Natura Impact Statement

NISA
North Irish Sea Array

Volume 2: Appendices

Appendix 13
Offshore and Intertidal Ornithology Population Viability Analysis

NISA Irish Sea Array Windfarm Ltd

Offshore Ornithology Population Viability Analysis

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Acronyms

Term	Definition
CGR	Counterfactual of Population Growth Rate
CPS	Counterfactual of Population Size
OWF	Offshore Wind Farm
PVA	Population Viability Analysis
SPA	Special Protection Area

1 Introduction

1.1 Project Background

This document has been prepared by Arup and GoBe Consultants Limited (GoBe) on behalf of North Irish Sea Array Windfarm Limited (NISA Ltd) (hereafter referred to as 'the Developer').

The Northern Irish Sea Array (hereafter 'NISA') Offshore Wind Farm (OWF), (referred to as 'proposed development' hereafter) is proposed for construction 11.3 km off the east coast of Ireland (at their nearest points to the mainland). The proposed development will consist of offshore wind turbine generators (WTG), an offshore substation platform (OSP), inter-array cables, export cables taking power to an onshore converter station. The area considered in the context of offshore ornithological receptors includes the entire array area, covering 89 km^2, an asymmetric 4 km buffer surrounding the array area, and the offshore Export Cable Corridor (ECC) covering a further 67.8 km^2.

Throughout the year, the Irish Sea region provides foraging, loafing and preening habitat for a range of seabirds, including (but not limited to) northern gannet, *Morus bassanus*, various gull species, and several species of auks and terns. An overview of key species present within and in close proximity to the proposed development, including data collection methods is presented in Appendix 11: Offshore and Intertidal Ornithology Technical Baseline.

1.2 Population Viability Analysis (PVA)

For species that have a high number of predicted mortalities due to displacement or collision, it is important to assess the implications of these moralities on SPA populations. To estimate the effect that a development, alone or in-combination, may have on a designated feature, Population Viability Analysis (PVA) can be used. Further analysis in the form of PVA was triggered if the impacts from the project alone or cumulatively with other projects were predicted to increase baseline mortality of a population by more than 1%.

PVA models use demographic parameters to forecast future populations levels under different scenarios over a set period, comparing 'baseline' conditions and 'impact' scenarios by alteration of demographic parameters (survival and productivity). The baseline conditions consider there to be no development and therefore the population will follow unaltered growth rates. Whereas the impact scenarios consider the development over a defined period with estimated impacts on the population level.

This report provides the modelling methodology and results using SPA populations (as presented in the technical baseline). PVA was carried out for the following species, for which predicted impacts exceeded a 1% increase in baseline mortality at a specific SPA (see Table 1.1):

- Common guillemot (*Uria aalge*);
- Herring gull (*Laurs argentatus*);
- Kittiwake (*Rissa Tridactyla*); and
- Razorbill (*Alca torda*).

Table 1.1 Initial SPA Population Sizes. Not applicable (NA) either due to the species not being a QI or impacts were not predicted to exceed the 1% increase in baseline mortality threshold.

Species	Howth Head SPA	Ireland's Eye SPA	Lambay Island SPA	Skerries SPA	Wicklow Head SPA
Common guillemot	NA	4,410	59,983	NA	NA
Herring gull	NA	662	1,812	20	NA
Kittiwake	3,546	3,220	6,640	NA	1,458
Razorbill	NA	1,600	NA	NA	NA

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

2 Methodology

2.1 Guidance and Models

The user guide for the Seabird PVA Tool provided by Natural England (Searle et al. 2019) has been followed for modelling and assessment of potential impacts. The demographic parameters used for the PVA are presented in Section 2.2.

2.2 PVA Modelling Approach And Demographic Parameters

2.2.1 Simulation Type

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

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

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

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

All PVA modelling in this report was undertaken with environmental and deterministic stochasticity. To ensure robust results, all simulations were set to run 5,000 times. All models were run for a 35-year time span, representing the likely lifespan of the proposed development. Demographic processes such as growth, survival, productivity and recruitment are density-dependent, as their rates change in relation to the number of individuals in a population. Density dependence can be described as being either compensatory or depensatory (Begon, Townsend & Harper 2005). Compensation is characterised by demographic changes that cause a stabilising effect on a populations long-term average. Depensation acts to further decrease the rate of population growth in declining populations and can delay the rate of recovery. This is typically exhibited in populations that have been significantly depleted in size and is caused by a reduction in the benefits associated with conspecific presence.

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

Two main metrics are used to report the results of PVA models, the counterfactual of population size (CPS) and the counterfactual of population growth rate (CGR). They present the relative difference in population size or growth rate of a population between two or more scenarios, including a baseline scenario (unimpacted) and an impacted scenario.

Although both the CPS and CGR are presented within this report, it is generally considered that CGR only should be used for interpreting the predicted impacts. This is because the CGR can be compared against known population trends for a feature / receptor and is relatively insensitive to the baseline rate of growth and direction (positive or negative). Whereas the CPS will predict very large differences in comparison to the baseline population size, especially when density dependent factors allowing for population recovery or preventing exponential growth are not considered within the PVA, as is the case with these assessments.

2.2.2 Demographic Parameters

The input parameters for each species are provided as default within the tool. These are predominately based on those presented in Horswill and Robinson (2015) (Table 2.1).

Table 2.1 Summary of demographic rates for PVA species. Source: Horswill and Robinson (2015) unless otherwise specified.

Demographic Parameter	Common guillemot	Herring gull	Kittiwake	Razorbill
Adult survival	0.94 (0.03)	0.83 (0.08)	0.85 (0.08)	0.90 (0.07)
Productivity (SD) (per pair)	0.53 (0.21)	0.92 (0.68)	0.54 (0.36)	0.48 (0.18)
Age of recruitment	6	5	4	5
Brood size (per pair)	1	3	2	1
Survival 0-1	0.56 (0.06)	0.83 (0.08)	0.79 (0.08)	0.63 (0.07)
Survival 1-2	0.79 (0.15)	0.83 (0.08)	0.85 (0.08)	0.63 (0.07)
Survival 2-3	0.92 (0.10)	0.83 (0.08)	0.85 (0.08)	0.90 (0.07)
Survival 3-4	0.12 (0.94)	0.83 (0.08)	0.85 (0.08)	0.90 (0.07)
Survival 4-5	0.03 (0.94)	0.83 (0.08)	-	0.90 (0.07)
Survival 5-6	0.94 (0.03)	-	-	-

3 Impacts Assessed

3.1 Magnitude of Impact

Each impact scenario has an additional population-level mortality due to the presence of WTG, and therefore imposed risk of collision and of displacement effects. This additional mortality impacts the survival rate and therefore predicts the magnitude of impact on an SPA population for different scenarios. The model used relative harvest which was calculated using the predicted mortalities apportioned to the site and the initial population size see (Table 1.1). These scenarios are presented in Table 3.1 to Table 3.4. Impacts from both the site-specific approach and generic approach are presented for guillemot, in the same way as they are throughout the NIS. See the Apportioning Appendix for further information.

Table 3.1 Common guillemot displacement magnitude of impact

Scenario			Annual mortalities	Impact on adult survival rate
Ireland's Eye SPA (Site-specific)	50%, 1%	alone	0.64	0.000
		in-combo with	8.43	0.002
	70%, 2%	alone	1.78	0.000
		in-combo with	23.61	0.005
	70%, 5%	alone	4.46	0.001
		in-combo with	59.04	0.013
Ireland's Eye SPA (generic)	50%, 1%	alone	1.58	0.000
		in-combo with	9.37	0.002
	70%, 2%	alone	4.43	0.001
		in-combo with	26.26	0.006
	70%, 5%	alone	11.08	0.003
		in-combo with	65.66	0.015
Lambay Island SPA (site-specific)	50%, 1%	alone	10.83	0.000
		in-combo with	84.28	0.001
	70%, 2%	alone	30.31	0.001
		in-combo with	235.99	0.004
	70%, 5%	alone	75.79	0.001
		in-combo with	589.97	0.010
Lambay Island SPA (generic)	50%, 1%	alone	37.90	0.001
		in-combo with	111.35	0.002
	70%, 2%	alone	106.12	0.002

		in-combo with	311.80	0.005
	70%, 5%	alone	265.29	0.004
		in-combo with	779.47	0.013

Table 3.2 Herring gull displacement magnitude of impact

Scenario		Mortalities	Impact on adult survival rate
Ireland's Eye SPA	alone	0.34	0.001
	in-combo with	3.23	0.005
Lambay Island SPA	alone	1.64	0.001
	in-combo with	6.57	0.004

Table 3.3 Kittiwake displacement magnitude of impact

Scenario		Mortalities	Impact on adult survival rate
Howth Head SPA alone	alone	0.37	0.000
	in-combo with	9.26	0.003
Ireland's Eye SPA alone	alone	0.11	0.000
	in-combo with	2.62	0.001
Lambay Island SPA alone	alone	1.71	0.000
	in-combo with	12.67	0.002

Table 3.4 Razorbill displacement magnitude of impact

Scenario			Mortalities	Impact on adult survival rate
Ireland's Eye SPA	50%, 1%	alone	0.13	0.000
		in-combo with	1.40	0.001
	70%, 2%	alone	0.36	0.000
		in-combo with	3.93	0.002
	70%, 5%	alone	0.89	0.001
		in-combo with	9.83	0.006

4 PVA Results

4.1 Introduction

The outputs of the Seabird PVA Tool are set out in Table 4.1 to Table 4.8 below for all four species for each SPA. The metrics used to summarise the PVA results are based on the counterfactual of population growth calculated as the median of the ratio of the annual growth rate of the impacted to un-impacted population, expressed as a percentage decrease.

4.2 Common Guillemot

4.2.1 Ireland's Eye SPA

Table 4.1 Metrics and counterfactuals for 5000 simulations over 35 years of the guillemot PVA at Ireland's Eye SPA

Scenario		CGR	CPS	Difference in GR (%)	Difference in PS (%)
Project alone	50%, 1% (site-specific)	1.000	0.994	0.015%	0.557%
	70%, 2% (site-specific)	1.000	0.983	0.044%	1.653%
	70%, 5% (site-specific)	0.999	0.960	0.112%	4.014%
	50%, 1% (generic)	1.000	0.985	0.041%	1.450%
	70%, 2% (generic)	0.999	0.960	0.113%	4.043 %
	70%, 5% (generic)	0.997	0.904	0.297%	9.570%
In-combination with	50%, 1% (site-specific)	0.998	0.926	0.212%	7.367%
	70%, 2% (site-specific)	0.994	0.806	0.597%	19.418%
	70%, 5% (site-specific)	0.985	0.582	1.490%	41.773%
	50%, 1% (generic)	0.998	0.918	0.238%	8.225%
	70%, 2% (generic)	0.993	0.787	0.664%	21.315%
	70%, 5% (generic)	0.983	0.548	1.657%	45.230%

4.2.2 Lambay Island SPA

Table 4.2 Metrics and counterfactuals for 5000 simulations over 35 years of the guillemot PVA at Lambay Island SPA

Scenario		CGR	CPS	Difference in GR (%)	Difference in PS (%)
Project alone	50%, 1% (site-specific)	1.000	0.993	0.020%	0.727%
	70%, 2% (site-specific)	0.999	0.980	0.056%	2.017%
	70%, 5% (site-specific)	0.999	0.951	0.140%	4.928%
	50%, 1% (generic)	0.999	0.975	0.070%	2.497%
	70%, 2% (generic)	0.998	0.932	0.197%	6.847%

	70%, 5% (generic)	0.995	0.837	0.492%	16.261%
In-combination with	50%, 1% (site-specific)	0.998	0.945	0.156%	5.461%
	70%, 2% (site-specific)	0.996	0.854	0.437%	14.603%
	70%, 5% (site-specific)	0.989	0.673	1.094%	32.697%
	50%, 1% (generic)	0.998	0.928	0.206%	7.151%
	70%, 2% (generic)	0.994	0.812	0.578%	18.837%
	70%, 5% (generic)	0.986	0.592	1.445%	40.793%

4.3 Herring Gull

4.3.1 Ireland's Eye SPA

Table 4.3 Metrics and counterfactuals for 5000 simulations over 35 years of the herring gull PVA at Ireland's Eye SPA

Scenario	CGR	CPS	Difference in GR (%)	Difference in PS (%)
Project alone	0.999	0.969	0.078%	3.080%
In-combination with	0.994	0.804	0.601%	19.632%

4.3.2 Lambay Island SPA

Table 4.4 Metrics and counterfactuals for 5000 simulations over 35 years of the herring gull PVA at Lambay Island SPA

Scenario	CGR	CPS	Difference in GR (%)	Difference in PS (%)
Project alone	0.999	0.965	0.099%	3.502%
In-combination with	0.996	0.857	0.433%	14.344%

4.3.3 Skerries SPA

PVA models simulating very small populations generally give rise to unreliable results. In this case, the very low population count for herring gull at Skerries Islands SPA (20 adults) resulted in PVA models that were unable to provide outputs for the required project lifetime of 35 years. Therefore, no result is presented for this qualifying interest at this site.

4.4 Kittiwake

4.4.1 Howth Head SPA

Table 4.5 Metrics and counterfactuals for 5000 simulations over 35 years of the kittiwake PVA at Howth Head SPA

Scenario	CGR	CPS	Difference in GR (%)	Difference in PS (%)
Project alone	1.000	0.995	0.014%	0.463%
In-combination with	0.997	0.894	0.309%	10.551%

4.4.2 Ireland's Eye SPA

Table 4.6 Metrics and counterfactuals for 5000 simulations over 35 years of the kittiwake PVA at Ireland's Eye SPA

Scenario	CGR	CPS	Difference in GR (%)	Difference in PS (%)
Project alone	1.000	0.997	0.011%	0.320%
In-combination with	0.999	0.965	0.099%	3.502%

4.4.3 Lambay Island SPA

Table 4.7 Metrics and counterfactuals for 5000 simulations over 35 years of the kittiwake PVA at Lambay Island SPA

Scenario	CGR	CPS	Difference in GR (%)	Difference in PS (%)
Project alone	1.000	0.988	0.031%	1.187%
In-combination with	0.998	0.922	0.228%	7.828%

4.5 Razorbill

4.5.1 Ireland's Eye SPA

Table 4.8 Metrics and counterfactuals for 5000 simulations over 35 years of the razorbill PVA at Ireland's Eye SPA

Scenario		CGR	CPS	Difference in GR (%)	Difference in PS (%)
Project alone	50%, 1%	1.000	0.995	0.016%	0.480%
	70%, 2%	1.000	0.990	0.026%	0.984%
	70%, 5%	0.999	0.977	0.067%	2.259%
In-combination with	50%, 1%	0.999	0.966	0.097%	3.384%
	70%, 2%	0.997	0.901	0.289%	9.879%
	70%, 5%	0.993	0.771	0.717%	22.924%

5 References

Begon, M., Townsend, C. R. and Harper John L. (2005) Ecology: From Individuals to Ecosystems. 4th Edition. Hoboken, New Jersey, USA: Wiley-Blackwell.

Caswell, H. (2000). Matrix Population Models. Sinauer Associates Inc., Sunderland.

Cook, A.S.C.P. and Robinson, R.A. (2016) Testing sensitivity of metrics of seabird population response to offshore wind farm effects, JNCC Report No. 553, JNCC, Peterborough, ISSN 0963-8091.

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

Ridge, K., Jones, C., Jones, G. & Kean, G. (2019). Norfolk Vanguard Offshore Wind Farm Examining Authority's Report of Findings and Conclusions and Recommendations to the Secretary of State for Business, Energy and Industrial Strategy.

Searle, K., Mobbs, D., Daunt, F. and Butler, A. (2019) A Population Viability Analysis Modelling Tool for Seabird Species. Natural England Commissioned Reports, Number 274.

WWT Consulting (2012). SOSS-04 Gannet Population Viability Analysis: Developing guidelines on the use of Population Viability Analysis for investigating bird impacts due to offshore wind farms. Report to The Crown Estate.

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