9998	0.9998	0.0005	0.9988	1.0007	0.9889	0.9892	0.0277	0.9365	1.0448	48.62	51.52
In-comb Lower disp	3.9	0.0003238	50	0.9997	0.9997	0.0005	0.9988	1.0007	0.9867	0.9870	0.0274	0.9341	1.0416	48.46	51.94
In-comb Upper disp	8.4	0.0006974	50	0.9994	0.9994	0.0005	0.9985	1.0004	0.9711	0.9719	0.0268	0.9216	1.0266	47.00	52.96

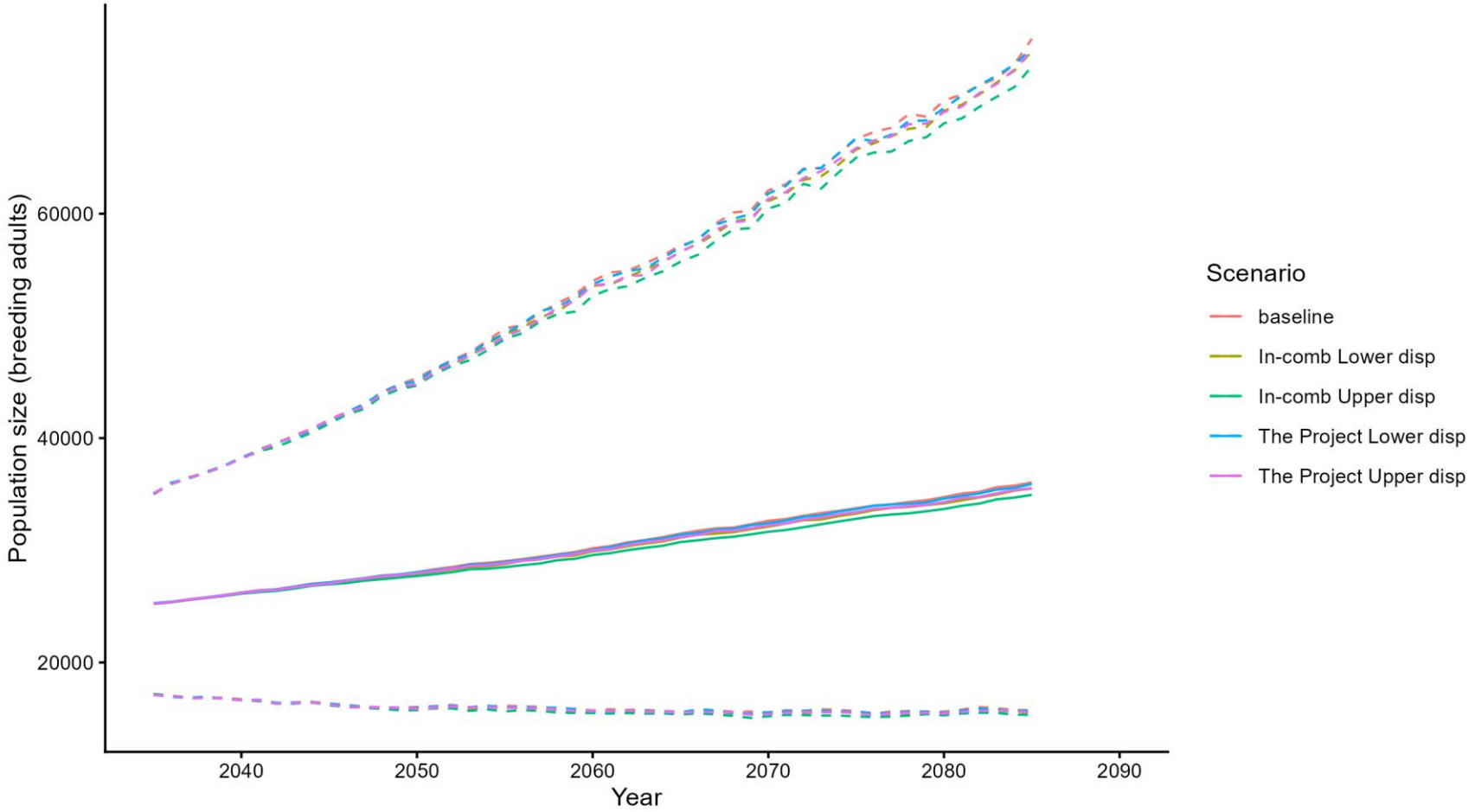


Figure 63: Razorbill – Shiant Islands SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.2.22 Razorbill: Skomer, Skokholm and the Seas off Pembrokeshire SPA

Table 133:Razorbill – Skomer, Skokholm and the Seas off Pembrokeshire SPA population PVA inputs for Project alone. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Skomer and Skokholm SPA CEH Scotland rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	8.374672e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0002511318
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	17883	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.44	Scenario C Impact on adult survival rate per pair mean	0.0005815579
Productivity rate per pair standard deviation	0.189	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.001090421
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 134:Razorbill – Skomer, Skokholm and the Seas off Pembrokeshire SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	1.5	0.0000837	25	0.9999	0.9999	0.0007	0.9985	1.0013	0.9978	0.9984	0.0217	0.9560	1.0419	49.66	50.30
The Project Upper disp	4.5	0.0002511	25	0.9997	0.9997	0.0007	0.9983	1.0011	0.9931	0.9932	0.0216	0.9511	1.0354	48.94	50.82
In-comb Lower disp	10.4	0.0005816	25	0.9993	0.9994	0.0007	0.9980	1.0008	0.9830	0.9835	0.0210	0.9433	1.0265	48.28	52.10
In-comb Upper disp	19.5	0.0010904	25	0.9988	0.9988	0.0007	0.9974	1.0002	0.9685	0.9690	0.0213	0.9292	1.0126	46.52	53.52
The Project Lower disp	1.5	0.0000837	35	0.9999	0.9999	0.0006	0.9987	1.0011	0.9969	0.9973	0.0244	0.9504	1.0465	49.84	50.22
The Project Upper disp	4.5	0.0002511	35	0.9997	0.9997	0.0006	0.9985	1.0010	0.9906	0.9905	0.0246	0.9430	1.0392	49.28	50.92
In-comb Lower disp	10.4	0.0005816	35	0.9993	0.9993	0.0006	0.9982	1.0005	0.9772	0.9771	0.0236	0.9309	1.0249	47.92	52.12
In-comb Upper disp	19.5	0.0010904	35	0.9988	0.9988	0.0006	0.9976	1.0000	0.9563	0.9569	0.0238	0.9115	1.0048	46.12	53.94
The Project Lower disp	1.5	0.0000837	50	0.9999	0.9999	0.0005	0.9989	1.0010	0.9972	0.9975	0.0287	0.9430	1.0554	49.92	50.10
The Project Upper disp	4.5	0.0002511	50	0.9998	0.9998	0.0005	0.9988	1.0009	0.9897	0.9904	0.0288	0.9336	1.0499	48.84	50.96
In-comb Lower disp	10.4	0.0005816	50	0.9995	0.9995	0.0005	0.9985	1.0006	0.9764	0.9769	0.0276	0.9229	1.0332	47.82	52.00
In-comb Upper disp	19.5	0.0010904	50	0.9991	0.9991	0.0005	0.9981	1.0002	0.9560	0.9568	0.0279	0.9037	1.0130	46.10	53.98

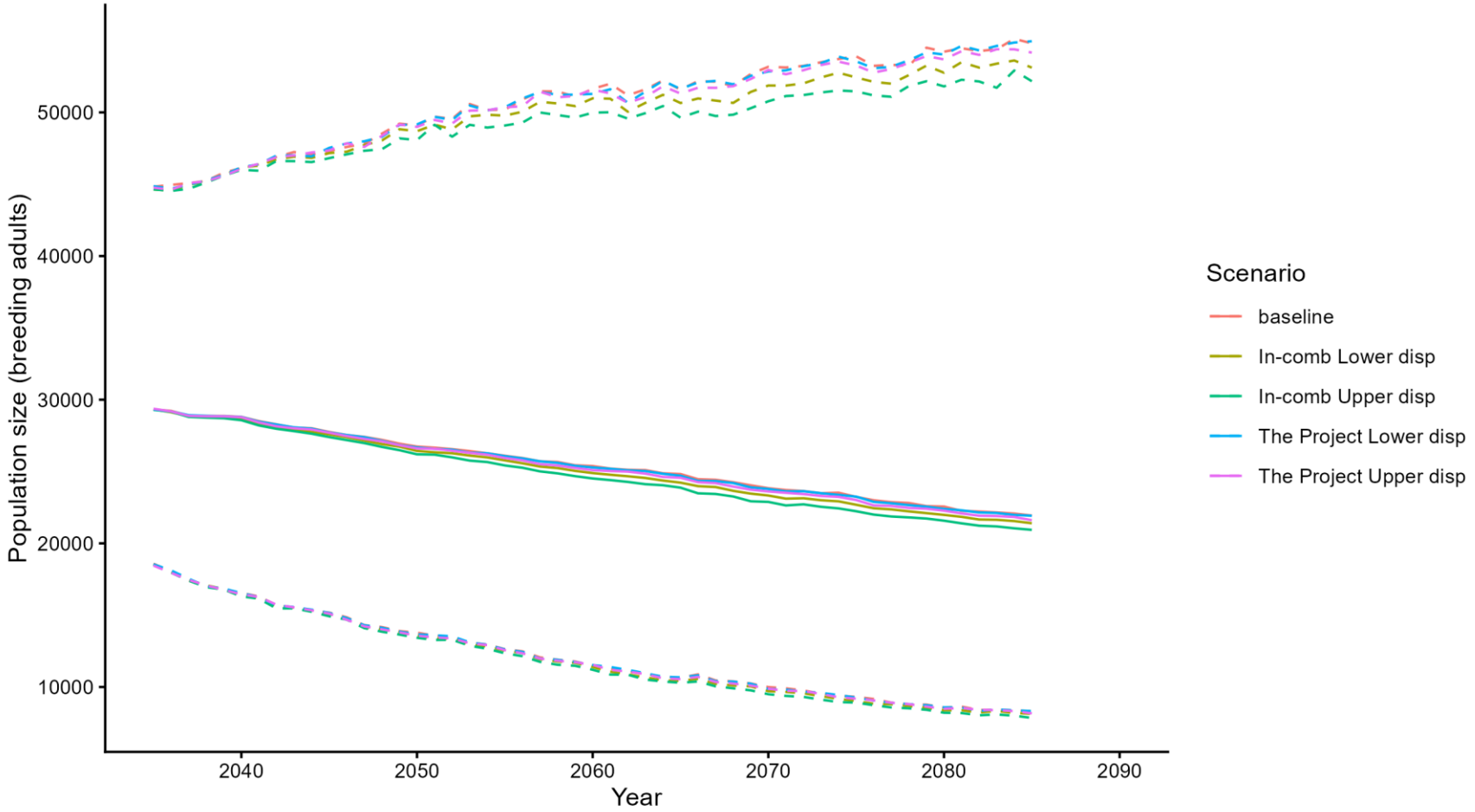


Figure 64: Razorbill – Skomer, Skokholm and the Seas off Pembrokeshire SPA PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 135:Razorbill – Skomer, Skokholm and the Seas off Pembrokeshire SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'site specific' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill Skomer and Skokholm SPA site specific rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	8.374672e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0002511318
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	17883	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.719	Scenario C Impact on adult survival rate per pair mean	0.0005815579
Productivity rate per pair standard deviation	0.231	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.895	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	0.001090421
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 136:Razorbill – Skomer, Skokholm and the Seas off Pembrokeshire SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'site specific' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	1.5	0.0000837	25	0.9999	0.9999	0.0004	0.9992	1.0006	0.9974	0.9975	0.0132	0.9713	1.0238	49.72	50.20
The Project Upper disp	4.5	0.0002511	25	0.9997	0.9997	0.0004	0.9990	1.0004	0.9924	0.9925	0.0131	0.9674	1.0188	49.40	50.88
In-comb Lower disp	10.4	0.0005816	25	0.9993	0.9993	0.0004	0.9986	1.0001	0.9825	0.9827	0.0131	0.9571	1.0086	48.18	51.98
In-comb Upper disp	19.5	0.0010904	25	0.9988	0.9988	0.0004	0.9980	0.9995	0.9676	0.9680	0.0130	0.9426	0.9937	46.72	53.68
The Project Lower disp	1.5	0.0000837	35	0.9999	0.9999	0.0003	0.9993	1.0005	0.9965	0.9964	0.0139	0.9682	1.0238	49.50	50.22
The Project Upper disp	4.5	0.0002511	35	0.9997	0.9997	0.0003	0.9991	1.0003	0.9895	0.9897	0.0139	0.9636	1.0175	48.94	50.98
In-comb Lower disp	10.4	0.0005816	35	0.9993	0.9993	0.0003	0.9987	0.9999	0.9762	0.9763	0.0137	0.9495	1.0034	47.40	52.10
In-comb Upper disp	19.5	0.0010904	35	0.9988	0.9988	0.0003	0.9982	0.9993	0.9557	0.9561	0.0136	0.9295	0.9832	45.44	54.24
The Project Lower disp	1.5	0.0000837	50	0.9999	0.9999	0.0002	0.9995	1.0004	0.9966	0.9964	0.0145	0.9678	1.0254	49.92	50.12
The Project Upper disp	4.5	0.0002511	50	0.9998	0.9998	0.0002	0.9993	1.0002	0.9894	0.9897	0.0144	0.9621	1.0183	48.90	50.72
In-comb Lower disp	10.4	0.0005816	50	0.9995	0.9995	0.0002	0.9991	1.0000	0.9759	0.9762	0.0144	0.9479	1.0045	47.58	51.98
In-comb Upper disp	19.5	0.0010904	50	0.9991	0.9991	0.0002	0.9987	0.9996	0.9557	0.9560	0.0142	0.9288	0.9847	45.52	53.84

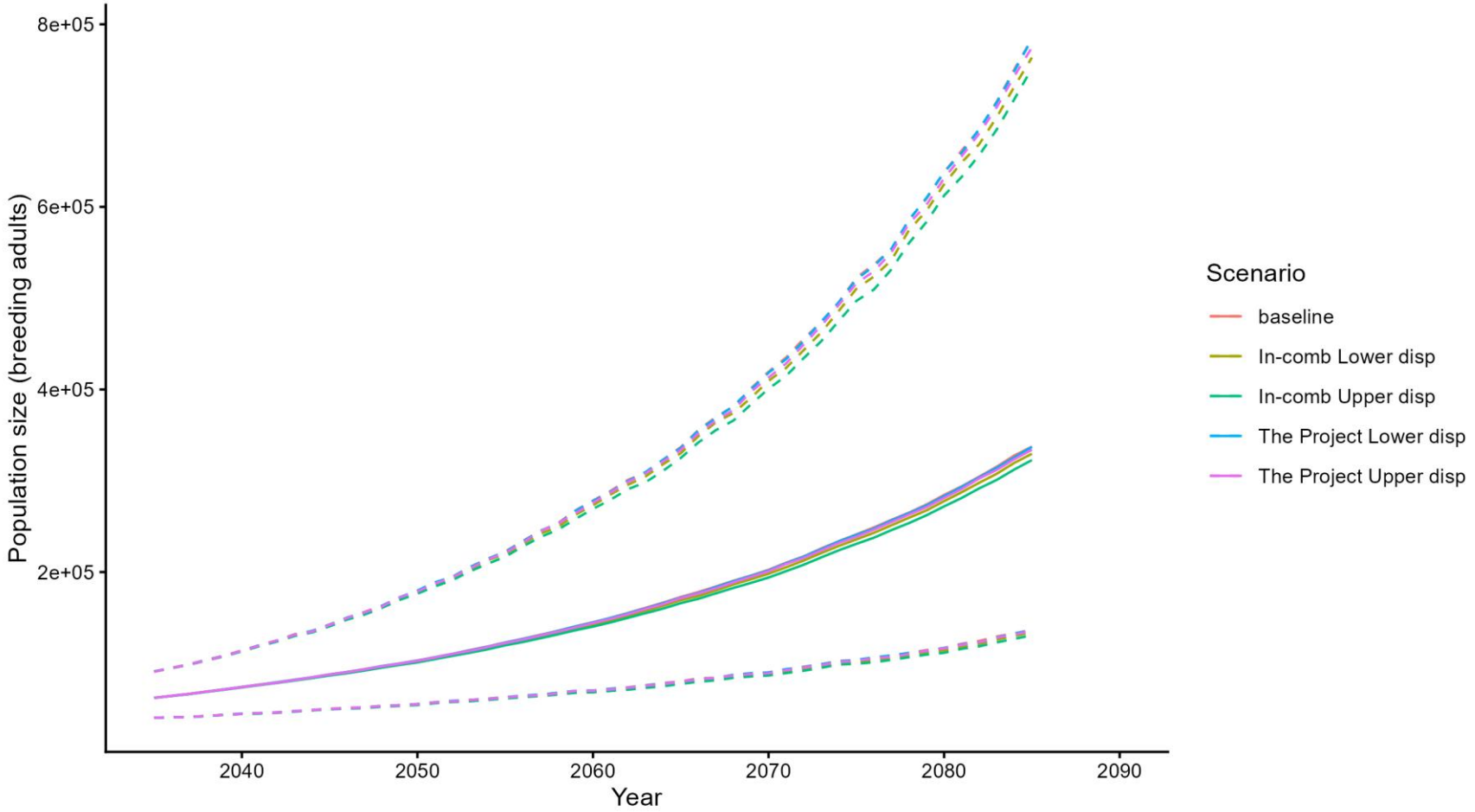


Figure 65: Razorbill – Skomer, Skokholm and the Seas off Pembrokeshire SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'site specific' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.2.23 Razorbill: St Kilda SPA

Table 137:Razorbill – St Kilda SPA population PVA inputs for Project alone. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill St Kilda SPA CEH Scotland rates	Number of scenarios of impact	2
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0003701881
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.001110118
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	1230	Scenario C name	
Year	2021	Scenario C Impact on productivity rate per pair mean	
Productivity rate per pair mean	0.44	Scenario C Impact on adult survival rate per pair mean	
Productivity rate per pair standard deviation	0.189	Scenario C Impact on immature survival rate mean	
Adult survival rate Mean	0.895	Scenario D name	
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 138:Razorbill – St Kilda SPA population PVA outputs for Project alone. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.5	0.0003702	25	0.9996	0.9996	0.0027	0.9943	1.0048	0.9890	0.9922	0.0816	0.8380	1.1635	48.60	51.24
The Project Upper disp	1.4	0.0011101	25	0.9987	0.9988	0.0026	0.9935	1.0040	0.9688	0.9714	0.0800	0.8204	1.1433	46.46	53.50
The Project Lower disp	0.5	0.0003702	35	0.9996	0.9996	0.0023	0.9951	1.0041	0.9845	0.9896	0.0925	0.8190	1.1904	48.92	51.32
The Project Upper disp	1.4	0.0011101	35	0.9988	0.9988	0.0023	0.9943	1.0033	0.9577	0.9604	0.0900	0.7928	1.1450	45.96	54.10
The Project Lower disp	0.5	0.0003702	50	0.9997	0.9997	0.0020	0.9958	1.0038	0.9849	0.9920	0.1113	0.7947	1.2321	48.28	52.04
The Project Upper disp	1.4	0.0011101	50	0.9991	0.9991	0.0020	0.9952	1.0032	0.9577	0.9630	0.1079	0.7693	1.1970	46.20	53.94

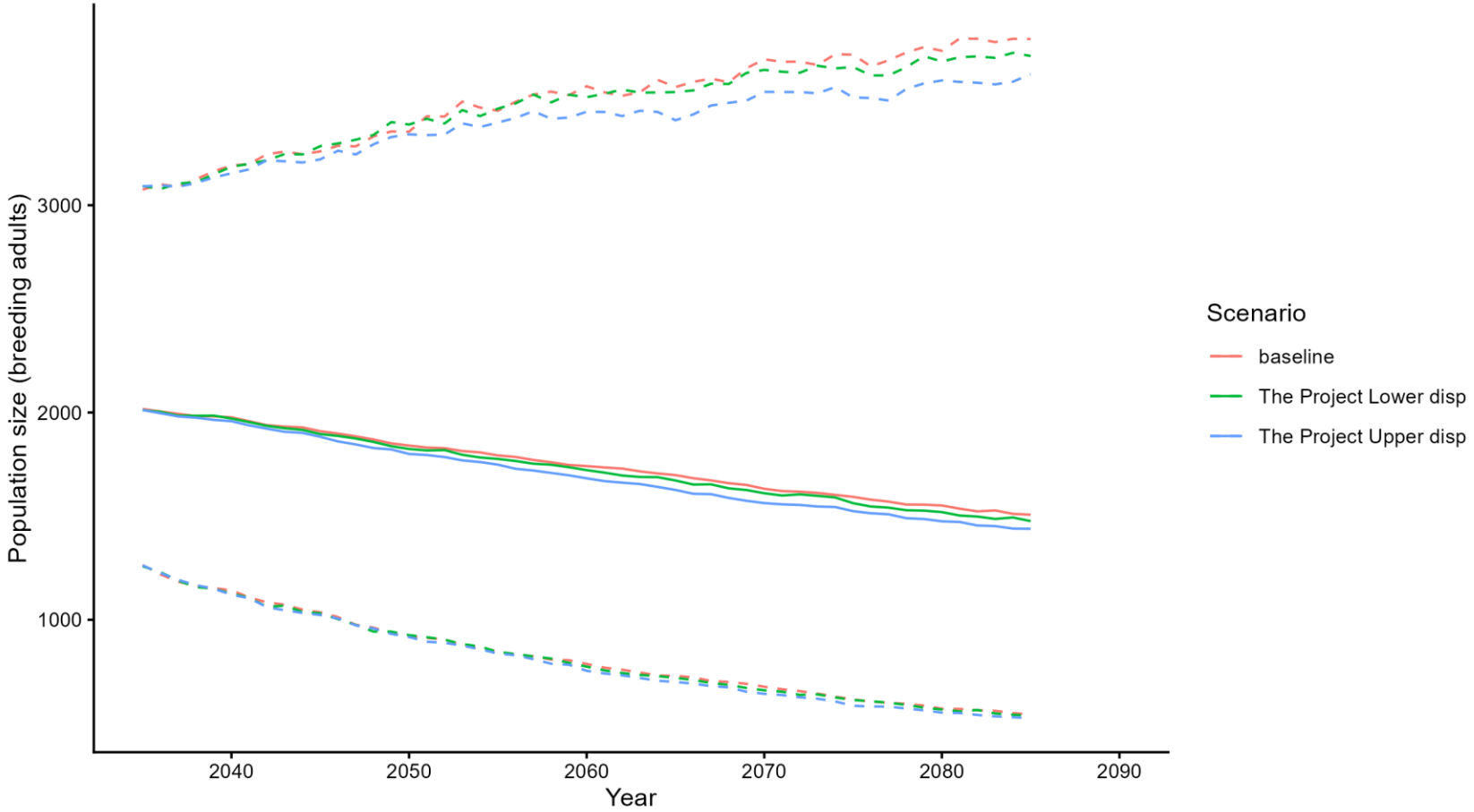


Figure 66: Razorbill – St Kilda SPA PVA outputs for Project alone using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Some trajectories are obscured in the plot due to being very similar to other trajectories. Solid line = mean population size, dashed line = 95% confidence intervals.

Table 139:Razorbill – St Kilda SPA population PVA inputs for Project alone. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Razorbill St Kilda Islands SPA Minches and W Scot rates	Number of scenarios of impact	2
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Razorbill	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0003701881
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.001110118
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	1230	Scenario C name	
Year	2021	Scenario C Impact on productivity rate per pair mean	
Productivity rate per pair mean	0.519	Scenario C Impact on adult survival rate per pair mean	
Productivity rate per pair standard deviation	0.052	Scenario C Impact on immature survival rate mean	
Adult survival rate Mean	0.895	Scenario D name	
Adult survival rate standard deviation	0.067	Scenario D Impact on productivity rate per pair mean	
Immatures survival rates 0 to 1 mean	0.794	Scenario D Impact on adult survival rate	
Immatures survival rates 0 to 1 standard deviation	0.067	Scenario D Impact on immature survival rate mean	
Immatures survival rates 1 to 2 mean	0.794	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.067	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.895	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.067	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.067	Scenario F Impact on productivity rate per pair mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 4 to 5 mean	0.895	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.067	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 140:Razorbill – St Kilda SPA population PVA inputs for Project alone. Local 'Minches and Western Scotland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.5	0.0003702	25	0.9996	0.9996	0.0022	0.9951	1.0038	0.9886	0.9917	0.0703	0.8586	1.1355	49.06	51.02
The Project Upper disp	1.4	0.0011101	25	0.9988	0.9988	0.0022	0.9944	1.0031	0.9686	0.9714	0.0687	0.8436	1.1140	46.30	53.68
The Project Lower disp	0.5	0.0003702	35	0.9995	0.9995	0.0018	0.9959	1.0032	0.9838	0.9876	0.0774	0.8417	1.1502	48.10	51.78
The Project Upper disp	1.4	0.0011101	35	0.9988	0.9987	0.0018	0.9951	1.0023	0.9563	0.9594	0.0746	0.8224	1.1180	45.92	54.64
The Project Lower disp	0.5	0.0003702	50	0.9997	0.9997	0.0015	0.9967	1.0027	0.9845	0.9875	0.0866	0.8258	1.1741	48.40	51.24
The Project Upper disp	1.4	0.0011101	50	0.9991	0.9991	0.0015	0.9961	1.0021	0.9540	0.9592	0.0838	0.8048	1.1399	46.44	53.46

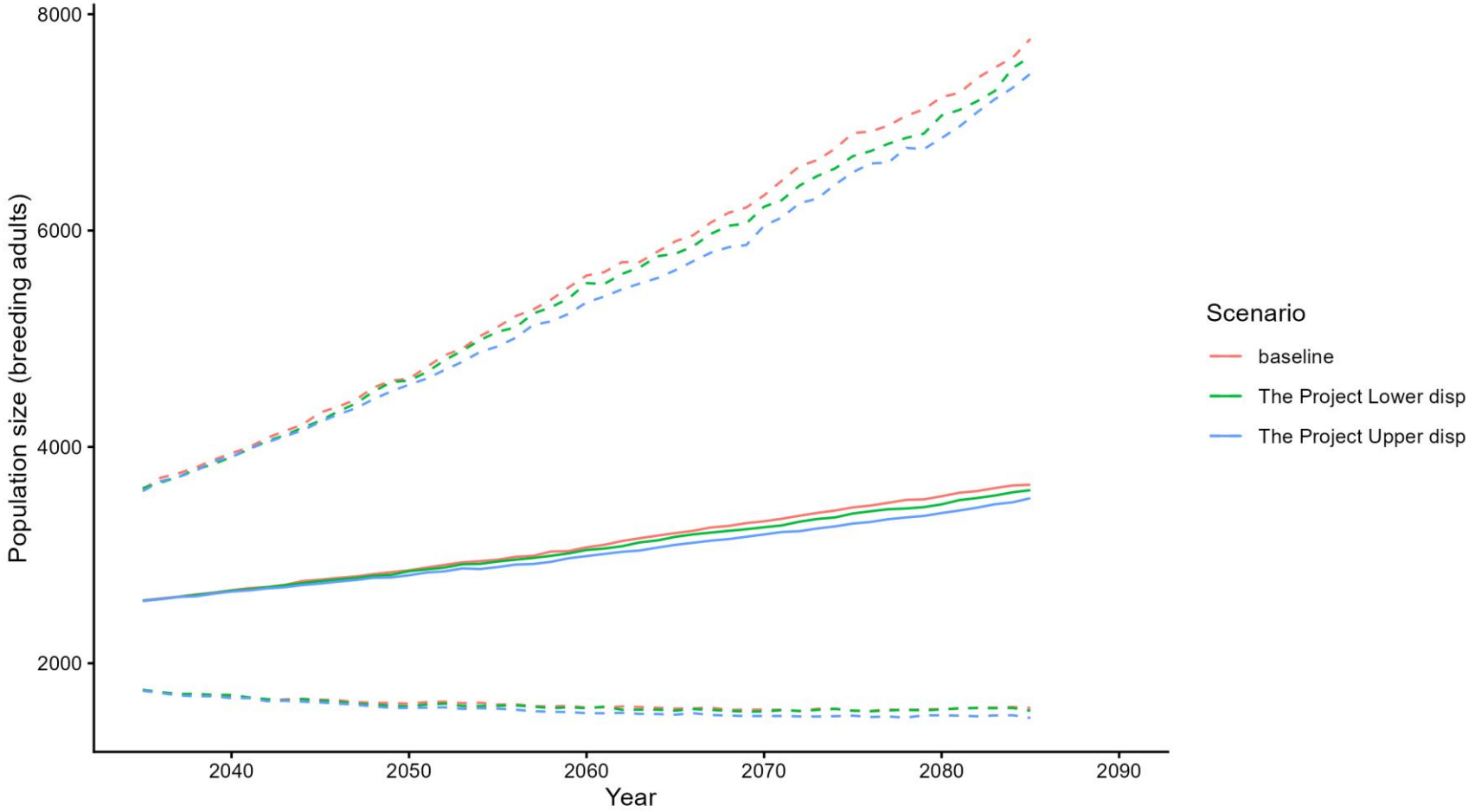


Figure 67: Razorbill – St Kilda SPA population PVA outputs for Project alone using local 'Minches and Western Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

5.2.24 Puffin: Rathlin Island SPA

Table 141:Puffin – Rathlin Island SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Puffin Rathlin Island SPA CEH Scotland rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Atlantic puffin	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0001077771
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0001824579
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	2348	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.415	Scenario C Impact on adult survival rate per pair mean	0.0001107325
Productivity rate per pair standard deviation	0.212	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.907	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.083	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.892	Scenario D Impact on adult survival rate	0.0001831346
Immatures survival rates 0 to 1 standard deviation	0.083	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.892	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.083	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.892	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.083	Scenario E Impact on immature survival rate mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.76	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.093	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.805	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.083	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 142:Puffin – Rathlin Island SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.3	0.0001078	25	0.9999	0.9999	0.0019	0.9961	1.0037	0.9977	0.9995	0.0590	0.8893	1.1208	49.80	50.18
The Project Upper disp	0.4	0.0001825	25	0.9998	0.9998	0.0019	0.9961	1.0036	0.9929	0.9953	0.0587	0.8857	1.1182	49.62	50.36
In-comb Lower disp	0.3	0.0001107	25	0.9999	0.9999	0.0019	0.9962	1.0036	0.9968	0.9992	0.0583	0.8895	1.1217	49.70	50.30
In-comb Upper disp	0.4	0.0001831	25	0.9999	0.9999	0.0019	0.9960	1.0036	0.9956	0.9975	0.0589	0.8849	1.1220	49.88	50.18
The Project Lower disp	0.3	0.0001078	35	0.9999	0.9999	0.0016	0.9967	1.0032	0.9957	0.9984	0.0662	0.8750	1.1343	49.84	50.22
The Project Upper disp	0.4	0.0001825	35	0.9998	0.9998	0.0016	0.9965	1.0030	0.9914	0.9936	0.0674	0.8671	1.1325	49.40	50.66
In-comb Lower disp	0.3	0.0001107	35	0.9999	0.9999	0.0016	0.9967	1.0030	0.9957	0.9982	0.0657	0.8751	1.1352	49.50	50.42
In-comb Upper disp	0.4	0.0001831	35	0.9998	0.9998	0.0016	0.9965	1.0030	0.9932	0.9954	0.0663	0.8696	1.1376	49.40	50.58
The Project Lower disp	0.3	0.0001078	50	0.9999	0.9999	0.0014	0.9971	1.0029	0.9953	0.9992	0.0792	0.8550	1.1747	49.82	50.14
The Project Upper disp	0.4	0.0001825	50	0.9998	0.9998	0.0014	0.9970	1.0027	0.9918	0.9942	0.0801	0.8434	1.1601	49.54	50.54
In-comb Lower disp	0.3	0.0001107	50	0.9999	0.9999	0.0014	0.9971	1.0027	0.9950	0.9988	0.0778	0.8511	1.1599	49.82	50.16
In-comb Upper disp	0.4	0.0001831	50	0.9999	0.9999	0.0014	0.9970	1.0026	0.9944	0.9965	0.0784	0.8481	1.1670	49.58	50.38

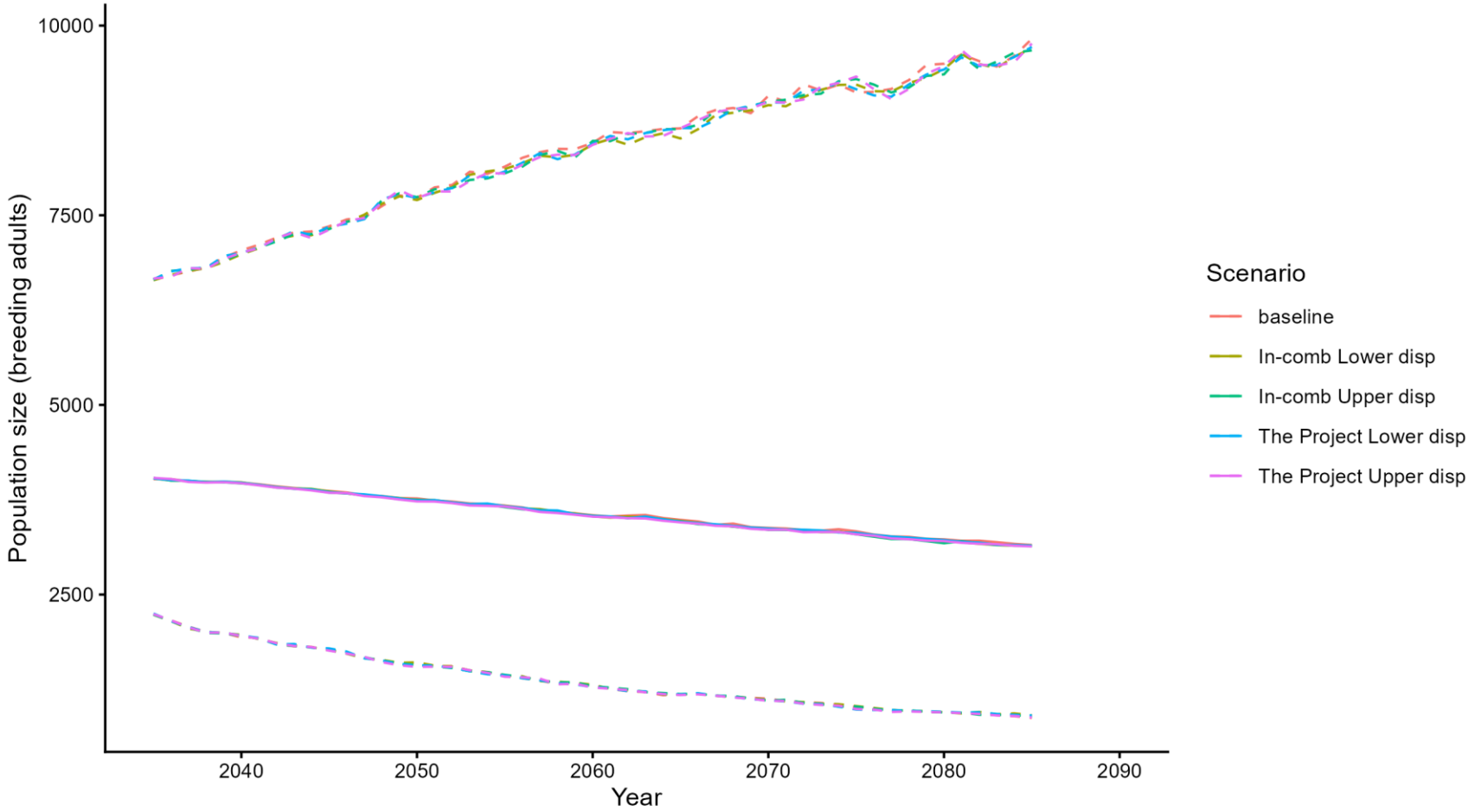


Figure 68: Puffin – Rathlin Island SPA PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 143:Puffin – Rathlin Island SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Western Scotland and East Ireland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Puffin Rathlin Island SPA W Scotland E Ireland rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	0	Scenario A name	The Project Lower disp
Species	Atlantic puffin	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	0.0001077771
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	0.0001824579
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	2348	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.501	Scenario C Impact on adult survival rate per pair mean	0.0001107325
Productivity rate per pair standard deviation	0.274	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.907	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.083	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.892	Scenario D Impact on adult survival rate	0.0001831346
Immatures survival rates 0 to 1 standard deviation	0.083	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.892	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.083	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.892	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.083	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.76	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.093	Scenario F Impact on productivity rate per pair mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 4 to 5 mean	0.805	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.083	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 144:Puffin – Rathlin Island SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Western Scotland and East Ireland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.3	0.0001078	25	0.9999	0.9998	0.0015	0.9968	1.0028	0.9972	0.9976	0.0493	0.9029	1.0976	49.60	50.24
The Project Upper disp	0.4	0.0001825	25	0.9997	0.9997	0.0015	0.9967	1.0028	0.9932	0.9948	0.0484	0.8997	1.0936	49.50	50.34
In-comb Lower disp	0.3	0.0001107	25	0.9999	0.9998	0.0015	0.9969	1.0029	0.9963	0.9974	0.0482	0.9052	1.0962	49.94	50.06
In-comb Upper disp	0.4	0.0001831	25	0.9997	0.9998	0.0015	0.9967	1.0028	0.9942	0.9955	0.0487	0.9029	1.0927	49.48	50.34
The Project Lower disp	0.3	0.0001078	35	0.9999	0.9998	0.0013	0.9972	1.0024	0.9956	0.9962	0.0546	0.8912	1.1052	49.46	50.68
The Project Upper disp	0.4	0.0001825	35	0.9997	0.9997	0.0013	0.9972	1.0023	0.9912	0.9924	0.0546	0.8876	1.1052	49.26	50.56
In-comb Lower disp	0.3	0.0001107	35	0.9998	0.9999	0.0013	0.9972	1.0023	0.9960	0.9964	0.0534	0.8924	1.1055	49.16	50.56
In-comb Upper disp	0.4	0.0001831	35	0.9997	0.9997	0.0013	0.9971	1.0022	0.9917	0.9929	0.0538	0.8878	1.1000	49.40	50.48
The Project Lower disp	0.3	0.0001078	50	0.9999	0.9999	0.0011	0.9977	1.0020	0.9946	0.9961	0.0615	0.8768	1.1228	49.50	50.42
The Project Upper disp	0.4	0.0001825	50	0.9998	0.9998	0.0011	0.9977	1.0019	0.9909	0.9924	0.0613	0.8772	1.1196	49.28	50.88
In-comb Lower disp	0.3	0.0001107	50	0.9999	0.9999	0.0010	0.9978	1.0019	0.9940	0.9962	0.0590	0.8836	1.1195	49.40	50.50
In-comb Upper disp	0.4	0.0001831	50	0.9998	0.9998	0.0010	0.9977	1.0019	0.9918	0.9934	0.0600	0.8777	1.1161	49.30	50.72

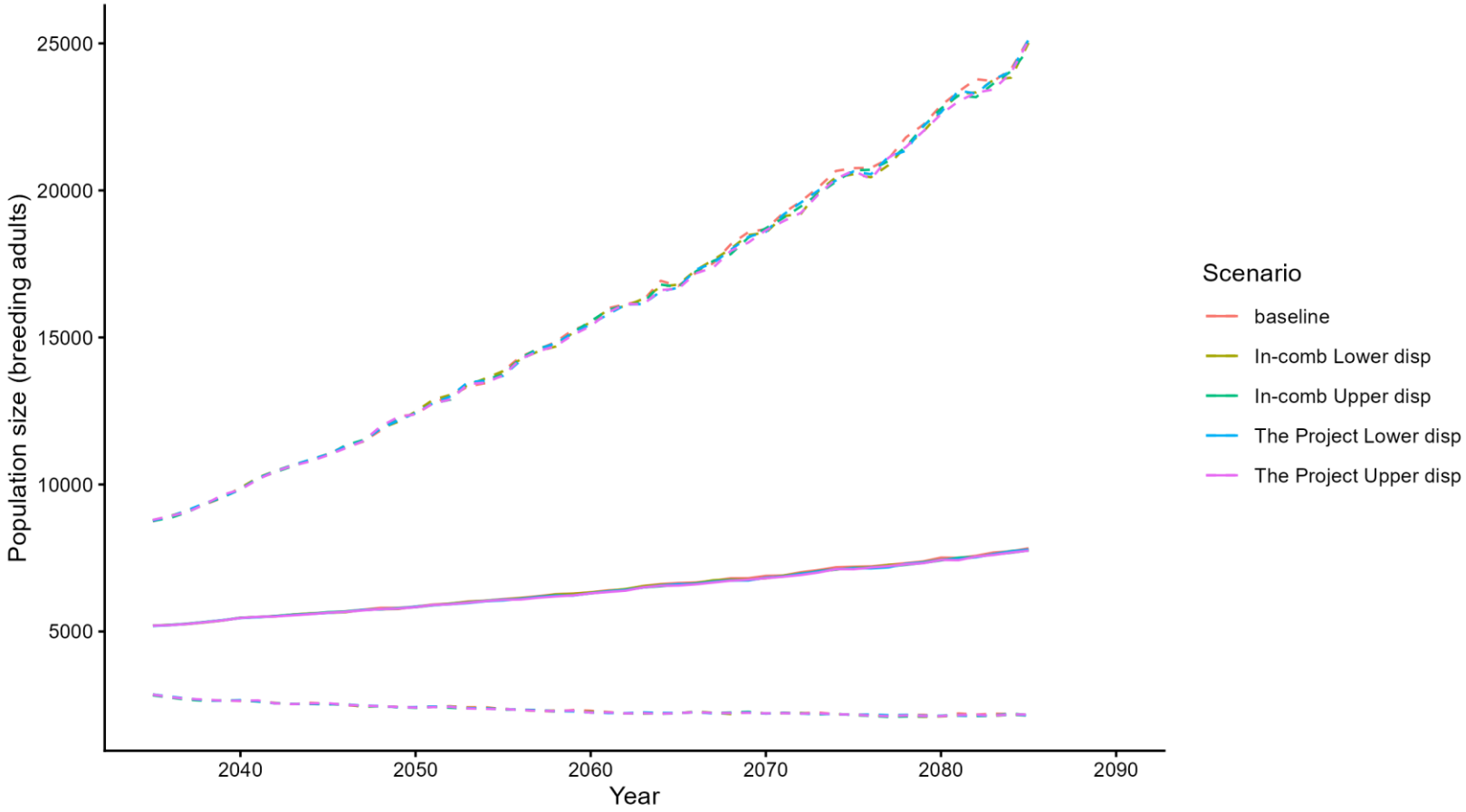


Figure 69: Puffin – Rathlin island SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Western Scotland and East Ireland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.2.25 Puffin: Sule Skerry and Sule Stack

Table 145: Puffin – Sule Skerry and Sule Stack SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Puffin Sule Skerry and Sule Stack SPA CEH Scotland rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Atlantic puffin	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	5.341209e-06
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	1.581417e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	95484	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.415	Scenario C Impact on adult survival rate per pair mean	0.0005142223
Productivity rate per pair standard deviation	0.212	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.907	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.083	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.892	Scenario D Impact on adult survival rate	0.0008629718
Immatures survival rates 0 to 1 standard deviation	0.083	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.892	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.083	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.892	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.083	Scenario E Impact on immature survival rate mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.76	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.093	Scenario F Impact on productivity rate per pair mean	
Immatures survival rates 4 to 5 mean	0.805	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.083	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 146:Puffin – Sule Skerry and Sule Stack SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.5	0.0000053	25	1.0000	1.0000	0.0003	0.9994	1.0006	0.9998	0.9998	0.0092	0.9816	1.0184	49.70	50.22
The Project Upper disp	1.5	0.0000158	25	1.0000	1.0000	0.0003	0.9994	1.0006	0.9998	0.9998	0.0092	0.9819	1.0179	49.92	50.06
In-comb Lower disp	49.1	0.0005142	25	0.9994	0.9994	0.0003	0.9988	1.0000	0.9851	0.9851	0.0088	0.9673	1.0030	48.76	51.36
In-comb Upper disp	82.4	0.0008630	25	0.9990	0.9990	0.0003	0.9984	0.9996	0.9751	0.9750	0.0089	0.9573	0.9927	47.88	52.34
The Project Lower disp	0.5	0.0000053	35	1.0000	1.0000	0.0003	0.9995	1.0005	0.9999	0.9999	0.0106	0.9793	1.0212	49.96	50.04
The Project Upper disp	1.5	0.0000158	35	1.0000	1.0000	0.0003	0.9995	1.0005	0.9998	0.9998	0.0104	0.9791	1.0204	50.16	49.90
In-comb Lower disp	49.1	0.0005142	35	0.9994	0.9994	0.0003	0.9989	0.9999	0.9794	0.9794	0.0100	0.9596	0.9997	48.46	51.52
In-comb Upper disp	82.4	0.0008630	35	0.9990	0.9990	0.0003	0.9985	0.9995	0.9657	0.9656	0.0102	0.9457	0.9855	47.40	52.44
The Project Lower disp	0.5	0.0000053	50	1.0000	1.0000	0.0002	0.9996	1.0004	0.9996	0.9999	0.0123	0.9760	1.0245	50.02	49.92
The Project Upper disp	1.5	0.0000158	50	1.0000	1.0000	0.0002	0.9996	1.0004	0.9998	0.9997	0.0122	0.9757	1.0239	50.08	49.80
In-comb Lower disp	49.1	0.0005142	50	0.9996	0.9996	0.0002	0.9991	1.0000	0.9794	0.9794	0.0118	0.9563	1.0035	48.66	51.40
In-comb Upper disp	82.4	0.0008630	50	0.9993	0.9993	0.0002	0.9989	0.9998	0.9658	0.9656	0.0121	0.9420	0.9898	47.78	52.42

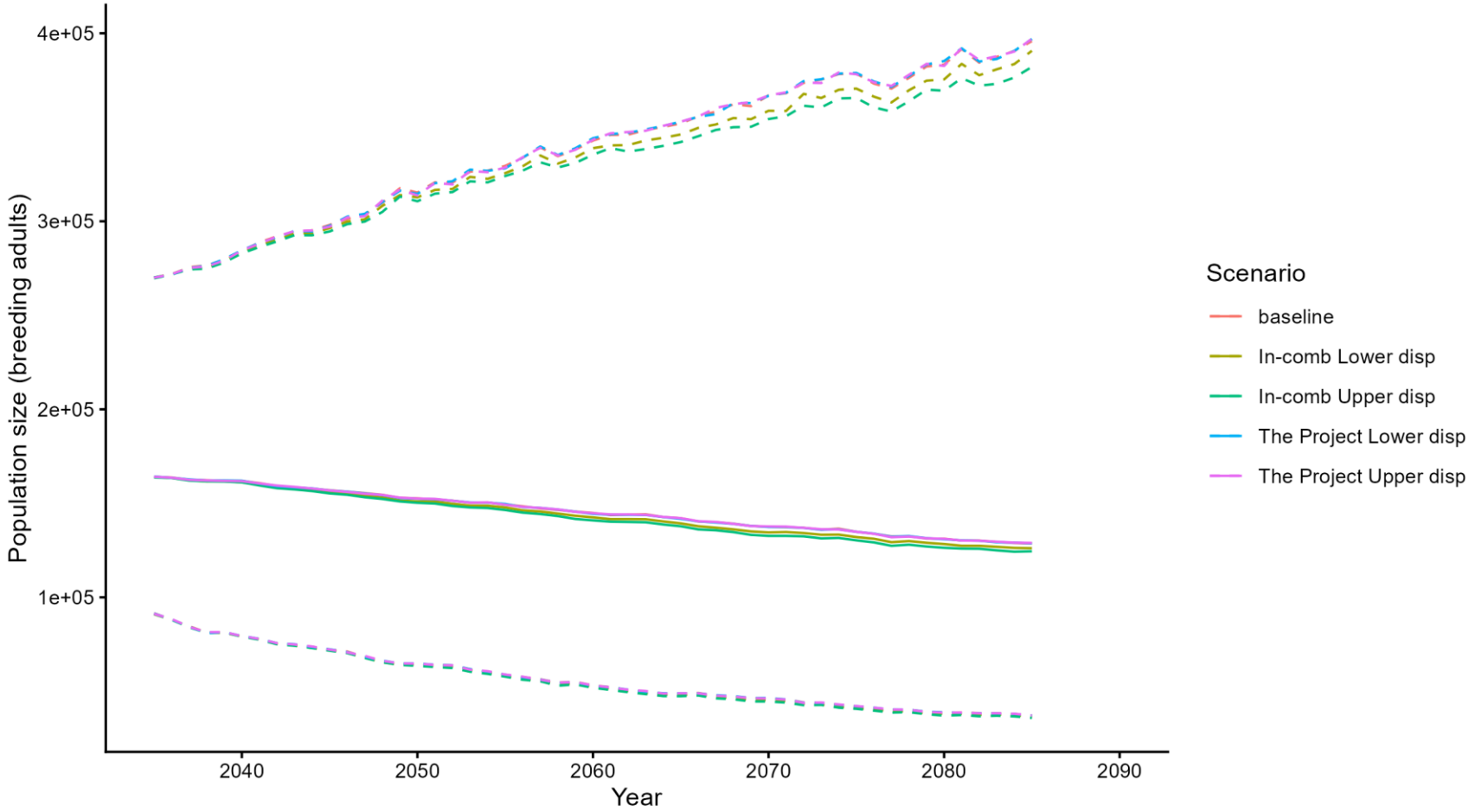


Figure 70: Puffin – Sule Skerry and Sule Stack SPA PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 147:Puffin – Sule Skerry and Sule Stack SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'Western Scotland and East Ireland' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Puffin Sule Skerry and Sule Stack SPA W Scotland E Ireland rates	Number of scenarios of impact	4
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Atlantic puffin	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	5.341209e-06
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	1.581417e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	95484	Scenario C name	In-comb Lower disp
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.501	Scenario C Impact on adult survival rate per pair mean	0.0005142223
Productivity rate per pair standard deviation	0.274	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.907	Scenario D name	In-comb Upper disp
Adult survival rate standard deviation	0.083	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.892	Scenario D Impact on adult survival rate	0.0008629718
Immatures survival rates 0 to 1 standard deviation	0.083	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.892	Scenario E name	
Immatures survival rates 1 to 2 standard deviation	0.083	Scenario E Impact on productivity rate per pair mean	
Immatures survival rates 2 to 3 mean	0.892	Scenario E Impact on adult survival rate	
Immatures survival rates 2 to 3 standard deviation	0.083	Scenario E Impact on immature survival rate mean	
Immatures survival rates 3 to 4 mean	0.76	Scenario F name	
Immatures survival rates 3 to 4 standard deviation	0.093	Scenario F Impact on productivity rate per pair mean	

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 4 to 5 mean	0.805	Scenario F Impact on adult survival rate	
Immatures survival rates 4 to 5 standard deviation	0.083	Scenario F Impact on immature survival rate mean	
Units for output	whole.population	Scenario G name	
		Scenario G Impact on productivity rate per pair mean	
		Scenario G Impact on adult survival rate	
		Scenario G Impact on immature survival rate mean	

Table 148:Puffin – Sule Skerry and Sule Stack SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'Western Scotland and East Ireland' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	0.5	0.0000053	25	1.0000	1.0000	0.0002	0.9995	1.0005	1.0000	1.0000	0.0078	0.9846	1.0155	50.06	49.90
The Project Upper disp	1.5	0.0000158	25	1.0000	1.0000	0.0002	0.9995	1.0005	0.9997	0.9997	0.0078	0.9842	1.0156	50.14	49.84
In-comb Lower disp	49.1	0.0005142	25	0.9994	0.9994	0.0002	0.9989	0.9999	0.9851	0.9853	0.0076	0.9707	1.0004	48.42	51.28
In-comb Upper disp	82.4	0.0008630	25	0.9990	0.9990	0.0002	0.9985	0.9995	0.9750	0.9751	0.0077	0.9602	0.9902	47.58	52.10
The Project Lower disp	0.5	0.0000053	35	1.0000	1.0000	0.0002	0.9996	1.0004	1.0000	1.0000	0.0086	0.9828	1.0171	50.02	49.94
The Project Upper disp	1.5	0.0000158	35	1.0000	1.0000	0.0002	0.9996	1.0004	0.9994	0.9996	0.0086	0.9827	1.0177	50.00	50.00
In-comb Lower disp	49.1	0.0005142	35	0.9994	0.9994	0.0002	0.9990	0.9998	0.9794	0.9795	0.0083	0.9638	0.9961	48.44	51.48
In-comb Upper disp	82.4	0.0008630	35	0.9990	0.9990	0.0002	0.9986	0.9994	0.9656	0.9657	0.0084	0.9494	0.9827	47.20	52.40
The Project Lower disp	0.5	0.0000053	50	1.0000	1.0000	0.0002	0.9997	1.0003	1.0001	1.0000	0.0096	0.9808	1.0192	49.90	50.16
The Project Upper disp	1.5	0.0000158	50	1.0000	1.0000	0.0002	0.9997	1.0003	0.9995	0.9996	0.0096	0.9811	1.0190	50.04	49.98
In-comb Lower disp	49.1	0.0005142	50	0.9996	0.9996	0.0002	0.9993	0.9999	0.9796	0.9796	0.0093	0.9616	0.9982	48.80	51.40
In-comb Upper disp	82.4	0.0008630	50	0.9993	0.9993	0.0002	0.9990	0.9996	0.9657	0.9658	0.0093	0.9479	0.9848	47.96	52.22

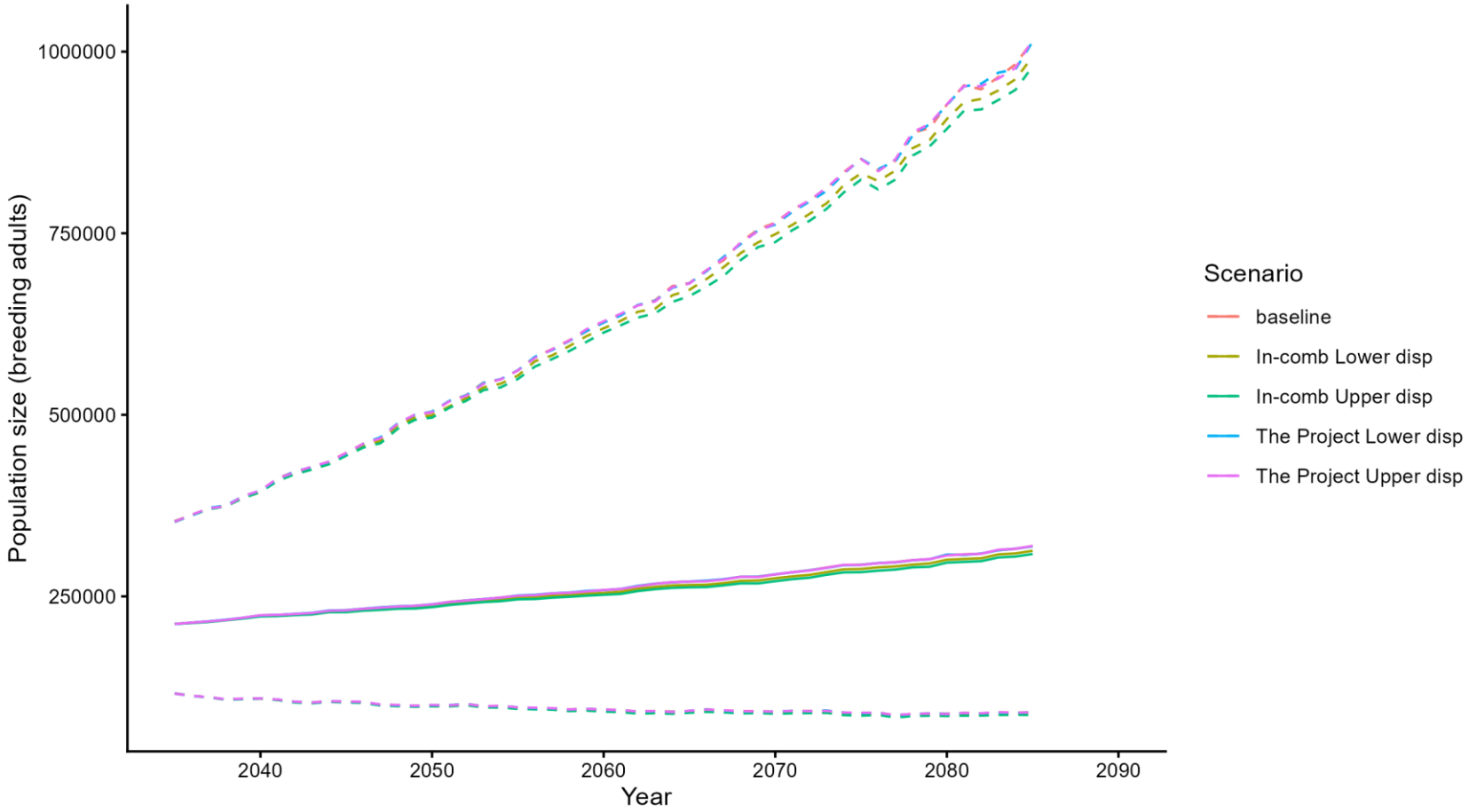


Figure 71: Puffin – Sule Skerry and Sule Stack SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'Western Scotland and East Ireland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

5.2.26 Gannet: Ailsa Craig SPA

Table 149:Gannet – Ailsa Craig SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Gannet Ailsa Craig SPA CEH National rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density dependence	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Northern Gannet	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	1.634615e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	4.830368e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	61930	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.697	Scenario C Impact on adult survival rate per pair mean	6.043287e-05
Productivity rate per pair standard deviation	0.086	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.919	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.042	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.424	Scenario D Impact on adult survival rate	7.677902e-05
Immatures survival rates 0 to 1 standard deviation	0.045	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.829	Scenario E name	The Project WCS CRM plus Upper disp

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 1 to 2 standard deviation	0.026	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.891	Scenario E Impact on adult survival rate	0.0001087366
Immatures survival rates 2 to 3 standard deviation	0.019	Scenario E Impact on immature survival rate mean	0
Immatures survival rates 3 to 4 mean	0.895	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.019	Scenario F Impact on productivity rate per pair mean	0
Immatures survival rates 4 to 5 mean	0.919	Scenario F Impact on adult survival rate	0.0001085096
Immatures survival rates 4 to 5 standard deviation	0.042	Scenario F Impact on immature survival rate mean	0
Units for output	whole.population	Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0003248829
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0002580333
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0003665429
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0005829162
		Scenario J Impact on immature survival rate mean	0

Table 150:Gannet – Ailsa Craig SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. 'CEH Scotland' productivity is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	1.0	0.0000163	25	1.0000	1.0000	0.0003	0.9994	1.0006	0.9997	0.9997	0.0097	0.9809	1.0192	49.82	50.14
The Project Upper disp	3.0	0.0000483	25	0.9999	1.0000	0.0003	0.9994	1.0006	0.9986	0.9987	0.0096	0.9800	1.0175	49.68	50.42
The Project WCS CRM	3.7	0.0000604	25	0.9999	0.9999	0.0003	0.9993	1.0005	0.9981	0.9982	0.0095	0.9796	1.0166	49.98	50.02
The Project WCS CRM plus lower disp	4.8	0.0000768	25	0.9999	0.9999	0.0003	0.9993	1.0005	0.9978	0.9976	0.0097	0.9784	1.0174	49.72	50.28
The Project WCS CRM plus Upper disp	6.7	0.0001087	25	0.9999	0.9999	0.0003	0.9993	1.0005	0.9967	0.9968	0.0094	0.9788	1.0156	49.30	50.60
In-comb Lower disp	6.7	0.0001085	25	0.9999	0.9999	0.0003	0.9993	1.0005	0.9967	0.9968	0.0096	0.9779	1.0160	49.48	50.78
In-comb Upper disp	20.1	0.0003249	25	0.9996	0.9996	0.0003	0.9990	1.0002	0.9900	0.9901	0.0095	0.9716	1.0089	48.08	51.86
In-comb WCS CRM	16.0	0.0002580	25	0.9997	0.9997	0.0003	0.9991	1.0003	0.9922	0.9922	0.0095	0.9737	1.0109	48.40	51.60
In-comb WCS CRM plus lower disp	22.7	0.0003665	25	0.9996	0.9996	0.0003	0.9990	1.0001	0.9890	0.9890	0.0094	0.9704	1.0074	47.94	52.16
In-comb WCS CRM plus upper disp	36.1	0.0005829	25	0.9993	0.9993	0.0003	0.9987	0.9999	0.9823	0.9822	0.0094	0.9633	1.0006	46.78	53.30
The Project Lower disp	1.0	0.0000163	35	1.0000	1.0000	0.0002	0.9995	1.0005	0.9992	0.9995	0.0107	0.9789	1.0212	49.84	50.14
The Project Upper disp	3.0	0.0000483	35	0.9999	0.9999	0.0003	0.9994	1.0005	0.9980	0.9982	0.0106	0.9776	1.0194	49.54	50.36
The Project WCS CRM	3.7	0.0000604	35	0.9999	0.9999	0.0002	0.9994	1.0004	0.9972	0.9975	0.0105	0.9773	1.0179	49.78	50.28
The Project WCS CRM plus lower disp	4.8	0.0000768	35	0.9999	0.9999	0.0003	0.9994	1.0004	0.9968	0.9968	0.0107	0.9763	1.0179	49.40	50.68
The Project WCS CRM plus Upper disp	6.7	0.0001087	35	0.9999	0.9999	0.0002	0.9994	1.0003	0.9955	0.9955	0.0104	0.9750	1.0161	49.20	50.80
In-comb Lower disp	6.7	0.0001085	35	0.9999	0.9999	0.0002	0.9994	1.0004	0.9954	0.9956	0.0106	0.9748	1.0164	49.08	50.76

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb Upper disp	20.1	0.0003249	35	0.9996	0.9996	0.0003	0.9991	1.0001	0.9864	0.9864	0.0105	0.9660	1.0067	47.54	52.52
In-comb WCS CRM	16.0	0.0002580	35	0.9997	0.9997	0.0002	0.9992	1.0002	0.9892	0.9892	0.0105	0.9690	1.0106	47.98	51.92
In-comb WCS CRM plus lower disp	22.7	0.0003665	35	0.9996	0.9996	0.0002	0.9991	1.0001	0.9847	0.9847	0.0104	0.9642	1.0053	47.32	52.62
In-comb WCS CRM plus upper disp	36.1	0.0005829	35	0.9993	0.9993	0.0002	0.9988	0.9998	0.9757	0.9755	0.0103	0.9552	0.9958	45.98	54.20
The Project Lower disp	1.0	0.0000163	50	1.0000	1.0000	0.0002	0.9996	1.0004	0.9991	0.9994	0.0120	0.9771	1.0239	49.52	50.48
The Project Upper disp	3.0	0.0000483	50	1.0000	1.0000	0.0002	0.9995	1.0004	0.9982	0.9981	0.0119	0.9748	1.0214	49.70	50.48
The Project WCS CRM	3.7	0.0000604	50	0.9999	0.9999	0.0002	0.9996	1.0003	0.9974	0.9974	0.0117	0.9747	1.0204	49.48	50.64
The Project WCS CRM plus lower disp	4.8	0.0000768	50	0.9999	0.9999	0.0002	0.9995	1.0004	0.9964	0.9967	0.0120	0.9732	1.0208	49.44	50.62
The Project WCS CRM plus Upper disp	6.7	0.0001087	50	0.9999	0.9999	0.0002	0.9995	1.0003	0.9956	0.9954	0.0117	0.9731	1.0187	49.12	50.90
In-comb Lower disp	6.7	0.0001085	50	0.9999	0.9999	0.0002	0.9995	1.0003	0.9952	0.9955	0.0119	0.9723	1.0190	49.04	51.04
In-comb Upper disp	20.1	0.0003249	50	0.9997	0.9997	0.0002	0.9993	1.0001	0.9863	0.9864	0.0118	0.9636	1.0098	47.80	52.24
In-comb WCS CRM	16.0	0.0002580	50	0.9998	0.9998	0.0002	0.9994	1.0002	0.9891	0.9892	0.0117	0.9669	1.0122	48.18	51.78
In-comb WCS CRM plus lower disp	22.7	0.0003665	50	0.9997	0.9997	0.0002	0.9993	1.0001	0.9847	0.9848	0.0115	0.9623	1.0079	47.72	52.42
In-comb WCS CRM plus upper disp	36.1	0.0005829	50	0.9995	0.9995	0.0002	0.9991	0.9999	0.9754	0.9755	0.0116	0.9531	0.9976	46.10	53.78

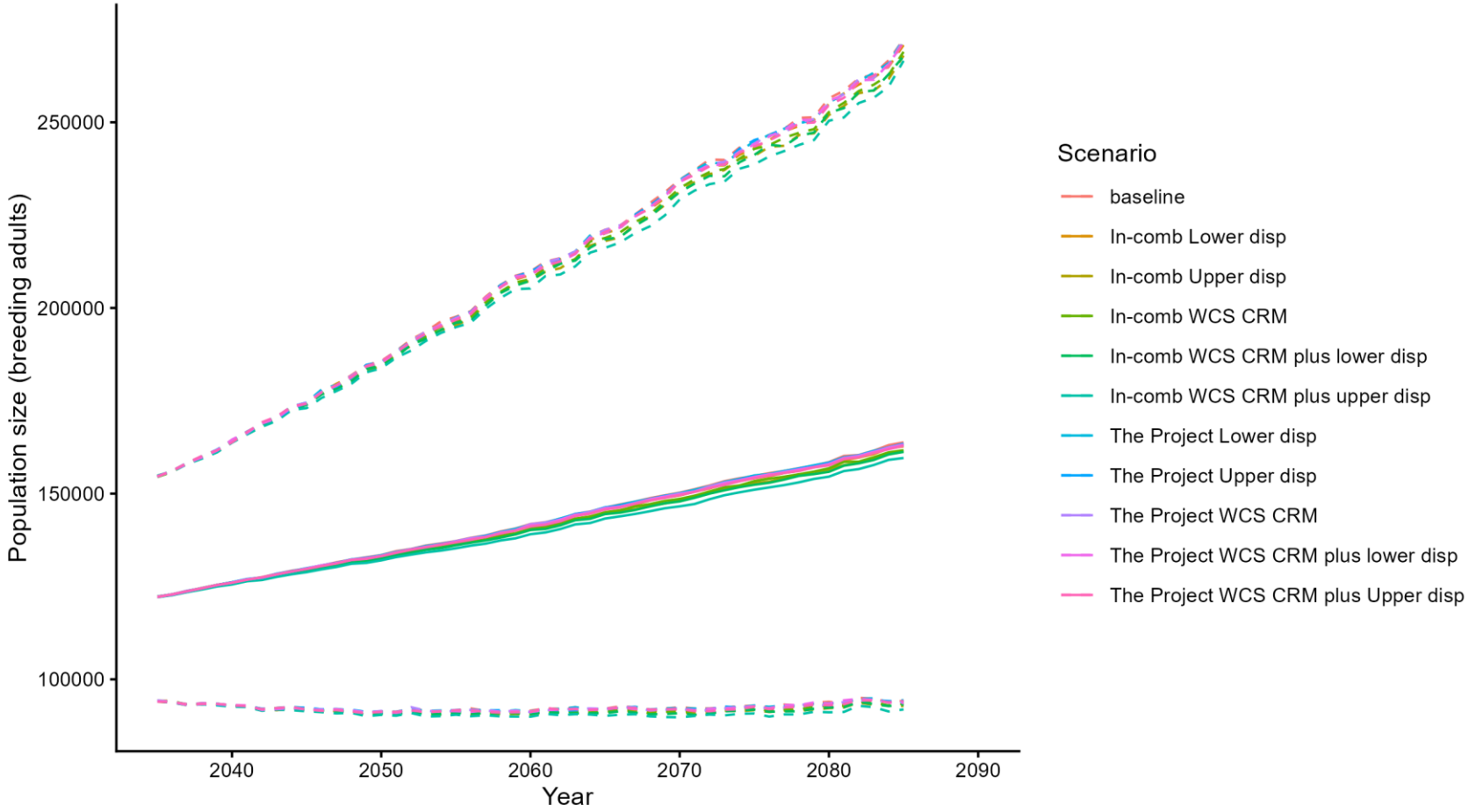


Figure 72: Gannet – Ailsa Craig SPA PVA outputs for Project alone and in-combination with other offshore windfarms using 'CEH Scotland' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals. Some trajectories are obscured in the plot due to being very similar to other trajectories.

Table 151:Gannet – Ailsa Craig SPA population PVA inputs for Project alone and in-combination with other offshore windfarms. Local 'site specific' productivity rate is taken from the NE PVA tool.

Baseline parameters	Settings	Impact parameters	Values
Reference name	Gannet Ailsa Craig SPA site specific rates	Number of scenarios of impact	10
Type	Simulation	Are impacts applied separately to each subpopulation	FALSE
Case studies	None	Are impacts specified separately for immatures	FALSE
Model to use for environmental stochasticity	Beta/Gamma	Are standard errors of impacts available	FALSE
Choose model for density dependence	No density	Should random seeds be matched for impact scenarios	TRUE
Include demographic stochasticity in model	TRUE	Impacts are specified as	Relative
Number of simulations	5000	Years in which impacts are assumed to begin	2035
Random seed	1971	Years in which impacts are assumed to end	2070
Years for burn in	5	Scenario A name	The Project Lower disp
Species	Northern Gannet	Scenario A Impact on productivity rate per pair mean	0
Age at first breeding	5	Scenario A Impact on adult survival rate	1.634615e-05
Is there an upper constraint on productivity in the model	TRUE	Scenario A Impact on immature survival rate mean	0
Maximum brood size per pair chicks will be constrained to be no greater than	1	Scenario B name	The Project Upper disp
Number of subpopulations	1	Scenario B Impact on productivity rate per pair mean	0
Units for initial population size	breeding.adults	Scenario B Impact on adult survival rate	4.830368e-05
Are baseline demographic rates specified separately for immatures	TRUE	Scenario B Impact on immature survival rate mean	0
Initial population size	61930	Scenario C name	The Project WCS CRM
Year	2021	Scenario C Impact on productivity rate per pair mean	0
Productivity rate per pair mean	0.784	Scenario C Impact on adult survival rate per pair mean	6.043287e-05
Productivity rate per pair standard deviation	0.122	Scenario C Impact on immature survival rate mean	0
Adult survival rate Mean	0.922	Scenario D name	The Project WCS CRM plus lower disp
Adult survival rate standard deviation	0.019	Scenario D Impact on productivity rate per pair mean	0
Immatures survival rates 0 to 1 mean	0.42	Scenario D Impact on adult survival rate	7.677902e-05
Immatures survival rates 0 to 1 standard deviation	0.084	Scenario D Impact on immature survival rate mean	0
Immatures survival rates 1 to 2 mean	0.852	Scenario E name	The Project WCS CRM plus Upper disp
Immatures survival rates 1 to 2 standard deviation	0.032	Scenario E Impact on productivity rate per pair mean	0
Immatures survival rates 2 to 3 mean	0.908	Scenario E Impact on adult survival rate	0.0001087366
Immatures survival rates 2 to 3 standard deviation	0.026	Scenario E Impact on immature survival rate mean	0

Baseline parameters	Settings	Impact parameters	Values
Immatures survival rates 3 to 4 mean	0.91	Scenario F name	In-comb Lower disp
Immatures survival rates 3 to 4 standard deviation	0.026	Scenario F Impact on productivity rate per pair mean	0
Immatures survival rates 4 to 5 mean	0.922	Scenario F Impact on adult survival rate	0.0001085096
Immatures survival rates 4 to 5 standard deviation	0.019	Scenario F Impact on immature survival rate mean	0
Units for output	whole.population	Scenario G name	In-comb Upper disp
		Scenario G Impact on productivity rate per pair mean	0
		Scenario G Impact on adult survival rate	0.0003248829
		Scenario G Impact on immature survival rate mean	0
		Scenario H name	In-comb WCS CRM
		Scenario H Impact on productivity rate per pair mean	0
		Scenario H Impact on adult survival rate	0.0002580333
		Scenario H Impact on immature survival rate mean	0
		Scenario I name	In-comb WCS CRM plus lower disp
		Scenario I Impact on productivity rate per pair mean	0
		Scenario I Impact on adult survival rate	0.0003665429
		Scenario I Impact on immature survival rate mean	0
		Scenario J name	In-comb WCS CRM plus upper disp
		Scenario J Impact on productivity rate per pair mean	0
		Scenario J Impact on adult survival rate	0.0005829162
		Scenario J Impact on immature survival rate mean	0

Table 152:Gannet – Ailsa Craig SPA population PVA outputs for Project alone and in-combination with other offshore windfarms. Local 'site specific' productivity rate is taken from the NE PVA tool.

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
The Project Lower disp	1.0	0.0000163	25	1.0000	1.0000	0.0002	0.9995	1.0004	0.9996	0.9997	0.0081	0.9840	1.0155	49.72	50.22
The Project Upper disp	3.0	0.0000483	25	0.9999	0.9999	0.0002	0.9995	1.0004	0.9988	0.9987	0.0082	0.9829	1.0146	49.52	50.44
The Project WCS CRM	3.7	0.0000604	25	0.9999	0.9999	0.0002	0.9995	1.0004	0.9982	0.9983	0.0079	0.9830	1.0138	49.80	50.22
The Project WCS CRM plus lower disp	4.8	0.0000768	25	0.9999	0.9999	0.0002	0.9994	1.0004	0.9977	0.9978	0.0081	0.9821	1.0136	49.48	50.50
The Project WCS CRM plus Upper disp	6.7	0.0001087	25	0.9999	0.9999	0.0002	0.9994	1.0003	0.9967	0.9967	0.0080	0.9811	1.0130	49.02	51.10
In-comb Lower disp	6.7	0.0001085	25	0.9999	0.9999	0.0002	0.9994	1.0004	0.9969	0.9970	0.0081	0.9811	1.0128	49.16	50.82
In-comb Upper disp	20.1	0.0003249	25	0.9996	0.9996	0.0002	0.9992	1.0001	0.9901	0.9902	0.0080	0.9749	1.0061	47.18	52.64
In-comb WCS CRM	16.0	0.0002580	25	0.9997	0.9997	0.0002	0.9992	1.0001	0.9920	0.9920	0.0080	0.9763	1.0074	47.70	52.18
In-comb WCS CRM plus lower disp	22.7	0.0003665	25	0.9996	0.9996	0.0002	0.9991	1.0000	0.9889	0.9889	0.0080	0.9734	1.0047	46.98	53.26
In-comb WCS CRM plus upper disp	36.1	0.0005829	25	0.9993	0.9993	0.0002	0.9988	0.9998	0.9823	0.9823	0.0080	0.9667	0.9981	45.12	54.72
The Project Lower disp	1.0	0.0000163	35	1.0000	1.0000	0.0002	0.9996	1.0004	0.9995	0.9995	0.0087	0.9827	1.0165	49.98	50.04
The Project Upper disp	3.0	0.0000483	35	0.9999	0.9999	0.0002	0.9996	1.0003	0.9983	0.9982	0.0087	0.9808	1.0153	49.64	50.40
The Project WCS CRM	3.7	0.0000604	35	0.9999	0.9999	0.0002	0.9996	1.0003	0.9977	0.9976	0.0085	0.9807	1.0144	49.64	50.56
The Project WCS CRM plus lower disp	4.8	0.0000768	35	0.9999	0.9999	0.0002	0.9995	1.0003	0.9969	0.9969	0.0087	0.9796	1.0140	49.08	50.58
The Project WCS CRM plus Upper disp	6.7	0.0001087	35	0.9999	0.9999	0.0002	0.9995	1.0003	0.9954	0.9955	0.0085	0.9790	1.0125	48.84	51.14
In-comb Lower disp	6.7	0.0001085	35	0.9999	0.9999	0.0002	0.9995	1.0003	0.9957	0.9957	0.0087	0.9785	1.0125	48.96	51.00

Scenario	Impact	Increase in mortality rate	Years since impact	C-PGR					C-PS					50% Quantiles	
				Med.	Mean	SD	LCI	UCI	Med.	Mean	SD	LCI	UCI	Q-UNIMP-50%	Q-IMP-50%
In-comb Upper disp	20.1	0.0003249	35	0.9996	0.9996	0.0002	0.9992	1.0000	0.9865	0.9865	0.0085	0.9700	1.0032	45.94	53.46
In-comb WCS CRM	16.0	0.0002580	35	0.9997	0.9997	0.0002	0.9993	1.0001	0.9889	0.9890	0.0085	0.9722	1.0055	46.98	52.74
In-comb WCS CRM plus lower disp	22.7	0.0003665	35	0.9996	0.9996	0.0002	0.9992	0.9999	0.9847	0.9846	0.0085	0.9684	1.0015	45.52	54.06
In-comb WCS CRM plus upper disp	36.1	0.0005829	35	0.9993	0.9993	0.0002	0.9989	0.9997	0.9758	0.9756	0.0086	0.9587	0.9923	43.24	55.92
The Project Lower disp	1.0	0.0000163	50	1.0000	1.0000	0.0001	0.9997	1.0003	0.9996	0.9996	0.0093	0.9817	1.0176	49.88	50.08
The Project Upper disp	3.0	0.0000483	50	1.0000	1.0000	0.0002	0.9997	1.0003	0.9981	0.9983	0.0093	0.9798	1.0168	49.82	50.22
The Project WCS CRM	3.7	0.0000604	50	1.0000	1.0000	0.0002	0.9997	1.0002	0.9976	0.9977	0.0092	0.9797	1.0160	49.66	50.54
The Project WCS CRM plus lower disp	4.8	0.0000768	50	0.9999	0.9999	0.0002	0.9996	1.0002	0.9969	0.9970	0.0094	0.9787	1.0155	49.44	50.90
The Project WCS CRM plus Upper disp	6.7	0.0001087	50	0.9999	0.9999	0.0001	0.9996	1.0002	0.9954	0.9955	0.0091	0.9778	1.0140	49.08	50.84
In-comb Lower disp	6.7	0.0001085	50	0.9999	0.9999	0.0002	0.9996	1.0002	0.9959	0.9958	0.0093	0.9778	1.0141	49.00	51.12
In-comb Upper disp	20.1	0.0003249	50	0.9997	0.9997	0.0001	0.9994	1.0000	0.9865	0.9866	0.0091	0.9686	1.0046	46.78	53.20
In-comb WCS CRM	16.0	0.0002580	50	0.9998	0.9998	0.0001	0.9995	1.0001	0.9890	0.9890	0.0090	0.9716	1.0065	47.50	52.66
In-comb WCS CRM plus lower disp	22.7	0.0003665	50	0.9997	0.9997	0.0002	0.9994	1.0000	0.9846	0.9846	0.0091	0.9670	1.0026	46.24	53.62
In-comb WCS CRM plus upper disp	36.1	0.0005829	50	0.9995	0.9995	0.0002	0.9992	0.9998	0.9757	0.9757	0.0092	0.9579	0.9937	44.30	55.96

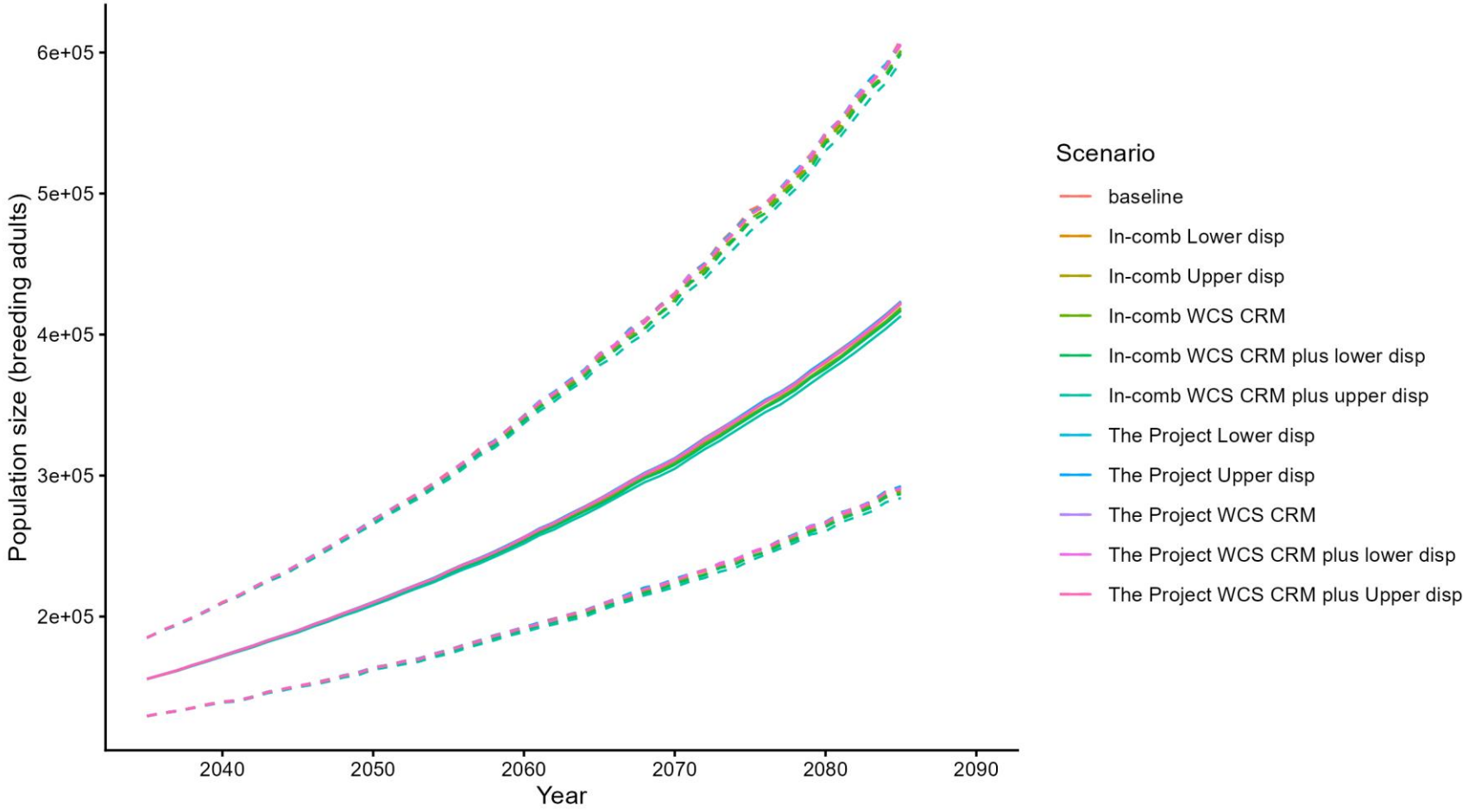


Figure 73: Gannet – Ailsa Craig SPA population PVA outputs for Project alone and in-combination with other offshore windfarms using local 'site specific' productivity rate. Baseline = unimpacted population. Lower disp = Lower displacement mortality. Upper disp = Upper displacement mortality. WCS CRM = worst-case scenario collision mortality. Solid line = mean population size, dashed line = 95% confidence intervals.

6.0 References

Burnell, D., Perkins, A.J., Newton, S.F., Bolton, M, Tierney, T.D. and Dunn, T.D. (2023). Seabirds Count, A census of breeding seabirds in Britain and Ireland (2015–2021). Lynx Nature Books, Barcelona.

Calladine, J. and Harris, M.P. (1997). Intermittent breeding in the Herring Gull *Larus argentatus* and the Lesser Black-backed Gull *Larus fuscus*. Ibis 139: 259-263.

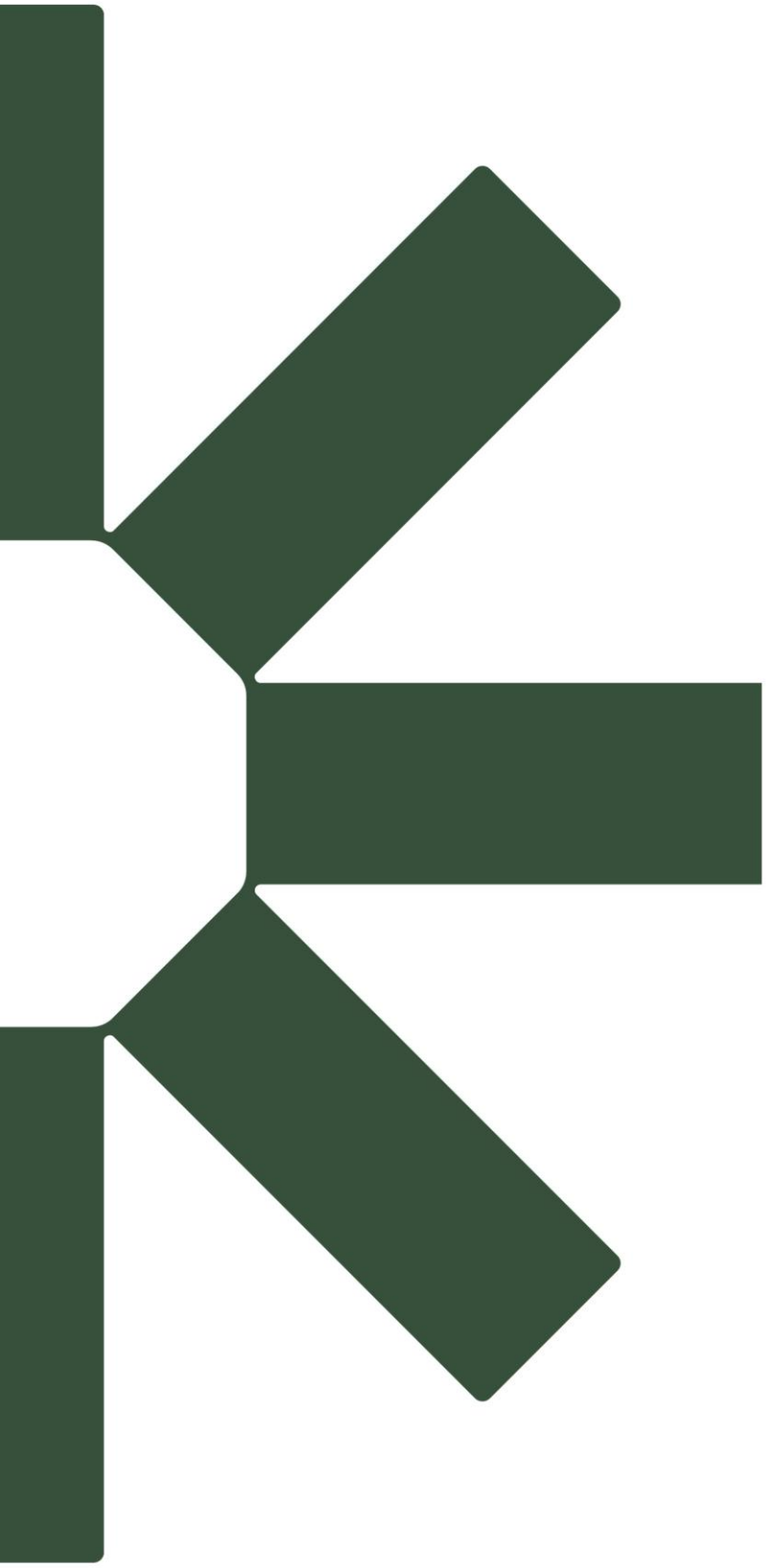
Caswell, H. (1989). Matrix Population Models – Construction, Analysis, and Interpretation. Sinauer Associates, Sunderland, MA, USA, 722 pp.

Horswill, C. and Robinson, R. A. (2015). Review of seabird demographic rates and density dependence. JNCC Report No. 552. Joint Nature Conservation Committee, Peterborough.

Piper, W.H., Grear, J.S. and Meyer, M.W. (2012). Juvenile survival in common loons *Gavia immer*: effects of natal lake size and pH. *Journal of Avian Biology*, 43, 280–288.

R Development Core Team (2024). A Language and Environment for Statistical Computing. R Foundation for Statistical Computing. Available at: https://www.R-project.org/. [Accessed April 2026]

Searle, K., Mobbs, D., Daunt, F., and Butler, A. (2019). A Population Viability Analysis Modelling Tool for Seabird Species. Centre for Ecology & Hydrology report for Natural England. Natural England Commissioned Report NECR274.



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