



Sporad na Mara Offshore Wind Farm

Offshore Project

Environmental Impact Assessment Report

Appendix 14.2: Displacement Report, Volume 2c

Document Reference No.: SNM-SNM-PAC-APP-1142

Date: February 2026



Quality Control Page

| | |
|------------------------|---|
| Document details | |
| Document title | Offshore Project Environmental Impact Assessment Report |
| Document subtitle | Appendix 14.2: Displacement Report |
| Document reference no. | SNM-SNM-PAC-APP-1142 |
| Date | February 2026 |
| Version | 1.0 |
| Author | NIRAS |
| Client Name | Spiorad na Mara Limited |

Document history

| Version | Revision | Issued | Checked | Approved | Date | Comments |
|---------|----------|--------|---------|----------|---------------|----------------------|
| 1.0 | A | NIRAS | WSP | SnM Ltd | February 2026 | Final for submission |

Contents

| | | |
|-----|--|------|
| 1 | Introduction..... | 1-1 |
| 1.1 | Overview | 1-1 |
| 1.2 | Purpose and scope of this appendix..... | 1-2 |
| 2 | Methodology..... | 2-5 |
| 2.1 | Species for consideration | 2-5 |
| 2.2 | Seasonality..... | 2-7 |
| 2.3 | Population estimates..... | 2-8 |
| 2.4 | Displacement and mortality rates..... | 2-10 |
| 3 | Results | 3-13 |
| 3.2 | Design-based abundance estimates..... | 3-14 |
| 3.3 | MRSea-based abundance estimates..... | 3-33 |
| 4 | Summary..... | 4-48 |
| 5 | Discussion..... | 5-50 |
| 6 | Glossary of terms and abbreviations..... | 6-52 |
| 7 | References | 7-54 |

List of Tables

| | | |
|------------|--|------|
| Table 2-1: | Identification of VORs for which analysis of displacement for the Offshore Project is required..... | 2-5 |
| Table 2-2: | Seasonal definitions as the basis for assessment, from NatureScot (2020) and Furness (2015)..... | 2-8 |
| Table 2-3: | Seasonal mean-peak abundances from Digital Aerial Survey data for use in the assessment for each bio-season..... | 2-10 |
| Table 2-4: | Displacement and mortality rates for use in the assessment during operation and maintenance phase..... | 2-12 |
| Table 3-1: | Mean predicted kittiwake mortality for the Displacement Study Area during pre-breeding season (design-based)..... | 3-14 |
| Table 3-2: | Mean predicted kittiwake mortality for the Displacement Study Area during breeding season (design-based)..... | 3-15 |
| Table 3-3: | Mean predicted kittiwake mortality for the Displacement Study Area during post-breeding season (design-based)..... | 3-16 |

| | |
|---|------|
| Table 3-4: Mean predicted guillemot mortality for the Displacement Study Area during breeding season (design-based)..... | 3-17 |
| Table 3-5: Mean predicted guillemot mortality for the Displacement Study Area during non-breeding season (design-based)..... | 3-18 |
| Table 3-6: Mean predicted razorbill mortality for the Displacement Study Area during pre-breeding season (design-based)..... | 3-19 |
| Table 3-7: Mean predicted razorbill mortality for the Displacement Study Area during breeding season (design-based)..... | 3-20 |
| Table 3-8: Mean predicted razorbill mortality for the Displacement Study Area during post-breeding season (design-based)..... | 3-21 |
| Table 3-9: Mean predicted razorbill mortality for the Displacement Study Area during non-breeding season (design-based)..... | 3-22 |
| Table 3-10: Mean predicted puffin mortality for the Displacement Study Area during breeding season (design-based)..... | 3-23 |
| Table 3-11 Mean predicted puffin mortality for the Displacement Study Area during non-breeding season (design-based)..... | 3-24 |
| Table 3-12: Mean predicted red-throated diver mortality for the Displacement Study Area during pre-breeding season (design-based). | 3-25 |
| Table 3-13: Mean predicted red-throated diver mortality for the Displacement Study Area during breeding season (design-based)..... | 3-26 |
| Table 3-14: Mean predicted red-throated diver mortality for the Displacement Study Area during post-breeding season (design-based). | 3-27 |
| Table 3-15: Mean predicted red-throated diver mortality for the Displacement Study Area during non-breeding season (design-based). | 3-28 |
| Table 3-16: Mean predicted great northern diver mortality for the Displacement Study Area during non-breeding season (design-based). | 3-29 |
| Table 3-17: Mean predicted gannet mortality for the Displacement Study Area during pre-breeding season (design-based)..... | 3-30 |
| Table 3-18: Mean predicted gannet mortality for the Displacement Study Area during breeding season (design-based)..... | 3-31 |
| Table 3-19 Mean predicted gannet mortality for the Displacement Study Area during post-breeding season (design-based)..... | 3-32 |
| Table 3-20: Mean predicted kittiwake mortality based on MRSea modelled data for the Displacement Study Area during pre-breeding season..... | 3-33 |

| | |
|---|------|
| Table 3-21: Mean predicted kittiwake mortality based on MRSea modelled data for the Displacement Study Area during breeding season. | 3-34 |
| Table 3-22: Mean predicted kittiwake mortality based on MRSea modelled data for the Displacement Study Area during post-breeding season. | 3-35 |
| Table 3-23: Mean predicted guillemot mortality based on MRSea modelled data for the Displacement Study Area during breeding season. | 3-36 |
| Table 3-24: Mean predicted guillemot mortality based on MRSea modelled data for the Displacement Study Area during non-breeding season. | 3-37 |
| Table 3-25: Mean predicted razorbill mortality based on MRSea modelled data for the Displacement Study Area during pre-breeding season. | 3-38 |
| Table 3-26: Mean predicted razorbill mortality based on MRSea modelled data for the Displacement Study Area during breeding season. | 3-39 |
| Table 3-27 Mean predicted razorbill mortality based on MRSea modelled data for the Displacement Study Area during post-breeding season. | 3-40 |
| Table 3-28: Mean predicted razorbill mortality based on MRSea modelled data for the Displacement Study Area during non-breeding season. | 3-41 |
| Table 3-29: Mean predicted puffin mortality based on MRSea modelled data for the Displacement Study Area during breeding season. | 3-42 |
| Table 3-30: Mean predicted puffin mortality based on MRSea modelled data for the Displacement Study Area during non-breeding season. | 3-43 |
| Table 3-31: Mean predicted gannet mortality based on MRSea modelled data for the Displacement Study Area during pre-breeding season. | 3-44 |
| Table 3-32 Mean predicted gannet mortality based on MRSea modelled data for the Displacement Study Area during breeding season. | 3-45 |
| Table 3-33: Mean predicted gannet mortality based on MRSea modelled data for the Displacement Study Area during post-breeding season. | 3-45 |
| Table 4-1: Summary of displacement analyses undertaken for the Displacement Study Area | 4-48 |
| Table 6-1 Acronyms and abbreviations | 6-52 |
| Table 6-2 Glossary | 6-52 |

1 INTRODUCTION

1.1 OVERVIEW

1.1.1.1 This appendix of the Environmental Impact Assessment Report (EIAR) presents the method and results of the matrix table approach to the assessment of seabird displacement resulting from the proposed Spiorad na Mara Offshore Wind Farm (hereafter referred to as 'the Project'), with respect to marine ornithology. This appendix accompanies Chapter 14: Marine and Nearshore Ornithology, Volume 2a of the EIAR.

1.1.1.2 This appendix should be read in conjunction with Chapter 3: Project Description, Volume 1a and the relevant parts of the following chapters and appendices:

- Appendix 14.1: Ornithology Baseline Report, Volume 2c;
- Annex 14.2.1: Ornithology Displacement Data, Volume 2c;
- Annex 14.2.2: SeabORD Report, Volume 2c;
- Appendix 14.6: EIA Ornithology Consultation, Volume 2c;
- Offshore Report to Inform Appropriate Assessment (RIAA).

1.1.2 PROJECT BACKGROUND

1.1.2.0 Spiorad na Mara Limited (hereafter referred to as 'the Applicant') is proposing to develop the Project. The Project is an offshore wind farm (OWF) that will consist of up to 60 fixed-bottom wind turbine generators (WTGs).

1.1.2.1 The Project will include both offshore and onshore infrastructure. This Offshore EIAR supports the application for the offshore components of the Project as outlined in Chapter 1: Introduction, Volume 1a. The offshore components of the Project (hereafter referred to as 'the Offshore Project') include all infrastructure and activities located seaward of MHWS) within the Array Area and Offshore Cable Area of Search (OCAS) (Figure 1.2: Offshore Project Location, Volume 1b). Further detailed information is provided in Chapter 3, Volume 1a.

1.1.2.2 The Offshore Project is situated off the northwest coast of Isle of Lewis/*Eilean Leòdhais* and the Array Area is located approximately 5-13 km offshore and is approximately 161 km² in size. It will comprise WTGs, foundations, Offshore Cables, Offshore Substation Platform (OSP) (if required), and Landfall. The Array Area combined with the OCAS is defined as the Offshore Project Boundary. The water depths across the Array Area range from 37 m-67 m with the southwest corner of the Array Area reaching 72 m. The proposed WTGs and fixed foundations will be located within a Turbine Area of approximately 140 km², within the Array Area.

1.2 PURPOSE AND SCOPE OF THIS APPENDIX

- 1.2.1.1 Seabirds can be impacted by OWF developments in a number of direct ways, including collision, displacement, and barrier effects. They can also be affected through indirect impacts such as changes to prey availability. In relation to an OWF development, displacement is defined as a reduction in the number of seabirds occurring within or immediately adjacent to an OWF (Furness *et al.*, 2013). Displacement may occur both in a development's array area and for some distance beyond it; this is known as a 'buffer' (e.g. Mendel *et al.*, 2014). This effectively represents indirect habitat loss through the reduction of the area available for feeding, loafing, and moulting for seabird species that may occur at an array. Displacement may also occur as a result of vessel or helicopter traffic related to an OWF, including movements to and from the array area, and vessel activities associated with the offshore export cable.
- 1.2.1.2 Displacement may occur due to disturbance, which is when a bird's normal pattern of activity is interrupted by an anthropogenic activity. Disturbance may be caused by activities during the construction, operation and maintenance, and decommissioning phases of an OWF. Disturbance has the potential to displace seabirds from the area of sea in which the activity is occurring, although disturbance does not always lead to displacement.
- 1.2.1.3 Alternatively, displacement may be caused by avoidance, which is when a seabird is less likely to approach a location where an anthropogenic activity is occurring. Seabird behavioural responses to OWFs are often species-specific and generally constitute an avoidance reaction in response to rotating wind turbines or vessel movements. Avoidance can result in indirect habitat loss, as species avoid areas in which operational wind farms are present, i.e. displacement (Maclean *et al.*, 2009; Langston, 2010).
- 1.2.1.4 Species differ greatly in their susceptibility to displacement and its effects. This may be because some species show greater disturbance responses, greater avoidance responses, or have greater habitat speciality and therefore suffer greater effects as a result of displacement. Species' sensitivity to displacement effects in response to offshore wind farms has been quantified by Garthe and Hüppop (2004), Furness *et al.* (2013), Bradbury *et al.* (2014), and Wade *et al.* (2016).
- 1.2.1.5 The degree of displacement may vary seasonally and between species, both in terms of length of time and the proportion of the original population affected. In a review of studies from 20 operational OWFs in Europe, Dierschke *et al.* (2016) assessed the extent of displacement or attraction of a number of seabird species. Diver species and gannet showed consistent and strong avoidance of operational OWFs; northern fulmar *Fulmarus glacialis* (hereafter referred to as 'fulmar'), common scoter *Melanitta nigra*, Manx shearwater *Puffinus puffinus*, razorbill *Alca torda*, common guillemot *Uria aalge* (hereafter referred to as 'guillemot'), little gull *Hydrocoloeus minutus*, and Sandwich tern *Thalasseus sandvicensis* showed less consistent displacement.
- 1.2.1.6 More recently, Garthe *et al.* (2023) analysed data for OWFs during construction and operation in the North Sea and also found that distribution and abundance of divers decreased substantially

from the 'before' to the 'after' periods in all 5 OWF clusters analysed (diver densities were significantly reduced at distances of up to 9-12 km from the OWF footprints; abundance declined by 94% within the OWF+ 1 km zone and by 52% within the + 10 km zone). Following a revised monitoring design, Vanermen *et al.*'s (2023) findings accorded with Dierschke *et al.*'s (2016), evidencing gannet avoidance and less consistent displacement (and in some cases potential habituation) for guillemot and razorbill.

- 1.2.1.7 As the result of disturbance, displaced seabirds may move to areas already occupied by other birds, subsequently facing higher intra/interspecific competition for resources. Alternatively, displaced birds may be forced to move into lower quality areas (e.g. areas of lower prey availability). Disturbance and resultant displacement can therefore ultimately affect the impacted seabirds' demographic fitness (i.e. survival rates and breeding productivity), as well as potentially impacting other seabirds in the areas to which displaced birds relocate.
- 1.2.1.8 Changes in mortality levels of displaced birds have been estimated for waders (e.g. Burton *et al.*, 2006). There remains, however, a lack of empirical evidence for the consequences of displacement for seabirds, in terms of both survival and productivity. For waterbirds such as waders, geese, and seaducks, simulations using individual-based models (IBMs) have demonstrated changes to mortality resulting from changes in individuals' energy budgets (Pettifor *et al.*, 2000; West *et al.*, 2003; Kaiser *et al.*, 2002). However, IBMs are rarely used to predict the impacts on fitness for seabirds displaced by offshore wind farms (Topping and Petersen, 2011).
- 1.2.1.9 Statutory Nature Conservation Bodies (SNCBs) have produced joint guidance to assess seabird displacement associated with offshore wind farms (Joint Nature Conservation Committee (JNCC) *et al.*, 2022), with NatureScot also having produced guidance specific to assessments in Scottish waters (NatureScot, 2023). The guidelines advocate for the use of a displacement matrix approach, which expresses the proportion of seabirds potentially displaced and subsequently subject to mortality as percentages (i.e. out of 100%) as a result of an offshore wind farm development. This method involves identifying the peak seasonal abundance of a species within the development area and then applying a percentage to estimate how many birds may be displaced due to the presence of the wind farm (e.g. 30% displaced). A further percentage is then applied to this displaced number to estimate how many of those birds may experience mortality as a result of displacement (e.g. 1% mortality of displaced birds). This straightforward calculation allows for the assessment of a range of potential impacts based on varying displacement and mortality rate scenarios. Both JNCC *et al.* (2022) and NatureScot (2023) detail that any effects from disturbance and displacement are expected to be spatially limited to the offshore wind farm footprint and within close proximity (birds are impacted by displacement up to 2 km from the wind farm footprint for most species, with displacement up to 4 km considered for divers and seaducks due to being the most sensitive species groups to disturbance from sound, boat and helicopter traffic).

1.2.1.10 The displacement assessment for the Offshore Project makes use of the displacement matrix approach alongside the SeabORD application (Searle *et al.*, 2018), as recommended by NatureScot in pre-application consultation (see Chapter 14, Volume 2a and Appendix 14.6, Volume 2c). The methodology and outputs from SeabORD modelling are provided in Annex 14.2.2, Volume 2c. It is noted that SeabORD outputs can sometimes produce higher estimates of mortality compared to the matrix approach, due to the model's structure and underlying assumptions (see Annex 14.2.2, Volume 2c for further details around this issue). Appropriate discussion on the applicability of each method—and justification for the preferred estimates used in the Offshore Project assessment—is provided within both Annex 14.2.2, Volume 2c and Chapter 14, Volume 2a.

1.2.1.11 This appendix is set out with the following sections:

- Section 2: Methodology;
 - Section 2.1: Species of consideration;
 - Section 2.2: Seasonality;
 - Section 2.3: Population estimates;
 - Section 2.4: Displacement and mortality rates;
- Section 3: Results;
 - Section 3.2: Design-based abundance estimates;
 - Section 3.3: MRSea-based abundance estimates;
- Section 4 and 5: Summary and discussion;
- Section 7: References.

2 METHODOLOGY

2.1 SPECIES FOR CONSIDERATION

2.1.1.1 This appendix considers seabird species that were identified as Valued Ornithological Receptors (VORs) in the Section 9 of Appendix 14.1, Volume 2c. A summary of the methods and results of the DAS are presented in Appendix 14.1, Volume 2c. Species that were not recorded in the DAS or not identified as VORs are not included in this appendix.

2.1.1.2 The following criteria is used to determine which VORs may be potentially affected by displacement and therefore require further analysis:

- Known to be vulnerable to displacement impacts (based on Wade *et al.*, 2016; Bradbury *et al.*, 2014) (level of uncertainty also taken into account);
- Recorded within the Offshore Ornithology Study Area, defined as the area over which potentially significant impacts from the Offshore Project have the most potential to occur to ornithological receptors, consisting of the Turbine Area plus a 4 km buffer (excluding land).
- The population recorded within this area is considered important when assessed against relevant population-scale thresholds (regional, national, or international) and expert judgement as detailed within Table 6-1 of Appendix 14.1, Volume 2c.

2.1.1.3 Table 2-1 identifies those VORs which were recorded during the DAS that were carried out between March 2022 and February 2024, and based on the criteria described above, which of these VORs require displacement analysis. The VORs taken forward for displacement analysis are highlighted green in Table 2-1.

Table 2-1: Identification of VORs for which analysis of displacement for the Offshore Project is required.

| VOR | Vulnerability to Displacement Impacts | Importance of Population at the Offshore Ornithology Study Area | Displacement Analysis Required (Yes/No) |
|--|---------------------------------------|---|--|
| Black-legged kittiwake <i>Rissa tridactyla</i> (hereafter 'kittiwake') | Low | Local | Yes – international conservation status, local importance, NatureScot requested species |
| Black-headed gull <i>Chroicocephalus ridibundus</i> | Low | Negligible | No – low vulnerability to displacement and low abundance (not recorded within the Turbine Area, nor the Turbine Area plus 2 km buffer; recorded in the Study Area in only a single survey) |

| VOR | Vulnerability to Displacement Impacts | Importance of Population at the Offshore Ornithology Study Area | Displacement Analysis Required (Yes/No) |
|--|---------------------------------------|---|---|
| Common gull <i>Larus canus</i> | Low | Negligible | No – low vulnerability to displacement and low abundance |
| Great black-backed gull <i>Larus marinus</i> | Low | Local (some months only) | No – low vulnerability to displacement and low abundance |
| Herring gull <i>Larus argentatus</i> | Low | Negligible | No – low vulnerability to displacement and low abundance |
| Common tern <i>Sterna hirundo</i> | Low | Negligible | No – low vulnerability to displacement and low abundance (not recorded in the Study Area) |
| Arctic tern <i>Sterna paradisaea</i> | Low | Regional (during breeding season only) | No – low vulnerability to displacement |
| Great skua <i>Stercorarius skua</i> | Very low | Negligible | No – very low vulnerability to displacement and low abundance |
| Arctic skua <i>Stercorarius parasiticus</i> | Very low | Negligible | No – very low vulnerability to displacement and low abundance (not recorded within the Turbine Area, nor the Turbine Area plus 2 km buffer; recorded in the Study Area in only a single survey) |
| Guillemot | High | Local | Yes – high displacement vulnerability, international conservation status, local importance |
| Razorbill | High | Regional | Yes – high displacement vulnerability, international conservation status, regional importance |
| Atlantic puffin <i>Fratercula arctica</i> (hereafter puffin) | Moderate | Local | Yes – moderate displacement vulnerability, international conservation status, local importance |
| Red-throated diver <i>Gavia stellata</i> | Very high | Negligible | Yes – very high displacement vulnerability, international conservation status |
| Great northern diver <i>Gavia immer</i> | High | Negligible | Yes – high displacement vulnerability, international conservation status |
| Fulmar | Very low | Local | No – very low vulnerability to displacement and low abundance |
| Manx shearwater | Very low | Local | No – very low vulnerability to displacement and low abundance |

| VOR | Vulnerability to Displacement Impacts | Importance of Population at the Offshore Ornithology Study Area | Displacement Analysis Required (Yes/No) |
|--|---------------------------------------|---|--|
| Northern gannet <i>Morus bassanus</i> (hereafter gannet) | High | Local | Yes – high displacement vulnerability, local importance |
| Cormorant <i>Phalacrocorax carbo</i> | Very low | Negligible | No – very low vulnerability to displacement and low abundance (not recorded in the Study Area) |
| Shag <i>Gulosus aristotelis</i> | Very low | Negligible | No – very low vulnerability to displacement and low abundance (not recorded in the Study Area) |

2.1.1.4 The following species were selected for displacement analysis:

- Kittiwake (international conservation status, local importance, NatureScot requested species);
- Guillemot (high displacement vulnerability, international conservation status, local importance);
- Razorbill (high displacement vulnerability, international conservation status, regional importance);
- Puffin (moderate displacement vulnerability, international conservation status, local importance);
- Red-throated diver (very high displacement vulnerability, international conservation status);
- Great northern diver (high displacement vulnerability, local importance);
- Gannet (high displacement vulnerability, local importance).

2.2 SEASONALITY

2.2.1.1 Bio-seasons used within the displacement assessment were defined according to the breeding, non-breeding, and migratory periods (autumn and spring migration) based on NatureScot (2020) and Furness (2015). In cases where seasonal periods overlap, priority has been given to the breeding season for the purposes of assessment. For example, for guillemot, the breeding season is defined as April-mid-August, while the non-breeding season spans mid-August-March. As such, August contains an overlap between the two. However, where overlap exists, priority has been given to the breeding season. Therefore, August is considered part of the guillemot breeding season within this assessment (see Table 2-2: Seasonal definitions as the basis for assessment, from NatureScot (2020) and Furness (2015)).

Table 2-2: Seasonal definitions as the basis for assessment, from NatureScot (2020) and Furness (2015).

| Species | Breeding | Post-Breeding | Non-Breeding | Pre-Breeding |
|----------------------|---------------------|------------------------|-------------------|-------------------|
| Kittiwake | Mid-April-August | September-December | N/A | January-Mid-April |
| Guillemot | April-Mid-August | N/A | Mid-August-March | N/A |
| Razorbill | April-Mid-August | Mid-August-October | November-December | January-March |
| Puffin | April-Mid-August | N/A | Mid-August-March | N/A |
| Red-throated diver | April-Mid-September | Mid-September-November | December-January | February-March |
| Great northern diver | N/A | N/A | September-May | N/A |
| Gannet | March to September | October-November | N/A | December-February |

2.3 POPULATION ESTIMATES

2.3.1.1 In line with SNCB advice (JNCC *et al.*, 2022), displacement can occur beyond a development area, and therefore displacement analysis relies in the population estimate of birds within a development area plus species-specific buffer zones. For the purposes of this technical report, this is referred to as the Displacement Study Area. The Displacement Study Area is defined as the Turbine Area plus a species-specific buffer zone:

- 2 km buffer for kittiwake, razorbill, guillemot, puffin, and gannet;
- 4 km buffer for red-throated diver and great northern diver.

2.3.1.2 According to guidance from SNCBs (JNCC, *et al.* 2022), a buffer of up to 10 km should be applied for red-throated diver if the plan or project is located within 10 km of a Special Protection Area (SPA) designated for non-breeding red-throated diver. If the plan or project is located more than 10 km from such an SPA, a 4 km buffer is recommended.

2.3.1.3 As the Offshore Project is situated more than 10 km from any SPA designated for non-breeding red-throated diver, a 4 km buffer was applied in line with SNCB guidance. This approach was confirmed and agreed with NatureScot during post-scoping consultation (see Appendix 14.6, Volume 2c).

2.3.1.4 Project-specific data for the Displacement Study Area has been collected by 2 years of DAS carried out between March 2022 and February 2024. These surveys encompassed the Offshore Ornithology Survey Area, defined as the Array Area plus a 10 km buffer (excluding land).

- 2.3.1.5 Further information on the DAS undertaken for the Offshore Project, and the methodologies used to derive population estimates, is provided in Section 4 of Appendix 14.1, Volume 2c. All population estimates in this report account for:
- Apportionment of unidentified birds;
 - Correction for availability bias, where relevant.
- 2.3.1.6 Refer to Section 4 of Appendix 14.1, Volume 2c for further details on methods used for apportionment and correction.
- 2.3.1.7 The analyses presented in this appendix have been informed by recent guidance published jointly by the United Kingdom (UK) SNCBs (JNCC *et al.*, 2022; SNCB, 2022).
- 2.3.1.8 Two approaches have been used to generate population estimates from DAS data. These approaches are referred to as “design-based” and “model-based”:
- Design-based estimates of bird abundance and density were calculated for each month using raw counts from geo-referenced aerial imagery. Mean counts per image were scaled up to the Survey Area, and non-parametric bootstrap methods (999 replicates) were used to generate 95% confidence intervals. A Poisson estimator was applied to derive a coefficient of variation as a measure of precision. All analyses were undertaken in the R programming language (R Development Core Team, 2012), with outputs including monthly abundance, density, confidence intervals, and associated precision where applicable;
 - Model-based estimates using the Marine Renewables Strategic Environmental Assessment (R package) (MRSea package) were produced to predict abundances across the offshore ornithology study area, with 95% confidence intervals to provide the level of uncertainty. Design-based estimates for bird abundances and densities in each month were also generated and compared to the MRSea estimates to provide additional validation of the MRSea outputs and estimates for months where low raw abundances prevented the use of the MRSea model. Red-throated diver and great northern diver were recorded infrequently and only have design-based abundance estimates.
- 2.3.1.9 Table 3-1 to Table 3-19 show the design-based mortality estimates, and Table 3-20 to Table 3-33 show the MRSea-based mortality estimates for a range of displacement rates and mortality rates.
- 2.3.1.10 The primary data that inform the basis for the assessment of displacement effects are seasonal mean-peak population estimates, including seabirds both on the water and in flight. Seasonal mean-peak population estimates of each species were calculated using the defined seasons identified in Table 2-2 to provide the number of seabirds at risk of displacement impacts (as shown in Table 2-3). The mean-peak abundances within Table 2-2 are generated using both MRSea-based and design-based abundance estimates.

2.3.1.11 Peak abundances in each season for each species considered within the displacement assessment are presented within Annex 14.2.1, Volume 2c.

Table 2-3: Seasonal mean-peak abundances from Digital Aerial Survey data for use in the assessment for each bio-season¹.

| Species | Breeding | | Post-breeding | | Non-breeding | | Pre-breeding | |
|----------------------|--------------|-------------|---------------|-------------|--------------|-------------|--------------|-------------|
| | Design-based | MRSea-based | Design-based | MRSea-based | Design-based | MRSea-based | Design-based | MRSea-based |
| Kittiwake | 34 | 33 | 214 | 217 | N/A | N/A | 590 | 660 |
| Guillemot | 449 | 484 | N/A | N/A | 2,561 | 2,661 | N/A | N/A |
| Razorbill | 379 | 410 | 401 | 467 | 0 | 0 | 685 | 649 |
| Puffin | 3,965 | 3,917 | N/A | N/A | 357 | 374 | N/A | N/A |
| Red-throated diver | N/A | 4 | N/A | 4 | N/A | 0 | N/A | 0 |
| Great northern diver | N/A | N/A | N/A | N/A | N/A | 27 | N/A | N/A |
| Gannet | 452 | 431 | 164 | 158 | N/A | N/A | 22 | 29 |

2.4 DISPLACEMENT AND MORTALITY RATES

2.4.1.1 Displacement rates are species-specific, and those used in assessment are presented in Table 2-4, following the NatureScot (2023) guidance. The advised displacement rates are applied uniformly across the Displacement Study Area, as described in the SNCB guidance (JNCC *et al.*, 2022; SNCB, 2022; NatureScot, 2023).

2.4.1.2 Mortality risk due to displacement depends on several factors. A key contributor is the size of the offshore wind farm, which affects the amount of habitat lost, distance deviated by birds in flight, availability of suitable replacement habitat, and, potentially, the level of increased competition. Mortality is also likely to differ with season and species, based on morphology, foraging range, foraging rates, and seasonal energetic needs, such as when provisioning for chicks (Masden *et al.*, 2010). Advised mortality rates during the breeding and non-breeding season are also presented in Table 2-4 (NatureScot, 2023).

2.4.1.3 In addition to the displacement and mortality rates provided by NatureScot (2023), rates based on recent evidence have also been modelled; this is referred to as the 'Applicant Approach' and is outlined below for each species;

- The Applicant Approach displacement rate for kittiwake (30%) matches the displacement rate advised by NatureScot (2023) and is consistent with previous advice on Forth and Tay Projects

¹ MRSea modelled abundance values are shown in brackets
Sporad na Mara EIAR Appendix 14.2 - Displacement Report, Volume 2c

(Marine Scotland, 2017). The Applicant Approach mortality rate for kittiwake applies a single value 1%, which is within the range advised under the NatureScot rates (1-3%). The mortality rate of 1% follows previous advice from the Marine Scotland on existing Forth and Tay Projects (Marine Scotland, 2017);

- For the Applicant Approach, a displacement rate of 50% and mortality rate of 1% for auks (here guillemot, razorbill, and puffin) was considered suitably precautionary for both the breeding and non-breeding season. APEM (2022a) undertook a review of auk displacement rates, and the Applicant Approach aligns with their recommended maximum rate. The displacement and mortality rates for puffin also follow rates discussed within the MacArthur Green 2019 and 2023 studies;
- The Applicant Approach displacement rate for gannet (70%) matches the NatureScot displacement rate as advised by NatureScot (2023), whilst the Applicant Approach mortality rate for gannet (1%) was chosen on the basis of previous recommendations from Natural England at the Norfolk Vanguard Development (MacArthur Green, 2019), and falls within the NatureScot-advised range of 1-3%;
- The Applicant Approach displacement rate of 100% and mortality rate of 10% for red-throated diver are consistent with previous advice on the Awel y Môr Offshore Wind Farm Array (RWE Renewables UK, 2022), and match the NatureScot rates advised by NatureScot (2023). The displacement rate reflects the strong evidence that red-throated divers are highly sensitive to disturbance and likely to be displaced (e.g. Webb *et al.*, 2017; Heinänen *et al.*, 2020). There is less empirical evidence to inform an appropriate mortality rate, but as red-throated diver have a relatively short foraging range (Woodward *et al.*, 2019) and scored as having low habitat flexibility (MacArthur Green, 2012), a mortality rate of 10% is considered reasonable whilst still precautionary;
- In comparison to red-throated diver, evidence regarding the sensitivity of great northern diver is sparse and at times contradictory. Some evidence (e.g. Bradbury *et al.*, 2014) indicates that great northern divers have high vulnerability to disturbance and displacement, while other research in Ireland has shown that great northern divers do not show a flush response to boat traffic, even when boats are within 20 m of some birds (Gittings *et al.*, 2015). As a precautionary approach, it is assumed that great northern diver sensitivity is high (Table 2-1). To reflect this, the Applicant Approach proposes a displacement rate of 100%, in accordance with the NatureScot recommended rate used in the North Irish Sea Offshore Wind Farm Array (2024). For mortality, the NatureScot rate is taken to be the same as for red-throated diver (10%) given the identical displacement rates (100%). However, for great northern diver, the Applicant Approach uses a range of 1–5%, on the premise that great northern divers are marginally less susceptible to mortality from displacement than red-throated diver. MacArthur Green (2012) presents a habitat flexibility vulnerability score of 4 for red-throated diver and 3 for great northern diver, reflecting the greater habitat flexibility of great northern diver. This means that great northern divers are able to respond better to displacement e.g. find suitable feeding grounds elsewhere. This reduces their likelihood of mortality. Therefore, to be highly

precautionary, the Applicant Approach uses the same displacement rate (100%) for red-throated diver and great northern diver, but uses a marginally lower mortality rate range to reflect the greater habitat flexibility of great northern diver.

2.4.1.4 Displacement matrices are presented in Section 3 for each of the selected species and their associated seasons. These matrices cover the complete range of potential displacement (i.e. 0-100%) and mortality rates (i.e. 0-100%), following recent SNCB guidance (JNCC *et al.*, 2022a; NatureScot, 2023). The set of rates used within the displacement matrices are presented in Table 2-4.

Table 2-4: Displacement and mortality rates for use in the assessment during operation and maintenance phase.

| Species | Approach | Displacement Rate | Mortality Rates (Breeding Season) | Mortality Rates (Non-breeding Seasons) |
|----------------------|------------|-------------------|-----------------------------------|--|
| Kittiwake | NatureScot | 30% | 1-3% | 1- 3% |
| | Applicant | 30% | 1% | 1% |
| Guillemot | NatureScot | 60% | 3-5% | 1- 3% |
| | Applicant | 50% | 1% | 1% |
| Razorbill | NatureScot | 60% | 3-5% | 1- 3% |
| | Applicant | 50% | 1% | 1% |
| Puffin | NatureScot | 60% | 3-5% | 1- 3% |
| | Applicant | 50% | 1% | 1% |
| Red-throated diver | NatureScot | 100% | 10% | 10% |
| | Applicant | 100% | 10% | 10% |
| Great northern diver | NatureScot | 100% | 10% | 10% |
| | Applicant | 100% | 1-5% | 1-5% |
| Gannet | NatureScot | 70% | 1- 3% | 1- 3% |
| | Applicant | 70% | 1% | 1% |

3 RESULTS

- 3.1.1.1 Displacement matrices using design-based abundance estimates for each species selected in Section 2.1 are presented in Section 3.2.
- 3.1.1.2 Displacement matrices using the MRSea estimates for each species selected in Section 2.1 are presented in Section 3.3. In months where available, these are provided for all species and associated seasons; design-based estimates are used where model-based estimates could not be calculated. MRSea estimates could not be calculated for red-throated diver nor great northern diver due to low raw abundances preventing the use of the MRSea model. Only design-based estimates are therefore presented for red-throated diver and great northern diver.
- 3.1.1.3 The seasons for each species align with Table 2-2, and it should be noted that not all species occur during all 4 seasons (post-breeding, breeding, post-breeding, and non-breeding). This is conveyed in Table 2-2 by the N/A greyed-out cells for the seasons in which the respective species do not occur.
- 3.1.1.4 In each matrix the range of displacement and mortality rates following application of the NatureScot guidance rates are highlighted in yellow, and the values following the application of the Applicant Approach are outlined in blue (refer to Table 2-4 for the rates used).

3.2 DESIGN-BASED ABUNDANCE ESTIMATES

3.2.1 KITTIWAKE

Table 3-1: Mean predicted kittiwake mortality for the Displacement Study Area during pre-breeding season (design-based).

| Kittiwake (Pre-breeding) | Mortality (%) | | | | | | | | | | | | | | |
|--------------------------|---------------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.59 | 1.18 | 1.77 | 2.95 | 5.91 | 11.81 | 17.72 | 23.62 | 29.53 | 35.43 | 41.34 | 47.24 | 53.15 | 59.05 |
| | 20 | 1.18 | 2.36 | 3.54 | 5.91 | 11.81 | 23.62 | 35.43 | 47.24 | 59.05 | 70.86 | 82.67 | 94.48 | 106.29 | 118.10 |
| | 30 | 1.77 | 3.54 | 5.31 | 8.86 | 17.72 | 35.43 | 53.15 | 70.86 | 88.58 | 106.29 | 124.01 | 141.72 | 159.44 | 177.15 |
| | 40 | 2.36 | 4.72 | 7.09 | 11.81 | 23.62 | 47.24 | 70.86 | 94.48 | 118.10 | 141.72 | 165.34 | 188.96 | 212.58 | 236.20 |
| | 50 | 2.95 | 5.91 | 8.86 | 14.76 | 29.53 | 59.05 | 88.58 | 118.10 | 147.63 | 177.15 | 206.68 | 236.20 | 265.73 | 295.25 |
| | 60 | 3.54 | 7.09 | 10.63 | 17.72 | 35.43 | 70.86 | 106.29 | 141.72 | 177.15 | 212.58 | 248.01 | 283.44 | 318.87 | 354.30 |
| | 70 | 4.13 | 8.27 | 12.40 | 20.67 | 41.34 | 82.67 | 124.01 | 165.34 | 206.68 | 248.01 | 289.35 | 330.68 | 372.02 | 413.35 |
| | 80 | 4.72 | 9.45 | 14.17 | 23.62 | 47.24 | 94.48 | 141.72 | 188.96 | 236.20 | 283.44 | 330.68 | 377.92 | 425.16 | 472.40 |
| | 90 | 5.31 | 10.63 | 15.94 | 26.57 | 53.15 | 106.29 | 159.44 | 212.58 | 265.73 | 318.87 | 372.02 | 425.16 | 478.31 | 531.45 |
| | 100 | 5.91 | 11.81 | 17.72 | 29.53 | 59.05 | 118.10 | 177.15 | 236.20 | 295.25 | 354.30 | 413.35 | 472.40 | 531.45 | 590.50 |

Table 3-2: Mean predicted kittiwake mortality for the Displacement Study Area during breeding season (design-based).

| Kittiwake (Breeding) | Mortality (%) | | | | | | | | | | | | | | | |
|------------------------|---------------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | |
| Displacement level (%) | 10 | 0.03 | 0.07 | 0.10 | 0.17 | 0.35 | 0.69 | 1.04 | 1.38 | 1.73 | 2.07 | 2.42 | 2.76 | 3.11 | 3.45 | |
| | 20 | 0.07 | 0.14 | 0.21 | 0.35 | 0.69 | 1.38 | 2.07 | 2.76 | 3.45 | 4.14 | 4.83 | 5.52 | 6.21 | 6.90 | |
| | 30 | 0.10 | 0.21 | 0.31 | 0.52 | 1.04 | 2.07 | 3.11 | 4.14 | 5.18 | 6.21 | 7.25 | 8.28 | 9.32 | 10.35 | |
| | 40 | 0.14 | 0.28 | 0.41 | 0.69 | 1.38 | 2.76 | 4.14 | 5.52 | 6.90 | 8.28 | 9.66 | 11.04 | 12.42 | 13.80 | |
| | 50 | 0.17 | 0.35 | 0.52 | 0.86 | 1.73 | 3.45 | 5.18 | 6.90 | 8.63 | 10.35 | 12.08 | 13.80 | 15.53 | 17.25 | |
| | 60 | 0.21 | 0.41 | 0.62 | 1.04 | 2.07 | 4.14 | 6.21 | 8.28 | 10.35 | 12.42 | 14.49 | 16.56 | 18.63 | 20.70 | |
| | 70 | 0.24 | 0.48 | 0.72 | 1.21 | 2.42 | 4.83 | 7.25 | 9.66 | 12.08 | 14.49 | 16.91 | 19.32 | 21.74 | 24.15 | |
| | 80 | 0.28 | 0.55 | 0.83 | 1.38 | 2.76 | 5.52 | 8.28 | 11.04 | 13.80 | 16.56 | 19.32 | 22.08 | 24.84 | 27.60 | |
| | 90 | 0.31 | 0.62 | 0.93 | 1.55 | 3.11 | 6.21 | 9.32 | 12.42 | 15.53 | 18.63 | 21.74 | 24.84 | 27.95 | 31.05 | |
| | 100 | 0.35 | 0.69 | 1.04 | 1.73 | 3.45 | 6.90 | 10.35 | 13.80 | 17.25 | 20.70 | 24.15 | 27.60 | 31.05 | 34.50 | |

Table 3-3: Mean predicted kittiwake mortality for the Displacement Study Area during post-breeding season (design-based).

| Kittiwake (Post- breeding) | Mortality (%) | | | | | | | | | | | | | | | |
|----------------------------------|---------------|------|------|------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | |
| Displacement level (%) | 10 | 0.21 | 0.43 | 0.64 | 1.07 | 2.14 | 4.28 | 6.42 | 8.56 | 10.70 | 12.84 | 14.98 | 17.12 | 19.26 | 21.40 | |
| | 20 | 0.43 | 0.86 | 1.28 | 2.14 | 4.28 | 8.56 | 12.84 | 17.12 | 21.40 | 25.68 | 29.96 | 34.24 | 38.52 | 42.80 | |
| | 30 | 0.64 | 1.28 | 1.93 | 3.21 | 6.42 | 12.84 | 19.26 | 25.68 | 32.10 | 38.52 | 44.94 | 51.36 | 57.78 | 64.20 | |
| | 40 | 0.86 | 1.71 | 2.57 | 4.28 | 8.56 | 17.12 | 25.68 | 34.24 | 42.80 | 51.36 | 59.92 | 68.48 | 77.04 | 85.60 | |
| | 50 | 1.07 | 2.14 | 3.21 | 5.35 | 10.70 | 21.40 | 32.10 | 42.80 | 53.50 | 64.20 | 74.90 | 85.60 | 96.30 | 107.00 | |
| | 60 | 1.28 | 2.57 | 3.85 | 6.42 | 12.84 | 25.68 | 38.52 | 51.36 | 64.20 | 77.04 | 89.88 | 102.72 | 115.56 | 128.40 | |
| | 70 | 1.50 | 3.00 | 4.49 | 7.49 | 14.98 | 29.96 | 44.94 | 59.92 | 74.90 | 89.88 | 104.86 | 119.84 | 134.82 | 149.80 | |
| | 80 | 1.71 | 3.42 | 5.14 | 8.56 | 17.12 | 34.24 | 51.36 | 68.48 | 85.60 | 102.72 | 119.84 | 136.96 | 154.08 | 171.20 | |
| | 90 | 1.93 | 3.85 | 5.78 | 9.63 | 19.26 | 38.52 | 57.78 | 77.04 | 96.30 | 115.56 | 134.82 | 154.08 | 173.34 | 192.60 | |
| | 100 | 2.14 | 4.28 | 6.42 | 10.70 | 21.40 | 42.80 | 64.20 | 85.60 | 107.00 | 128.40 | 149.80 | 171.20 | 192.60 | 214.00 | |

3.2.2 GUILLEMOT

Table 3-4: Mean predicted guillemot mortality for the Displacement Study Area during breeding season (design-based).

| Guillemot (Breeding) | Mortality (%) | | | | | | | | | | | | | | |
|------------------------|---------------|------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.45 | 0.90 | 1.35 | 2.25 | 4.49 | 8.98 | 13.47 | 17.96 | 22.45 | 26.94 | 31.43 | 35.92 | 40.41 | 44.90 |
| | 20 | 0.90 | 1.80 | 2.69 | 4.49 | 8.98 | 17.96 | 26.94 | 35.92 | 44.90 | 53.88 | 62.86 | 71.84 | 80.82 | 89.80 |
| | 30 | 1.35 | 2.69 | 4.04 | 6.74 | 13.47 | 26.94 | 40.41 | 53.88 | 67.35 | 80.82 | 94.29 | 107.76 | 121.23 | 134.70 |
| | 40 | 1.80 | 3.59 | 5.39 | 8.98 | 17.96 | 35.92 | 53.88 | 71.84 | 89.80 | 107.76 | 125.72 | 143.68 | 161.64 | 179.60 |
| | 50 | 2.25 | 4.49 | 6.74 | 11.23 | 22.45 | 44.90 | 67.35 | 89.80 | 112.25 | 134.70 | 157.15 | 179.60 | 202.05 | 224.50 |
| | 60 | 2.69 | 5.39 | 8.08 | 13.47 | 26.94 | 53.88 | 80.82 | 107.76 | 134.70 | 161.64 | 188.58 | 215.52 | 242.46 | 269.40 |
| | 70 | 3.14 | 6.29 | 9.43 | 15.72 | 31.43 | 62.86 | 94.29 | 125.72 | 157.15 | 188.58 | 220.01 | 251.44 | 282.87 | 314.30 |
| | 80 | 3.59 | 7.18 | 10.78 | 17.96 | 35.92 | 71.84 | 107.76 | 143.68 | 179.60 | 215.52 | 251.44 | 287.36 | 323.28 | 359.20 |
| | 90 | 4.04 | 8.08 | 12.12 | 20.21 | 40.41 | 80.82 | 121.23 | 161.64 | 202.05 | 242.46 | 282.87 | 323.28 | 363.69 | 404.10 |
| | 100 | 4.49 | 8.98 | 13.47 | 22.45 | 44.90 | 89.80 | 134.70 | 179.60 | 224.50 | 269.40 | 314.30 | 359.20 | 404.10 | 449.00 |

Table 3-5: Mean predicted guillemot mortality for the Displacement Study Area during non-breeding season (design-based).

| Guillemot (Non-breeding) | Mortality (%) | | | | | | | | | | | | | | |
|--------------------------|---------------|-------|-------|-------|--------|--------|--------|--------|----------|----------|----------|----------|----------|----------|----------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 2.56 | 5.12 | 7.68 | 12.81 | 25.62 | 51.23 | 76.85 | 102.46 | 128.08 | 153.69 | 179.31 | 204.92 | 230.54 | 256.15 |
| | 20 | 5.12 | 10.25 | 15.37 | 25.62 | 51.23 | 102.46 | 153.69 | 204.92 | 256.15 | 307.38 | 358.61 | 409.84 | 461.07 | 512.30 |
| | 30 | 7.68 | 15.37 | 23.05 | 38.42 | 76.85 | 153.69 | 230.54 | 307.38 | 384.23 | 461.07 | 537.92 | 614.76 | 691.61 | 768.45 |
| | 40 | 10.25 | 20.49 | 30.74 | 51.23 | 102.46 | 204.92 | 307.38 | 409.84 | 512.30 | 614.76 | 717.22 | 819.68 | 922.14 | 1,024.60 |
| | 50 | 12.81 | 25.62 | 38.42 | 64.04 | 128.08 | 256.15 | 384.23 | 512.30 | 640.38 | 768.45 | 896.53 | 1,024.60 | 1,152.68 | 1,280.75 |
| | 60 | 15.37 | 30.74 | 46.11 | 76.85 | 153.69 | 307.38 | 461.07 | 614.76 | 768.45 | 922.14 | 1,075.83 | 1,229.52 | 1,383.21 | 1,536.90 |
| | 70 | 17.93 | 35.86 | 53.79 | 89.65 | 179.31 | 358.61 | 537.92 | 717.22 | 896.53 | 1,075.83 | 1,255.14 | 1,434.44 | 1,613.75 | 1,793.05 |
| | 80 | 20.49 | 40.98 | 61.48 | 102.46 | 204.92 | 409.84 | 614.76 | 819.68 | 1,024.60 | 1,229.52 | 1,434.44 | 1,639.36 | 1,844.28 | 2,049.20 |
| | 90 | 23.05 | 46.11 | 69.16 | 115.27 | 230.54 | 461.07 | 691.61 | 922.14 | 1,152.68 | 1,383.21 | 1,613.75 | 1,844.28 | 2,074.82 | 2,305.35 |
| | 100 | 25.62 | 51.23 | 76.85 | 128.08 | 256.15 | 512.30 | 768.45 | 1,024.60 | 1,280.75 | 1,536.90 | 1,793.05 | 2,049.20 | 2,305.35 | 2,561.50 |

3.2.3 RAZORBILL

Table 3-6: Mean predicted razorbill mortality for the Displacement Study Area during pre-breeding season (design-based).

| Razorbill (Pre-breeding) | Mortality (%) | | | | | | | | | | | | | | |
|--------------------------|---------------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.69 | 1.37 | 2.06 | 3.43 | 6.85 | 13.70 | 20.55 | 27.40 | 34.25 | 41.10 | 47.95 | 54.80 | 61.65 | 68.50 |
| | 20 | 1.37 | 2.74 | 4.11 | 6.85 | 13.70 | 27.40 | 41.10 | 54.80 | 68.50 | 82.20 | 95.90 | 109.60 | 123.30 | 137.00 |
| | 30 | 2.06 | 4.11 | 6.17 | 10.28 | 20.55 | 41.10 | 61.65 | 82.20 | 102.75 | 123.30 | 143.85 | 164.40 | 184.95 | 205.50 |
| | 40 | 2.74 | 5.48 | 8.22 | 13.70 | 27.40 | 54.80 | 82.20 | 109.60 | 137.00 | 164.40 | 191.80 | 219.20 | 246.60 | 274.00 |
| | 50 | 3.43 | 6.85 | 10.28 | 17.13 | 34.25 | 68.50 | 102.75 | 137.00 | 171.25 | 205.50 | 239.75 | 274.00 | 308.25 | 342.50 |
| | 60 | 4.11 | 8.22 | 12.33 | 20.55 | 41.10 | 82.20 | 123.30 | 164.40 | 205.50 | 246.60 | 287.70 | 328.80 | 369.90 | 411.00 |
| | 70 | 4.80 | 9.59 | 14.39 | 23.98 | 47.95 | 95.90 | 143.85 | 191.80 | 239.75 | 287.70 | 335.65 | 383.60 | 431.55 | 479.50 |
| | 80 | 5.48 | 10.96 | 16.44 | 27.40 | 54.80 | 109.60 | 164.40 | 219.20 | 274.00 | 328.80 | 383.60 | 438.40 | 493.20 | 548.00 |
| | 90 | 6.17 | 12.33 | 18.50 | 30.83 | 61.65 | 123.30 | 184.95 | 246.60 | 308.25 | 369.90 | 431.55 | 493.20 | 554.85 | 616.50 |
| | 100 | 6.85 | 13.70 | 20.55 | 34.25 | 68.50 | 137.00 | 205.50 | 274.00 | 342.50 | 411.00 | 479.50 | 548.00 | 616.50 | 685.00 |

Table 3-7: Mean predicted razorbill mortality for the Displacement Study Area during breeding season (design-based).

| Razorbill (Breeding) | Mortality (%) | | | | | | | | | | | | | | |
|---------------------------|---------------|------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.38 | 0.76 | 1.14 | 1.89 | 3.79 | 7.57 | 11.36 | 15.14 | 18.93 | 22.71 | 26.50 | 30.28 | 34.07 | 37.85 |
| | 20 | 0.76 | 1.51 | 2.27 | 3.79 | 7.57 | 15.14 | 22.71 | 30.28 | 37.85 | 45.42 | 52.99 | 60.56 | 68.13 | 75.70 |
| | 30 | 1.14 | 2.27 | 3.41 | 5.68 | 11.36 | 22.71 | 34.07 | 45.42 | 56.78 | 68.13 | 79.49 | 90.84 | 102.20 | 113.55 |
| | 40 | 1.51 | 3.03 | 4.54 | 7.57 | 15.14 | 30.28 | 45.42 | 60.56 | 75.70 | 90.84 | 105.98 | 121.12 | 136.26 | 151.40 |
| | 50 | 1.89 | 3.79 | 5.68 | 9.46 | 18.93 | 37.85 | 56.78 | 75.70 | 94.63 | 113.55 | 132.48 | 151.40 | 170.33 | 189.25 |
| | 60 | 2.27 | 4.54 | 6.81 | 11.36 | 22.71 | 45.42 | 68.13 | 90.84 | 113.55 | 136.26 | 158.97 | 181.68 | 204.39 | 227.10 |
| | 70 | 2.65 | 5.30 | 7.95 | 13.25 | 26.50 | 52.99 | 79.49 | 105.98 | 132.48 | 158.97 | 185.47 | 211.96 | 238.46 | 264.95 |
| | 80 | 3.03 | 6.06 | 9.08 | 15.14 | 30.28 | 60.56 | 90.84 | 121.12 | 151.40 | 181.68 | 211.96 | 242.24 | 272.52 | 302.80 |
| | 90 | 3.41 | 6.81 | 10.22 | 17.03 | 34.07 | 68.13 | 102.20 | 136.26 | 170.33 | 204.39 | 238.46 | 272.52 | 306.59 | 340.65 |
| | 100 | 3.79 | 7.57 | 11.36 | 18.93 | 37.85 | 75.70 | 113.55 | 151.40 | 189.25 | 227.10 | 264.95 | 302.80 | 340.65 | 378.50 |

Table 3-8: Mean predicted razorbill mortality for the Displacement Study Area during post-breeding season (design-based).

| Razorbill (Post- breeding) | Mortality (%) | | | | | | | | | | | | | | |
|----------------------------------|---------------|------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.40 | 0.80 | 1.20 | 2.01 | 4.01 | 8.02 | 12.03 | 16.04 | 20.05 | 24.06 | 28.07 | 32.08 | 36.09 | 40.10 |
| | 20 | 0.80 | 1.60 | 2.41 | 4.01 | 8.02 | 16.04 | 24.06 | 32.08 | 40.10 | 48.12 | 56.14 | 64.16 | 72.18 | 80.20 |
| | 30 | 1.20 | 2.41 | 3.61 | 6.02 | 12.03 | 24.06 | 36.09 | 48.12 | 60.15 | 72.18 | 84.21 | 96.24 | 108.27 | 120.30 |
| | 40 | 1.60 | 3.21 | 4.81 | 8.02 | 16.04 | 32.08 | 48.12 | 64.16 | 80.20 | 96.24 | 112.28 | 128.32 | 144.36 | 160.40 |
| | 50 | 2.01 | 4.01 | 6.02 | 10.03 | 20.05 | 40.10 | 60.15 | 80.20 | 100.25 | 120.30 | 140.35 | 160.40 | 180.45 | 200.50 |
| | 60 | 2.41 | 4.81 | 7.22 | 12.03 | 24.06 | 48.12 | 72.18 | 96.24 | 120.30 | 144.36 | 168.42 | 192.48 | 216.54 | 240.60 |
| | 70 | 2.81 | 5.61 | 8.42 | 14.04 | 28.07 | 56.14 | 84.21 | 112.28 | 140.35 | 168.42 | 196.49 | 224.56 | 252.63 | 280.70 |
| | 80 | 3.21 | 6.42 | 9.62 | 16.04 | 32.08 | 64.16 | 96.24 | 128.32 | 160.40 | 192.48 | 224.56 | 256.64 | 288.72 | 320.80 |
| | 90 | 3.61 | 7.22 | 10.83 | 18.05 | 36.09 | 72.18 | 108.27 | 144.36 | 180.45 | 216.54 | 252.63 | 288.72 | 324.81 | 360.90 |
| | 100 | 4.01 | 8.02 | 12.03 | 20.05 | 40.10 | 80.20 | 120.30 | 160.40 | 200.50 | 240.60 | 280.70 | 320.80 | 360.90 | 401.00 |

Table 3-9: Mean predicted razorbill mortality for the Displacement Study Area during non-breeding season (design-based).

| Razorbill (Non- breeding) | Mortality (%) | | | | | | | | | | | | | | |
|---------------------------------|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 100 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

3.2.4 PUFFIN

Table 3-10: Mean predicted puffin mortality for the Displacement Study Area during breeding season (design-based).

| Puffin (Breeding) | Mortality (%) | | | | | | | | | | | | | | |
|------------------------|---------------|-------|-------|--------|--------|--------|--------|----------|----------|----------|----------|----------|----------|----------|----------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 3.97 | 7.93 | 11.90 | 19.83 | 39.65 | 79.30 | 118.95 | 158.60 | 198.25 | 237.90 | 277.55 | 317.20 | 356.85 | 396.50 |
| | 20 | 7.93 | 15.86 | 23.79 | 39.65 | 79.30 | 158.60 | 237.90 | 317.20 | 396.50 | 475.80 | 555.10 | 634.40 | 713.70 | 793.00 |
| | 30 | 11.90 | 23.79 | 35.69 | 59.48 | 118.95 | 237.90 | 356.85 | 475.80 | 594.75 | 713.70 | 832.65 | 951.60 | 1,070.55 | 1,189.50 |
| | 40 | 15.86 | 31.72 | 47.58 | 79.30 | 158.60 | 317.20 | 475.80 | 634.40 | 793.00 | 951.60 | 1,110.20 | 1,268.80 | 1,427.40 | 1,586.00 |
| | 50 | 19.83 | 39.65 | 59.48 | 99.13 | 198.25 | 396.50 | 594.75 | 793.00 | 991.25 | 1,189.50 | 1,387.75 | 1,586.00 | 1,784.25 | 1,982.50 |
| | 60 | 23.79 | 47.58 | 71.37 | 118.95 | 237.90 | 475.80 | 713.70 | 951.60 | 1,189.50 | 1,427.40 | 1,665.30 | 1,903.20 | 2,141.10 | 2,379.00 |
| | 70 | 27.76 | 55.51 | 83.27 | 138.78 | 277.55 | 555.10 | 832.65 | 1,110.20 | 1,387.75 | 1,665.30 | 1,942.85 | 2,220.40 | 2,497.95 | 2,775.50 |
| | 80 | 31.72 | 63.44 | 95.16 | 158.60 | 317.20 | 634.40 | 951.60 | 1,268.80 | 1,586.00 | 1,903.20 | 2,220.40 | 2,537.60 | 2,854.80 | 3,172.00 |
| | 90 | 35.69 | 71.37 | 107.06 | 178.43 | 356.85 | 713.70 | 1,070.55 | 1,427.40 | 1,784.25 | 2,141.10 | 2,497.95 | 2,854.80 | 3,211.65 | 3,568.50 |
| | 100 | 39.65 | 79.30 | 118.95 | 198.25 | 396.50 | 793.00 | 1,189.50 | 1,586.00 | 1,982.50 | 2,379.00 | 2,775.50 | 3,172.00 | 3,568.50 | 3,965.00 |

Table 3-11 Mean predicted puffin mortality for the Displacement Study Area during non-breeding season (design-based).

| Puffin (Non-breeding) | Mortality (%) | | | | | | | | | | | | | | |
|------------------------|---------------|------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.36 | 0.71 | 1.07 | 1.78 | 3.57 | 7.13 | 10.70 | 14.26 | 17.83 | 21.39 | 24.96 | 28.52 | 32.09 | 35.65 |
| | 20 | 0.71 | 1.43 | 2.14 | 3.57 | 7.13 | 14.26 | 21.39 | 28.52 | 35.65 | 42.78 | 49.91 | 57.04 | 64.17 | 71.30 |
| | 30 | 1.07 | 2.14 | 3.21 | 5.35 | 10.70 | 21.39 | 32.09 | 42.78 | 53.48 | 64.17 | 74.87 | 85.56 | 96.26 | 106.95 |
| | 40 | 1.43 | 2.85 | 4.28 | 7.13 | 14.26 | 28.52 | 42.78 | 57.04 | 71.30 | 85.56 | 99.82 | 114.08 | 128.34 | 142.60 |
| | 50 | 1.78 | 3.57 | 5.35 | 8.91 | 17.83 | 35.65 | 53.48 | 71.30 | 89.13 | 106.95 | 124.78 | 142.60 | 160.43 | 178.25 |
| | 60 | 2.14 | 4.28 | 6.42 | 10.70 | 21.39 | 42.78 | 64.17 | 85.56 | 106.95 | 128.34 | 149.73 | 171.12 | 192.51 | 213.90 |
| | 70 | 2.50 | 4.99 | 7.49 | 12.48 | 24.96 | 49.91 | 74.87 | 99.82 | 124.78 | 149.73 | 174.69 | 199.64 | 224.60 | 249.55 |
| | 80 | 2.85 | 5.70 | 8.56 | 14.26 | 28.52 | 57.04 | 85.56 | 114.08 | 142.60 | 171.12 | 199.64 | 228.16 | 256.68 | 285.20 |
| | 90 | 3.21 | 6.42 | 9.63 | 16.04 | 32.09 | 64.17 | 96.26 | 128.34 | 160.43 | 192.51 | 224.60 | 256.68 | 288.77 | 320.85 |
| | 100 | 3.57 | 7.13 | 10.70 | 17.83 | 35.65 | 71.30 | 106.95 | 142.60 | 178.25 | 213.90 | 249.55 | 285.20 | 320.85 | 356.50 |

3.2.5 RED-THROATED DIVER

Table 3-12: Mean predicted red-throated diver mortality for the Displacement Study Area during pre-breeding season (design-based).

| Red-throated diver (Pre-breeding) | Mortality (%) | | | | | | | | | | | | | |
|-----------------------------------|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | | 1 | 2 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.00 | 0.01 | 0.02 | 0.04 | 0.08 | 0.12 | 0.16 | 0.20 | 0.24 | 0.28 | 0.32 | 0.36 | 0.40 |
| | 20 | 0.01 | 0.02 | 0.04 | 0.08 | 0.16 | 0.24 | 0.32 | 0.40 | 0.48 | 0.56 | 0.64 | 0.72 | 0.80 |
| | 30 | 0.01 | 0.02 | 0.06 | 0.12 | 0.24 | 0.36 | 0.48 | 0.60 | 0.72 | 0.84 | 0.96 | 1.08 | 1.20 |
| | 40 | 0.02 | 0.03 | 0.08 | 0.16 | 0.32 | 0.48 | 0.64 | 0.80 | 0.96 | 1.12 | 1.28 | 1.44 | 1.60 |
| | 50 | 0.02 | 0.04 | 0.10 | 0.20 | 0.40 | 0.60 | 0.80 | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 |
| | 60 | 0.02 | 0.05 | 0.12 | 0.24 | 0.48 | 0.72 | 0.96 | 1.20 | 1.44 | 1.68 | 1.92 | 2.16 | 2.40 |
| | 70 | 0.03 | 0.06 | 0.14 | 0.28 | 0.56 | 0.84 | 1.12 | 1.40 | 1.68 | 1.96 | 2.24 | 2.52 | 2.80 |
| | 80 | 0.03 | 0.06 | 0.16 | 0.32 | 0.64 | 0.96 | 1.28 | 1.60 | 1.92 | 2.24 | 2.56 | 2.88 | 3.20 |
| | 90 | 0.04 | 0.07 | 0.18 | 0.36 | 0.72 | 1.08 | 1.44 | 1.80 | 2.16 | 2.52 | 2.88 | 3.24 | 3.60 |
| | 100 | 0.04 | 0.08 | 0.20 | 0.40 | 0.80 | 1.20 | 1.60 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 |

Table 3-13: Mean predicted red-throated diver mortality for the Displacement Study Area during breeding season (design-based).

| Red-throated diver (Breeding) | Mortality (%) | | | | | | | | | | | | | |
|-------------------------------|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | | 1 | 2 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.00 | 0.01 | 0.02 | 0.04 | 0.08 | 0.12 | 0.16 | 0.20 | 0.24 | 0.28 | 0.32 | 0.36 | 0.40 |
| | 20 | 0.01 | 0.02 | 0.04 | 0.08 | 0.16 | 0.24 | 0.32 | 0.40 | 0.48 | 0.56 | 0.64 | 0.72 | 0.80 |
| | 30 | 0.01 | 0.02 | 0.06 | 0.12 | 0.24 | 0.36 | 0.48 | 0.60 | 0.72 | 0.84 | 0.96 | 1.08 | 1.20 |
| | 40 | 0.02 | 0.03 | 0.08 | 0.16 | 0.32 | 0.48 | 0.64 | 0.80 | 0.96 | 1.12 | 1.28 | 1.44 | 1.60 |
| | 50 | 0.02 | 0.04 | 0.10 | 0.20 | 0.40 | 0.60 | 0.80 | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 |
| | 60 | 0.02 | 0.05 | 0.12 | 0.24 | 0.48 | 0.72 | 0.96 | 1.20 | 1.44 | 1.68 | 1.92 | 2.16 | 2.40 |
| | 70 | 0.03 | 0.06 | 0.14 | 0.28 | 0.56 | 0.84 | 1.12 | 1.40 | 1.68 | 1.96 | 2.24 | 2.52 | 2.80 |
| | 80 | 0.03 | 0.06 | 0.16 | 0.32 | 0.64 | 0.96 | 1.28 | 1.60 | 1.92 | 2.24 | 2.56 | 2.88 | 3.20 |
| | 90 | 0.04 | 0.07 | 0.18 | 0.36 | 0.72 | 1.08 | 1.44 | 1.80 | 2.16 | 2.52 | 2.88 | 3.24 | 3.60 |
| | 100 | 0.04 | 0.08 | 0.20 | 0.40 | 0.80 | 1.20 | 1.60 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 |

Table 3-14: Mean predicted red-throated diver mortality for the Displacement Study Area during post-breeding season (design-based).

| Red-throated diver (Post-breeding) | Mortality (%) | | | | | | | | | | | | | |
|------------------------------------|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | | 1 | 2 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.00 | 0.01 | 0.02 | 0.04 | 0.08 | 0.12 | 0.16 | 0.20 | 0.24 | 0.28 | 0.32 | 0.36 | 0.40 |
| | 20 | 0.01 | 0.02 | 0.04 | 0.08 | 0.16 | 0.24 | 0.32 | 0.40 | 0.48 | 0.56 | 0.64 | 0.72 | 0.80 |
| | 30 | 0.01 | 0.02 | 0.06 | 0.12 | 0.24 | 0.36 | 0.48 | 0.60 | 0.72 | 0.84 | 0.96 | 1.08 | 1.20 |
| | 40 | 0.02 | 0.03 | 0.08 | 0.16 | 0.32 | 0.48 | 0.64 | 0.80 | 0.96 | 1.12 | 1.28 | 1.44 | 1.60 |
| | 50 | 0.02 | 0.04 | 0.10 | 0.20 | 0.40 | 0.60 | 0.80 | 1.00 | 1.20 | 1.40 | 1.60 | 1.80 | 2.00 |
| | 60 | 0.02 | 0.05 | 0.12 | 0.24 | 0.48 | 0.72 | 0.96 | 1.20 | 1.44 | 1.68 | 1.92 | 2.16 | 2.40 |
| | 70 | 0.03 | 0.06 | 0.14 | 0.28 | 0.56 | 0.84 | 1.12 | 1.40 | 1.68 | 1.96 | 2.24 | 2.52 | 2.80 |
| | 80 | 0.03 | 0.06 | 0.16 | 0.32 | 0.64 | 0.96 | 1.28 | 1.60 | 1.92 | 2.24 | 2.56 | 2.88 | 3.20 |
| | 90 | 0.04 | 0.07 | 0.18 | 0.36 | 0.72 | 1.08 | 1.44 | 1.80 | 2.16 | 2.52 | 2.88 | 3.24 | 3.60 |
| | 100 | 0.04 | 0.08 | 0.20 | 0.40 | 0.80 | 1.20 | 1.60 | 2.00 | 2.40 | 2.80 | 3.20 | 3.60 | 4.00 |

Table 3-15: Mean predicted red-throated diver mortality for the Displacement Study Area during non-breeding season (design-based).

| Red-throated diver (Non-breeding) | Mortality (%) | | | | | | | | | | | | | | |
|-----------------------------------|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| | | 1 | 2 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | |
| Displacement level (%) | 10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 100 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |

3.2.6 GREAT NORTHERN DIVER

Table 3-16: Mean predicted great northern diver mortality for the Displacement Study Area during non-breeding season (design-based).

| Great northern diver (Non-breeding) | Mortality (%) | | | | | | | | | | | | | |
|-------------------------------------|---------------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|
| | | 1 | 2 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.03 | 0.05 | 0.14 | 0.27 | 0.54 | 0.81 | 1.08 | 1.35 | 1.62 | 1.89 | 2.16 | 2.43 | 2.70 |
| | 20 | 0.05 | 0.11 | 0.27 | 0.54 | 1.08 | 1.62 | 2.16 | 2.70 | 3.24 | 3.78 | 4.32 | 4.86 | 5.40 |
| | 30 | 0.08 | 0.16 | 0.41 | 0.81 | 1.62 | 2.43 | 3.24 | 4.05 | 4.86 | 5.67 | 6.48 | 7.29 | 8.10 |
| | 40 | 0.11 | 0.22 | 0.54 | 1.08 | 2.16 | 3.24 | 4.32 | 5.40 | 6.48 | 7.56 | 8.64 | 9.72 | 10.80 |
| | 50 | 0.14 | 0.27 | 0.68 | 1.35 | 2.70 | 4.05 | 5.40 | 6.75 | 8.10 | 9.45 | 10.80 | 12.15 | 13.50 |
| | 60 | 0.16 | 0.32 | 0.81 | 1.62 | 3.24 | 4.86 | 6.48 | 8.10 | 9.72 | 11.34 | 12.96 | 14.58 | 16.20 |
| | 70 | 0.19 | 0.38 | 0.95 | 1.89 | 3.78 | 5.67 | 7.56 | 9.45 | 11.34 | 13.23 | 15.12 | 17.01 | 18.90 |
| | 80 | 0.22 | 0.43 | 1.08 | 2.16 | 4.32 | 6.48 | 8.64 | 10.80 | 12.96 | 15.12 | 17.28 | 19.44 | 21.60 |
| | 90 | 0.24 | 0.49 | 1.22 | 2.43 | 4.86 | 7.29 | 9.72 | 12.15 | 14.58 | 17.01 | 19.44 | 21.87 | 24.30 |
| | 100 | 0.27 | 0.54 | 1.35 | 2.70 | 5.40 | 8.10 | 10.80 | 13.50 | 16.20 | 18.90 | 21.60 | 24.30 | 27.00 |

3.2.7 GANNET

Table 3-17: Mean predicted gannet mortality for the Displacement Study Area during pre-breeding season (design-based).

| Gannet (Pre-breeding) | Mortality (%) | | | | | | | | | | | | | | | |
|---------------------------|---------------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|--|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | |
| Displacement level (%) | 10 | 0.02 | 0.04 | 0.07 | 0.11 | 0.22 | 0.44 | 0.66 | 0.88 | 1.10 | 1.32 | 1.54 | 1.76 | 1.98 | 2.20 | |
| | 20 | 0.04 | 0.09 | 0.13 | 0.22 | 0.44 | 0.88 | 1.32 | 1.76 | 2.20 | 2.64 | 3.08 | 3.52 | 3.96 | 4.40 | |
| | 30 | 0.07 | 0.13 | 0.20 | 0.33 | 0.66 | 1.32 | 1.98 | 2.64 | 3.30 | 3.96 | 4.62 | 5.28 | 5.94 | 6.60 | |
| | 40 | 0.09 | 0.18 | 0.26 | 0.44 | 0.88 | 1.76 | 2.64 | 3.52 | 4.40 | 5.28 | 6.16 | 7.04 | 7.92 | 8.80 | |
| | 50 | 0.11 | 0.22 | 0.33 | 0.55 | 1.10 | 2.20 | 3.30 | 4.40 | 5.50 | 6.60 | 7.70 | 8.80 | 9.90 | 11.00 | |
| | 60 | 0.13 | 0.26 | 0.40 | 0.66 | 1.32 | 2.64 | 3.96 | 5.28 | 6.60 | 7.92 | 9.24 | 10.56 | 11.88 | 13.20 | |
| | 70 | 0.15 | 0.31 | 0.46 | 0.77 | 1.54 | 3.08 | 4.62 | 6.16 | 7.70 | 9.24 | 10.78 | 12.32 | 13.86 | 15.40 | |
| | 80 | 0.18 | 0.35 | 0.53 | 0.88 | 1.76 | 3.52 | 5.28 | 7.04 | 8.80 | 10.56 | 12.32 | 14.08 | 15.84 | 17.60 | |
| | 90 | 0.20 | 0.40 | 0.59 | 0.99 | 1.98 | 3.96 | 5.94 | 7.92 | 9.90 | 11.88 | 13.86 | 15.84 | 17.82 | 19.80 | |
| | 100 | 0.22 | 0.44 | 0.66 | 1.10 | 2.20 | 4.40 | 6.60 | 8.80 | 11.00 | 13.20 | 15.40 | 17.60 | 19.80 | 22.00 | |

Table 3-18: Mean predicted gannet mortality for the Displacement Study Area during breeding season (design-based).

| Gannet (Breeding) | Mortality (%) | | | | | | | | | | | | | | |
|------------------------|---------------|------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.45 | 0.90 | 1.36 | 2.26 | 4.52 | 9.04 | 13.56 | 18.08 | 22.60 | 27.12 | 31.64 | 36.16 | 40.68 | 45.20 |
| | 20 | 0.90 | 1.81 | 2.71 | 4.52 | 9.04 | 18.08 | 27.12 | 36.16 | 45.20 | 54.24 | 63.28 | 72.32 | 81.36 | 90.40 |
| | 30 | 1.36 | 2.71 | 4.07 | 6.78 | 13.56 | 27.12 | 40.68 | 54.24 | 67.80 | 81.36 | 94.92 | 108.48 | 122.04 | 135.60 |
| | 40 | 1.81 | 3.62 | 5.42 | 9.04 | 18.08 | 36.16 | 54.24 | 72.32 | 90.40 | 108.48 | 126.56 | 144.64 | 162.72 | 180.80 |
| | 50 | 2.26 | 4.52 | 6.78 | 11.30 | 22.60 | 45.20 | 67.80 | 90.40 | 113.00 | 135.60 | 158.20 | 180.80 | 203.40 | 226.00 |
| | 60 | 2.71 | 5.42 | 8.14 | 13.56 | 27.12 | 54.24 | 81.36 | 108.48 | 135.60 | 162.72 | 189.84 | 216.96 | 244.08 | 271.20 |
| | 70 | 3.16 | 6.33 | 9.49 | 15.82 | 31.64 | 63.28 | 94.92 | 126.56 | 158.20 | 189.84 | 221.48 | 253.12 | 284.76 | 316.40 |
| | 80 | 3.62 | 7.23 | 10.85 | 18.08 | 36.16 | 72.32 | 108.48 | 144.64 | 180.80 | 216.96 | 253.12 | 289.28 | 325.44 | 361.60 |
| | 90 | 4.07 | 8.14 | 12.20 | 20.34 | 40.68 | 81.36 | 122.04 | 162.72 | 203.40 | 244.08 | 284.76 | 325.44 | 366.12 | 406.80 |
| | 100 | 4.52 | 9.04 | 13.56 | 22.60 | 45.20 | 90.40 | 135.60 | 180.80 | 226.00 | 271.20 | 316.40 | 361.60 | 406.80 | 452.00 |

Table 3-19 Mean predicted gannet mortality for the Displacement Study Area during post-breeding season (design-based).

| Gannet (Post-breeding) | Mortality (%) | | | | | | | | | | | | | | |
|------------------------|---------------|------|------|------|------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.16 | 0.33 | 0.49 | 0.82 | 1.64 | 3.28 | 4.92 | 6.56 | 8.20 | 9.84 | 0.00 | 13.12 | 14.76 | 16.40 |
| | 20 | 0.33 | 0.66 | 0.98 | 1.64 | 3.28 | 6.56 | 9.84 | 13.12 | 16.40 | 19.68 | 22.96 | 26.24 | 29.52 | 32.80 |
| | 30 | 0.49 | 0.98 | 1.48 | 2.46 | 4.92 | 9.84 | 14.76 | 19.68 | 24.60 | 29.52 | 34.44 | 39.36 | 44.28 | 49.20 |
| | 40 | 0.66 | 1.31 | 1.97 | 3.28 | 6.56 | 13.12 | 19.68 | 26.24 | 32.80 | 39.36 | 45.92 | 52.48 | 59.04 | 65.60 |
| | 50 | 0.82 | 1.64 | 2.46 | 4.10 | 8.20 | 16.40 | 24.60 | 32.80 | 41.00 | 49.20 | 57.40 | 65.60 | 73.80 | 82.00 |
| | 60 | 0.98 | 1.97 | 2.95 | 4.92 | 9.84 | 19.68 | 29.52 | 39.36 | 49.20 | 59.04 | 68.88 | 78.72 | 88.56 | 98.40 |
| | 70 | 1.15 | 2.30 | 3.44 | 5.74 | 11.48 | 22.96 | 34.44 | 45.92 | 57.40 | 68.88 | 80.36 | 91.84 | 103.32 | 114.80 |
| | 80 | 1.31 | 2.62 | 3.94 | 6.56 | 13.12 | 26.24 | 39.36 | 52.48 | 65.60 | 78.72 | 91.84 | 104.96 | 118.08 | 131.20 |
| | 90 | 1.48 | 2.95 | 4.43 | 7.38 | 14.76 | 29.52 | 44.28 | 59.04 | 73.80 | 88.56 | 103.32 | 118.08 | 132.84 | 147.60 |
| | 100 | 1.64 | 3.28 | 4.92 | 8.20 | 16.40 | 32.80 | 49.20 | 65.60 | 82.00 | 98.40 | 114.80 | 131.20 | 147.60 | 164.00 |

3.3 MRSEA-BASED ABUNDANCE ESTIMATES

3.3.1 KITTIWAKE

Table 3-20: Mean predicted kittiwake mortality based on MRSea modelled data for the Displacement Study Area during pre-breeding season.

| Kittiwake (Pre- breeding) | Mortality (%) | | | | | | | | | | | | | | |
|---------------------------------|---------------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.66 | 1.32 | 1.98 | 3.30 | 6.60 | 13.21 | 19.81 | 26.42 | 33.02 | 39.63 | 46.23 | 52.84 | 59.44 | 66.05 |
| | 20 | 1.32 | 2.64 | 3.96 | 6.60 | 13.21 | 26.42 | 39.63 | 52.84 | 66.05 | 79.26 | 92.47 | 105.68 | 118.88 | 132.09 |
| | 30 | 1.98 | 3.96 | 5.94 | 9.91 | 19.81 | 39.63 | 59.44 | 79.26 | 99.07 | 118.88 | 138.70 | 158.51 | 178.33 | 198.14 |
| | 40 | 2.64 | 5.28 | 7.93 | 13.21 | 26.42 | 52.84 | 79.26 | 105.68 | 132.09 | 158.51 | 184.93 | 211.35 | 237.77 | 264.19 |
| | 50 | 3.30 | 6.60 | 9.91 | 16.51 | 33.02 | 66.05 | 99.07 | 132.09 | 165.12 | 198.14 | 231.17 | 264.19 | 297.21 | 330.24 |
| | 60 | 3.96 | 7.93 | 11.89 | 19.81 | 39.63 | 79.26 | 118.88 | 158.51 | 198.14 | 237.77 | 277.40 | 317.03 | 356.65 | 396.28 |
| | 70 | 4.62 | 9.25 | 13.87 | 23.12 | 46.23 | 92.47 | 138.70 | 184.93 | 231.17 | 277.40 | 323.63 | 369.86 | 416.10 | 462.33 |
| | 80 | 5.28 | 10.57 | 15.85 | 26.42 | 52.84 | 105.68 | 158.51 | 211.35 | 264.19 | 317.03 | 369.86 | 422.70 | 475.54 | 528.38 |
| | 90 | 5.94 | 11.89 | 17.83 | 29.72 | 59.44 | 118.88 | 178.33 | 237.77 | 297.21 | 356.65 | 416.10 | 475.54 | 534.98 | 594.42 |
| | 100 | 6.60 | 13.21 | 19.81 | 33.02 | 66.05 | 132.09 | 198.14 | 264.19 | 330.24 | 396.28 | 462.33 | 528.38 | 594.42 | 660.47 |

Table 3-21: Mean predicted kittiwake mortality based on MRSea modelled data for the Displacement Study Area during breeding season.

| Kittiwake (Breeding) | Mortality (%) | | | | | | | | | | | | | | |
|---------------------------|---------------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.03 | 0.07 | 0.10 | 0.16 | 0.33 | 0.66 | 0.99 | 1.32 | 1.65 | 1.98 | 2.31 | 2.64 | 2.97 | 3.30 |
| | 20 | 0.07 | 0.13 | 0.20 | 0.33 | 0.66 | 1.32 | 1.98 | 2.64 | 3.30 | 3.96 | 4.61 | 5.27 | 5.93 | 6.59 |
| | 30 | 0.10 | 0.20 | 0.30 | 0.49 | 0.99 | 1.98 | 2.97 | 3.96 | 4.94 | 5.93 | 6.92 | 7.91 | 8.90 | 9.89 |
| | 40 | 0.13 | 0.26 | 0.40 | 0.66 | 1.32 | 2.64 | 3.96 | 5.27 | 6.59 | 7.91 | 9.23 | 10.55 | 11.87 | 13.18 |
| | 50 | 0.16 | 0.33 | 0.49 | 0.82 | 1.65 | 3.30 | 4.94 | 6.59 | 8.24 | 9.89 | 11.54 | 13.18 | 14.83 | 16.48 |
| | 60 | 0.20 | 0.40 | 0.59 | 0.99 | 1.98 | 3.96 | 5.93 | 7.91 | 9.89 | 11.87 | 13.84 | 15.82 | 17.80 | 19.78 |
| | 70 | 0.23 | 0.46 | 0.69 | 1.15 | 2.31 | 4.61 | 6.92 | 9.23 | 11.54 | 13.84 | 16.15 | 18.46 | 20.76 | 23.07 |
| | 80 | 0.26 | 0.53 | 0.79 | 1.32 | 2.64 | 5.27 | 7.91 | 10.55 | 13.18 | 15.82 | 18.46 | 21.09 | 23.73 | 26.37 |
| | 90 | 0.30 | 0.59 | 0.89 | 1.48 | 2.97 | 5.93 | 8.90 | 11.87 | 14.83 | 17.80 | 20.76 | 23.73 | 26.70 | 29.66 |
| | 100 | 0.33 | 0.66 | 0.99 | 1.65 | 3.30 | 6.59 | 9.89 | 13.18 | 16.48 | 19.78 | 23.07 | 26.37 | 29.66 | 32.96 |

Table 3-22: Mean predicted kittiwake mortality based on MRSea modelled data for the Displacement Study Area during post-breeding season.

| Kittiwake (Post- breeding) | Mortality (%) | | | | | | | | | | | | | | |
|----------------------------------|---------------|------|------|------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.22 | 0.43 | 0.65 | 1.08 | 2.17 | 4.33 | 6.50 | 8.66 | 10.83 | 12.99 | 15.16 | 17.32 | 19.49 | 21.65 |
| | 20 | 0.43 | 0.87 | 1.30 | 2.17 | 4.33 | 8.66 | 12.99 | 17.32 | 21.65 | 25.98 | 30.31 | 34.64 | 38.97 | 43.30 |
| | 30 | 0.65 | 1.30 | 1.95 | 3.25 | 6.50 | 12.99 | 19.49 | 25.98 | 32.48 | 38.97 | 45.47 | 51.96 | 58.46 | 64.95 |
| | 40 | 0.87 | 1.73 | 2.60 | 4.33 | 8.66 | 17.32 | 25.98 | 34.64 | 43.30 | 51.96 | 60.62 | 69.28 | 77.94 | 86.60 |
| | 50 | 1.08 | 2.17 | 3.25 | 5.41 | 10.83 | 21.65 | 32.48 | 43.30 | 54.13 | 64.95 | 75.78 | 86.60 | 97.43 | 108.25 |
| | 60 | 1.30 | 2.60 | 3.90 | 6.50 | 12.99 | 25.98 | 38.97 | 51.96 | 64.95 | 77.94 | 90.93 | 103.92 | 116.91 | 129.90 |
| | 70 | 1.52 | 3.03 | 4.55 | 7.58 | 15.16 | 30.31 | 45.47 | 60.62 | 75.78 | 90.93 | 106.09 | 121.24 | 136.40 | 151.55 |
| | 80 | 1.73 | 3.46 | 5.20 | 8.66 | 17.32 | 34.64 | 51.96 | 69.28 | 86.60 | 103.92 | 121.24 | 138.56 | 155.88 | 173.20 |
| | 90 | 1.95 | 3.90 | 5.85 | 9.74 | 19.49 | 38.97 | 58.46 | 77.94 | 97.43 | 116.91 | 136.40 | 155.88 | 175.37 | 194.85 |
| | 100 | 2.17 | 4.33 | 6.50 | 10.83 | 21.65 | 43.30 | 64.95 | 86.60 | 108.25 | 129.90 | 151.55 | 173.20 | 194.85 | 216.50 |

3.3.2 GUILLEMOT

Table 3-23: Mean predicted guillemot mortality based on MRSea modelled data for the Displacement Study Area during breeding season.

| Guillemot (Breeding) | Mortality (%) | | | | | | | | | | | | | | |
|------------------------|---------------|------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.48 | 0.97 | 1.45 | 2.42 | 4.84 | 9.69 | 14.53 | 19.37 | 24.22 | 29.06 | 33.90 | 38.75 | 43.59 | 48.43 |
| | 20 | 0.97 | 1.94 | 2.91 | 4.84 | 9.69 | 19.37 | 29.06 | 38.75 | 48.43 | 58.12 | 67.81 | 77.50 | 87.18 | 96.87 |
| | 30 | 1.45 | 2.91 | 4.36 | 7.27 | 14.53 | 29.06 | 43.59 | 58.12 | 72.65 | 87.18 | 101.71 | 116.24 | 130.77 | 145.30 |
| | 40 | 1.94 | 3.87 | 5.81 | 9.69 | 19.37 | 38.75 | 58.12 | 77.50 | 96.87 | 116.24 | 135.62 | 154.99 | 174.36 | 193.74 |
| | 50 | 2.42 | 4.84 | 7.27 | 12.11 | 24.22 | 48.43 | 72.65 | 96.87 | 121.09 | 145.30 | 169.52 | 193.74 | 217.96 | 242.17 |
| | 60 | 2.91 | 5.81 | 8.72 | 14.53 | 29.06 | 58.12 | 87.18 | 116.24 | 145.30 | 174.36 | 203.43 | 232.49 | 261.55 | 290.61 |
| | 70 | 3.39 | 6.78 | 10.17 | 16.95 | 33.90 | 67.81 | 101.71 | 135.62 | 169.52 | 203.43 | 237.33 | 271.23 | 305.14 | 339.04 |
| | 80 | 3.87 | 7.75 | 11.62 | 19.37 | 38.75 | 77.50 | 116.24 | 154.99 | 193.74 | 232.49 | 271.23 | 309.98 | 348.73 | 387.48 |
| | 90 | 4.36 | 8.72 | 13.08 | 21.80 | 43.59 | 87.18 | 130.77 | 174.36 | 217.96 | 261.55 | 305.14 | 348.73 | 392.32 | 435.91 |
| | 100 | 4.84 | 9.69 | 14.53 | 24.22 | 48.43 | 96.87 | 145.30 | 193.74 | 242.17 | 290.61 | 339.04 | 387.48 | 435.91 | 484.35 |

Table 3-24: Mean predicted guillemot mortality based on MRSea modelled data for the Displacement Study Area during non-breeding season.

| Guillemot (Non-breeding) | Mortality (%) | | | | | | | | | | | | | | |
|--------------------------|---------------|-------|-------|-------|--------|--------|--------|--------|----------|----------|----------|----------|----------|----------|----------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 2.66 | 5.32 | 7.98 | 13.31 | 26.61 | 53.22 | 79.83 | 106.44 | 133.05 | 159.66 | 186.27 | 212.88 | 239.49 | 266.10 |
| | 20 | 5.32 | 10.64 | 15.97 | 26.61 | 53.22 | 106.44 | 159.66 | 212.88 | 266.10 | 319.32 | 372.54 | 425.76 | 478.98 | 532.20 |
| | 30 | 7.98 | 15.97 | 23.95 | 39.92 | 79.83 | 159.66 | 239.49 | 319.32 | 399.15 | 478.98 | 558.81 | 638.64 | 718.47 | 798.30 |
| | 40 | 10.64 | 21.29 | 31.93 | 53.22 | 106.44 | 212.88 | 319.32 | 425.76 | 532.20 | 638.64 | 745.08 | 851.52 | 957.96 | 1,064.40 |
| | 50 | 13.31 | 26.61 | 39.92 | 66.53 | 133.05 | 266.10 | 399.15 | 532.20 | 665.25 | 798.30 | 931.35 | 1,064.40 | 1,197.45 | 1,330.50 |
| | 60 | 15.97 | 31.93 | 47.90 | 79.83 | 159.66 | 319.32 | 478.98 | 638.64 | 798.30 | 957.96 | 1,117.62 | 1,277.28 | 1,436.94 | 1,596.60 |
| | 70 | 18.63 | 37.25 | 55.88 | 93.14 | 186.27 | 372.54 | 558.81 | 745.08 | 931.35 | 1,117.62 | 1,303.89 | 1,490.16 | 1,676.43 | 1,862.70 |
| | 80 | 21.29 | 42.58 | 63.86 | 106.44 | 212.88 | 425.76 | 638.64 | 851.52 | 1,064.40 | 1,277.28 | 1,490.16 | 1,703.04 | 1,915.92 | 2,128.80 |
| | 90 | 23.95 | 47.90 | 71.85 | 119.75 | 239.49 | 478.98 | 718.47 | 957.96 | 1,197.45 | 1,436.94 | 1,676.43 | 1,915.92 | 2,155.41 | 2,394.90 |
| | 100 | 26.61 | 53.22 | 79.83 | 133.05 | 266.10 | 532.20 | 798.30 | 1,064.40 | 1,330.50 | 1,596.60 | 1,862.70 | 2,128.80 | 2,394.90 | 2,661.00 |

3.3.3 RAZORBILL

Table 3-25: Mean predicted razorbill mortality based on MRSea modelled data for the Displacement Study Area during pre-breeding season.

| Razorbill (Pre- breeding) | Mortality (%) | | | | | | | | | | | | | | |
|---------------------------------|---------------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.65 | 1.30 | 1.95 | 3.24 | 6.49 | 12.98 | 19.47 | 25.96 | 32.45 | 38.94 | 45.43 | 51.92 | 58.41 | 64.90 |
| | 20 | 1.30 | 2.60 | 3.89 | 6.49 | 12.98 | 25.96 | 38.94 | 51.92 | 64.90 | 77.88 | 90.85 | 103.83 | 116.81 | 129.79 |
| | 30 | 1.95 | 3.89 | 5.84 | 9.73 | 19.47 | 38.94 | 58.41 | 77.88 | 97.34 | 116.81 | 136.28 | 155.75 | 175.22 | 194.69 |
| | 40 | 2.60 | 5.19 | 7.79 | 12.98 | 25.96 | 51.92 | 77.88 | 103.83 | 129.79 | 155.75 | 181.71 | 207.67 | 233.63 | 259.58 |
| | 50 | 3.24 | 6.49 | 9.73 | 16.22 | 32.45 | 64.90 | 97.34 | 129.79 | 162.24 | 194.69 | 227.14 | 259.58 | 292.03 | 324.48 |
| | 60 | 3.89 | 7.79 | 11.68 | 19.47 | 38.94 | 77.88 | 116.81 | 155.75 | 194.69 | 233.63 | 272.56 | 311.50 | 350.44 | 389.38 |
| | 70 | 4.54 | 9.09 | 13.63 | 22.71 | 45.43 | 90.85 | 136.28 | 181.71 | 227.14 | 272.56 | 317.99 | 363.42 | 408.84 | 454.27 |
| | 80 | 5.19 | 10.38 | 15.58 | 25.96 | 51.92 | 103.83 | 155.75 | 207.67 | 259.58 | 311.50 | 363.42 | 415.33 | 467.25 | 519.17 |
| | 90 | 5.84 | 11.68 | 17.52 | 29.20 | 58.41 | 116.81 | 175.22 | 233.63 | 292.03 | 350.44 | 408.84 | 467.25 | 525.66 | 584.06 |
| | 100 | 6.49 | 12.98 | 19.47 | 32.45 | 64.90 | 129.79 | 194.69 | 259.58 | 324.48 | 389.38 | 454.27 | 519.17 | 584.06 | 648.96 |

Table 3-26: Mean predicted razorbill mortality based on MRSea modelled data for the Displacement Study Area during breeding season.

| Razorbill (Breeding) | Mortality (%) | | | | | | | | | | | | | | |
|---------------------------|---------------|------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.41 | 0.82 | 1.23 | 2.05 | 4.10 | 8.20 | 12.30 | 16.39 | 20.49 | 24.59 | 28.69 | 32.79 | 36.89 | 40.99 |
| | 20 | 0.82 | 1.64 | 2.46 | 4.10 | 8.20 | 16.39 | 24.59 | 32.79 | 40.99 | 49.18 | 57.38 | 65.58 | 73.78 | 81.97 |
| | 30 | 1.23 | 2.46 | 3.69 | 6.15 | 12.30 | 24.59 | 36.89 | 49.18 | 61.48 | 73.78 | 86.07 | 98.37 | 110.66 | 122.96 |
| | 40 | 1.64 | 3.28 | 4.92 | 8.20 | 16.39 | 32.79 | 49.18 | 65.58 | 81.97 | 98.37 | 114.76 | 131.16 | 147.55 | 163.95 |
| | 50 | 2.05 | 4.10 | 6.15 | 10.25 | 20.49 | 40.99 | 61.48 | 81.97 | 102.47 | 122.96 | 143.45 | 163.95 | 184.44 | 204.93 |
| | 60 | 2.46 | 4.92 | 7.38 | 12.30 | 24.59 | 49.18 | 73.78 | 98.37 | 122.96 | 147.55 | 172.14 | 196.73 | 221.33 | 245.92 |
| | 70 | 2.87 | 5.74 | 8.61 | 14.35 | 28.69 | 57.38 | 86.07 | 114.76 | 143.45 | 172.14 | 200.83 | 229.52 | 258.21 | 286.90 |
| | 80 | 3.28 | 6.56 | 9.84 | 16.39 | 32.79 | 65.58 | 98.37 | 131.16 | 163.95 | 196.73 | 229.52 | 262.31 | 295.10 | 327.89 |
| | 90 | 3.69 | 7.38 | 11.07 | 18.44 | 36.89 | 73.78 | 110.66 | 147.55 | 184.44 | 221.33 | 258.21 | 295.10 | 331.99 | 368.88 |
| | 100 | 4.10 | 8.20 | 12.30 | 20.49 | 40.99 | 81.97 | 122.96 | 163.95 | 204.93 | 245.92 | 286.90 | 327.89 | 368.88 | 409.86 |

Table 3-27 Mean predicted razorbill mortality based on MRSea modelled data for the Displacement Study Area during post-breeding season.

| Razorbill (Post- breeding) | Mortality (%) | | | | | | | | | | | | | | |
|----------------------------------|---------------|------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.47 | 0.93 | 1.40 | 2.34 | 4.67 | 9.34 | 14.02 | 18.69 | 23.36 | 28.03 | 32.71 | 37.38 | 42.05 | 46.72 |
| | 20 | 0.93 | 1.87 | 2.80 | 4.67 | 9.34 | 18.69 | 28.03 | 37.38 | 46.72 | 56.07 | 65.41 | 74.76 | 84.10 | 93.45 |
| | 30 | 1.40 | 2.80 | 4.21 | 7.01 | 14.02 | 28.03 | 42.05 | 56.07 | 70.08 | 84.10 | 98.12 | 112.13 | 126.15 | 140.17 |
| | 40 | 1.87 | 3.74 | 5.61 | 9.34 | 18.69 | 37.38 | 56.07 | 74.76 | 93.45 | 112.13 | 130.82 | 149.51 | 168.20 | 186.89 |
| | 50 | 2.34 | 4.67 | 7.01 | 11.68 | 23.36 | 46.72 | 70.08 | 93.45 | 116.81 | 140.17 | 163.53 | 186.89 | 210.25 | 233.61 |
| | 60 | 2.80 | 5.61 | 8.41 | 14.02 | 28.03 | 56.07 | 84.10 | 112.13 | 140.17 | 168.20 | 196.23 | 224.27 | 252.30 | 280.34 |
| | 70 | 3.27 | 6.54 | 9.81 | 16.35 | 32.71 | 65.41 | 98.12 | 130.82 | 163.53 | 196.23 | 228.94 | 261.65 | 294.35 | 327.06 |
| | 80 | 3.74 | 7.48 | 11.21 | 18.69 | 37.38 | 74.76 | 112.13 | 149.51 | 186.89 | 224.27 | 261.65 | 299.02 | 336.40 | 373.78 |
| | 90 | 4.21 | 8.41 | 12.62 | 21.03 | 42.05 | 84.10 | 126.15 | 168.20 | 210.25 | 252.30 | 294.35 | 336.40 | 378.45 | 420.50 |
| | 100 | 4.67 | 9.34 | 14.02 | 23.36 | 46.72 | 93.45 | 140.17 | 186.89 | 233.61 | 280.34 | 327.06 | 373.78 | 420.50 | 467.23 |

Table 3-28: Mean predicted razorbill mortality based on MRSea modelled data for the Displacement Study Area during non-breeding season.

| Razorbill (Non- breeding) | Mortality (%) | | | | | | | | | | | | | | | |
|---------------------------------|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | |
| Displacement level (%) | 10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | 100 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |

3.3.4 PUFFIN

Table 3-29: Mean predicted puffin mortality based on MRSea modelled data for the Displacement Study Area during breeding season.

| Puffin (Breeding) | Mortality (%) | | | | | | | | | | | | | | | |
|------------------------|---------------|-------|-------|--------|--------|--------|--------|----------|----------|----------|----------|----------|----------|----------|----------|--|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | |
| Displacement level (%) | 10 | 3.92 | 7.83 | 11.75 | 19.58 | 39.17 | 78.33 | 117.50 | 156.66 | 195.83 | 234.99 | 274.16 | 313.32 | 352.49 | 391.65 | |
| | 20 | 7.83 | 15.67 | 23.50 | 39.17 | 78.33 | 156.66 | 234.99 | 313.32 | 391.65 | 469.98 | 548.31 | 626.64 | 704.97 | 783.30 | |
| | 30 | 11.75 | 23.50 | 35.25 | 58.75 | 117.50 | 234.99 | 352.49 | 469.98 | 587.48 | 704.97 | 822.47 | 939.96 | 1,057.46 | 1,174.95 | |
| | 40 | 15.67 | 31.33 | 47.00 | 78.33 | 156.66 | 313.32 | 469.98 | 626.64 | 783.30 | 939.96 | 1,096.62 | 1,253.28 | 1,409.94 | 1,566.60 | |
| | 50 | 19.58 | 39.17 | 58.75 | 97.91 | 195.83 | 391.65 | 587.48 | 783.30 | 979.13 | 1,174.95 | 1,370.78 | 1,566.60 | 1,762.43 | 1,958.25 | |
| | 60 | 23.50 | 47.00 | 70.50 | 117.50 | 234.99 | 469.98 | 704.97 | 939.96 | 1,174.95 | 1,409.94 | 1,644.93 | 1,879.92 | 2,114.91 | 2,349.90 | |
| | 70 | 27.42 | 54.83 | 82.25 | 137.08 | 274.16 | 548.31 | 822.47 | 1,096.62 | 1,370.78 | 1,644.93 | 1,919.09 | 2,193.24 | 2,467.40 | 2,741.55 | |
| | 80 | 31.33 | 62.66 | 94.00 | 156.66 | 313.32 | 626.64 | 939.96 | 1,253.28 | 1,566.60 | 1,879.92 | 2,193.24 | 2,506.56 | 2,819.88 | 3,133.20 | |
| | 90 | 35.25 | 70.50 | 105.75 | 176.24 | 352.49 | 704.97 | 1,057.46 | 1,409.94 | 1,762.43 | 2,114.91 | 2,467.40 | 2,819.88 | 3,172.37 | 3,524.85 | |
| | 100 | 39.17 | 78.33 | 117.50 | 195.83 | 391.65 | 783.30 | 1,174.95 | 1,566.60 | 1,958.25 | 2,349.90 | 2,741.55 | 3,133.20 | 3,524.85 | 3,916.50 | |

Table 3-30: Mean predicted puffin mortality based on MRSea modelled data for the Displacement Study Area during non-breeding season.

| Puffin (Non-breeding) | Mortality (%) | | | | | | | | | | | | | | |
|------------------------|---------------|------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.37 | 0.75 | 1.12 | 1.87 | 3.74 | 7.48 | 11.22 | 14.96 | 18.70 | 22.44 | 26.18 | 29.92 | 33.66 | 37.40 |
| | 20 | 0.75 | 1.50 | 2.24 | 3.74 | 7.48 | 14.96 | 22.44 | 29.92 | 37.40 | 44.88 | 52.36 | 59.84 | 67.32 | 74.80 |
| | 30 | 1.12 | 2.24 | 3.37 | 5.61 | 11.22 | 22.44 | 33.66 | 44.88 | 56.10 | 67.32 | 78.54 | 89.76 | 100.98 | 112.20 |
| | 40 | 1.50 | 2.99 | 4.49 | 7.48 | 14.96 | 29.92 | 44.88 | 59.84 | 74.80 | 89.76 | 104.72 | 119.68 | 134.64 | 149.60 |
| | 50 | 1.87 | 3.74 | 5.61 | 9.35 | 18.70 | 37.40 | 56.10 | 74.80 | 93.50 | 112.20 | 130.90 | 149.60 | 168.30 | 187.00 |
| | 60 | 2.24 | 4.49 | 6.73 | 11.22 | 22.44 | 44.88 | 67.32 | 89.76 | 112.20 | 134.64 | 157.08 | 179.52 | 201.96 | 224.40 |
| | 70 | 2.62 | 5.24 | 7.85 | 13.09 | 26.18 | 52.36 | 78.54 | 104.72 | 130.90 | 157.08 | 183.26 | 209.44 | 235.62 | 261.80 |
| | 80 | 2.99 | 5.98 | 8.98 | 14.96 | 29.92 | 59.84 | 89.76 | 119.68 | 149.60 | 179.52 | 209.44 | 239.36 | 269.28 | 299.20 |
| | 90 | 3.37 | 6.73 | 10.10 | 16.83 | 33.66 | 67.32 | 100.98 | 134.64 | 168.30 | 201.96 | 235.62 | 269.28 | 302.94 | 336.60 |
| | 100 | 3.74 | 7.48 | 11.22 | 18.70 | 37.40 | 74.80 | 112.20 | 149.60 | 187.00 | 224.40 | 261.80 | 299.20 | 336.60 | 374.00 |

3.3.5 GANNET

Table 3-31: Mean predicted gannet mortality based on MRSea modelled data for the Displacement Study Area during pre-breeding season.

| Gannet (Pre- breeding) | Mortality (%) | | | | | | | | | | | | | | |
|------------------------------|---------------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.03 | 0.06 | 0.09 | 0.15 | 0.29 | 0.58 | 0.87 | 1.16 | 1.45 | 1.75 | 2.04 | 2.33 | 2.62 | 2.91 |
| | 20 | 0.06 | 0.12 | 0.17 | 0.29 | 0.58 | 1.16 | 1.75 | 2.33 | 2.91 | 3.49 | 4.07 | 4.66 | 5.24 | 5.82 |
| | 30 | 0.09 | 0.17 | 0.26 | 0.44 | 0.87 | 1.75 | 2.62 | 3.49 | 4.36 | 5.24 | 6.11 | 6.98 | 7.86 | 8.73 |
| | 40 | 0.12 | 0.23 | 0.35 | 0.58 | 1.16 | 2.33 | 3.49 | 4.66 | 5.82 | 6.98 | 8.15 | 9.31 | 10.48 | 11.64 |
| | 50 | 0.15 | 0.29 | 0.44 | 0.73 | 1.45 | 2.91 | 4.36 | 5.82 | 7.27 | 8.73 | 10.18 | 11.64 | 13.09 | 14.55 |
| | 60 | 0.17 | 0.35 | 0.52 | 0.87 | 1.75 | 3.49 | 5.24 | 6.98 | 8.73 | 10.48 | 12.22 | 13.97 | 15.71 | 17.46 |
| | 70 | 0.20 | 0.41 | 0.61 | 1.02 | 2.04 | 4.07 | 6.11 | 8.15 | 10.18 | 12.22 | 14.26 | 16.30 | 18.33 | 20.37 |
| | 80 | 0.23 | 0.47 | 0.70 | 1.16 | 2.33 | 4.66 | 6.98 | 9.31 | 11.64 | 13.97 | 16.30 | 18.62 | 20.95 | 23.28 |
| | 90 | 0.26 | 0.52 | 0.79 | 1.31 | 2.62 | 5.24 | 7.86 | 10.48 | 13.09 | 15.71 | 18.33 | 20.95 | 23.57 | 26.19 |
| | 100 | 0.29 | 0.58 | 0.87 | 1.45 | 2.91 | 5.82 | 8.73 | 11.64 | 14.55 | 17.46 | 20.37 | 23.28 | 26.19 | 29.10 |

Table 3-32 Mean predicted gannet mortality based on MRSea modelled data for the Displacement Study Area during breeding season.

| Gannet (Breeding) | Mortality (%) | | | | | | | | | | | | | | |
|------------------------|---------------|------|------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.43 | 0.86 | 1.29 | 2.16 | 4.31 | 8.63 | 12.94 | 17.25 | 21.57 | 25.88 | 30.19 | 34.51 | 38.82 | 43.13 |
| | 20 | 0.86 | 1.73 | 2.59 | 4.31 | 8.63 | 17.25 | 25.88 | 34.51 | 43.13 | 51.76 | 60.39 | 69.01 | 77.64 | 86.26 |
| | 30 | 1.29 | 2.59 | 3.88 | 6.47 | 12.94 | 25.88 | 38.82 | 51.76 | 64.70 | 77.64 | 90.58 | 103.52 | 116.46 | 129.40 |
| | 40 | 1.73 | 3.45 | 5.18 | 8.63 | 17.25 | 34.51 | 51.76 | 69.01 | 86.26 | 103.52 | 120.77 | 138.02 | 155.28 | 172.53 |
| | 50 | 2.16 | 4.31 | 6.47 | 10.78 | 21.57 | 43.13 | 64.70 | 86.26 | 107.83 | 129.40 | 150.96 | 172.53 | 194.10 | 215.66 |
| | 60 | 2.59 | 5.18 | 7.76 | 12.94 | 25.88 | 51.76 | 77.64 | 103.52 | 129.40 | 155.28 | 181.16 | 207.04 | 232.91 | 258.79 |
| | 70 | 3.02 | 6.04 | 9.06 | 15.10 | 30.19 | 60.39 | 90.58 | 120.77 | 150.96 | 181.16 | 211.35 | 241.54 | 271.73 | 301.93 |
| | 80 | 3.45 | 6.90 | 10.35 | 17.25 | 34.51 | 69.01 | 103.52 | 138.02 | 172.53 | 207.04 | 241.54 | 276.05 | 310.55 | 345.06 |
| | 90 | 3.88 | 7.76 | 11.65 | 19.41 | 38.82 | 77.64 | 116.46 | 155.28 | 194.10 | 232.91 | 271.73 | 310.55 | 349.37 | 388.19 |
| | 100 | 4.31 | 8.63 | 12.94 | 21.57 | 43.13 | 86.26 | 129.40 | 172.53 | 215.66 | 258.79 | 301.93 | 345.06 | 388.19 | 431.32 |

Table 3-33: Mean predicted gannet mortality based on MRSea modelled data for the Displacement Study Area during post-breeding season.

| Gannet (Post-breeding) | Mortality (%) | | | | | | | | | | | | | | |
|------------------------|---------------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 1 | 2 | 3 | 5 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Displacement level (%) | 10 | 0.16 | 0.32 | 0.47 | 0.79 | 1.58 | 3.16 | 4.74 | 6.32 | 7.90 | 9.48 | 11.06 | 12.64 | 14.22 | 15.80 |
| | 20 | 0.32 | 0.63 | 0.95 | 1.58 | 3.16 | 6.32 | 9.48 | 12.64 | 15.80 | 18.96 | 22.12 | 25.28 | 28.44 | 31.60 |
| | 30 | 0.47 | 0.95 | 1.42 | 2.37 | 4.74 | 9.48 | 14.22 | 18.96 | 23.70 | 28.44 | 33.18 | 37.92 | 42.66 | 47.40 |
| | 40 | 0.63 | 1.26 | 1.90 | 3.16 | 6.32 | 12.64 | 18.96 | 25.28 | 31.60 | 37.92 | 44.24 | 50.56 | 56.88 | 63.20 |

| | | | | | | | | | | | | | | | |
|------------------------|---------------|------|------|------|------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|
| Gannet (Post-breeding) | Mortality (%) | | | | | | | | | | | | | | |
| | 50 | 0.79 | 1.58 | 2.37 | 3.95 | 7.90 | 15.80 | 23.70 | 31.60 | 39.50 | 47.40 | 55.30 | 63.20 | 71.10 | 79.00 |
| | 60 | 0.95 | 1.90 | 2.84 | 4.74 | 9.48 | 18.96 | 28.44 | 37.92 | 47.40 | 56.88 | 66.36 | 75.84 | 85.32 | 94.80 |
| | 70 | 1.11 | 2.21 | 3.32 | 5.53 | 11.06 | 22.12 | 33.18 | 44.24 | 55.30 | 66.36 | 77.42 | 88.48 | 99.54 | 110.60 |
| | 80 | 1.26 | 2.53 | 3.79 | 6.32 | 12.64 | 25.28 | 37.92 | 50.56 | 63.20 | 75.84 | 88.48 | 101.12 | 113.76 | 126.40 |
| | 90 | 1.42 | 2.84 | 4.27 | 7.11 | 14.22 | 28.44 | 42.66 | 56.88 | 71.10 | 85.32 | 99.54 | 113.76 | 127.98 | 142.20 |
| | 100 | 1.58 | 3.16 | 4.74 | 7.90 | 15.80 | 31.60 | 47.40 | 63.20 | 79.00 | 94.80 | 110.60 | 126.40 | 142.20 | 158.00 |



This page has intentionally been left blank

4 SUMMARY

4.1.1.1 Table 4-1 provides a summary of the results of the displacement analyses undertaken for each species in Sections 3.2 and 1.1 during the operation and maintenance phase of the Offshore Project.

Table 4-1: Summary of displacement analyses undertaken for the Displacement Study Area

| Species | Season | Approach | Displacement Rate | Mortality Rates | Displacement Mortality (Range) (Design-Based) | Displacement Mortality (Range) (MRSea) |
|--------------------|---------------|------------|-------------------|-----------------|---|--|
| Kittiwake | Pre-breeding | NatureScot | 30% | 1-3% | 1.77-5.31 | 1.98-5.94 |
| | | Applicant | 30% | 1% | 1.77 | 1.98 |
| | Breeding | NatureScot | 30% | 1-3% | 0.10-0.31 | 0.10-0.30 |
| | | Applicant | 30% | 1% | 0.10 | 0.10 |
| | Post-breeding | NatureScot | 30% | 1-3% | 0.64-1.93 | 0.65-1.95 |
| | | Applicant | 30% | 1% | 0.64 | 0.65 |
| Guillemot | Breeding | NatureScot | 60% | 3-5% | 8.08-13.47 | 8.72-14.53 |
| | | Applicant | 50% | 1% | 2.25 | 2.42 |
| | Non-breeding | NatureScot | 60% | 1-3% | 15.37-46.11 | 15.97-47.90 |
| | | Applicant | 50% | 1% | 12.81 | 13.31 |
| Razorbill | Pre-breeding | NatureScot | 60% | 1-3% | 4.11-12.33 | 3.89-11.68 |
| | | Applicant | 50% | 1% | 3.43 | 3.24 |
| | Breeding | NatureScot | 60% | 3-5% | 6.81-11.36 | 7.38-12.30 |
| | | Applicant | 50% | 1% | 1.89 | 2.05 |
| | Post-breeding | NatureScot | 60% | 1-3% | 2.41-7.22 | 2.80-8.41 |
| | | Applicant | 50% | 1% | 2.01 | 2.34 |
| | Non-breeding | NatureScot | 60% | 1-3% | 0.00-0.00 | 0.00-0.00 |
| | | Applicant | 50% | 1% | 0.00 | 0.00 |
| Puffin | Breeding | NatureScot | 60% | 3-5% | 71.37-118.95 | 70.50-117.50 |
| | | Applicant | 50% | 1% | 19.83 | 19.58 |
| | Non-breeding | NatureScot | 60% | 1-3% | 2.14-6.42 | 2.24-6.73 |
| | | Applicant | 50% | 1% | 1.78 | 1.87 |
| Red-throated diver | Pre-breeding | NatureScot | 100% | 10% | 0.40 | 0.00 |
| | | Applicant | 100% | 10% | 0.40 | 0.00 |
| | Breeding | NatureScot | 100% | 10% | 0.40 | 0.00 |
| | | Applicant | 100% | 10% | 0.40 | 0.00 |

| Species | Season | Approach | Displacement Rate | Mortality Rates | Displacement Mortality (Range) (Design-Based) | Displacement Mortality (Range) (MRSea) |
|----------------------|---------------|------------|-------------------|-----------------|---|--|
| | Post-breeding | NatureScot | 100% | 10% | 0.40 | 0.00 |
| | | Applicant | 100% | 10% | 0.40 | 0.00 |
| | Non-breeding | NatureScot | 100% | 10% | 0.00 | 0.00 |
| | | Applicant | 100% | 10% | 0.00 | 0.00 |
| Great northern diver | Non-breeding | NatureScot | 100% | 10% | 2.70 | 0.00 |
| | | Applicant | 100% | 1-5% | 0.27-1.35 | 0.00-0.00 |
| Gannet | Pre-breeding | NatureScot | 70% | 1-3% | 0.15-0.46 | 0.20-0.61 |
| | | Applicant | 70% | 1% | 0.15 | 0.20 |
| | Breeding | NatureScot | 70% | 1-3% | 3.16-9.49 | 3.02-9.06 |
| | | Applicant | 70% | 1% | 3.16 | 3.02 |
| | Post-breeding | NatureScot | 70% | 1-3% | 1.15-3.44 | 1.11-3.32 |
| | | Applicant | 70% | 1% | 1.15 | 1.11 |

5 DISCUSSION

- 5.1.1.1 The range of displacement and mortality rates provided in Table 4-1 above is in line with that typically recommended for the assessment of impacts of OWFs (e.g. JNCC *et al.* 2022).
- 5.1.1.2 Displacement rates can be empirically inferred on the basis of a change in density between before and after the construction of an OWFs. Even so, there is uncertainty; individual studies may struggle to fully attribute a causal relationship with the construction of an OWFs given that seabird abundance distribution is known to show spatial and temporal variation as a result of a wide range of biotic and abiotic factors (Pérez-Lapeña *et al.*, 2010).
- 5.1.1.3 Furthermore, there is evidence that displacement rates may vary regionally; for example, it has been noted that red-throated diver displacement rates and buffers recorded in the German Bight appear to be higher than those recorded in UK waters (MacArthur Green, 2019). This may be due to ecological conditions, such as the density of birds and distribution of available habitat, or it may be a behavioural response that depends on the visual backdrop and the extent of background vessel traffic in the region.
- 5.1.1.4 Given the potential for regional variation in displacement rates, it is noteworthy that a recent study at another northern offshore wind farm, Beatrice Offshore Wind Farm in the Moray Firth/*An Cuan Moireach*, found no evidence of auk displacement (MacArthur Green, 2023). Overall, a recent review reported auk displacement rates ranging from +112% (i.e. attraction) to -75% (APEM, 2022a). For gannet, a review found displacement rates ranging from no significant effect to 98% displacement within an array area (APEM, 2022b).
- 5.1.1.5 Mortality rates are harder to quantify. It is acknowledged that even the concept of estimating the impact of displacement by means of applying a mortality rate to displaced birds is flawed (JNCC *et al.* 2022; Searle *et al.*, 2018). Impacts will not solely accrue by means of mortality of displaced individuals. Displacement may lead to mortality of non-displaced individuals as a result of increased competition. During the breeding season, displacement may impact the survival of juveniles if the foraging success of parents is reduced or if nests are left unattended for longer periods of time. Displacement may also have sub-lethal effects that lead to population-level impacts, such as reduced productivity as a result of increased incidences of missed breeding, or reduced clutch size if a breeding attempt is made. These complications make estimating a displacement-consequent mortality rate from empirical observation currently an intractable problem. However, studies which have considered mortality rates (reviewed in APEM, 2022a, b) found that the evidence is incompatible with a 10% mortality rate for either auks or gannets, and that the best supported position is a negligible impact on mortality rates.
- 5.1.1.6 Therefore, while this appendix presents a range of displacement and mortality rates, it is important to note that the upper end of this range is considered precautionary, particularly in relation to displacement-related mortality. This reflects more recent and regionally relevant evidence

indicating that displacement is likely to occur at lower rates than those represented by the upper values proposed by the SNCBs. The lower end of the range is considered more plausible, although it too incorporates a degree of precaution, given the variability in published estimates, including studies in Scottish waters that report low or negligible displacement and associated mortality rates. A full assessment using all scenarios (both NatureScot and Applicant Approach) is presented in Chapter 14, Volume 2a, with discussion and emphasis placed on the rate deemed most appropriate based on its alignment with observed real-world behaviours.

6 GLOSSARY OF TERMS AND ABBREVIATIONS

6.1.1.1 A list of key terms and acronyms used in this appendix are provided in Table 6-1 and Table 6-2.

Table 6-1 Acronyms and abbreviations

| Term | Definition |
|-------|--|
| DAS | Digital Aerial Survey |
| EIAR | Environmental Impact Assessment Report |
| IBM | Individual-Based Model |
| JNCC | Joint Nature Conservation Committee |
| MHWS | Mean High Water Springs |
| MRSea | Marine Renewables Strategic Environmental Assessment (R package) |
| OCAS | Offshore Cable Area of Search |
| OSP | Offshore Substation Platform |
| OWF | Offshore Wind Farm |
| SNCBs | Statutory Nature Conservation Bodies |
| SPA | Special Protection Area |
| UK | United Kingdom |
| VOR | Valued Ornithological Receptors |
| WTG | Wind Turbine Generators |

Table 6-2 Glossary

| Term | Meaning |
|---------------------------------|---|
| the Applicant | Sporad na Mara Limited (the Project owner) |
| Applicant Approach | The assessment parameters proposed by the Applicant, based on the most recent and compelling research and evidence. |
| Array Area | The offshore area within which the offshore wind turbine generators (WTGs), associated foundations, Offshore Cables, and Offshore Substation Platform (OSP) (if required), will be located. This area encompasses the Turbine Area that will contain all above water surface infrastructure (WTGs/OSP) and an additional area within which further below water infrastructure (foundations and cables) may also be located. |
| Displacement Study Area | The Displacement Study Area is defined as the Turbine Area plus a species-specific buffer zone: <ul style="list-style-type: none"> • 2 km buffer for kittiwake, razorbill, guillemot, puffin, and gannet; • 4 km buffer for red-throated diver and great northern diver. |
| Offshore Ornithology Study Area | The area over which potentially significant impacts from the Offshore Project have the most potential to occur to ornithological receptors, consisting of the Turbine Area plus a 4 km buffer (excluding land). |

| Term | Meaning |
|----------------------------------|---|
| Offshore Ornithology Survey Area | The area covered by Digital Aerial Survey (DAS), consisting of the Array Area plus a 10 km buffer (excluding land). |
| Offshore Project | The components of the Sporad na Mara offshore wind farm (the Project) located seaward of Mean High Water Springs (MHWS). |
| Turbine Area | A reduced area within the Array Area where above water surface infrastructure would be located i.e. wind turbine generators (WTG) and Offshore Substation Platform (OSP) (if required). This area has been developed and refined through stakeholder engagement and environmental assessment. |

7 REFERENCES

APEM (2022a). Review of evidence to support auk displacement and mortality rates in relation to offshore wind farms. APEM Scientific Report P00007416. Ørsted, January 2022.

APEM (2022b). Gannet Displacement and Mortality Evidence Review. APEM Scientific Report P00007416. Ørsted, March 2022.

Bradbury, G., Trinder, M., Furness, B., Banks, A.N., Caldow, R.W. and Hume, D. (2014). Mapping seabird sensitivity to offshore wind farms. *PLoS one*, 9(9), e106366.

Burton, N.H.K., Rehfisch, M.M., Clark, N.A. and Dodd, S.G. (2006). Impacts of sudden winter habitat loss on the body condition and survival of Redshank *Tringa totanus*. *Journal of Applied Ecology*, 43, 464–473.

Dierschke V., Furness R.W. and Garthe S. (2016). Seabirds and offshore wind farms in European waters: Avoidance and attraction. *Biological Conservation*, 202, 59-68.

Furness R. W., Wade, H. M. and Masden E.A. (2013). Assessing vulnerability of marine bird populations to offshore wind farms. *Journal of Environmental Management*, 119, 56-66.

Furness, R.W. (2015). Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Reports (164).

Garthe, S and Hüppop, O. (2004). Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. *Journal of Applied Ecology*, 41, 724-734.

Garthe, S., Schwemmer, H., Peschko, V., Markones, N., Müller, S., Schwemmer, P. and Mercker, M. (2023). Large-scale effects of offshore wind farms on seabirds of high conservation concern. *Scientific Reports*, 13(1), 4779.

Gittings, T., Peppiatt, C. and Troake, P. (2015). Disturbance response of great northern divers *Gavia immer* to boat traffic in inner Galway Bay. *Irish Birds*, 10(2), 163-166.

Heinänen, S., Žydelis, R., Kleinschmidt, B., Dorsch, M., Burger, C., Morkūnas, J., Quillfeldt, P. & Nehls, G. (2020). Satellite telemetry and digital aerial surveys show strong displacement of red-throated divers (*Gavia stellata*) from offshore wind farms. *Marine Environmental Research*, 104989.

JNCC, Natural Resources Wales, Department of Agriculture, Environment and Rural Affairs/Northern Ireland Environment Agency, Natural England and Scottish Natural Heritage, (2022). Joint SNCB Interim Displacement Advice Note. [Online]. Available at: <https://data.jncc.gov.uk/data/9aecb87c-80c5-4cfb-9102-39f0228dcc9a/joint-sncb-interim-displacement-advice-note-2022.pdf> [Accessed February 2026].

Kaiser, M., Elliott, A., Galanidi, M., Ivor, E., Rees, S., Caldow, R., Stillman, R., Sutherland, W. and Showler, D. (2002). Predicting the Displacement of Common Scoter *Melanitta nigra* from Benthic

Feeding Areas Due to Offshore Windfarms (Report No. COWRIE-BEN-03-2002). Report by Bangor University. Report for Collaborative Offshore Wind Research into the Environment (COWRIE).

Langston, R.H.W. (2010). Offshore wind farms and birds: Round 3 zones, extensions to Round 1 and 2 sites and Scottish Territorial Waters. RSPB Research Report No. 39.

MacArthur Green (2012). Vulnerability of Scottish Seabirds to Offshore Wind Turbines.

MacArthur Green (2019). Norfolk Vanguard Offshore Wind Farm. The Applicant Responses to First Written Questions. Appendix 3.3 – Operational Auk and Gannet Displacement: update and clarification.

MacArthur Green (2023). Beatrice Offshore Wind Farm. Year 2 Post-construction Ornithological Monitoring Report. Maclean, I.M.D., Wright, L.J., Showler, D.A. and Rehfisch, M.M. (2009). A review of assessment methodologies for offshore wind farms. British Trust for Ornithology Report, commissioned by COWRIE Ltd.

Masden, E. A., Haydon, D. T., Fox, A. D. and Furness, R. W. (2010). Barriers to movement: modelling energetic costs of avoiding marine wind farms amongst breeding seabirds. *Marine Pollution Bulletin*, 60(7), 1085-1091.

Mendel, B., Kotzerka, J., Sommerfeld, J., Schwemmer, H., Sonntag, N. and Garthe, S. (2014). Effects of the alpha ventus offshore test site on distribution patterns, behaviour and flight heights of seabirds. In *Ecological Research at the Offshore Windfarm alpha ventus* (pp. 95-110). Springer Fachmedien Wiesbaden.

NatureScot (2020). Seasonal Periods for Birds in the Scottish Marine Environment. Short Guidance Note Version 2. October 2020.

NatureScot (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. Available at: <https://www.nature.scot/doc/guidance-note-8-guidance-support-offshore-wind-applications-marine-ornithology-advice-assessing> [Accessed February 2026].

North Irish Sea Array (2024). Environmental Impact Assessment Report. Volume 3: Offshore Chapters; Chapter 15: Offshore and Intertidal Ornithology. Ove Arup and Partners Ireland Limited.

Pettifor, R.A., Caldow, R.W.G., Rowcliffe, J.M., Goss-Custard, J.D. and Black, J.M. (2000). Spatially explicit, individual-based, behavioural models of the annual cycle of two migratory goose populations. *Journal of Applied Ecology*, 37, 103–35.

RWE Renewables UK (2022). Awel y Môr Offshore Wind Farm Category 6: Environmental Statement Volume 4, Annex 4.5: Offshore Ornithology Scoping and Consultation Responses. Available at: https://awelymor.cymru/wp-content/uploads/6.4.4.5_AyM_ES_Volume_4_Annex4.5_ScopingConsultationResponsesAnnex_vFinal.pdf [Accessed February 2026].

Searle, K.R., Mobbs, D.C., Butler, A., Furness, R.W., Trinder, M.N. and Daunt, F. (2018) Finding out the fate of displaced birds. *Scottish Marine and Freshwater Science*, 9(8), 149.

Statutory Nature Conservation Bodies (2022). Joint SNCB interim advice on the treatment of displacement for red-throated diver. Available at: <https://data.jncc.gov.uk/data/9aecb87c-80c5-4cfb-9102-39f0228dcc9a/interim-sncb-advice-rtd-displacement-buffer.pdf> [Accessed February 2026].

Topping, C. and Petersen, I.K. (2011). Report on a red-throated diver agent-based model to assess the cumulative impact from offshore wind farms. Report commissioned by Vattenfall A/S. Aarhus University, DCE – Danish Centre for Environment and Energy.

Vanermen, N., Stienen, E.W.M., Courtens, W., Onkelinx, T., Van de walle, M. and Verstraete, H. (2016). Bird monitoring at offshore wind farms in the Belgian part of the North Sea - Assessing seabird displacement effects. *Rapporten van het Instituut voor Natuur- en Bosonderzoek 2013* (INBO.R.2013.755887). Instituut voor Natuur- en Bosonderzoek, Brussels.

Wade, H.M., Masden E.M., Jackson, A.C. and Furness, R.W. (2016). Incorporating data uncertainty when estimating potential vulnerability of Scottish seabirds to marine renewable energy developments. *Marine Policy*, 70, 108-113.

Webb, A., Irwin, C., Mackenzie, M., Scott-Hayward, L., Caneco, B. & Donovan, C. (2017). Lincs Wind Farm: Third Annual Post-Construction Aerial Ornithological Monitoring Report. HiDef Aerial Surveying Ltd report to Lincs Wind Farm Ltd.

West, A.D., Goss-Custard, J.D., McGroarty, S., Stillman, R.A., Durell, S.E.A. le V. Dit, Stewart, B., Walker, P., Palmer, D.W. and Coates, P. (2003). The Burry shellfishery and oystercatchers: using a behaviour-based model to advise on shellfishery management policy. *Marine Ecology Progress Series*, 248, 279-292.

Woodward, I., Thaxter, C.B., Owen, E., Cook, A.S.C.P. (2019). Desk-based revision of seabird foraging ranges used for HRA screening. BTO Research Report 724.