Bowdun Offshore Wind Farm, Offshore EIA Report

Volume 3, Technical Appendix 11.6: Offshore Ornithology Apportioning Technical Report

TWP-BOW-RPS-OFE-RPT-00024 | April 2026

Contents

List of Annexes

Volume 3, Technical Appendix 11.6: Offshore Ornithology Apportioning Technical Report: Annex A: Colony Distances from the Array Area.

Volume 3, Technical Appendix 11.6: Offshore Ornithology Apportioning Technical Report: Annex B: Full Breeding Season Apportioning Results.

List of Tables

List of Figures

Glossary

Defined term	Definition
Array Area	The Array Area is the area in which the Offshore Generation Assets will be located.
Digital Aerial Surveys (DAS)	A method for undertaking baseline ornithological data collection surveys. Usually undertaken over a period of 24 months.
Displacement	An impact that occurs when a bird is forced away from an area of habitual usage. This can be temporary (i.e. a ship moving) or permanent (i.e. the placement of offshore infrastructure).
Effect	Term used to express the consequence of an impact (i.e. the result of change or changes) on specific environmental resources or receptors. The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity of the receptor or resource in accordance with defined significance criteria.
Environmental Impact Assessment (EIA)	Process for the assessment of likely significant environmental effects of a project on the physical, biological, and human environment during construction, Operation and Maintenance (O&M) and decommissioning.
Export Cable Corridor	The area seaward of Mean High-Water Springs (MHWS) which connects the Array Area with the Landfall within which the Offshore Export Cables will be installed.
Habitats Regulations Appraisal (HRA)	An assessment carried out under the Habitats Regulations to determine if a plan or project could adversely affect the integrity of a European Site.
Inter-Array Cables (IAC)	Cables which link the Wind Turbines to each other and with the Offshore Substation Platforms (OSPs).
Interconnector Cables	Cables which will connect individual OSPs to each other to provide redundancy against cable failure elsewhere.
Plan Option Area (POA)	A location identified in the Sectoral Marine Plan (SMP) as a preferred area for commercial scale offshore wind development.
Proposed Development	Term used to define the Offshore Infrastructure associated with the Project seaward of MHWS for which consent is being sought. Further details of the parameters are included in Volume 1, Chapter 3: Project Description.
Qualifying Features	The features for which a European Site has been officially designated to protect.
Report to Inform Appropriate Assessment (RIAA)	The RIAA provides detailed information to support the process of Appropriate Assessment (undertaken by the competent authority) as part of the HRA, which evaluates the potential impacts of a project or plan on protected European Sites.
Scoping Opinion	A document produced by MD-LOT, which is issued in response to submission and review of the Offshore Scoping Report. The Scoping Opinion is supported with feedback and advice from consultees, which details what is expected to be included in the Offshore EIA Report and what can be scoped out of the EIA process.
Sectoral Marine Plan (SMP)	A plan developed by the Scottish Government which provides the strategically planned spatial footprint for offshore wind development in Scotland.

Defined term	Definition
Special Protection Areas (SPAs)	SPAs are sites that are designated to protect rare or vulnerable birds (as listed on Annex I of the Directive 2009/147/EC on the conservation of wild birds), as well as regularly occurring migratory species.
Study Area	For each environmental topic, the baseline environment will be characterised, and the potential environmental impacts will be described within a topic-specific study area. Specific study areas are defined for each topic and are based on the maximum spatial extent across which potential impacts of the Project may be experienced by the relevant receptors (i.e. Zone of Influence).
Thistle Wind Partners (TWP)	Company established for the development of the Project.
Wind Turbines	Structures comprising of a tubular tower, rotor blades, and a nacelle which houses the Wind Turbine generator.

Acronyms

Acronym	Definition
AOB	Apparently Occupied Burrow
AON	Apparently Occupied Nest
AOS	Apparently Occupied Site
AOT	Apparently Occupied Territorie
BDMPS	Biologically Defined Minimum Population Scales
CRM	Collision Risk Modelling
DAS	Digital Aerial Surveys
EIA	Environmental Impact Assessment
HRA	Habitats Regulations Appraisal
IND	Individual
MD-LOT	Marine Directorate – Licensing Operations Team
OWF	Offshore Wind Farm
SD	Standard Deviation
SPA	Special Protection Area
SSE	Scottish and Southern Energy
UK	United Kingdom
VOR	Valued Ornithological Receptor

Table of Units

Units	Definition
km	Kilometre
km^2	Square kilometre
%	Percent

1 Introduction

1.1.1 This Ornithology Technical Report presents the offshore ornithology species apportioning for the offshore elements of the Bowdun Offshore Wind Farm (OWF) Project (hereafter referred to as the Proposed Development). The Proposed Development covers the Option Lease Area comprises the Array Area, which is located in the E3 Plan Option Area detailed in the Scottish Sectoral Marine Plan (Scottish Government, 2020), and the Export Cable Corridor. The Array Area is located 38 km from the Aberdeenshire coast at its closest point, covering an area of 187 km^2 (Figure 1.1). The Proposed Development will comprise Wind Turbines (fixed foundations), Inter-Array Cables, Offshore Substation Platforms, Interconnector Cables, Offshore Export Cables and any necessary scour/cable protection. The Export Cable Corridor will include a maximum of three High Voltage Alternating Current Offshore Export Cables, each with a length of up to 70 km and will make Landfall at Benholm, Aberdeenshire.

1.1.2 Marine renewable developments, such as the Proposed Development, are often within the foraging range of several breeding seabird colonies, including those protected as Special Protected Areas (SPAs). Due to this, it is important to determine the potential impact on seabirds named as Qualifying Features and/or named as part of species assemblages within these SPAs through apportioning.

1.1.3 To apportion the impacts of displacement and Collision Risk Modelling (CRM) to seabirds during the breeding season, NatureScot (2018) presents a theoretical approach. This approach involves determining which seabird colonies are within foraging range, and therefore have connectivity, with the Array Area for each species before calculating proportions of individuals likely to come from each colony. For the non-breeding season, the standard approach to apportioning uses information presented in Furness (2015). Once determined, these proportions, or apportioning values, can then be used to distribute impacts across both SPA and non-SPA colonies.

1.1.4 The information from this technical report informs Volume 3, Technical Appendix 11.3: Offshore Ornithology Displacement Technical Report and Volume 3, Technical Appendix 11.4: Offshore Ornithology Collision Risk Model Technical Report. This report accompanies the Environmental Impact Assessment (EIA) provided in Volume 2, Chapter 11: Offshore Ornithology to support the consent application for the Proposed Development. The results of this Appendix will be used within the Report to Inform Appropriate Assessment as part of the Habitats Regulations Appraisal (HRA) for the Proposed Development.

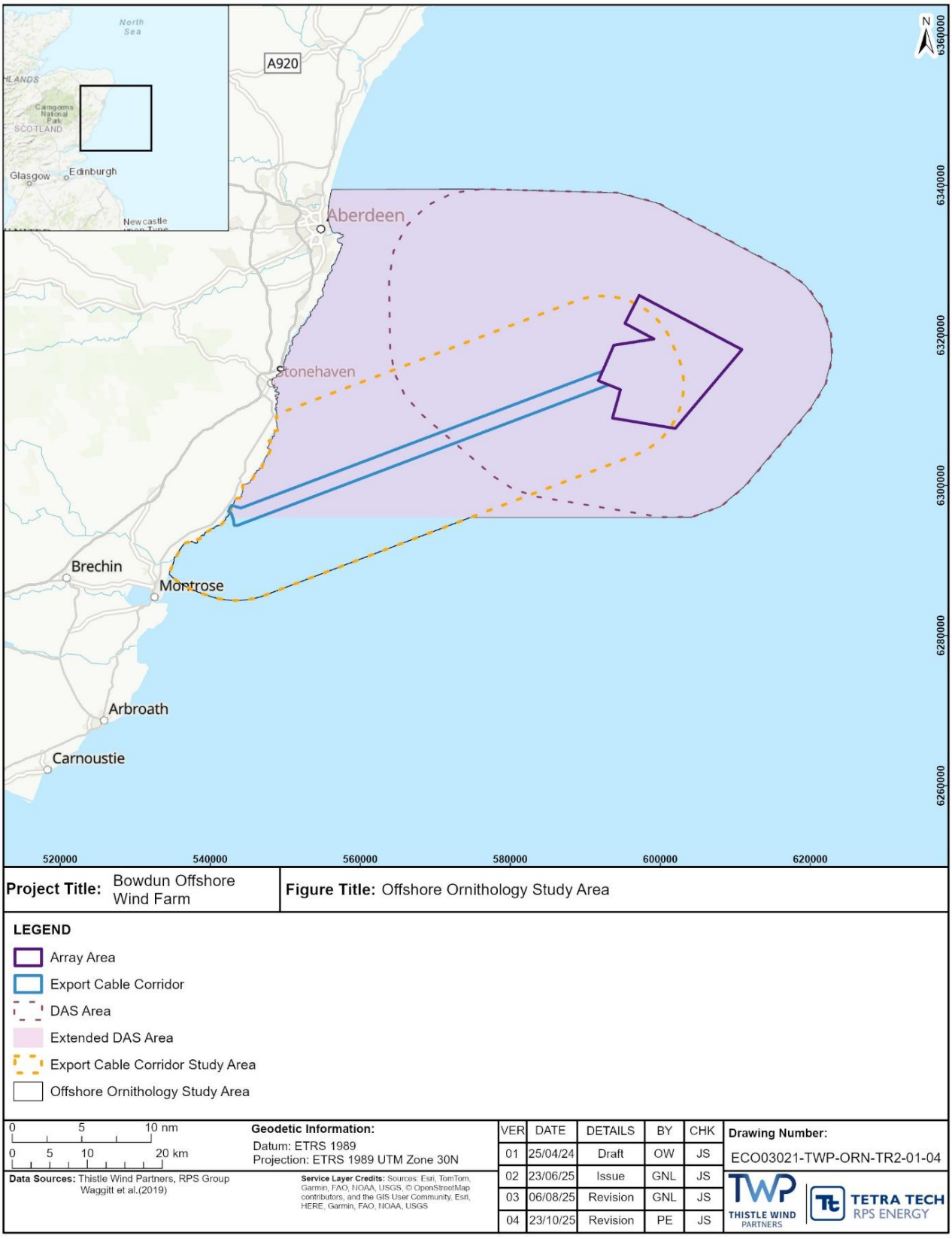

Figure 1.1: Offshore Ornithology Study Area

2 Methodology

2.1 Species

2.1.1 Apportioning was carried out for all species identified as Valued Ornithological Receptors (VOR). A species was identified as a VOR based on their abundance within the Array Area Study Area, their vulnerability to impacts (as described in Bradbury *et al.,* 2014) and their status as a Qualifying Feature of SPAs with theoretical connectivity to the Array Area. A detailed description of this process is presented in Section 4.3: Identification of Valued Ornithological Receptors of Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report.

2.1.2 Breeding season and non-breeding season apportioning was carried out when appropriate for nine key species identified as VOR:

- northern fulmar *Fulmarus glacialis*, hereafter 'fulmar';
- northern gannet *Morus bassanus*, hereafter 'gannet';
- black-legged kittiwake *Rissa tridactyla*, hereafter 'kittiwake';
- great black-backed gull *Larus marinus*;
- European herring gull *Larus argentatus*, hereafter 'herring gull';
- Arctic tern *Sterna paradisaea*;
- common guillemot *Uria aalge*, hereafter 'guillemot';
- razorbill *Alca torda*; and
- Atlantic puffin *Fratercula arctica*, hereafter 'puffin'.

2.1.3 Apportioning was carried out for impacts from displacement, collision, and the combined impact of displacement and collision. Displacement impacts were apportioned for auk species (guillemot, razorbill and puffin) and fulmar; CRM impacts were apportioned for Arctic tern, herring gull and great black-backed gull; and both displacement and CRM were apportioned for gannet and kittiwake (see Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report for more information on impact selection for species).

2.2 Apportioning of Potential Impacts During the Breeding Season

2.2.1 Although the Marine Scotland Apportioning Tool (Butler *et al.*, 2020) is available to carry out apportioning for three species (guillemot, kittiwake, and razorbill), apportioning was carried out following the theoretical approach presented by NatureScot (2018) for all species. This method was implemented as the Apportioning Tool relies on data from the Seabird 2000 census which has been superseded by the Seabird Count census (Burnell *et al.,* 2023) carried out between 2015 to 2021.

2.2.2 The NatureScot (2018) approach has two stages. Firstly, a long list of colonies, and the number of breeding adults present, with connectivity to the Proposed

Development must be collated. Once the long list has been compiled, calculations are subsequently carried out to determine the proportional weightings, hereafter 'apportioning values', for each colony.

Determining Colonies with Connectivity to the Proposed Development

2.2.3 Adults are central place foragers during the breeding season, meaning that they are strongly associated with a breeding colony. Due to this, the individuals impacted by the Proposed Development are expected to be associated with colonies within foraging range of the Array Area. These colonies are said to have connectivity with the Proposed Development.

2.2.4 To determine whether a colony has connectivity, the distance was measured from the closest edge of the Array Area to the closest edge or point of the colony. If this distance was less than or equal to the recommended foraging ranges, derived from Woodward *et al*. (2019), and presented in NatureScot (2023a) guidance (Table 2.1), then the colony was determined to have connectivity with the Proposed Development.

Table 2.1: Foraging Ranges Used to Determine Connectivity of Colonies With the Array Area During the Breeding Season, Taken from Woodward *et al.* (2019)

Species	Mean max foraging range (km)	Standard deviation (SD) (km)	Foraging range used for apportioning (km)
Fulmar	542.3	657.9	1,200.2
Gannet[1]	315.2	194.2	509.4
Kittiwake	156.1	144.5	300.6
Great black-backed gull	73.0	-	73.0
Herring gull	58.8	26.8	85.6
Arctic tern	25.7	14.8	40.5
Guillemot[2]	55.5	39.7	95.2
Razorbill[3]	73.8	48.4	122.2
Puffin	137.1	128.3	265.4

[1]For gannet, a foraging range of 590.0 km, 516.7 km and 709.0 km were used to determine connectivity for Forth Islands SPA, Grassholm SPA and St Kilda SPA following NatureScot guidance (2023a).
[2]For guillemot, a foraging range of 153.7 km was used to determine connectivity for all Northern Isle SPAs and colonies following NatureScot guidance (2023a).
[3]For razorbill, a foraging range of 164.6 km was used to determine connectivity for all Northern Isle SPAs and colonies following NatureScot guidance (2023a).

2.2.5 'By-sea' distances were used throughout apportioning, instead of 'straight-line' distances, as these better represent seabirds' real-life movements. For SPA colonies, distances were measured from the closest edge of the Array Area to the closest edge of the SPA boundary when determining connectivity. For non-SPA colonies, distances were measured to the closest sub-site within the Seabird Monitoring Programme database. Distances are presented in Annex A.

2.2.6 Once colonies with connectivity to the Array Area had been determined, the number of breeding adults at each colony were collated. Counts for SPA colonies were taken from the Seabird Counts census (Burnell *et al.*, 2023) where possible[1]. Remaining colony counts were taken from the Seabird Monitoring Programme database. For each non-SPA colony, the most recent counts available in the data were used, unless the most recent count was taken before 2000. In these cases, it was assumed the colony no longer exists, and the sub-site was excluded.

2.2.7 All counts were converted to individuals (IND) using the following rules:

- counts measured in Apparently Occupied Nests (AON), Apparently Occupied Sites (AOS), Apparently Occupied Burrows (AOB) and Apparently Occupied Territories (AOT) were multiplied by two; and
- for guillemot and razorbill, counts measured in IND were multiplied by a correction factor of 1.34 (Walsh *et al.*, 1995)[2].

Apportioning Calculations

2.2.8 To determine the resulting weighting for each colony, three colony-specific weighting factors were applied to each colony using the following formula (NatureScot, 2018):

$$Resulting\ weighting = \left(\frac{Colony\ population}{Sum\ of\ populations}\right) x \left(\frac{\sum(Distance)^2}{Distance^2}\right) x \left(\frac{\left(\frac{1}{Prop\ of\ foraging\ range\ at\ sea}\right)}{\sum\left(\frac{1}{Prop.of\ foraging\ range\ at\ sea}\right)}\right)$$

2.2.9 The first weighting applied to each colony accounts for the fact that larger colonies are expected to contribute more individuals to those found in the Array Area. Colony counts used were collated as previously described.

2.2.10 It is assumed that as the distance from the colony increases the density of birds will decrease by a factor proportional to 1/distance^2 as area increases

[1] Colony counts were taken for the North Caithness Cliffs SPA in 2023 and the East Caithness Cliffs in 2024 and 2025. These surveys were undertaken by the North-East and Eastern Ornithology Group. Results from these surveys are presented in Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report. Although these survey counts are not used in the impact assessment, they are used to provide important contextual information on recent populations trends for these SPAs in the Report to Information the Appropriate Assessment.

[2] Walsh *et al.* (1995) states that a count of 1 IND is equivalent to 0.67 breeding pairs for guillemot and razorbill. Therefore, in order to correct counts recorded in IND so that one IND is equal to half of a breeding pair, a correction factor of 1.34 was applied to counts. An example of the working used to determine this correction factor using a count of 10 IND is shown below:

1. Calculation of breeding pairs using original count: 10 IND x 0.67 = 6.7 breeding pairs
2. Calculation of IND from breeding pairs: 6.7 breeding pairs x 2 = 13.4 IND (corrected)
3. Calculation of correction factor: 13.4 IND (corrected) / IND = 1.34

proportionally to πr^2. To account for this trend in seabird density, a second weighting based on 1/distance^2 was used.

2.2.11 Following NatureScot (2018) guidance, by-sea distances were measured from the centre of the Array Area to the geometrical centre of the colony where possible when calculating resulting weighting. Each SPA was treated as one colony, meaning a single point was used to measure distances for each SPA. For non-SPA colonies which consisted of sub-sites represented by point locations, the distance to each sub-site was measured and the mean distance was used in calculations.

2.2.12 The geometric centre of Forth Islands SPA was not found to be representative of the location of breeding colonies. Due to this, the Isle of May was used as the location for all species included in analysis other than gannet. For gannet, distances were measured to Bass Rock.

2.2.13 The third weighting accounts for an increase in bird density with a decrease in the proportion of foraging range at sea. The proportion of the foraging range at sea was calculated by creating a buffer, with a radius equal to the relevant foraging range (Table 2.1), around each colony point.

2.2.14 Once resulting weightings were calculated by multiplying the three weightings, the apportioning values were calculated for each colony by dividing the resultant weighting by the sum of all the resultant weightings.

2.3 Immature and Sabbatical Birds During the Breeding Season

2.3.1 During the breeding season, seabird populations are likely to consist of multiple age classes, including breeding adults, immature birds (i.e. those which have not yet reached breeding age) and non-breeding adults (i.e. birds which have reached breeding age but are not breeding).

2.3.2 It is important to identify the proportion of breeding adults as this is relevant for the HRA.

Proportion of Immature Birds

2.3.3 A significant proportion of seabird populations are comprised of immature birds which have not yet reached the age of breeding. It is important to distinguish between age classes, as a proportion of these immature birds will return to natal colonies during the breeding season alongside adult birds. Within this technical report, site-specific Digital Aerial Survey (DAS), flown over the Array Area Study Area (Figure 1.1), and data from Horswill and Robinson (2015) have been used to determine the proportion of immatures present depending on the species.

2.3.4 Site-specific DAS data can be used to calculate the proportion of immatures for gannet, kittiwake, and large gull species as immatures and adults are easily distinguishable. The proportion of the immatures observed within the DAS data are presented in Table 2.2. This method was not used for great black-backed gull, as no individuals were observed within the Array Area during the breeding season.

Table 2.2: Number of Birds Assigned to Different Age Class Categories During Site-specific Surveys of the Array Area During the Breeding Season

Species	Breeding Season	Number of Birds for which Age was not Identified	Number of Adults Observed	Number of Immatures Observed	Proportion of Adult Birds (%)	Proportion of Immature Birds (%)
Gannet	Mid-March to September	25	386	11	97.23	2.77
Kittiwake	Mid-April to August	302	449	14	96.98	3.02
Herring gull	April to August	169	59	18	76.62	23.38

2.3.5 For kittiwake, the identification of different age classes can vary. For example, one year old individuals can be easily identified due to differences in plumage compared to adults. However, other age classes, such as second- and third-year old individuals, are not possible to be identified using at sea data (Coulson, 2011; Olsen and Larsson, 2003). Due to this it is likely that the proportion of immatures presented in Table 2.2 is an underestimate and therefore the proportion of breeding adults is an overestimation.

2.3.6 To correct for the underestimation of immature birds, values from Horswill and Robinson (2015) have been used as shown in Table 2.3. It is likely that the proportion of immatures derived using this correction is still a slight underestimation as second- and third-year immatures show a greater affinity for natal waters than first-year birds.

Table 2.3: Steps Used to Account for the Underestimation of Immature Kittiwake Using DAS Imagery

Step in analysis	Formula	Value
(A) Proportion of immatures identified in DAS (assumed to be 1 year old)	Number immatures/Number of individuals aged	3.02%
(B) Survival rate immature age classes (Horswill and Robinson, 2015)	NA	0.854
(C) Proportion of kittiwake assigned to two year old birds	C = A x B	2.58%
(D) Proportion of kittiwake assigned to three year old birds	D = C x B	2.21%
(E) Proportion of kittiwake assumed to be juvenile/immature	E = A + C + D	7.81%
(F) Proportion of kittiwake assumed to be adult	F = 100% - E	92.19%

2.3.7 For species which could not be aged using DAS data, the proportion of adults was derived from survival rates presented in Horswill and Robinson (2015). From these rates, the stable age structure and proportion of each age class within the population was calculated (Table 2.4).

Table 2.4: Proportion of Age Classes Used for Species Which Could Not be Aged Using DAS Data. Survival Rates are Derived From Information Presented in Horswill and Robinson (2015)

Species	Parameter	Age Class (years)										Productivity (chicks per pair)
		0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	Adult	
Fulmar	Survival rate	0.845	0.845	0.845	0.845	0.845	0.845	0.845	0.845	0.936	0.936	0.419
	Proportion in population	0.101	0.086	0.073	0.062	0.053	0.045	0.039	0.033	0.028	0.480	
Great black-backed gull	Survival rate	0.930	0.930	0.930	0.930	0.930	-	-	-	-	0.930	1.139
	Proportion in population	0.194	0.156	0.126	0.102	0.082	-	-	-	-	0.340	
Herring gull	Survival rate	0.798	0.834	0.834	0.834	0.834	-	-	-	-	0.834	0.920
	Proportion in population	0.178	0.141	0.117	0.097	0.080	-	-	-	-	0.387	
Arctic tern	Survival rate	0.837	0.837	0.837	0.837	-	-	-	-	-	0.837	0.380
	Proportion in population	0.116	0.103	0.091	0.080	-	-	-	-	-	0.611	
Guillemot	Survival rate	0.560	0.792	0.917	0.939	0.939	0.939	-	-	-	0.939	0.672
	Proportion in population	0.168	0.091	0.070	0.062	0.056	0.051	-	-	-	0.501	
Razorbill	Survival rate	0.794	0.794	0.895	0.895	0.895	-	-	-	-	0.895	0.570
	Proportion in population	0.145	0.113	0.088	0.078	0.069	-	-	-	-	0.508	
Puffin	Survival rate	0.892	0.892	0.892	0.760	0.805	-	-	-	-	0.906	0.617
	Proportion in population	0.143	0.124	0.108	0.094	0.069	-	-	-	-	0.463	

Proportion of Sabbatical Birds

2.3.8 It is important to consider adults which are not breeding, hereby known as sabbatical birds, as including non-breeding adults during apportioning is likely to lead to an overestimation of the potential impacts (Marine Scotland, 2017a; 2017b).

2.3.9 To account for sabbatical birds within a given sea area, published estimates, advised by Marine Scotland (2017a; 2017b), have been used during the assessment (Table 2.5).

Table 2.5: Sabbatical Rates Used During the Assessment

Species	Sabbatical Rate Used (%)
Fulmar	0
Gannet	10
Kittiwake	10
Great black-backed gull	35
Herring gull	35
Arctic tern	0
Guillemot	7
Razorbill	7
Puffin	7

2.4 Apportioning of Potential Impacts During the Non-breeding Season

2.4.1 The method used to carry out apportioning during the non-breeding season varied by species, following the recommendations by NatureScot (2023b). For the majority of species, apportioning was carried out using information from the Biologically Defined Minimum Population Scales (BDMPS) presented in Furness (2015). For guillemot and herring gull a different approach was taken.

All Species Except Guillemot and Herring Gull

2.4.2 For the relevant species, the number of United Kingdom (UK) individuals (adults and immatures) from each SPA were divided by the relevant BDMPS estimates (Furness, 2015) shown in Table 2.6.

Table 2.6: BDMPS Estimates from Furness (2015) Used to Carry Out Non-breeding Season Apportioning[1]

Species	Season	Season Definition	BDMPS estimate (adults and immature)
Fulmar	Winter	November	568,736
	Migration	September and October; December to March	957,502
Gannet	Autumn	September to November	456,299
	Spring	December to March	428,385

Species	Season	Season Definition	BDMPS estimate (adults and immature)
Kittiwake	Autumn migration	August to December	829,937
	Spring migration	January to April	627,816
Great black-backed gull	Non-breeding	September to March	91,399
Arctic tern	Migration seasons	July to early September; late April to May	163,390
Razorbill	Migration	August to October; January to March	591,874
	Winter	November to December	218,622
Puffin	Non-breeding	Mid-August to March	231,957

[1]Non-breeding season apportioning was not carried using BDMPS estimates for two VORs: guillemot and herring gull.

2.4.3 The number of adults and immatures present within each BDMPS were taken from Furness (2015) where possible. For SPA colonies found to have connectivity with the Proposed Development during the breeding season which are not presented within Furness (2015), the number of immatures from each SPA have been calculated using the breeding adult counts from Burnell *et al*. (2023) multiplied by the number of immatures per adult reported in Furness (2015). The number of individuals from each SPA within the BDMPS have been calculated using the proportion of birds present in the BDMPS area from the nearest named designated site.

Guillemot

2.4.4 For guillemot, NatureScot (2023a) advises the use of the mean max foraging range plus one Standard Deviation (SD) (Woodward *et al*., 2019; Table 2.1) to define non-breeding season regional populations. This is due to evidence from Buckingham *et al*. (2022) which found that guillemots are likely to stay within the vicinity of their breeding colonies during the non-breeding season.

2.4.5 Due to this the theoretical approach (NatureScot, 2018) has been used to apportion impacts to guillemots during the non-breeding season, and the non-breeding season regional population is assumed to be the same as the breeding season regional population throughout the assessment.

Herring Gull

2.4.6 To apportion impacts during the non-breeding season for herring gull, the number of mortalities were apportioned using the values calculated using the NatureScot (2018) method. Once calculated, a correction (0.675) to account for the influx of birds from non-UK and west coast UK colonies was applied, following the methodology used in the assessment for Berwick Bank OWF (Scottish and Southern Energy (SSE) Renewables, 2022). This correction was used to calculate the non-breeding season regional population.

2.4.7 To calculate the non-breeding regional population for herring gull, the foraging range population (19,101) was used following advice from the Scoping Opinion

(Marine Directorate – Licensing Operations Team (MD-LOT), 2024). A correction factor was added to the foraging range population to allow for the influx of birds from west coast and non-UK colonies, using BDMPS proportions (Furness, 2015). In Furness (2015), there is a total of 466,511 herring gull in the 'UK North Sea and Channel' BDMPS, 314,860 of which are from north coast colonies, 135,130 of which are from non-UK colonies, and 16,521 of which are from west coast colonies (Furness, 2015). The proportion of herring gull from UK North Sea and Channel colonies is therefore 0.675 (314,860/466,511). Applying this proportion to the foraging range population gives a non-breeding population of 28,298 (19,101/0.675).

3 Results

3.1.1 The results of breeding and non-breeding season apportioning analysis are presented in Sections 3.2 to 3.10.

3.1.2 The apportioning values presented are the proportional weighting for each colony, meaning that values of 1.000 equate to 100%, 0.100 equates to 10% and 0.010 equates to 1%. Any designated colonies with an apportioning value of 0.000 have been excluded. For a full list of designated sites, see Annex B.

3.2 Fulmar

3.2.1 Apportioning was carried out for impacts from displacement in fulmar. Breeding season apportioning values for SPAs which include fulmar as a Qualifying Feature or named as part of the seabird assemblage and are within foraging range of the Array Area are presented in Table 3.1. Apportioning weightings for non-designated breeding colonies are presented in Annex B. Apportioning values for the non-breeding season are presented in Table 3.2.

Table 3.1: Apportioning Values for Fulmar During the Breeding Season

SPA	Colony count (AOS) (Burnell *et al.*, 2023)	Number of breeding adults (individuals)	Distance to the Array Area (km)	Proportion of foraging range at sea	Resulting weighting	Apportioning value
Buchan Ness to Collieston Coast	826	1,652	55.88	0.676	0.327	0.060
Calf of Eday	2,324	4,648	275.74	0.719	0.036	0.007
Cape Wrath	1,477	2,954	321.17	0.754	0.016	0.003
Clare Island	2,647	5,294	975.71	0.849	0.003	0.001
Cliffs of Moher	4,801	9,602	1,076.06	0.821	0.004	0.001
Copinsay	1,618	3,236	228.29	0.712	0.036	0.007
East Caithness Cliffs	13,964	27,928	190.53	0.712	0.452	0.083
Fair Isle	32,491	64,982	285.11	0.710	0.471	0.087
Fetlar	9,177	18,354	451.74	0.717	0.053	0.010
Flamborough and Filey Coast	846	1,692	321.22	0.586	0.012	0.002

SPA	Colony count (AOS) (Burnell *et al.*, 2023)	Number of breeding adults (individuals)	Distance to the Array Area (km)	Proportion of foraging range at sea	Resulting weighting	Apportioning value
Flannan Isles	3,066	6,132	485.72	0.812	0.013	0.002
Foula	10,253	20,506	354.36	0.725	0.094	0.017
Fowlsheugh	525	1,050	51.30	0.677	0.246	0.045
Handa	723	1,446	361.40	0.757	0.006	0.001
Hermaness, Saxa Vord and Valla Field	13,208	26,416	470.05	0.719	0.070	0.013
Hoy	20,541	41,082	233.21	0.722	0.438	0.081
Mingulay and Berneray	7,048	14,096	585.69	0.799	0.022	0.004
North Caithness Cliffs	15,370	30,740	221.21	0.718	0.366	0.067
North Rona and Sula Sgeir	2,210	4,420	382.88	0.786	0.016	0.003
Noss	5,092	10,184	353.17	0.712	0.048	0.009
Rousay	2,192	4,384	266.18	0.723	0.036	0.007
Shiant Isles	1,506	3,012	443.67	0.779	0.008	0.002
St Kilda	29,186	58,372	552.99	0.827	0.097	0.018
Sumburgh Head	5,950	11,900	321.31	0.711	0.068	0.012
Troup, Pennan and Lion's Heads	1,894	3,788	107.04	0.687	0.201	0.037
West Westray	1,214	2,428	278.84	0.726	0.018	0.003
Non-designated sites[1]	-	290,618	-	-	-	0.416

[1]Non-designated colonies include non-SPA colonies and SPA colonies for which fulmar are not a Qualifying Feature and/or named within a qualifying seabird assemblage.

Table 3.2: Apportioning Value for Fulmar During Winter and Migration Seasons

SPA[1]	Winter			Migration		
	BDMPS population (no. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value	BDMPS population (no. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value
Buchan Ness to Collieston Coast	568,736	2,422	0.004	957,502	4,090	0.004
Calf of Eday	568,736	3,264	0.006	957,502	5,143	0.005
Cliffs of Moher[2]	568,736	371	0.001	957,502	357	0.000
Copinsay	568,736	2,888	0.005	957,502	4,551	0.005
East Caithness Cliffs	568,736	25,166	0.044	957,502	42,492	0.044
Fair Isle	568,736	52,538	0.092	957,502	82,780	0.086
Fetlar	568,736	35,011	0.062	957,502	24,882	0.026
Flamborough and Filey Coast	568,736	1,556	0.003	957,502	2,627	0.003
Flannan Isles	568,736	566	0.001	957,502	545	0.001
Foula	568,736	35,011	0.062	957,502	55,164	0.058
Fowlsheugh	568,736	342	0.001	957,502	577	0.001
Hermaness, Saxa Vord and Valla Field	568,736	12,404	0.022	957,502	19,544	0.020
Hoy	568,736	34,706	0.061	957,502	54,684	0.057
Mingulay and Berneray	568,736	698	0.001	957,502	673	0.001
North Caithness Cliffs	568,736	25,251	0.044	957,502	39,786	0.042
North Rona and Sula Sgeir	568,736	386	0.001	957,502	372	0.000
Noss	568,736	9,299	0.016	957,502	14,652	0.015
Rousay	568,736	1,825	0.003	957,502	2,876	0.003
Shiant Isles	568,736	339	0.001	957,502	326	0.000
St Kilda	568,736	5,099	0.009	957,502	4,914	0.005

SPA[1]	Winter			Migration		
	BDMPS population (no. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value	BDMPS population (no. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value
Sumburgh Head	568,736	413	0.001	957,502	651	0.001
Troup, Pennan and Lion's Heads	568,736	3,181	0.006	957,502	5,371	0.006
West Westray	568,736	1,200	0.002	957,502	1,890	0.002

[1] SPA colonies with an apportioning value of 0.000 for both winter and migration have been removed. For a full list of designated sites, see Annex B.
[2] SPA colony not presented in Furness (2015) but was found to have connectivity within the Array Area during the breeding season.

3.3 Gannet

3.3.1 Apportioning was carried out for impacts from collision and displacement in gannet. Breeding season apportioning values for SPAs which include gannet as a Qualifying Feature or named as part of the seabird assemblage and are within foraging range of the Array Area are presented in Table 3.3. Apportioning weightings for non-designated breeding colonies are presented in Annex B. Apportioning values for the non-breeding season are presented in Table 3.4.

Table 3.3: Apportioning Values for Gannet During the Breeding Season

SPA	Colony count (AOS/AON) (Burnell *et al.*, 2023)	Number of breeding adults (individuals)	Distance to the Array Area (km)	Proportion of foraging range at sea	Resulting weighting	Apportioning value
Fair Isle	4,971	9,942	285.11	0.855	0.029	0.009
Flamborough and Filey Coast	13,392	26,784	321.22	0.605	0.087	0.027
Forth Islands	75,259	150,518[2]	127.89[2]	0.733	2.559	0.798
Hermaness, Saxa Vord and Valla Field	29,562	59,124	470.05	0.865	0.063	0.020
North Rona and Sula Sgeir	12,271	24,542	382.88	0.883	0.039	0.012
Noss	13,765	27,530	353.17	0.851	0.053	0.016
St Kilda	60,290	120,580	552.99	0.858	0.094	0.029

SPA	Colony count (AOS/AON) (Burnell *et al.*, 2023)	Number of breeding adults (individuals)	Distance to the Array Area (km)	Proportion of foraging range at sea	Resulting weighting	Apportioning value
Sule Skerry and Sule Stack	9,065	18,130	305.64	0.880	0.045	0.014
Non-designated sites[1]	-	27,904	-	-	-	0.074

[1]Non-designated colonies include non-SPA colonies and SPA colonies for which gannet are not a Qualifying Feature and/or named within a qualifying seabird assemblage.
[2]The distance from the Array Area was measured from Bass Rock, the only breeding colony of gannet within Forth Islands SPA.

Table 3.4: Apportioning Values for Gannet During Both Autumn and Spring Migration

SPA	Autumn Migration			Spring Migration		
	BDMPS population (no. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value	BDMPS population (no. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value
Ailsa Craig	456,299	4,395	0.010	248,385	0	0.000
Fair Isle	456,299	11,364	0.025	248,385	8,036	0.032
Flamborough and Filey Coast	456,299	38,249	0.084	248,385	22,653	0.091
Forth Islands	456,299	191,857	0.420	248,385	113,627	0.457
Grassholm	456,299	6,365	0.014	248,385	0	0.000
Hermaness, Saxa Vord and Valla Field	456,299	70,526	0.155	248,385	49,875	0.201
North Rona and Sula Sgeir	456,299	4,834	0.011	248,385	0	0.000
Noss	456,299	28,285	0.062	248,385	20,003	0.081
St Kilda	456,299	31,242	0.068	248,385	0	0.000
Sule Skerry and Sule Stack	456,299	2,450	0.005	248,385	0	0.000

3.4 Kittiwake

3.4.1 Apportioning was carried out for impacts from collision and displacement in kittiwake. Breeding season apportioning values for SPAs which include kittiwake as a Qualifying Feature or named as part of the seabird assemblage and are within foraging range of the Array Area are presented in Table 3.5. Apportioning weightings for non-designated breeding colonies are presented in Annex B. Apportioning values for the non-breeding season are presented in Table 3.6.

Table 3.5: Apportioning Values for Kittiwake During the Breeding Season

SPA	Colony count (AON) (Burnell *et al.*, 2023)	Number of breeding adults (individuals)	Distance to the Array Area (km)	Proportion of foraging range at sea	Resulting weighting	Apportioning value
Buchan Ness to Collieston Coast	11,295	22,590	55.88	0.721	0.933	0.213
Copinsay	955	1,910	228.29	0.833	0.004	0.001
East Caithness Cliffs	24,479	48,958	190.53	0.773	0.162	0.037
Farne Islands	4,402	8,804	150.62	0.612	0.059	0.013
Flamborough and Filey Coast	45,504	91,008	321.22	0.589	0.139	0.032
Forth Islands	4,542	9,084	115.07[2]	0.609	0.105	0.024
Fowlsheugh	14,039	28,078	51.30	0.673	1.474	0.337
Marwick Head	906	1,812	264.96	0.839	0.003	0.001
North Caithness Cliffs	5,571	11,142	221.21	0.805	0.026	0.006
St Abb's Head to Fast Castle	5,150	10,300	127.88	0.601	0.097	0.022
Troup, Pennan and Lion's Heads	10,616	21,232	107.04	0.735	0.234	0.054
West Westray	2,755	5,510	278.84	0.859	0.008	0.002
Non-designated sites[1]	-	58,398	-	-	-	0.257

[1]Non-designated colonies include non-SPA colonies and SPA colonies for which kittiwake are not a Qualifying Feature and/or named within a qualifying seabird assemblage.
[2] The distance from the Array Area was measured to the Isle of May instead of the geometric centre

Table 3.6: Apportioning Values for Kittiwake During Both Autumn and Spring Migration

SPA[1]	Autumn Migration			Spring Migration		
	BDMPS population (no. of individuals)	SPA population within BDMPS (No. of individuals)	Apportioning value	BDMPS population (No. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value
Buchan Ness to Collieston Coast	829,937	23,880	0.029	627,816	21,673	0.035
Calf of Eday	829,937	1,422	0.002	627,816	1,291	0.002
Cape Wrath	829,937	1,117	0.001	627,816	571	0.001
Copinsay	829,937	1,268	0.002	627,816	1,151	0.002
East Caithness Cliffs	829,937	76,941	0.093	627,816	69,828	0.111
Fair Isle	829,937	1,468	0.002	627,816	1,332	0.002
Farne Islands	829,937	6,555	0.008	627,816	5,950	0.009
Flamborough and Filey Coast SPA	829,937	71,623	0.086	627,816	65,002	0.104
Forth Islands	829,937	5,902	0.007	627,816	5,357	0.009
Foula	829,937	623	0.001	627,816	565	0.001
Fowlsheugh	829,937	17,778	0.021	627,816	16,134	0.026
Hermaness, Saxa Vord and Valla Field SPA	829,937	744	0.001	627,816	676	0.001
Hoy	829,937	756	0.001	627,816	686	0.001
Marwick Head	829,937	1,002	0.001	627,816	909	0.001
North Caithness Cliffs	829,937	19,326	0.023	627,816	17,539	0.028
North Colonsay and Western Cliffs	829,937	601	0.001	627,816	307	0.000
Noss	829,937	965	0.001	627,816	876	0.001
Rathlin Island	829,937	856	0.001	627,816	437	0.001
Rousay	829,937	3,359	0.004	627,816	3,048	0.005
St Abb's Head to Fast Castle	829,937	6,479	0.008	627,816	5,880	0.009

SPA[1]	Autumn Migration			Spring Migration		
	BDMPS population (no. of individuals)	SPA population within BDMPS (No. of individuals)	Apportioning value	BDMPS population (No. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value
Sumburgh Head	829,937	400	0.000	627,816	363	0.001
Troup, Pennan and Lion's Heads	829,937	28,362	0.034	627,816	25,740	0.041
West Westray	829,937	22,953	0.028	627,816	20,831	0.033

[1]SPA colonies with an apportioning value of 0.000 for both autumn and spring migration have been removed. For a full list of designated sites, see Annex B.

3.5 Great Black-backed Gull

3.5.1 Apportioning was carried out for impacts from collision in great black-backed gull. There are no SPAs which include great black-backed gull as a Qualifying Feature or named as part of the seabird assemblage within foraging range of the Array Area. Consequently, only apportioning for non-designated sites is presented in Table 3.7. Apportioning weightings for non-designated breeding colonies are presented in Annex B. Apportioning values for the non-breeding season are presented in Table 3.8.

Table 3.7: Apportioning Values for Great Black-backed Gull During the Breeding Season

SPA	Colony count (Burnell *et al.*, 2023)	Number of breeding adults (individuals)	Distance of the Array Area (km)	Proportion of foraging range at sea	Resulting weighting	Apportioning value
Non-designated sites[1]	-	161	-	-	-	1.000

[1]Non-designated colonies include non-SPA colonies and SPA colonies for which great black-backed gull are not a Qualifying Feature and/or named within a qualifying seabird assemblage.

Table 3.8: Apportioning Values for Great Black-backed Gull During the Non-breeding Season

SPA	BDMPS population (no. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value
Calf of Eday	91,399	1,270	0.014
Copinsay	91,399	985	0.011
East Caithness Cliffs	91,399	791	0.009
Hoy	91,399	271	0.003
Isles of Scilly	91,399	245	0.003
North Rona and Sula Sgeir	91,399	52	0.001

3.6 Herring Gull

3.6.1 Apportioning was carried out for impacts from collision in herring gull. Breeding season apportioning values for SPAs which include herring gull as a Qualifying Feature or named as part of the seabird assemblage and are within foraging range of the Array Area are presented in Table 3.9. Apportioning weightings for non-designated breeding colonies are presented in Annex B. As described in Section 2.3, a correction (0.675) for the non-breeding season is to be applied after apportioning impacts using breeding season apportioning values.

Table 3.9: Apportioning Values for Herring Gull During the Breeding Season

SPA	Colony count (AON) (Burnell *et al.*, 2023)	Number of breeding adults (individuals)	Distance to the Array Area (km)	Proportion of foraging range at sea	Resulting weighting	Apportioning value
Buchan Ness to Collieston Coast	2,077	4,154	55.88	0.704	0.239	0.181
Fowlsheugh	1,035	2,070	51.30	0.542	0.184	0.139
Non-designated sites[1]	-	12,951	-	-	-	0.680

[1]Non-designated colonies include non-SPA colonies and SPA colonies for which herring gull are not a Qualifying Feature and/or named within a qualifying seabird assemblage.

3.7 Arctic Tern

3.7.1 Apportioning was carried out for impacts from collision in Arctic tern. Breeding season apportioning values for SPAs which include Arctic tern as a Qualifying Feature or named as part of the seabird assemblage and are within foraging range of the Array Area are presented in Table 3.10. Apportioning weightings for non-designated breeding colonies are presented in Annex B. Apportioning values for the non-breeding season are presented in Table 3.11.

Table 3.10: Apportioning Values for Arctic Tern During the Breeding Season

SPA	Colony count (AON) (Burnell *et al.*, 2023)	Number of breeding adults (individuals)	Distance to the Array Area (km)	Proportion of foraging range at sea	Resulting weighting	Apportioning value
Non-designated sites[1]	-	3,196	-	-	-	1.000

[1]Non-designated colonies include non-SPA colonies and SPA colonies for which Arctic tern are not a Qualifying Feature and/or named within a qualifying seabird assemblage.

Table 3.11: Apportioning Values for Arctic Tern During the Non-breeding Season. All counts are Composed of Adults and Immatures

SPA	BDMPS population (no. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value
Auskerry	163,930	1,872	0.011
Coquet Island	163,930	3,442	0.021
Farne Islands	163,930	5,402	0.033
Forth Islands	163,930	745	0.005
Papa Stour	163,930	2,925	0.018
Papa Westray (North Hill and Holm)	163,930	439	0.003
Rousay	163,930	150	0.001
Sumburgh Head	163,930	507	0.003
West Westray	163,930	1,248	0.008

[1]SPA colonies with an apportioning value of 0.000 have been removed. For a full list of designated sites, see Annex B.

3.8 Guillemot

3.8.1 Apportioning was carried out for impacts from displacement in guillemot. Apportioning values for SPAs which include guillemot as a Qualifying Feature or named as part of the seabird assemblage and are within foraging range of the Array Area are presented in Table 3.12. Following NatureScot (2023a) guidance, the same apportioning values were used for both breeding and non-breeding seasons. Apportioning weightings for non-designated breeding colonies are presented in Annex B.

Table 3.12: Apportioning Values for Guillemot During the Breeding and Non-breeding Season

SPA	Colony count (Burnell *et al.*, 2023)	Number of breeding adults (individuals)	Distance to the Array Area (km)	Proportion of foraging range at sea	Resulting weighting	Apportioning value
Buchan Ness to Collieston Coast	29,433	39,440	55.88	0.714	0.216	0.201
Fowlsheugh	69,828	93,570	51.30	0.558	0.780	0.724
Non-designated sites[1]	-	10,959	-	-	-	0.075

[1]Non-designated colonies include non-SPA colonies and SPA colonies for which guillemot are not a Qualifying Feature and/or named within a qualifying seabird assemblage.

3.9 Razorbill

3.9.1 Apportioning was carried out for impacts from displacement in razorbill. Breeding season apportioning values for SPAs which include razorbill as a Qualifying Feature or named as part of the seabird assemblage and are within foraging range of the Array Area are presented in Table 3.13. Apportioning weightings for non-designated breeding colonies are presented in Annex B. Apportioning values for the non-breeding season are presented in Table 3.14.

Table 3.13: Apportioning Values for Razorbill During the Breeding Season

SPA	Colony count (Burnell *et al.*, 2023)	Number of breeding adults (individuals)	Distance to the Array Area (km)	Proportion of foraging range at sea	Resulting weighting	Apportioning value
Forth Islands	5,695	7,631	115.07	0.401	0.094	0.064
Fowlsheugh	14,063	18,844	51.30	0.592	0.790	0.536
St Abb's Head to Fast Castle	2,931	3,928	127.88	0.487	0.032	0.022
Troup, Pennan and Lion's Heads	4,518	6,054	107.04	0.663	0.052	0.035
Non-designated sites[1]	-	15,268	-	-	-	0.343

[1]Non-designated colonies include non-SPA colonies and SPA colonies for which razorbill are not a Qualifying Feature and/or named within a qualifying seabird assemblage.
[2]The distance from the Array Area was measured to the Isle of May instead of the geometric centre.

Table 3.14: Apportioning Values for Razorbill During Migration and Winter

SPA	Migration			Winter		
	BDMPS population (no. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value	BDMPS population (no. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value
Cape Wrath	591,874	240	0.000	218,622	575	0.003
East Caithness Cliffs	591,874	41,875	0.071	218,622	9,375	0.043
Fair Isle	591,874	2,974	0.005	218,622	686	0.003
Flamborough and Filey	591,874	33,503	0.057	218,622	7,501	0.034
Flannan Islands	591,874	121	0.000	218,622	289	0.001
Forth Islands	591,874	8,794	0.015	218,622	1,969	0.009
Foula	591,874	1,219	0.002	218,622	281	0.001
Fowlsheugh	591,874	11,805	0.020	218,622	2,643	0.012
Handa	591,874	594	0.001	218,622	1,420	0.006

SPA	Migration			Winter		
	BDMPS population (no. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value	BDMPS population (no. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value
Mingulay and Berneray	591,874	1,163	0.002	218,622	2,781	0.013
North Caithness Cliffs	591,874	5,525	0.009	218,622	1,275	0.006
North Rona and Sula Sgeir	591,874	125	0.000	218,622	299	0.001
Rathlin Island	591,874	1,770	0.003	218,622	1,539	0.007
Shiant Isles	591,874	489	0.001	218,622	1,168	0.005
Skomer, Skokholm and the Seas off Pembrokeshire	591,874	690	0.001	218,622	600	0.003
St Abb's to Fast Castle	591,874	4,084	0.007	218,622	914	0.004
St Kilda	591,874	196	0.000	218,622	468	0.002
Troup, Pennan and Lion's Heads	591,874	5,839	0.010	218,622	1,307	0.006
West Westray	591,874	1,788	0.003	218,622	412	0.002

3.10 Puffin

3.10.1 Apportioning was carried out for impacts from displacement in puffin. Breeding season apportioning values for SPAs which include puffin as a Qualifying Feature or named as part of the seabird assemblage and are within foraging range of the Array Area are presented in Table 3.15. Apportioning weightings for non-designated breeding colonies are presented in Annex B. Apportioning values for the non-breeding season are presented in Table 3.16.

Table 3.15: Apportioning Values for Puffin During the Breeding Season

SPA	Colony count (Burnell *et al.*, 2023)	Number of breeding adults (individuals)	Distance to the Array Area (km)	Proportion of foraging range at sea	Resulting weighting	Apportioning value
Coquet Island	25,029	50,058	182.92	0.577	0.324	0.119
Farne Islands	43,752	87,504	150.62	0.588	0.822	0.301
Forth Islands	42,923	85,846	115.07	0.566	1.434	0.525
Hoy	430	860	233.21	0.803	0.002	0.001
North Caithness Cliffs	3,039	6,078	221.21	0.782	0.020	0.007
Non-designated sites[1]	-	18,477	-	-	-	0.047

[1]Non-designated colonies include non-SPA colonies and SPA colonies for which puffin are not a Qualifying Feature and/or named within a qualifying seabird assemblage.
[2]The distance from the Array Area was measured to the Isle of May instead of the geometric centre.

Table 3.16: Apportioning Values for Puffin During the Non-breeding Season

SPA	BDMPS population (no. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value
Coquet Island	231,957	12,858	0.055
Fair Isle	231,957	3,657	0.016
Farne Islands	231,957	41,624	0.179
Flamborough and Filey Coast	231,957	998	0.004
Forth Islands	231,957	64,820	0.279

SPA	BDMPS population (no. of individuals)	SPA population within BDMPS (no. of individuals)	Apportioning value
Foula	231,957	7,686	0.033
Hermaness, Saxa Vord and Valla Field	231,957	8,083	0.035
Hoy	231,957	1,196	0.005
North Caithness Cliffs	231,957	333	0.001
Noss	231,957	274	0.001
Shiant Isles SPA	231,957	266	0.001
St Kilda	231,957	580	0.003
Sule Skerry and Sule Stack	231,957	243	0.001

[1]SPA colonies with an apportioning value of 0.000 have been removed. For a full list of designated sites, see Annex B.

4 Discussion

4.1 Overview

4.1.1 Apportioning was carried out using the NatureScot (2018) approach for all species during the breeding season. During the non-breeding season, apportioning for the majority of species were carried out using information from the BDMPS presented in Furness (2015).

4.2 Results

4.2.1 Mortalities are expected to be widely distributed across designated SPAs for fulmar during the breeding season, with no SPAs expected to contribute more than 10% of individuals within the Array Area, and five designated SPAs contributing over 5%:

- East Caithness Cliffs SPA (8.3%);
- Hoy SPA (8.1%);
- North Caithness Cliffs SPA (6.7%);
- Fair Isle SPA (8.7%); and
- Buchan Ness to Collieston Coast SPA (6.0%).

4.2.2 In both the winter and migration seasons, Fair Isle SPA had the highest apportioning values (Winter = 9.2%; Migration = 8.6%). The next highest apportioning values for fulmar during the winter and migration seasons are Hoy SPA (Winter = 6.1%, Migration = 5.7%), Fetlar SPA (Winter = 6.2%, Migration = 2.6%), East Caithness Cliffs (Winter = 4.4%, Migration = 4.4%) and North Caithness Cliffs SPA (Winter = 4.4%, Migration = 4.2%).

4.2.3 For gannet, the Forth Islands SPA was found to have the highest apportioning value across all three seasons: breeding season (79.8%), autumn migration (42.0%), and spring migration (45.7%). The only other apportioning value greater than 10% for gannet is Hermaness, Saxa Vord and Valla Field SPA during autumn migration (15.5%) and spring migration (20.1%).

4.2.4 Approximately one third of kittiwake mortalities during the breeding season are expected to impact individuals associated with Fowlsheugh SPA (33.7%), followed by Buchan Ness to Collieston Coast SPA (21.3%). During the autumn and spring migration, East Caithness Cliffs SPA had the highest apportioning values (Autumn = 9.3%, Spring = 11.1%), followed by Flamborough and Filey Coast SPA (Autumn = 8.6%, Spring = 10.4%).

4.2.5 For great black-backed gull, there were no designated SPAs with connectivity to the Proposed Development. The highest apportioning value for the non-breeding season for great black-backed gull was Calf of Eday SPA (1.4%), followed by Copinsay SPA (1.1%).

4.2.6 There were only two designated colonies with connectivity to the Proposed Development during the breeding and non-breeding season for herring gull: Buchan Ness to Collieston Coast SPA (18.1%), and Fowlsheugh SPA (13.9%).

4.2.7 There were no designated SPAs with connectivity to the Proposed Development during the breeding season for the Arctic tern. During the non-breeding season, mortalities were distributed across multiple SPAs meaning the most impacted colonies, such as Farne Islands SPA (3.3%) and Coquet Island SPA (2.1%), were relatively low.

4.2.8 For guillemot, there were only two designated SPAs with connectivity to the Proposed Development during the breeding and non-breeding season; Buchan Ness to Collieston Coast SPA (20.1%) and Fowlsheugh SPA (72.4%).

4.2.9 For razorbill, the majority of the breeding season impact was attributed to one SPA, Fowlsheugh SPA (53.6%). However, during the non-breeding season the number of mortalities attributed to each colony was much lower and more evenly spread, with the highest apportioning values attributed to East Caithness Cliffs SPA in winter (4.3%), and migration (7.1%).

4.2.10 For puffin, the highest apportioning values were attributed to Forth Islands SPA (52.5%), Farne Islands SPA (30.1%), and Coquet Island SPA (11.9%) during the breeding season. During the non-breeding season, the only SPAs to have an apportioning value of over 10% were the Forth Islands SPA (27.9%) and Farne Islands SPA (17.9%).

4.2.11 The apportioning values taken forward to apportion mortalities from displacement and CRM are shown in Table 4.1.

Table 4.1: Apportioning Values Used to Apportion Mortalities from Displacement and CRM Analysis. Only SPAs with an Apportioning Value Greater Than 0.000 for Either Season Have Been Presented

SPA	Breeding Season Apportioning Value	Non-breeding Season Apportioning Value[1]
Fulmar		
Buchan Ness to Collieston Coast	0.060	W = 0.004; M = 0.004
Calf of Eday	0.007	W = 0.006; M = 0.005
Cape Wrath	0.003	W = 0.000; M = 0.000
Clare Island	0.001	W = 0.000; M = 0.000
Cliffs of Moher	0.001	W = 0.001; M = 0.000
Copinsay	0.007	W = 0.005; M = 0.005
East Caithness Cliffs	0.083	W = 0.044; M = 0.044
Fair Isle	0.087	W = 0.092; M = 0.086
Fetlar	0.010	W = 0.062; M = 0.026
Flamborough and Filey Coast	0.002	W = 0.003; M = 0.003
Flannan Isles	0.002	W = 0.001; M = 0.001
Foula	0.017	W = 0.062; M = 0.058
Fowlsheugh	0.045	W = 0.001; M = 0.001
Handa	0.001	W = 0.000; M = 0.000
Hermaness, Saxa Vord and Valla Field	0.013	W = 0.022; M = 0.020
Hoy	0.081	W = 0.061; M = 0.057
Mingulay and Berneray	0.004	W = 0.001; M = 0.001
North Caithness Cliffs	0.067	W = 0.044; M = 0.042
North Rona and Sula Sgeir	0.003	W = 0.001; M = 0.000
Noss	0.009	W = 0.016; M = 0.015
Rousay	0.007	W = 0.003; M = 0.003
Shiant Isles	0.002	W = 0.001; M = 0.000

SPA	Breeding Season Apportioning Value	Non-breeding Season Apportioning Value[1]
St Kilda	0.018	W = 0.009; M = 0.005
Sumburgh Head	0.012	W = 0.001; M = 0.001
Troup, Pennan and Lion's Heads	0.037	W = 0.006; M = 0.006
West Westray	0.003	W = 0.002; M = 0.002
Gannet		
Ailsa Craig	-	A = 0.010; S = 0.000
Fair Isle	0.009	A = 0.025; S = 0.032
Flamborough and Filey Coast	0.027	A = 0.084; S = 0.091
Forth Islands	0.798	A = 0.420; S = 0.457
Grassholm	-	A = 0.014; S = 0.000
Hermaness, Saxa Vord and Valla Field	0.020	A = 0.155; S = 0.201
North Rona and Sula Sgeir	0.012	A = 0.011; S = 0.000
Noss	0.016	A = 0.062; S = 0.081
St Kilda	0.029	A = 0.068; S = 0.000
Sule Skerry and Sule Stack	0.014	A = 0.005; S = 0.000
Kittiwake		
Buchan Ness to Collieston Coast	0.213	A = 0.029; S = 0.035
Calf of Eday	0.000	A = 0.002; S = 0.002
Cape Wrath	-	A = 0.001; S = 0.001
Copinsay	0.001	A = 0.002; S = 0.002
East Caithness Cliffs	0.037	A = 0.093; S = 0.111
Fair Isle	-	A = 0.002; S = 0.002
Farne Islands	0.013	A = 0.008; S = 0.009
Flamborough and Filey Coast	0.032	A = 0.086; S = 0.104
Forth Islands	0.024	A = 0.007; S = 0.009

SPA	Breeding Season Apportioning Value	Non-breeding Season Apportioning Value[1]
Foula	-	A = 0.001; S = 0.001
Fowlsheugh	0.337	A = 0.021; S = 0.026
Hermaness, Saxa Vord and Valla Field	-	A = 0.001; S = 0.001
Hoy	0.000	A = 0.001; S = 0.001
Marwick Head	0.001	A = 0.001; S = 0.001
North Caithness Cliffs	0.006	A = 0.023; S = 0.028
North Colonsay and Western Cliffs	-	A = 0.001; S = 0.000
Noss	-	A = 0.001; S = 0.001
Rathlin Island	-	A = 0.001; S = 0.001
Rousay	0.000	A = 0.004; S = 0.005
St Abb's Head to Fast Castle	0.022	A = 0.008; S = 0.009
Sumburgh Head	-	A = 0.000; S = 0.001
Troup, Pennan and Lion's Heads	0.054	A = 0.034; S = 0.041
West Westray	0.002	A = 0.028; S = 0.033
Great black-backed gull		
Calf of Eday	-	0.014
Copinsay	-	0.011
East Caithness Cliffs	-	0.009
Hoy	-	0.003
Isles of Scilly	-	0.003
North Rona and Sula Sgeir	-	0.001
Herring gull		
Buchan Ness to Collieston Coast	0.181	0.182[2]
Fowlsheugh	0.139	0.140[2]

SPA	Breeding Season Apportioning Value	Non-breeding Season Apportioning Value[1]
Arctic tern		
Auskerry	-	0.011
Coquet Island	-	0.021
Farne Islands	-	0.033
Forth Islands	-	0.005
Papa Stour	-	0.018
Papa Westray (North Hill and Holm)	-	0.003
Rousay	-	0.001
Sumburgh Head	-	0.003
West Westray	-	0.008
Guillemot		
Buchan Ness to Collieston Coast	0.201	0.201
Fowlsheugh	0.724	0.726
Razorbill		
Cape Wrath	-	W = 0.003; M = 0.000
East Caithness Cliffs	-	W = 0.043; M = 0.071
Fair Isle	-	W = 0.003; M = 0.005
Flamborough and Filey	-	W = 0.034; M = 0.057
Flannan Islands	-	W = 0.001; M = 0.000
Forth Islands	0.064	W = 0.009; M = 0.015
Foula	-	W = 0.001; M = 0.002
Fowlsheugh	0.536	W = 0.012; M = 0.020
Handa	-	W = 0.006; M = 0.001
Mingulay and Berneray	-	W = 0.013; M = 0.002
North Caithness Cliffs	-	W = 0.006; M = 0.009

SPA	Breeding Season Apportioning Value	Non-breeding Season Apportioning Value[1]
North Rona and Sula Sgeir	-	W = 0.001; M = 0.000
Rathlin Island	-	W = 0.007; M = 0.003
Shiant Isles	-	W = 0.005; M = 0.001
Skomer, Skokholm and the Seas off Pembrokeshire	-	W = 0.003; M = 0.001
St Abb's Head to Fast Castle	0.022	W = 0.004; M = 0.007
St Kilda	-	W = 0.002; M = 0.000
Troup, Pennan and Lion's Heads	0.035	W = 0.006; M = 0.010
West Westray	-	W = 0.002; M = 0.003
Puffin		
Coquet Island	0.119	0.055
Fair Isle	-	0.016
Farne Islands	0.301	0.179
Forth Islands	0.525	0.279
Foula	-	0.033
Hermaness, Saxa Vord and Valla Field	-	0.035
Hoy	0.001	0.005
North Caithness Cliffs	0.007	0.001
Noss	-	0.001
Shiant Isles	-	0.001
St Kilda	-	0.003
Sule Skerry and Sule Stack	-	0.001

[1]For species where more than one non-breeding season is presented in Furness (2015), multiple apportioning values are reported. 'A' indicates values for autumn migration, 'S' for spring migration, 'M' for migration seasons, and 'W' for winter.
[2]Once apportioned mortalities have been calculated, a correction of 0.675 is applied.

4.3 Methodology – Assumptions and Caveats

4.3.1 The methodology used to carry out apportioning within this report are underlined by various assumptions. For example, it is assumed that birds at sea are evenly distributed which is unlikely due to various factors such as patchy prey distributions. Moreover, it is assumed that breeding colonies are independent of each other and individuals can only be associated with one colony.

4.3.2 An alternative approach to non-breeding season apportioning has been used for gannet in other applications (e.g. Xodus, 2024; SSE Renewables, 2022; MacArthur Green, 2015). In these applications, tracking data presented in MacArthur Green (2015) has been used to estimate the number of individuals from each colony expected to travel through the Array Area during migration. The apportioning value is then calculated by dividing the number of individuals from a given SPA expected to travel through the Array Area by the total number of individuals expected to travel through the Array Area. It is expected that using this method would likely result in lower mortalities and impacts to survival rates for colonies, such as Fair Isle SPA and Noss SPA, where tracking data showed that only half of the population within the BDMPS are expected to travel over the Array Area during migration. However, as there are low numbers of gannet present in the non-breeding season, as they migrate south, use of the alternative method would make minimal difference to the predicted impact during the non-breeding season.

4.3.3 The Scottish Government's Ornithology Road Map gave high priority to increasing tracking studies as the resulting data are highly informative on breeding season foraging distribution. Studies reveal significant variation in distribution between colonies and between seasons, so it is important that insights from tracking are used to help add realism to the apportioning process.

4.4 Immature Proportions

4.4.1 For some species, such as kittiwake, not all immature age classes can be identified successfully from at sea imagery collected during DAS. In the case of kittiwake, this could potentially lead to an underestimation of the immature proportion as older immature individuals (two- or three-year old) are more likely to show affinity to natal waters.

4.4.2 To account for this the approach described in Section 2.3 was applied. However, this method could still lead to an underestimation of the number of immatures, and therefore an overestimation of the number of adults carried through to assessment.

References

Bradbury, G., Trinder, M., Furness, B., Banks, A. N., Caldow, R. W. G. and Hume, D. (2014). Mapping Seabird Sensitivity to OWFs. PLoS ONE, 9(9). DOI: 10.1371/journal.pone.0106366.

Buckingham, L., Bogdanova, M.I., Green, J.A., Dunn, R.E., Wanless, S., Bennett, S., Bevan, R.M., Call, A., Canham, M., Corse, C.J., Harris, M.P., Heward, C.J., Jardine, D.C., Lennon, J., Parnaby, D., Redfern, C.P.F., Scott, L., Swann, R.L., Ward, R.M., Weston, E.D., Furness, R.W., Daunt, F. (2022). Interspecific variation in non-breeding aggregation: a multi-colony tracking study of two sympatric seabirds. Marine Ecology Progress Series. 684: 181-197.

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

Butler, A., Carroll, M., Searle, K., Bolton, M., Waggitt, J., Evans, P., Rehfisch, M., Goddard, B., et al. (2020). Attributing seabirds at sea to appropriate breeding colonies. Scottish Marine and Freshwater Science 11(8). Marine Scotland Science.

Coulson, J.C. (2011). The Kittiwake. T and AD Poyser, London, UK.

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, No. 164.

Horswill, C. and Robinson, R.A. (2015). Review of seabird demographic rates and density dependence. JNCC Report No. 522.

MacArthur Green (2015). *East Anglia THREE. Information for Habitats Regulations Assessment. Appendix 3: Apportioning of the Flamborough Head and Filey Coast SPA Gannet Population among North Sea Offshore Windfarms*. Available at: https://nsip-documents.planninginspectorate.gov.uk/published-documents/EN010079-002687-ExA;%20FurtherWQApp23.1;%2010.D4.6_EA3%20HRA%20Appendix%203.pdf Accessed on: 22 August 2025.

Marine Scotland (2017a). *Marine Scotland - Licensing Operations Team Scoping Opinion. Addendum: Ornithology. Scoping Opinion for Inch Cape Offshore Windfarm – Revised Design Parameters – Ornithology*. Available at: https://marine.gov.scot/sites/default/files/00523413.pdf. Accessed on: 19 August 2025.

Marine Scotland (2017b). *Marine Scotland - Licensing Operations Team Scoping Opinion. Scoping Opinion For The Proposed Section 36 Consent And Associated Marine Licence Application For The Revised Seagreen Phase 1 Offshore Project*. Available at: https://marine.gov.scot/sites/default/files/00524860_1.pdf. Accessed on: 19 August 2025.

MD-LOT (2024). *Scoping Opinion – Bowdun Offshore Wind Farm.* Marine Directorate – Licensing Operations Team. Available at: https://marine.gov.scot/sites/default/files/scoping_opinion_17.pdf. Accessed on: 01 May 2025.

NatureScot. (2018). *Interim Guidance on apportioning impacts from marine renewable developments to breeding seabird populations in SPAs*. Available at: https://www.nature.scot/doc/interim-guidance-apportioning-impacts-marine-renewable-developments-breeding-seabird-populations. Accessed on: 19 August 2025.

NatureScot. (2023a). *Guidance Note 3: Guidance to support Offshore Wind applications: Martine Birds – Identifying theoretical connectivity with breeding site Special protection areas using breeding season foraging ranges*. Available at: https://www.nature.scot/doc/guidance-note-3-guidance-support-offshore-wind-applications-marine-birds-identifying-theoretical. Accessed on: 19 August 2025.

NatureScot. (2023b). *Guidance Note 4: Guidance to Support Offshore Wind Applications: Ornithology – Determining Connectivity of Marine birds with Marine Special protection Areas and Breeding Seabirds from Colony SPAs in the Non-Breeding Season*. Available at: https://www.nature.scot/doc/guidance-note-4-guidance-support-offshore-wind-applications-ornithology-determining-connectivity. Accessed on: 19 August 2025.

Olsen, K.M. and Larsson, H. (2003). Gulls of Europe, Asia and North America. Christopher Helm, London.

Scottish Government (2020). *Sectoral Marine Plan for Offshore Wind Energy*. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2020/10/sectoral-marine-plan-offshore-wind-energy/documents/sectoral-marine-plan-offshore-wind-energy/sectoral-marine-plan-offshore-wind-energy/govscot%3Adocument/sectoral-marine-plan-offshore-wind-energy.pdf. Accessed on: 19 August 2025.

SSE Renewables (2022). *Berwick Bank Wind Farm Offshore Environmental Impact Assessment. Appendix 11.5: ornithology Apportioning Technical Report*. Available at: https://marine.gov.scot/sites/default/files/beae821.pdf. Accessed on: 19 August 2025.

Walsh, P.M., Halley, D.J., Harris, M.P., del Nevo, A., Sim, I.M.W. and Tasker, M.L. (1995). Seabird monitoring handbook for Britain and Ireland. JNCC / RSPB / ITE / Seabird Group, Peterbrough. ISBN 1 873701 73 X

Woodward, I., Thaxter, C.B., Owen, E. and Cook, A.S.C.P. (2019). Desk-based revision of seabird foraging ranges used for HRA screening. BTO research report No. 724.

Xodus (2024). *Cenos EIA. Appendix 24 – Apportioning Report*. Available at: https://marine.gov.scot/sites/default/files/cenos_eia_vol.4_-_a24_-_apportioning_report_redacted.pdf. Accessed on: 19 August 2025.