



# Environmental Impact Assessment Report

## Volume 4

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Appendix 10.4 Offshore  
Ornithology Displacement

A photograph taken from an airplane window, showing a vast expanse of white and grey cumulus clouds against a dark blue sky. The perspective is looking down and slightly forward, with the horizon visible in the distance.

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## Technical Appendix 10.4: Offshore Ornithology Displacement

Codling Wind Park Limited



19 April 2024

1320532

Codling Wind Park Limited

## Document history

<b>Author</b>	Anne Mouillier, Assistant Environmental Consultant	18 April 2024
<b>Checked</b>	Graeme Cook, Principal Environmental Consultant	18 April 2024
<b>Approved</b>	Chris Pendlebury, Director of Offshore Consenting & Environment	19 April 2024

### Client Details

Contact Sean Leake  
Client Name Codling Wind Park Limited  
Address Codling Wind Park Ltd  
Trintech Building  
2nd Floor  
South County Business Park  
Leopardstown  
Dublin D18 H5H9

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### Local Office:

First Floor  
Suite 6, The Mall  
Beacon Court  
Sandyford  
Dublin 18  
Tel: +353 (0) 169 713 44

### Registered Office:

The Natural Power Consultants Limited  
The Green House  
Forrest Estate, Dalry  
Castle Douglas, Kirkcudbrightshire  
DG7 3XS

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# 1. Introduction

## 1.1. Project Background

Codling Wind Park Limited (hereafter the 'Applicant') is proposing to develop the Codling Wind Park (CWP) Project, which is located in the Irish sea approximately 13 - 22 km off the east coast of Ireland, at County Wicklow. This is a Technical Appendix to the Ornithology chapter of the Environmental Impact Assessment Report (EIAR) for the CWP Project.

The purpose of the EIAR is to provide the decision-maker, stakeholders and all interested parties with the environmental information required to develop an informed view of any likely significant effects resulting from the CWP Project, as required by the European Union (EU) Directive 2011/92/EU (as amended by Directive 2014/52/EU) (the Environmental Impact Assessment (EIA) Directive). This has been transposed into Irish law in the Planning and Development Act (PDA) (2000-2020), the Planning and Development Regulations (2001-2020) (as amended by S.I. No. 296 of 2018), and the Maritime Area Planning Act (MAPA) 2021.

## 1.2. Displacement Analysis

The presence of offshore Wind Turbine Generators (WTGs) has the potential to directly displace seabirds that would normally utilise areas within and around the CWP array site. This in effect represents indirect habitat loss, potentially reducing the area available for those seabirds sensitive to disturbance to utilise as they are currently able to. There is also the potential for the construction and decommissioning of WTGs, substations and cable laying to directly disturb and displace seabirds, though the nature of such potential impacts is more restricted spatially and temporally by virtue of the nature of those phases of the development. This document focusses principally on the anticipated operational phase displacement.

Following Impact Screening, (**Chapter 10: Ornithology**; Disturbance and Displacement) six seabird species have been identified for which potential disturbance and displacement should be considered in relation to the CWP array site. These are:

- Gannet (*Morus bassanus*);
- Guillemot (*Uria aalge*);
- Razorbill (*Alca torda*);
- Puffin (*Fratercula arctica*)
- Red-throated diver (*Gavia stellata*); and
- Manx shearwater (*Puffinus puffinus*)

## 2. Methods

Assessment of disturbance and displacement impacts is found within **Chapter 10: Ornithology**. Within this assessment, as is the standard approach in the UK (SNCBs, 2017), displacement mortalities are presented for each species considering a range of proportions of individuals displaced from impacted areas and a range of those displaced individuals which experience mortality. These species-specific ranges are based on those proposed by UK SNCBs, e.g. NatureScot (2023). Whilst this range is provided, attribution of significance is based on a single value for which justification is provided.

In the general absence of construction (and decommissioning) specific displacement rates and following the precedent of recent UK OWF assessment of construction phase disturbance and displacement impacts to seabirds (for example, Awel Y Mor EIAR, 2022), impact magnitude has been determined as per during the operational phase, but with displacement ranges and central values considered to be half of those used in the operational phase assessment. For example, where operational phase gannet displacement within the array site was undertaken on the basis of a displacement range of 60 to 80 % and a central value of 70 % used, a range of 30-40 % and central value of 35 % is used in the construction-phase). The same mortality rates resultant from displacement (central values and ranges) are used to determine construction phase disturbance and displacement impact magnitudes within the array site as during the operational phase assessment.

**Table 2.1** provides species-specific displacement proportion ranges and central values and mortality rates used to predict seabird construction, operation and maintenance, and decommissioning phase displacement impacts associated with works within the array site.

Table 2.1 Species-specific displacement and mortality proportions

Species/Species group	Displacement (range)		Mortality (range) All phases
	Construction and decommissioning phases	Operation and Maintenance phase	
Auks	25% (15 – 35%)	50% (30 – 70%)	1% (1-5%)
Red-throated diver	50% (45 – 50%)	100% (90 – 100%)	1% (1-5%)
Manx shearwater	25% (15 – 35%)	50% (30 – 70%)	1%
Gannet	35% (30 – 40%)	70% (60 – 80%)	1%

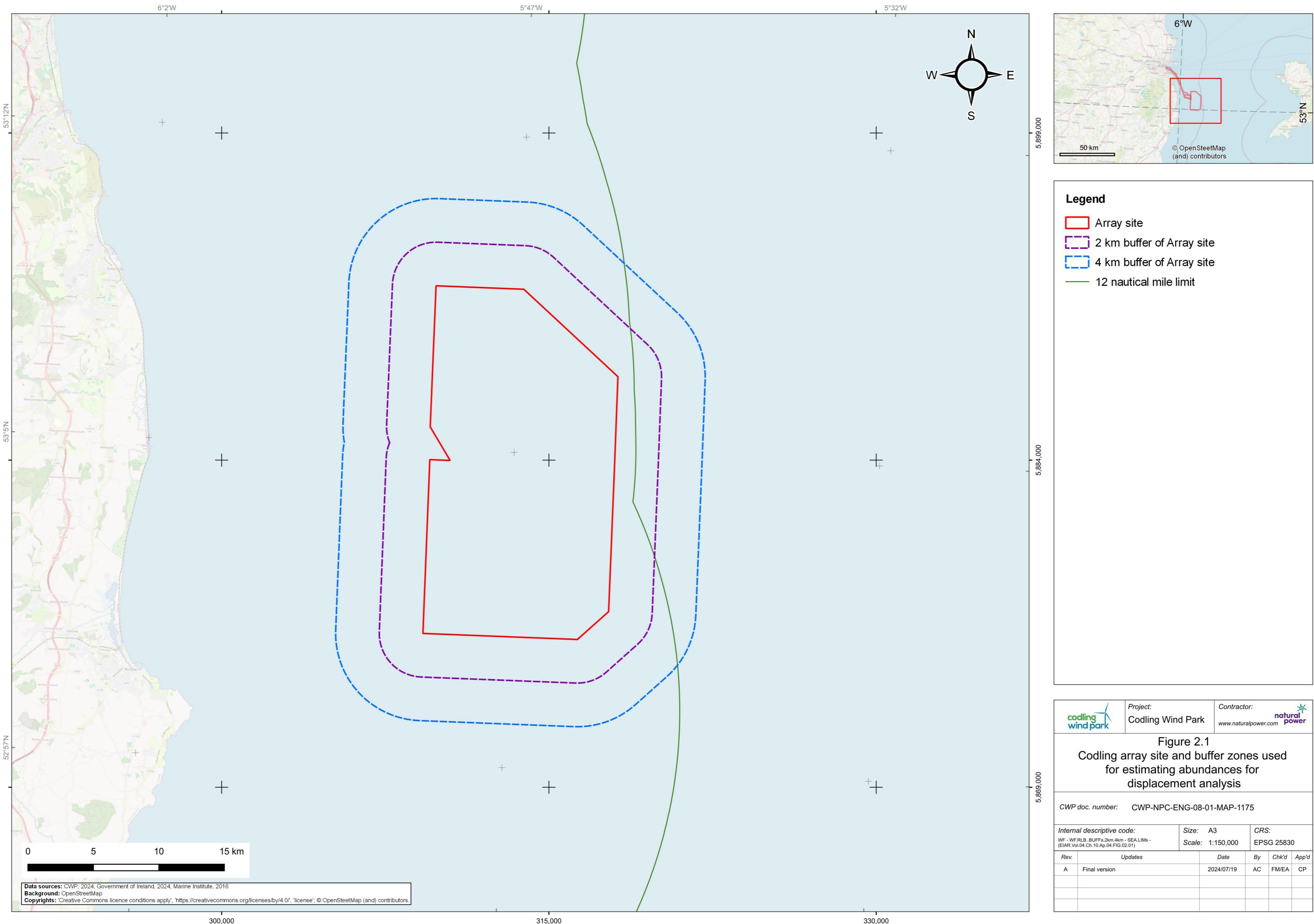
### 2.1. Buffers for Displacement

This report presents displacement matrices that consider gannet, Manx shearwater, guillemot, razorbill, puffin, and red-throated diver. These matrices are derived from abundances of gannet, Manx shearwater, guillemot, razorbill and puffin within the CWP array site plus a 2 km buffer, and from abundance of red-throated diver within the CWP array site plus a 4 km buffer.

With regard to red-throated diver, since 2022 UK SNCBs have recommended the use of a 10 km buffer where proposed OWF array sites are located within 10 km of SPAs which include red-throated diver as a designated feature (UK SNCBs, 2022). In 2023 the boundary of The Murrough SPA, for which red-throated diver is a SCI, was extended towards the CWP array site, such that, where this SPA had formerly been located beyond 10 km from the array site boundary, the revised site boundary is now located within 10 km of the array site boundary.

To consider the potential from disturbance and displacement impacts from the presence of OWF infrastructure within the array site upon red-throated diver within the revised boundary of The Murrough SPA, data from ObSERVE visual aerial surveys undertaken in 2016 were investigated to assess the number of divers recorded within the revised SPA boundary and within 10 km of the array site (data provided by Mark Jessopp – 19/04/2024).

From review of this dataset it is apparent that there were relatively few records of divers between 4 to 10 km from the array site. Furthermore, where diver records occur within the revised boundary of The Murrough SPA, the large majority were in inshore areas of the SPA, beyond 10 km from the array site. These observations of relatively low diver population density within areas 4 to 10 km from the array site (between the array site and Irish coast), may align with the presence of a major freight shipping route to and from Dublin passing through that area and the observed response of red-throated divers to avoid shipping routes (i.e. Burger *et al.*, 2019). Consequently, regional distributional data indicates limited potential for disturbance from the presence of infrastructure within the array site to result in *in-situ* effects to red-throated diver within the revised boundary of The Murrough SPA.



## 2.2. Data sources for displacement matrices

The data contributing to this annex are taken from the 24 months of aerial digital surveys across CWP plus buffers, covering May 2020 to April 2022, inclusive (**Technical Appendix 10.5: Baseline Characterisation Report**). Calculated abundances include apportionment of unidentified birds and corrections for availability bias, where appropriate. Displacement matrices are presented for each species separately for each bio-season. For all species records of both flying and ‘sitting’ (including birds observed diving, landing and taking off) individuals were used to generate abundances used in displacement analysis.

## 2.3. Presentation of displacement by bio-seasons

Species-specific bio-seasonal definitions are presented in **Table 2.2**. Derivation of these bio-season definitions is provided in **Technical Appendix 10.5: Baseline Characterisation Report**.

**Table 2.2: Species bio-seasons**

Bio-season	Gannet	Guillemot	Razorbill	Puffin <sup>1</sup>	Red-throated diver	Manx shearwater
Return migration (RM)	Dec-Mar	N/A	Jan-Mar	Mar-Apr	Feb-Apr	Mar-May
Migration-free breeding (MFB)	Apr-Aug	N/A	Apr-Jul	May-Jul	May-Aug	Jun-Jul
Post-breeding migration (PBM)	Sept-Nov	N/A	Aug-Oct	Aug	Sep-Nov	Aug-Oct
Migration-free non-breeding (MFNB)	N/A	N/A	Nov-Dec	Sep-Feb	Dec-Jan	Nov-Feb
Breeding (B)	N/A	Mar-Jul	N/A	N/A	N/A	N/A
Non-breeding (NB)	N/A	Aug-Feb	N/A	N/A	N/A	N/A

## 2.4. Bio-season mean peak abundances

As per SNCB (2017) guidance, the displacement assessment is based on bio-season mean peak abundances. Bio-season mean peak abundances are calculated from the highest recorded monthly abundance within each bio-season averaged across the two years of baseline data. It should be noted that calculating bio-season abundance in such a way is considered precautionary, as it is highly unlikely that the abundance within a given bio-season remains at such a high level (i.e. mean peak) throughout that bio-season. Calculated bio-season mean peak abundances used for these analyses are presented in **Table 2.3**.

<sup>1</sup> Puffin bio-seasons adjusted from Furness (2015) to correspond with whole months

Table 2.3: Bio-season mean peak abundances within the array site and species-specific buffer areas

Species	Survey area	Bio-season mean peak abundance					
		RM	MFB	PBM	MFNB	B	NB
Gannet	array site + 2 km buffer	104.876	104.876	55.351	N/A	N/A	N/A
Guillemot	array site + 2 km buffer	N/A	N/A	N/A	N/A	3623.790	13340.160
Razorbill	array site + 2 km buffer	409.130	674.582	4360.134	640.381	N/A	N/A
Puffin	array site + 2 km buffer	6.449	93.746	55.306	44.555	N/A	N/A
Red-throated diver	array site + 4 km buffer	179.372	8.984	63.092	206.581	N/A	N/A
Manx shearwater	array site + 2 km buffer	780.411	180.162	1125.063	0	N/A	N/A

### 3. Results

Predicted operation and maintenance phase displacement mortalities for each species for each bio-season under a range of proportions of birds within impacted areas experiencing displacement and a range of proportions of those displaced birds experiencing mortality, are provided in Tables 3.1 to 3.21. Species-specific displacement and mortality ranges considered in assessment are denoted by their inclusion with a box, while central values progressed in assessment shown in bold.

Construction and decommissioning phase displacement mortality estimate values are halved from the figures provided in Tables 3.1 to 3.21.

#### 3.1. Gannet displacement matrices

Table 3.1: Gannet return migration displacement matrix (based on a mean peak abundance of 104.876 within the array site and a 2 km buffer)

Displacement (%)	Mortality (%)														
	0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
1	0.005	0.010	0.021	0.031	0.052	0.105	0.210	0.315	0.420	0.524	0.629	0.734	0.839	0.944	1.049
10	0.052	0.105	0.210	0.315	0.524	1.049	2.098	3.146	4.195	5.244	6.293	7.341	8.390	9.439	10.488
20	0.105	0.210	0.420	0.629	1.049	2.098	4.195	6.293	8.390	10.488	12.585	14.683	16.780	18.878	20.975
30	0.157	0.315	0.629	0.944	1.573	3.146	6.293	9.439	12.585	15.731	18.878	22.024	25.170	28.317	31.463
40	0.210	0.420	0.839	1.259	2.098	4.195	8.390	12.585	16.780	20.975	25.170	29.365	33.560	37.755	41.950
50	0.262	0.524	1.049	1.573	2.622	5.244	10.488	15.731	20.975	26.219	31.463	36.707	41.950	47.194	52.438
60	0.315	0.629	1.259	1.888	3.146	6.293	12.585	18.878	25.170	31.463	37.755	44.048	50.340	56.633	62.926
70	0.367	0.734	1.468	2.202	3.671	7.341	14.683	22.024	29.365	36.707	44.048	51.389	58.731	66.072	73.413
80	0.420	0.839	1.678	2.517	4.195	8.390	16.780	25.170	33.560	41.950	50.340	58.731	67.121	75.511	83.901
90	0.472	0.944	1.888	2.832	4.719	9.439	18.878	28.317	37.755	47.194	56.633	66.072	75.511	84.950	94.388
100	0.524	1.049	2.098	3.146	5.244	10.488	20.975	31.463	41.950	52.438	62.926	73.413	83.901	94.388	104.876

Table 3.2: Gannet migration-free breeding displacement matrix (based on a mean-peak abundance of 104.876 within the array site and a 2 km buffer)

		Mortality (%)														
		0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
Displacement (%)	1	0.005	0.010	0.021	0.031	0.052	0.105	0.210	0.315	0.420	0.524	0.629	0.734	0.839	0.944	1.049
	10	0.052	0.105	0.210	0.315	0.524	1.049	2.098	3.146	4.195	5.244	6.293	7.341	8.390	9.439	10.488
	20	0.105	0.210	0.420	0.629	1.049	2.098	4.195	6.293	8.390	10.488	12.585	14.683	16.780	18.878	20.975
	30	0.157	0.315	0.629	0.944	1.573	3.146	6.293	9.439	12.585	15.731	18.878	22.024	25.170	28.317	31.463
	40	0.210	0.420	0.839	1.259	2.098	4.195	8.390	12.585	16.780	20.975	25.170	29.365	33.560	37.755	41.950
	50	0.262	0.524	1.049	1.573	2.622	5.244	10.488	15.731	20.975	26.219	31.463	36.707	41.950	47.194	52.438
	60	0.315	0.629	1.259	1.888	3.146	6.293	12.585	18.878	25.170	31.463	37.755	44.048	50.340	56.633	62.926
	70	0.367	0.734	1.468	2.202	3.671	7.341	14.683	22.024	29.365	36.707	44.048	51.389	58.731	66.072	73.413
	80	0.420	0.839	1.678	2.517	4.195	8.390	16.780	25.170	33.560	41.950	50.340	58.731	67.121	75.511	83.901
	90	0.472	0.944	1.888	2.832	4.719	9.439	18.878	28.317	37.755	47.194	56.633	66.072	75.511	84.950	94.388
	100	0.524	1.049	2.098	3.146	5.244	10.488	20.975	31.463	41.950	52.438	62.926	73.413	83.901	94.388	104.876

Table 3.3: Gannet post-breeding migration displacement matrix (based on a mean peak abundance of 55.351 within the array site and a 2 km buffer)

		Mortality (%)														
		0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
Displacement (%)	1	0.003	0.006	0.011	0.017	0.028	0.055	0.111	0.166	0.221	0.277	0.332	0.387	0.443	0.498	0.554
	10	0.028	0.055	0.111	0.166	0.277	0.554	1.107	1.661	2.214	2.768	3.321	3.875	4.428	4.982	5.535
	20	0.055	0.111	0.221	0.332	0.554	1.107	2.214	3.321	4.428	5.535	6.642	7.749	8.856	9.963	11.070
	30	0.083	0.166	0.332	0.498	0.830	1.661	3.321	4.982	6.642	8.303	9.963	11.624	13.284	14.945	16.605
	40	0.111	0.221	0.443	0.664	1.107	2.214	4.428	6.642	8.856	11.070	13.284	15.498	17.712	19.926	22.140
	50	0.138	0.277	0.554	0.830	1.384	2.768	5.535	8.303	11.070	13.838	16.605	19.373	22.140	24.908	27.676
	60	0.166	0.332	0.664	0.996	1.661	3.321	6.642	9.963	13.284	16.605	19.926	23.247	26.568	29.890	33.211
	70	0.194	0.387	0.775	1.162	1.937	3.875	7.749	11.624	15.498	19.373	23.247	27.122	30.997	34.871	38.746
	80	0.221	0.443	0.886	1.328	2.214	4.428	8.856	13.284	17.712	22.140	26.568	30.997	35.425	39.853	44.281
	90	0.249	0.498	0.996	1.494	2.491	4.982	9.963	14.945	19.926	24.908	29.890	34.871	39.853	44.834	49.816
	100	0.277	0.554	1.107	1.661	2.768	5.535	11.070	16.605	22.140	27.676	33.211	38.746	44.281	49.816	55.351

### 3.2. Guillemot displacement matrices

Table 3.4: Guillemot breeding displacement matrix (based on a mean peak abundance of 3623.79 within the array site and a 2 km buffer)

Displacement (%)	Mortality (%)														
	0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
1	0.181	0.362	0.725	1.087	1.812	3.624	7.248	10.871	14.495	18.119	21.743	25.367	28.990	32.614	36.238
10	1.812	3.624	7.248	10.871	18.119	36.238	72.476	108.714	144.952	181.190	217.427	253.665	289.903	326.141	362.379
20	3.624	7.248	14.495	21.743	36.238	72.476	144.952	217.427	289.903	362.379	434.855	507.331	579.806	652.282	724.758
30	5.436	10.871	21.743	32.614	54.357	108.714	217.427	326.141	434.855	543.569	652.282	760.996	869.710	978.423	1087.137
40	7.248	14.495	28.990	43.485	72.476	144.952	289.903	434.855	579.806	724.758	869.710	1014.661	1159.613	1304.564	1449.516
50	9.059	18.119	36.238	54.357	90.595	181.190	362.379	543.569	724.758	905.948	1087.137	1268.327	1449.516	1630.706	1811.895
60	10.871	21.743	43.485	65.228	108.714	217.427	434.855	652.282	869.710	1087.137	1304.564	1521.992	1739.419	1956.847	2174.274
70	12.683	25.367	50.733	76.100	126.833	253.665	507.331	760.996	1014.661	1268.327	1521.992	1775.657	2029.322	2282.988	2536.653
80	14.495	28.990	57.981	86.971	144.952	289.903	579.806	869.710	1159.613	1449.516	1739.419	2029.322	2319.226	2609.129	2899.032
90	16.307	32.614	65.228	97.842	163.071	326.141	652.282	978.423	1304.564	1630.706	1956.847	2282.988	2609.129	2935.270	3261.411
100	18.119	36.238	72.476	108.714	181.190	362.379	724.758	1087.137	1449.516	1811.895	2174.274	2536.653	2899.032	3261.411	3623.790

Table 3.5: Guillemot non-breeding displacement matrix (based on a mean peak abundance of 13340.164 within the array site and a 2 km buffer)

Displacement (%)	Mortality (%)														
	0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	
1	0.667	1.334	2.668	4.002	6.670	13.340	26.680	40.020	53.361	66.701	80.041	93.381	106.721	120.061	133.402
10	6.670	13.340	26.680	40.020	66.701	133.402	266.803	400.205	533.607	667.008	800.410	933.811	1067.213	1200.615	1334.016
20	13.340	26.680	53.361	80.041	133.402	266.803	533.607	800.410	1067.213	1334.016	1600.820	1867.623	2134.426	2401.230	2668.033
30	20.010	40.020	80.041	120.061	200.102	400.205	800.410	1200.615	1600.820	2001.025	2401.230	2801.434	3201.639	3601.844	4002.049
40	26.680	53.361	106.721	160.082	266.803	533.607	1067.213	1600.820	2134.426	2668.033	3201.639	3735.246	4268.852	4802.459	5336.066
50	33.350	66.701	133.402	200.102	333.504	667.008	1334.016	2001.025	2668.033	3335.041	4002.049	4669.057	5336.066	6003.074	6670.082
60	40.020	80.041	160.082	240.123	400.205	800.410	1600.820	2401.230	3201.639	4002.049	4802.459	5602.869	6403.279	7203.689	8004.098
70	46.691	93.381	186.762	280.143	466.906	933.811	1867.623	2801.434	3735.246	4669.057	5602.869	6536.680	7470.492	8404.303	9338.115
80	53.361	106.721	213.443	320.164	533.607	1067.213	2134.426	3201.639	4268.852	5336.066	6403.279	7470.492	8537.705	9604.918	10672.131
90	60.031	120.061	240.123	360.184	600.307	1200.615	2401.230	3601.844	4802.459	6003.074	7203.689	8404.303	9604.918	10805.533	12006.148
100	66.701	133.402	266.803	400.205	667.008	1334.016	2668.033	4002.049	5336.066	6670.082	8004.098	9338.115	10672.131	12006.148	13340.164

### 3.3. Razorbill displacement matrices

Table 3.6: Razorbill return migration displacement matrix (based on a mean peak abundance of 409.130 within the array site and a 2 km buffer).

		Mortality (%)														
		0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
Displacement (%)	1	0.020	0.041	0.082	0.123	0.205	0.409	0.818	1.227	1.637	2.046	2.455	2.864	3.273	3.682	4.091
	10	0.205	0.409	0.818	1.227	2.046	4.091	8.183	12.274	16.365	20.457	24.548	28.639	32.730	36.822	40.913
	20	0.409	0.818	1.637	2.455	4.091	8.183	16.365	24.548	32.730	40.913	49.096	57.278	65.461	73.643	81.826
	30	0.614	1.227	2.455	3.682	6.137	12.274	24.548	36.822	49.096	61.370	73.643	85.917	98.191	110.465	122.739
	40	0.818	1.637	3.273	4.910	8.183	16.365	32.730	49.096	65.461	81.826	98.191	114.556	130.922	147.287	163.652
	50	1.023	2.046	4.091	6.137	10.228	20.457	40.913	61.370	81.826	102.283	122.739	143.196	163.652	184.109	204.565
	60	1.227	2.455	4.910	7.364	12.274	24.548	49.096	73.643	98.191	122.739	147.287	171.835	196.382	220.930	245.478
	70	1.432	2.864	5.728	8.592	14.320	28.639	57.278	85.917	114.556	143.196	171.835	200.474	229.113	257.752	286.391
	80	1.637	3.273	6.546	9.819	16.365	32.730	65.461	98.191	130.922	163.652	196.382	229.113	261.843	294.574	327.304
	90	1.841	3.682	7.364	11.047	18.411	36.822	73.643	110.465	147.287	184.109	220.930	257.752	294.574	331.395	368.217
	100	2.046	4.091	8.183	12.274	20.457	40.913	81.826	122.739	163.652	204.565	245.478	286.391	327.304	368.217	409.130

Table 3.7: Razorbill migration-free breeding displacement matrix (based on a mean peak abundance of 674.582 within the array site and a 2 km buffer).

		Mortality (%)														
		0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
Displacement (%)	1	0.034	0.067	0.135	0.202	0.337	0.675	1.349	2.024	2.698	3.373	4.047	4.722	5.397	6.071	6.746
	10	0.337	0.675	1.349	2.024	3.373	6.746	13.492	20.237	26.983	33.729	40.475	47.221	53.967	60.712	67.458
	20	0.675	1.349	2.698	4.047	6.746	13.492	26.983	40.475	53.967	67.458	80.950	94.441	107.933	121.425	134.916
	30	1.012	2.024	4.047	6.071	10.119	20.237	40.475	60.712	80.950	101.187	121.425	141.662	161.900	182.137	202.375
	40	1.349	2.698	5.397	8.095	13.492	26.983	53.967	80.950	107.933	134.916	161.900	188.883	215.866	242.850	269.833
	50	1.686	3.373	6.746	10.119	16.865	33.729	67.458	101.187	134.916	168.646	202.375	236.104	269.833	303.562	337.291
	60	2.024	4.047	8.095	12.142	20.237	40.475	80.950	121.425	161.900	202.375	242.850	283.324	323.799	364.274	404.749
	70	2.361	4.722	9.444	14.166	23.610	47.221	94.441	141.662	188.883	236.104	283.324	330.545	377.766	424.987	472.207
	80	2.698	5.397	10.793	16.190	26.983	53.967	107.933	161.900	215.866	269.833	323.799	377.766	431.732	485.699	539.666
	90	3.036	6.071	12.142	18.214	30.356	60.712	121.425	182.137	242.850	303.562	364.274	424.987	485.699	546.411	607.124
	100	3.373	6.746	13.492	20.237	33.729	67.458	134.916	202.375	269.833	337.291	404.749	472.207	539.666	607.124	674.582

Table 3.8: Razorbill post-breeding migration displacement matrix (based on a mean peak abundance of 4360.134 within the array site and a 2 km buffer).

		Mortality (%)														
		0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
Displacement (%)	1	0.218	0.436	0.872	1.308	2.180	4.360	8.720	13.080	17.441	21.801	26.161	30.521	34.881	39.241	43.601
	10	2.180	4.360	8.720	13.080	21.801	43.601	87.203	130.804	174.405	218.007	261.608	305.209	348.811	392.412	436.013
	20	4.360	8.720	17.441	26.161	43.601	87.203	174.405	261.608	348.811	436.013	523.216	610.419	697.621	784.824	872.027
	30	6.540	13.080	26.161	39.241	65.402	130.804	261.608	392.412	523.216	654.020	784.824	915.628	1046.432	1177.236	1308.040
	40	8.720	17.441	34.881	52.322	87.203	174.405	348.811	523.216	697.621	872.027	1046.432	1220.838	1395.243	1569.648	1744.054
	50	10.900	21.801	43.601	65.402	109.003	218.007	436.013	654.020	872.027	1090.034	1308.040	1526.047	1744.054	1962.060	2180.067
	60	13.080	26.161	52.322	78.482	130.804	261.608	523.216	784.824	1046.432	1308.040	1569.648	1831.256	2092.864	2354.472	2616.080
	70	15.260	30.521	61.042	91.563	152.605	305.209	610.419	915.628	1220.838	1526.047	1831.256	2136.466	2441.675	2746.884	3052.094
	80	17.441	34.881	69.762	104.643	174.405	348.811	697.621	1046.432	1395.243	1744.054	2092.864	2441.675	2790.486	3139.296	3488.107
	90	19.621	39.241	78.482	117.724	196.206	392.412	784.824	1177.236	1569.648	1962.060	2354.472	2746.884	3139.296	3531.709	3924.121
	100	21.801	43.601	87.203	130.804	218.007	436.013	872.027	1308.040	1744.054	2180.067	2616.080	3052.094	3488.107	3924.121	4360.134

Table 3.9: Razorbill migration-free winter displacement matrix (based on a mean peak abundance of 640.381 within the array site and a 2 km buffer)

		Mortality (%)														
		0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
Displacement (%)	1	0.032	0.064	0.128	0.192	0.320	0.640	1.281	1.921	2.562	3.202	3.842	4.483	5.123	5.763	6.404
	10	0.320	0.640	1.281	1.921	3.202	6.404	12.808	19.211	25.615	32.019	38.423	44.827	51.230	57.634	64.038
	20	0.640	1.281	2.562	3.842	6.404	12.808	25.615	38.423	51.230	64.038	76.846	89.653	102.461	115.269	128.076
	30	0.961	1.921	3.842	5.763	9.606	19.211	38.423	57.634	76.846	96.057	115.269	134.480	153.691	172.903	192.114
	40	1.281	2.562	5.123	7.685	12.808	25.615	51.230	76.846	102.461	128.076	153.691	179.307	204.922	230.537	256.152
	50	1.601	3.202	6.404	9.606	16.010	32.019	64.038	96.057	128.076	160.095	192.114	224.133	256.152	288.171	320.191
	60	1.921	3.842	7.685	11.527	19.211	38.423	76.846	115.269	153.691	192.114	230.537	268.960	307.383	345.806	384.229
	70	2.241	4.483	8.965	13.448	22.413	44.827	89.653	134.480	179.307	224.133	268.960	313.787	358.613	403.440	448.267
	80	2.562	5.123	10.246	15.369	25.615	51.230	102.461	153.691	204.922	256.152	307.383	358.613	409.844	461.074	512.305
	90	2.882	5.763	11.527	17.290	28.817	57.634	115.269	172.903	230.537	288.171	345.806	403.440	461.074	518.709	576.343
	100	3.202	6.404	12.808	19.211	32.019	64.038	128.076	192.114	256.152	320.191	384.229	448.267	512.305	576.343	640.381

### 3.4. Puffin displacement matrices

Table 3.10 Puffin return migration displacement matrix (based on a mean peak abundance of 6.449 within the array site and a 2 km buffer).

		Mortality (%)															
		0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100	
Displacement (%)	1	0.000	0.001	0.001	0.002	0.003	0.006	0.013	0.019	0.026	0.032	0.039	0.045	0.052	0.058	0.064	
	10	0.003	0.006	0.013	0.019	0.032	0.064	0.129	0.193	0.258	0.322	0.387	0.451	0.516	0.580	0.645	
	20	0.006	0.013	0.026	0.039	0.064	0.129	0.258	0.387	0.516	0.645	0.774	0.903	1.032	1.161	1.290	
	30	0.010	0.019	0.039	0.058	0.097		0.193	0.387	0.580	0.774	0.967	1.161	1.354	1.548	1.741	1.935
	40	0.013	0.026	0.052	0.077	0.129		0.258	0.516	0.774	1.032	1.290	1.548	1.806	2.064	2.322	2.580
	50	0.016	<b>0.032</b>	0.064	0.097	0.161		0.322	0.645	0.967	1.290	1.612	1.935	2.257	2.580	2.902	3.225
	60	0.019	0.039	0.077	0.116	0.193		0.387	0.774	1.161	1.548	1.935	2.322	2.709	3.096	3.482	3.869
	70	0.023	0.045	0.090	0.135	0.226		0.451	0.903	1.354	1.806	2.257	2.709	3.160	3.611	4.063	4.514
	80	0.026	0.052	0.103	0.155	0.258		0.516	1.032	1.548	2.064	2.580	3.096	3.611	4.127	4.643	5.159
	90	0.029	0.058	0.116	0.174	0.290		0.580	1.161	1.741	2.322	2.902	3.482	4.063	4.643	5.224	5.804
	100	0.032	0.064	0.129	0.193	0.322		0.645	1.290	1.935	2.580	3.225	3.869	4.514	5.159	5.804	6.449

Table 3.11 Puffin migration free breeding season displacement matrix (based on a mean peak abundance of 93.746 within the array site and a 2 km buffer)

		Mortality (%)															
		0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100	
Displacement (%)	1	0.005	0.009	0.019	0.028	0.047	0.094	0.187	0.281	0.375	0.469	0.562	0.656	0.750	0.844	0.937	
	10	0.047	0.094	0.187	0.281	0.469	0.937	1.875	2.812	3.750	4.687	5.625	6.562	7.500	8.437	9.375	
	20	0.094	0.187	0.375	0.562	0.937	1.875	3.750	5.625	7.500	9.375	11.250	13.124	14.999	16.874	18.749	
	30	0.141	0.281	0.562	0.844	1.406		2.812	5.625	8.437	11.250	14.062	16.874	19.687	22.499	25.311	28.124
	40	0.187	0.375	0.750	1.125	1.875		3.750	7.500	11.250	14.999	18.749	22.499	26.249	29.999	33.749	37.498
	50	0.234	<b>0.469</b>	0.937	1.406	2.344		4.687	9.375	14.062	18.749	23.437	28.124	32.811	37.498	42.186	46.873
	60	0.281	0.562	1.125	1.687	2.812		5.625	11.250	16.874	22.499	28.124	33.749	39.373	44.998	50.623	56.248
	70	0.328	0.656	1.312	1.969	3.281		6.562	13.124	19.687	26.249	32.811	39.373	45.936	52.498	59.060	65.622
	80	0.375	0.750	1.500	2.250	3.750		7.500	14.999	22.499	29.999	37.498	44.998	52.498	59.997	67.497	74.997
	90	0.422	0.844	1.687	2.531	4.219		8.437	16.874	25.311	33.749	42.186	50.623	59.060	67.497	75.934	84.371
	100	0.469	0.937	1.875	2.812	4.687		9.375	18.749	28.124	37.498	46.873	56.248	65.622	74.997	84.371	93.746

Table 3.12 Puffin post-breeding migration season displacement matrix (based on a mean peak abundance of 55.306 within the array site and a 2 km buffer)

		Mortality (%)														
		0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
Displacement (%)	1	0.003	0.006	0.011	0.017	0.028	0.055	0.111	0.166	0.221	0.277	0.332	0.387	0.442	0.498	0.553
	10	0.028	0.055	0.111	0.166	0.277	0.553	1.106	1.659	2.212	2.765	3.318	3.871	4.424	4.978	5.531
	20	0.055	0.111	0.221	0.332	0.553	1.106	2.212	3.318	4.424	5.531	6.637	7.743	8.849	9.955	11.061
	30	0.083	0.166	0.332	0.498	0.830	1.659	3.318	4.978	6.637	8.296	9.955	11.614	13.273	14.933	16.592
	40	0.111	0.221	0.442	0.664	1.106	2.212	4.424	6.637	8.849	11.061	13.273	15.486	17.698	19.910	22.122
	50	0.138	0.277	0.553	0.830	1.383	2.765	5.531	8.296	11.061	13.827	16.592	19.357	22.122	24.888	27.653
	60	0.166	0.332	0.664	0.996	1.659	3.318	6.637	9.955	13.273	16.592	19.910	23.229	26.547	29.865	33.184
	70	0.194	0.387	0.774	1.161	1.936	3.871	7.743	11.614	15.486	19.357	23.229	27.100	30.971	34.843	38.714
	80	0.221	0.442	0.885	1.327	2.212	4.424	8.849	13.273	17.698	22.122	26.547	30.971	35.396	39.820	44.245
	90	0.249	0.498	0.996	1.493	2.489	4.978	9.955	14.933	19.910	24.888	29.865	34.843	39.820	44.798	49.775
	100	0.277	0.553	1.106	1.659	2.765	5.531	11.061	16.592	22.122	27.653	33.184	38.714	44.245	49.775	55.306

Table 3.13 Puffin migration-free winter season displacement matrix (based on a mean peak abundance of 44.555 within the array site and a 2 km buffer)

		Mortality (%)														
		0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
Displacement (%)	1	0.002	0.004	0.009	0.013	0.022	0.045	0.089	0.134	0.178	0.223	0.267	0.312	0.356	0.401	0.446
	10	0.022	0.045	0.089	0.134	0.223	0.446	0.891	1.337	1.782	2.228	2.673	3.119	3.564	4.010	4.456
	20	0.045	0.089	0.178	0.267	0.446	0.891	1.782	2.673	3.564	4.456	5.347	6.238	7.129	8.020	8.911
	30	0.067	0.134	0.267	0.401	0.668	1.337	2.673	4.010	5.347	6.683	8.020	9.357	10.693	12.030	13.367
	40	0.089	0.178	0.356	0.535	0.891	1.782	3.564	5.347	7.129	8.911	10.693	12.475	14.258	16.040	17.822
	50	0.111	0.223	0.446	0.668	1.114	2.228	4.456	6.683	8.911	11.139	13.367	15.594	17.822	20.050	22.278
	60	0.134	0.267	0.535	0.802	1.337	2.673	5.347	8.020	10.693	13.367	16.040	18.713	21.386	24.060	26.733
	70	0.156	0.312	0.624	0.936	1.559	3.119	6.238	9.357	12.475	15.594	18.713	21.832	24.951	28.070	31.189
	80	0.178	0.356	0.713	1.069	1.782	3.564	7.129	10.693	14.258	17.822	21.386	24.951	28.515	32.080	35.644
	90	0.200	0.401	0.802	1.203	2.005	4.010	8.020	12.030	16.040	20.050	24.060	28.070	32.080	36.090	40.100
	100	0.223	0.446	0.891	1.337	2.228	4.456	8.911	13.367	17.822	22.278	26.733	31.189	35.644	40.100	44.555

### 3.5. Red-throated diver displacement matrices

Table 3.14: Red-throated diver return migration displacement matrix (based on a mean peak abundance of 179.372 within the array site and a 4 km buffer)

Displacement (%)	Mortality (%)														
	0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
1	0.009	0.018	0.036	0.054	0.090	0.179	0.359	0.538	0.717	0.897	1.076	1.256	1.435	1.614	1.794
10	0.090	0.179	0.359	0.538	0.897	1.794	3.587	5.381	7.175	8.969	10.762	12.556	14.350	16.143	17.937
20	0.179	0.359	0.717	1.076	1.794	3.587	7.175	10.762	14.350	17.937	21.525	25.112	28.700	32.287	35.874
30	0.269	0.538	1.076	1.614	2.691	5.381	10.762	16.143	21.525	26.906	32.287	37.668	43.049	48.430	53.812
40	0.359	0.717	1.435	2.152	3.587	7.175	14.350	21.525	28.700	35.874	43.049	50.224	57.399	64.574	71.749
50	0.448	0.897	1.794	2.691	4.484	8.969	17.937	26.906	35.874	44.843	53.812	62.780	71.749	80.717	89.686
60	0.538	1.076	2.152	3.229	5.381	10.762	21.525	32.287	43.049	53.812	64.574	75.336	86.099	96.861	107.623
70	0.628	1.256	2.511	3.767	6.278	12.556	25.112	37.668	50.224	62.780	75.336	87.892	100.448	113.004	125.560
80	0.717	1.435	2.870	4.305	7.175	14.350	28.700	43.049	57.399	71.749	86.099	100.448	114.798	129.148	143.498
90	0.807	1.614	3.229	4.843	8.072	16.143	32.287	48.430	64.574	80.717	96.861	113.004	129.148	145.291	161.435
100	0.897	1.794	3.587	5.381	8.969	17.937	35.874	53.812	71.749	89.686	107.623	125.560	143.498	161.435	179.372

Table 3.15: Red-throated diver migration-free breeding displacement matrix (based on a mean peak abundance of 8.984 within the array site and a 4 km buffer)

Displacement (%)	Mortality (%)														
	0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
1	0.000	0.001	0.002	0.003	0.004	0.009	0.018	0.027	0.036	0.045	0.054	0.063	0.072	0.081	0.090
10	0.004	0.009	0.018	0.027	0.045	0.090	0.180	0.270	0.359	0.449	0.539	0.629	0.719	0.809	0.898
20	0.009	0.018	0.036	0.054	0.090	0.180	0.359	0.539	0.719	0.898	1.078	1.258	1.437	1.617	1.797
30	0.013	0.027	0.054	0.081	0.135	0.270	0.539	0.809	1.078	1.348	1.617	1.887	2.156	2.426	2.695
40	0.018	0.036	0.072	0.108	0.180	0.359	0.719	1.078	1.437	1.797	2.156	2.516	2.875	3.234	3.594
50	0.022	0.045	0.090	0.135	0.225	0.449	0.898	1.348	1.797	2.246	2.695	3.144	3.594	4.043	4.492
60	0.027	0.054	0.108	0.162	0.270	0.539	1.078	1.617	2.156	2.695	3.234	3.773	4.312	4.851	5.390
70	0.031	0.063	0.126	0.189	0.314	0.629	1.258	1.887	2.516	3.144	3.773	4.402	5.031	5.660	6.289
80	0.036	0.072	0.144	0.216	0.359	0.719	1.437	2.156	2.875	3.594	4.312	5.031	5.750	6.468	7.187
90	0.040	0.081	0.162	0.243	0.404	0.809	1.617	2.426	3.234	4.043	4.851	5.660	6.468	7.277	8.086
100	0.045	0.090	0.180	0.270	0.449	0.898	1.797	2.695	3.594	4.492	5.390	6.289	7.187	8.086	8.984

Table 3.16: Red-throated diver post-breeding migration displacement matrix (based on a mean peak abundance of 63.092 within the array site and a 4km buffer)

		Mortality (%)														
		0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
Displacement (%)	1	0.003	0.006	0.013	0.019	0.032	0.063	0.126	0.189	0.252	0.315	0.379	0.442	0.505	0.568	0.631
	10	0.032	0.063	0.126	0.189	0.315	0.631	1.262	1.893	2.524	3.155	3.786	4.416	5.047	5.678	6.309
	20	0.063	0.126	0.252	0.379	0.631	1.262	2.524	3.786	5.047	6.309	7.571	8.833	10.095	11.357	12.618
	30	0.095	0.189	0.379	0.568	0.946	1.893	3.786	5.678	7.571	9.464	11.357	13.249	15.142	17.035	18.928
	40	0.126	0.252	0.505	0.757	1.262	2.524	5.047	7.571	10.095	12.618	15.142	17.666	20.189	22.713	25.237
	50	0.158	0.315	0.631	0.946	1.577	3.155	6.309	9.464	12.618	15.773	18.928	22.082	25.237	28.391	31.546
	60	0.189	0.379	0.757	1.136	1.893	3.786	7.571	11.357	15.142	18.928	22.713	26.499	30.284	34.070	37.855
	70	0.221	0.442	0.883	1.325	2.208	4.416	8.833	13.249	17.666	22.082	26.499	30.915	35.332	39.748	44.164
	80	0.252	0.505	1.009	1.514	2.524	5.047	10.095	15.142	20.189	25.237	30.284	35.332	40.379	45.426	50.474
	90	0.284	0.568	1.136	1.703	2.839	5.678	11.357	17.035	22.713	28.391	34.070	39.748	45.426	51.105	56.783
	100	0.315	0.631	1.262	1.893	3.155	6.309	12.618	18.928	25.237	31.546	37.855	44.164	50.474	56.783	63.092

Table 3.17: Red-throated diver migration-free winter displacement matrix (based on a mean peak abundance of 206.581 within the array site and a 4 km buffer)

		Mortality (%)														
		0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
Displacement (%)	1	0.010	0.021	0.041	0.062	0.103	0.207	0.413	0.620	0.826	1.033	1.239	1.446	1.653	1.859	2.066
	10	0.103	0.207	0.413	0.620	1.033	2.066	4.132	6.197	8.263	10.329	12.395	14.461	16.526	18.592	20.658
	20	0.207	0.413	0.826	1.239	2.066	4.132	8.263	12.395	16.526	20.658	24.790	28.921	33.053	37.185	41.316
	30	0.310	0.620	1.239	1.859	3.099	6.197	12.395	18.592	24.790	30.987	37.185	43.382	49.579	55.777	61.974
	40	0.413	0.826	1.653	2.479	4.132	8.263	16.526	24.790	33.053	41.316	49.579	57.843	66.106	74.369	82.632
	50	0.516	1.033	2.066	3.099	5.165	10.329	20.658	30.987	41.316	51.645	61.974	72.303	82.632	92.961	103.291
	60	0.620	1.239	2.479	3.718	6.197	12.395	24.790	37.185	49.579	61.974	74.369	86.764	99.159	111.554	123.949
	70	0.723	1.446	2.892	4.338	7.230	14.461	28.921	43.382	57.843	72.303	86.764	101.225	115.685	130.146	144.607
	80	0.826	1.653	3.305	4.958	8.263	16.526	33.053	49.579	66.106	82.632	99.159	115.685	132.212	148.738	165.265
	90	0.930	1.859	3.718	5.578	9.296	18.592	37.185	55.777	74.369	92.961	111.554	130.146	148.738	167.331	185.923
	100	1.033	2.066	4.132	6.197	10.329	20.658	41.316	61.974	82.632	103.291	123.949	144.607	165.265	185.923	206.581

### 3.6. Manx shearwater displacement matrices

Table 3.18: Manx shearwater return migration displacement matrix (based on a mean peak abundance of 780.411 within the array site and a 2 km buffer).

Displacement (%)	Mortality (%)														
	0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
1	0.039	0.078	0.156	0.234	0.390	0.780	1.561	2.341	3.122	3.902	4.682	5.463	6.243	7.024	7.804
10	0.390	0.780	1.561	2.341	3.902	7.804	15.608	23.412	31.216	39.021	46.825	54.629	62.433	70.237	78.041
20	0.780	1.561	3.122	4.682	7.804	15.608	31.216	46.825	62.433	78.041	93.649	109.258	124.866	140.474	156.082
30	1.171	2.341	4.682	7.024	11.706	23.412	46.825	70.237	93.649	117.062	140.474	163.886	187.299	210.711	234.123
40	1.561	3.122	6.243	9.365	15.608	31.216	62.433	93.649	124.866	156.082	187.299	218.515	249.732	280.948	312.164
50	1.951	3.902	7.804	11.706	19.510	39.021	78.041	117.062	156.082	195.103	234.123	273.144	312.164	351.185	390.206
60	2.341	4.682	9.365	14.047	23.412	46.825	93.649	140.474	187.299	234.123	280.948	327.773	374.597	421.422	468.247
70	2.731	5.463	10.926	16.389	27.314	54.629	109.258	163.886	218.515	273.144	327.773	382.401	437.030	491.659	546.288
80	3.122	6.243	12.487	18.730	31.216	62.433	124.866	187.299	249.732	312.164	374.597	437.030	499.463	561.896	624.329
90	3.512	7.024	14.047	21.071	35.118	70.237	140.474	210.711	280.948	351.185	421.422	491.659	561.896	632.133	702.370
100	3.902	7.804	15.608	23.412	39.021	78.041	156.082	234.123	312.164	390.206	468.247	546.288	624.329	702.370	780.411

Table 3.19: Manx shearwater migration-free breeding displacement matrix (based on a mean peak abundance of 180.162 within the array site and a 2 km buffer).

Displacement (%)	Mortality (%)														
	0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
1	0.009	0.018	0.036	0.054	0.090	0.180	0.360	0.540	0.721	0.901	1.081	1.261	1.441	1.621	1.802
10	0.090	0.180	0.360	0.540	0.901	1.802	3.603	5.405	7.206	9.008	10.810	12.611	14.413	16.215	18.016
20	0.180	0.360	0.721	1.081	1.802	3.603	7.206	10.810	14.413	18.016	21.619	25.223	28.826	32.429	36.032
30	0.270	0.540	1.081	1.621	2.702	5.405	10.810	16.215	21.619	27.024	32.429	37.834	43.239	48.644	54.049
40	0.360	0.721	1.441	2.162	3.603	7.206	14.413	21.619	28.826	36.032	43.239	50.445	57.652	64.858	72.065
50	0.450	0.901	1.802	2.702	4.504	9.008	18.016	27.024	36.032	45.041	54.049	63.057	72.065	81.073	90.081
60	0.540	1.081	2.162	3.243	5.405	10.810	21.619	32.429	43.239	54.049	64.858	75.668	86.478	97.287	108.097
70	0.631	1.261	2.522	3.783	6.306	12.611	25.223	37.834	50.445	63.057	75.668	88.279	100.891	113.502	126.113
80	0.721	1.441	2.883	4.324	7.206	14.413	28.826	43.239	57.652	72.065	86.478	100.891	115.304	129.717	144.130
90	0.811	1.621	3.243	4.864	8.107	16.215	32.429	48.644	64.858	81.073	97.287	113.502	129.717	145.931	162.146
100	0.901	1.802	3.603	5.405	9.008	18.016	36.032	54.049	72.065	90.081	108.097	126.113	144.130	162.146	180.162

Table 3.14: Manx shearwater post-breeding migration displacement matrix (based on a mean peak abundance of 1125.063 within the array site and a 2 km buffer).

Displacement (%)	Mortality (%)														
	0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
1	0.056	0.113	0.225	0.338	0.563	1.125	2.250	3.375	4.500	5.625	6.750	7.875	9.001	10.126	11.251
10	0.563	1.125	2.250	3.375	5.625	11.251	22.501	33.752	45.003	56.253	67.504	78.754	90.005	101.256	112.506
20	1.125	2.250	4.500	6.750	11.251	22.501	45.003	67.504	90.005	112.506	135.008	157.509	180.010	202.511	225.013
30	1.688	3.375	6.750	10.126	16.876	33.752	67.504	101.256	135.008	168.759	202.511	236.263	270.015	303.767	337.519
40	2.250	4.500	9.001	13.501	22.501	45.003	90.005	135.008	180.010	225.013	270.015	315.018	360.020	405.023	450.025
50	2.813	5.625	11.251	16.876	28.127	56.253	112.506	168.759	225.013	281.266	337.519	393.772	450.025	506.278	562.532
60	3.375	6.750	13.501	20.251	33.752	67.504	135.008	202.511	270.015	337.519	405.023	472.526	540.030	607.534	675.038
70	3.938	7.875	15.751	23.626	39.377	78.754	157.509	236.263	315.018	393.772	472.526	551.281	630.035	708.790	787.544
80	4.500	9.001	18.001	27.002	45.003	90.005	180.010	270.015	360.020	450.025	540.030	630.035	720.040	810.045	900.050
90	5.063	10.126	20.251	30.377	50.628	101.256	202.511	303.767	405.023	506.278	607.534	708.790	810.045	911.301	1012.557
100	5.625	11.251	22.501	33.752	56.253	112.506	225.013	337.519	450.025	562.532	675.038	787.544	900.050	1012.557	1125.063

Table 3.15: Manx shearwater migration free winter displacement matrix (based on a mean peak abundance of 0 within the array site and a 2 km buffer)

Displacement (%)	Mortality (%)														
	0.5	1	2	3	5	10	20	30	40	50	60	70	80	90	100
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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