Bowdun Offshore Wind Farm, Offshore EIA Report

Volume 3, Technical Appendix 11.4: Offshore Ornithology Collision Risk Model Technical Report

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Glossary

Defined Term	Definition
Air Gap	The distance between the sea surface and the blade tip. This can be measured from Highest Astronomical Tide (HAT), Lowest Astronomical Tide (LAT) and Mean High Water Springs (MHWS). Regardless of parameter used, conversion factors are applied to ensure the distance will always be the same. Air gap is an important parameter in Collision Risk Modelling (CRM).
Applicant (the)	Bowdun Offshore Wind Farm Limited (BOWFL).
Array Area	The Array Area is the area in which the Offshore Generation Assets will be located.
Collision	The effect by which a bird may be impacted by direct collision. Birds passing through an offshore wind farm are at risk of colliding with the Wind Turbines (moving and stationary parts).
Digital Aerial Surveys (DAS)	A method for undertaking baseline ornithological and marine mammal data collection surveys. Usually undertaken over a period of 24 months.
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, Operations and Maintenance (O&M) and decommissioning.
Export Cable Corridor	The area of seabed seaward of Mean High Water Springs (MHWS) which connects the Array Area with the Landfall within which the Offshore Export Cables will be installed.
Impact	A change caused by an action that occurs during a project's lifetime.
Offshore Export Cables	Subsea cables used to transmit electricity generated offshore by the Wind Turbines from the OSPs to shore. The Transition Joint Bay is the location where the Offshore Export Cables terminate, and the onshore cabling begins.
Offshore Substation Platform(s) (OSPs)	OSPs comprise the support structure, topside and electrical components used for collecting and/or converting electricity generated by the Wind Turbines for transmission by the Offshore Export Cables.
Plan Option Area (POA)	A location identified in the Sectoral Marine Plan (SMP) as a preferred area for commercial scale offshore wind development.
Project (the)	An overarching term for the Bowdun Offshore Wind Farm (Bowdun OWF) comprising the offshore and onshore infrastructure required to generate and transmit electricity from the Array Area to the onshore Grid Connection Point. The Project includes the Offshore Generation Assets, the Offshore Transmission Assets and the Onshore Transmission Assets.

Defined Term	Definition
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.
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.
Site Boundary	The boundary within which all elements of the Proposed Development will be located. The Site Boundary comprises the Array Area and Export Cable Corridor which ends at MHWS.
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
CRH	Collision Risk Height
CRM	Collision Risk Modelling
DAS	Digital Aerial Surveys
EIA	Environmental Impact Assessment
HRA	Habitats Regulations Appraisal
JNCC	Joint Nature Conservation Committee
LiDAR	Light Detection and Ranging
LSE	Likely Significant Effect
MD-LOT	Marine Directorate – Licensing Operations Team
MLS	Most Likely Scenario
O&M	Operation and Monitoring
OWF	Offshore Wind Farm
RIAA	Report to Inform Appropriate Assessment
sCRM	Stochastic Collision Risk Model
SD	Standard Deviation
SNCB	Statutory Nature Conservation Body
TWP	Thistle Wind Partners
WCS	Worst Case Scenario

Table of Units

Units	Definition
%	Percent
°	Degree
GWh	Gigawatt-hour
km	Kilometre
km^2	Square kilometre
m	Metre
m/s	Metre per second
rpm	Rotations per minute

1 Introduction

1.1.1 This Offshore Ornithology Technical Report presents the modelled collision risk impacts 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 and 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 (see 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 Due to species-specific life history strategies, some marine bird species are at risk of collision with offshore Wind Turbines (Furness *et al.,* 2013) leading to injury or death. Collision Risk Modelling (CRM) aims to predict the number of bird collisions that may be caused by a wind farm development. CRM requires a number of assumptions, notably on the rate of avoidance of Wind Turbines by different species, and also species-specific life history information, site-specific Wind Turbine parameters and densities of flying birds from site-specific surveys (notably from Digital Aerial Surveys (DAS)). This technical report presents the method and results of the CRM for the assessment of collision risk resulting from the Proposed Development during the Operation and Maintenance (O&M) phase.

1.1.3 The information from this technical report informs the Environmental Impact Assessment (EIA) and Habitats Regulations Appraisal (HRA) to assess of the likely significant environmental effects/Likely Significant Effect (LSEs) of the Proposed Development on offshore ornithological receptors. This report accompanies the EIA provided in Volume 2, Chapter 11: Offshore Ornithology to support the consent application for the Proposed Development.

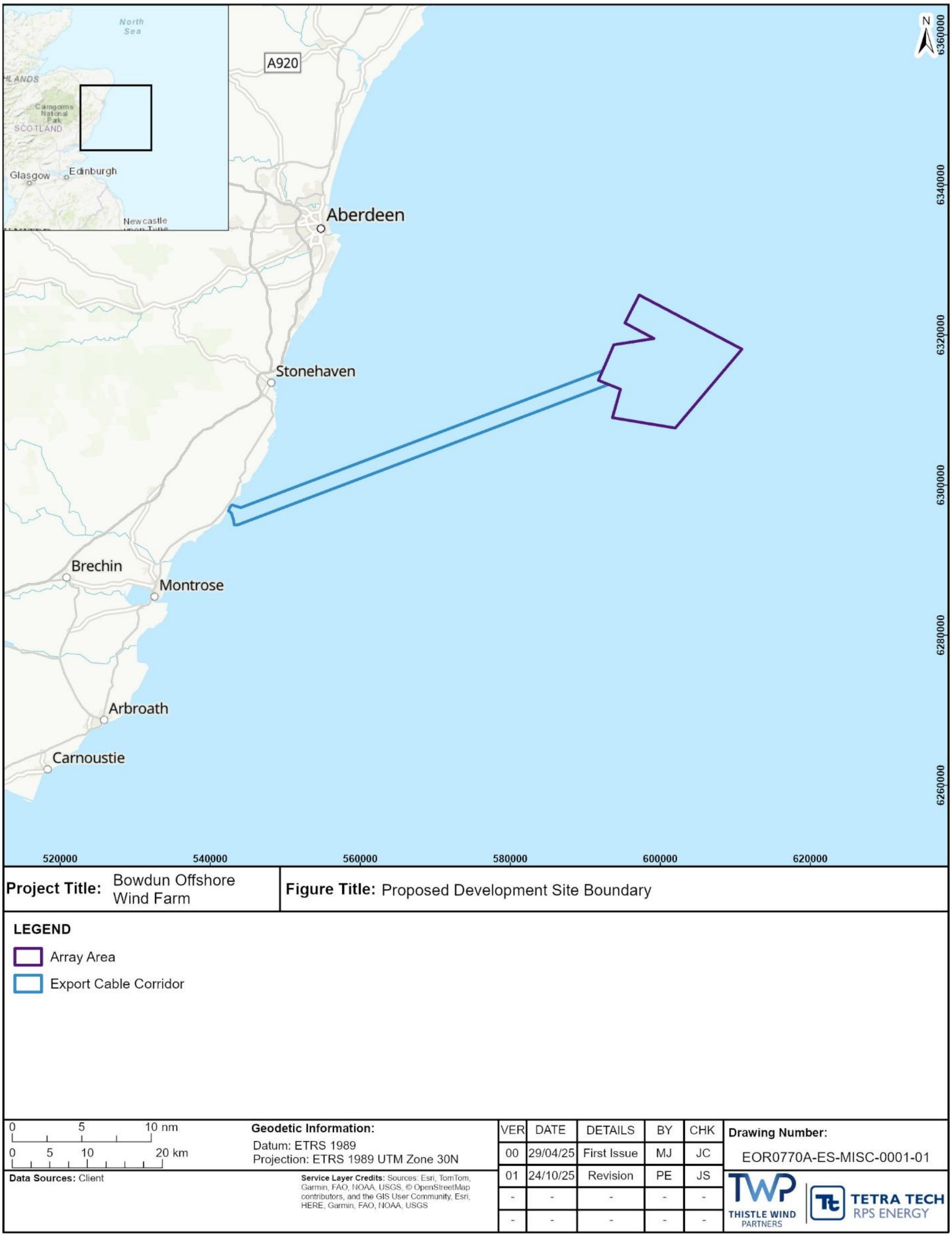

Figure 1.1: Proposed Development Site Boundary

2 Methods

2.1 Species for Consideration

2.1.1 CRM was conducted for the following five species:

- northern gannet *Morus bassanus*, hereafter 'gannet';
- black-legged kittiwake *Rissa tridactyla*, hereafter 'kittiwake';
- great black-backed gull *Larus marinus*;
- herring gull *Larus argentatus*; and
- Arctic tern *Sterna paradisaea*.

2.1.2 These five species were identified as potentially at risk of collision due to their recorded abundance in the Array Area (Figure 1.1) and their vulnerability to collision (Bradbury *et al.,* 2014; Wade *et al.,* 2016).

2.1.3 Species-specific vulnerability to collision with offshore Wind Turbines have been assessed in both Bradbury *et al.* (2014) and Wade *et al.* (2016) (Table 2.1). The five species in this technical report have moderate to very high vulnerability, with the highest vulnerability for herring gull and lowest for Arctic tern. Uncertainty in the vulnerability to collision risk with OWFs is reported in Wade *et al.* (2016). The lowest uncertainty, and therefore highest confidence in vulnerability rankings, was recorded in gannet, kittiwake and herring gull, with the highest uncertainty in vulnerability recorded in Arctic tern (Wade *et al.,* 2016).

Table 2.1: The Vulnerability of Species to Collision with Offshore Wind Turbines

Species	Vulnerability[1]	Uncertainty[2]
Gannet	High/High	Very low
Kittiwake	High/Very high	Very low
Great black-backed gull	Very high/Very high	Low
Herring gull	Very high/Very high	Very low
Arctic tern	Low/Moderate	Moderate

[1]As determined in Bradbury *et al.* (2014)/Wade *et al.* (2016). The numerical rankings of Wade *et al.* (2016) have been translated to vulnerability: >200 = Very High, 101 to 200 = High, 51 to 100 = Moderate, 1 to 50 = Low, 0 = Low.
[2]As determined in Wade *et al.* (2016).

2.1.4 Northern fulmar *Fulmarus glacialis,* hereafter 'fulmar', was not included in this technical report as advised in the Bowdun Offshore Scoping Opinion (Marine Directorate – Licensing Operations Team (MD-LOT), 2024). Fulmar was not considered to be at high risk of collision impact, as the species' flight height is generally close to the sea surface and below potential collision height (Johnston *et al.,* 2014).

2.1.5 Other birds excluded from further analysis are Manx shearwater *Puffinus puffinus* and lesser black-backed gull *Larus fuscus.* Both species were infrequently recorded within the Array Area in low numbers. Manx shearwater was only observed during two surveys (April and July 2022), with a peak density of 0.03 flying birds per km^2 recorded in July 2022. Therefore, with a peak density of 0.02 birds per km^2 used within CRM, collision rates would be negligible. Lesser black-backed gull were only recorded in June 2023, at a density of 0.04 flying birds per km^2, equating to a density of 0.02 flying birds per km^2 to be used within CRM. Such a low occurrence in the Array Area means collision risk was evidently negligible so was excluded from CRM.

2.2 Overview of CRM Methods

2.2.1 There are two CRM approaches to predict the number of bird collisions:

- **Deterministic Band CRM** (Band, 2012), hereafter referred to as the 'Band CRM'; and
- **Stochastic CRM** (sCRM); Masden, 2015; McGregor *et al.*, 2018).

2.2.2 The Band CRM provides deterministic estimates for the assessment of collision risk, with no variability in input parameters, and the sCRM approach extends this by incorporating variation of input parameters to allow for the estimation of uncertainty around predicted values. Both the Band CRM and sCRM are required as part of the ornithological impact assessment as advised in the Bowdun Offshore Scoping Opinion (MD-LOT, 2024).

2.2.3 CRM was therefore undertaken to obtain predicted collision impacts for the Array Area for Band CRM and sCRM (the latter using the sCRM shiny app (version 0.2.0; Caneco & Humphries, 2022)).

2.2.4 Band CRM and sCRM were conducted in line with one of four model frameworks (Masden, 2015); Option 2, as advised in the Bowdun Offshore Scoping Opinion (MD-LOT, 2024). Option 2 calculates the proportion of birds at collision risk height based on generic flight height distributions from Johnston *et al.* (2014) assuming a uniform distribution of risk over the rotor swept area (NatureScot, 2023).

2.2.5 For kittiwake, Option 1 of the model was also run using site-specific flight height data, collected using Light Detection and Ranging (LiDAR) surveys commissioned by Thistle Wind Partners (TWP) and covering the Array Area. In order to incorporate LiDAR data into the model, the proportion of kittiwake flying within the rotor swept area, and therefore at risk potential collision risk height (CRH), was calculated to be 0.008.

2.2.6 Further detail of the methods used to collect LiDAR data can be found in Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report, Annex E.

2.2.7 Two Wind Turbine scenarios have been modelled for the Proposed Development, as advised by NatureScot (2023):

- **Worst Case Scenario (WCS):** use of maximum rotation speeds with fixed foundation Wind Turbines, no curtailment and 67 Wind Turbines; and
- **Most Likely Scenario (MLS):** use of maximum rotation speeds with fixed foundation Wind Turbines, 5% predicted curtailment and 50 Wind Turbines.

2.2.8 As recommended in NatureScot (2023), the WCS was identified by the Maximum Design Scenario (see Table 2.1 and Volume 2, Chapter 11: Offshore Ornithology) and represents the scenario expected to have the largest impact. The MLS refers to the scenario that is most likely to be built and draws upon the most likely Wind Turbine option in the Project Design Envelope, combined with average turbine downtimes (curtailment) that are a better reflection of real-world scenarios.

2.2.9 Curtailment refers to reducing or stopping production of energy from Wind Turbines due to external factors. Typically, this is applied when the amount of energy being produced exceeds the capacity of the electrical grid to distribute that energy. As Wind Turbines will not be operating during this time, curtailment has been incorporated within the downtime (%) for the MLS (Section 2.4).

2.2.10 The evidence for curtailment was reviewed on 15 May 2025 using data from Wind Table (https://www.windtable.co.uk). It was found that curtailment figures in Scotland ranged from 0% (Aberdeen Bay) to 66% (SeaGreen), with an unweighted average of 13.5%, and a weighted average of 31.5% (Table 2.2).

Table 2.2: Review of Curtailment Losses in Scottish OWFs

Wind Farm	Potential Annual Yield (GWh)	Capacity Factor	Curtailment Losses (%) ↓	Actual Annual Yield (GWh)
Seagreen	4,304	16%	66%	1,462
Moray East	3,678	29%	38%	2,282
Moray West	2,933	64%	11%	2,603
Beatrice	2,275	45%	2%	2,229
Neart Na Gaoithe	926	28%	17%	764
Aberdeen Bay	318	38%	0%	318
Robin Rigg West	294	37%	1%	292
Robin Rigg East	264	36%	0%	264
Kincardine	152	38%	0%	152
Hywind	136	54%	0%	136

2.2.11 Following this review and having consulted with NatureScot on 29 July 2025, collision risk was modelled in the MLS using a precautionary 5% additional downtime to allow for the incorporation of curtailment in the model. This is well below the unweighted average for curtailment figures in Scotland and will thus provide a precautionary estimate of collision risk.

2.3 Wind Turbine Parameters

2.3.1 Wind Turbine parameters used for the two scenarios (WCS and MLS) for the Proposed Development are provided in Table 2.3. The outlined scenarios involve 67 or 50 Wind Turbines with fixed foundations for both scenarios.

Table 2.3: Wind Turbine Parameters for Two Scenarios of the Proposed Development

Parameter	WCS	MLS
Number of Wind Turbines	67	50
Number of rotor blades	3	3
Maximum chord width (m)	6.5	7.5
Average blade pitch (°)	5.1	5.1
Maximum rotator radius (m)	118	138
Average rotation speed (rpm)	7.1	6.1
Maximum rotation speed (rpm)	8.4	7.2
Tidal offset (m)	1.88	1.88
Lower blade tip height above the HAT (m) (Air Gap)	29.28	29.28
Array Area width (km)	18.4	18.4
Latitude	56.98	56.98
Large array correction (standard)	Yes	Yes

2.4 Total Wind Availability

2.4.1 The total percentage of operational time for the Wind Turbines is hereafter termed 'total availability'. Total availability of the Proposed Development is calculated using predicted mean downtime and monthly wind availability.

2.4.2 To calculate monthly wind availability (Table 2.4), a correction was applied to the values presented in Berwick Bank OWF application (Berwick Bank Wind Farm, 2022) using a cut-in speed of 3 m/s and a cut-out speed of 30 m/s. Information was taken from the Berwick Bank OWF application due to the proximity to the Proposed Development.

2.4.3 The total availability of the Wind Turbines on average is 92.18% and 87.40% for the WCS and MLS respectively (Table 2.4). WCS assumes a 3% downtime due to maintenance activities. MLS assumes an 8% downtime, with 3% due to maintenance activities and 5% due to curtailment.

Table 2.4: Total Monthly Operational Time (%) Accounting for Wind Availability (%) and Downtime. Downtime for WCS and MLS are 3% and 8% Respectively

Month	Wind availability, %	Maintenance, %	Curtailment, %	WCS total availability, %	MLS total availability, %
January	97.60	3	5	94.67	89.79
February	96.79	3	5	93.89	89.05
March	95.32	3	5	92.46	87.70
April	94.70	3	5	91.86	87.13
May	92.67	3	5	89.89	85.25
June	93.53	3	5	90.73	86.05
July	92.13	3	5	89.73	84.76
August	92.62	3	5	89.84	85.21

Month	Wind availability, %	Maintenance, %	Curtailment, %	WCS total availability, %	MLS total availability, %
September	95.55	3	5	92.68	87.91
October	96.77	3	5	93.87	89.03
November	95.00	3	5	92.15	87.40
December	97.31	3	5	94.39	89.53
Average	**95.00%**	**3%**	**5%**	**92.18%**	**87.40%**

2.5 Seabird Parameters

2.5.1 Band CRM and sCRM use recommended seabird parameters (Table 2.5 and Table 2.6), as provided by the Joint Nature Conservation Committee (JNCC) (JNCC *et al.*, 2024). All recommended seabird parameters within JNCC *et al.*, (2024) were derived from a variety of sources. Flight speeds were derived from Alerstam *et al.* (2007) except for gannet, which was taken from Pennycuik (1997). Nocturnal activity scores were derived from Garthe and Hüppop (2004), except for gannet and arctic tern, which were derived from Furness *et al.,* (2018), Garthe and Hüppop (2004), and Band (2012).

2.5.2 The latest JNCC guidance regarding avoidance rates (JNCC *et al.*, 2024) states that the European Offshore Wind Deployment Centre bird collision avoidance study in Aberdeen Bay (Tjørnløv *et al.*, 2023) was published after the guidance came out, so its data could not be included in the current advice on avoidance rates. The Statutory Nature Conservation Bodies (SNCBs) advise against using avoidance rates based on data from single wind farms. Instead, they recommend using avoidance rates derived from a meta-analysis of all available evidence across multiple wind farms and locations (Ozasanlav-Harris *et al.,* 2023). Future updates to SNCB advice will consider new evidence, as it becomes available (e.g. Tjørnløv *et al.*, 2023, ongoing monitoring at Neart Na Gaoithe OWF and Kincardine OWF).

2.5.3 Taking account of NatureScot (2023) guidance, additional CRM has been undertaken for gannet to replicate the macro-avoidance demonstrated by this species (NatureScot, 2023; Furness *et al.,* 2013; Ozasanlav-Harris *et al.,* 2023). During the non-breeding season, a 70% reduction in mortalities was calculated to demonstrate this (NatureScot, 2023).

2.5.4 Nocturnal activity of Arctic tern was determined with the ranking from Garthe and Hüppop (2004), who gave the Arctic tern a nocturnal activity score of one out of five (one being hardly any flight activity at night to five much flight activity at night). Band (2012) recommended that a nocturnal flight activity of one translates to 0% of daytime flight activity. Thus, 0% has been assigned to nocturnal flight activity for Arctic tern.

2.5.5 Band CRM was undertaken for the highest and lowest nocturnal activity levels of great black-backed gull and herring gull, in accordance with JNCC *et al.* (2024).

Table 2.5: Seabird Parameters Used for Band CRM as Recommended by JNCC *et al.* (2024)

Species	Body length (m)	Wingspan (m)	Flight speed (m/s^{-1})	Nocturnal activity (%)	Flight type	Upwind flight (%)
Gannet	0.94	1.72	14.9	14	Gliding	50
Kittiwake	0.39	1.08	13.1	40	Flapping	50
Great black-backed gull	0.71	1.58	13.7	25 to 50	Flapping	50
Herring gull	0.60	1.44	12.8	25 to 50	Flapping	50
Arctic tern	0.38	1.00	10.3	0[3]	Flapping	50

[3]Nocturnal activity of Arctic tern based on guidance from Garthe and Hüppop (2004) and Band (2012) – see text for more detail.

Table 2.6: Seabird Parameters Used for sCRM as Recommended by JNCC *et al.* (2024). Standard Deviations (SD) are Provided in Parentheses

Species	Body length (m)	Wingspan (m)	Flight speed (m/s^{-1})	Nocturnal activity (%)	Flight type	Upwind flight (%)
Gannet	0.94 (0.0325)	1.72 (0.0375)	14.9 (0)	14 (10)	Gliding	50
Kittiwake	0.39 (0.005)	1.08 (0.0625)	13.1 (0.4)	40 (12)	Flapping	50
Great black-backed gull	0.71 (0.035)	1.58 (0.0375)	13.7 (1.2)	37.5 (6.37)	Flapping	50
Herring gull	0.60 (0.0225)	1.44 (0.03)	12.8 (1.8)	37.5 (6.37)	Flapping	50
Arctic tern	0.38 (0.005)	1.00 (0.04)	10.3 (3.4)	0[4] (0)	Flapping	50

[4]Nocturnal activity of Arctic tern based on guidance from Garthe and Hüppop (2004) and Band (2012) – see text for more detail.

2.5.6 CRM uses mean monthly densities of flying birds within the Array Area. The mean monthly densities of flying birds were calculated using two years of DAS data from the Array Area. Estimates of flying birds in the Array Area only are presented in Annex A.

2.5.7 JNCC (2024) provides avoidance rates for Band CRM and sCRM (Table 2.7).

Table 2.7: Avoidance Rates for Band CRM (Band, 2012) and sCRM (Masden, 2015) from JNCC (2024). SD are Provided in Parentheses

Species	Band CRM	sCRM
Gannet	0.9923	0.9929 (0.0003)
Kittiwake	0.9923	0.9929 (0.0003)
Great black-backed gull	0.9936	0.9940 (0.0004)
Herring gull	0.9936	0.9940 (0.0004)
Arctic tern[5]	0.9902	0.9908 (0.0004)

[5]All ‘other tern’ species rate was used.

2.6 Seasonality

2.6.1 Collision mortality estimates are presented monthly and per season for each assessed seabird species. Within this assessment, both the breeding and non-breeding seasons follow NatureScot (2020) guidance (Table 2.8) and are defined as follows:

- **Breeding season:** birds are strongly associated with nest site, including nesting, egg laying and provisioning young; and
- **Non-breeding season**: birds are not strongly associated with nest site but present in significant numbers in Scottish marine areas.

2.6.2 NatureScot (2020) define a further period in the phenology of some seabird species, where birds attend breeding sites but are not closely associated with nest sites, occurring immediately before and/or after the breeding period. For the purpose of this assessment, the breeding site attendance period is attributed to the non-breeding season as per other OWF assessments (e.g. Berwick Bank Wind Farm, 2022).

2.6.3 Only the breeding season attendance period is provided for the Arctic tern as Arctic tern are not present in significant numbers in Scottish waters during the non-breeding season (NatureScot, 2020).

Table 2.8: Seasonal Definitions of Seabird Species Included in CRM, Taken from NatureScot (2020). The Range is Inclusive of Whole Months

Species	Breeding season	Non-breeding season
Gannet	mid-March to September	October to mid-March
Kittiwake	mid-April to August	September to mid-April
Great black-backed gull	April to August	September to March
Herring gull	April to August	September to March
Arctic tern	May to August	September to April

3 Results

3.1.1 For all species, monthly collision mortality estimates from the sCRM shiny app (Caneco & Humphries, 2022) are presented for the Band CRM (Table 3.1, Figure 3.1 and Figure 3.2) and sCRM (Table 3.2, Figure 3.1 and Figure 3.2).

3.1.2 As expected, WCS calculations give higher collisions than MLS, as the WCS was modelled with maximum rotation speed and reduced downtime compared to the MLS (Table 2.3 to Table 2.4). For all species, the WCS resulted in higher mean collisions compared to MLS using both Band CRM and sCRM (Table 3.1 to Table 3.2).

3.1.3 Band CRM and sCRM resulted in similar estimated collisions. sCRM incorporates variability around input parameters, allowing uncertainty around input parameters to be accounted for. This results in a larger variability of collision number predictions compared to the estimates of Band CRM (Figure 3.1 and Figure 3.2).

3.1.4 Whilst monthly estimates have been generated, seasonal and annual estimates have been carried forward for Population Viability Analysis within the EIA (Volume 3, Technical Appendix 11.7: Offshore Ornithology Population Viability Analysis Technical Report) and HRA (Report to Inform Appropriate Assessment (RIAA), Part 2: Special Areas of Conservation (TWP-BOW-RPS-ENV-RPT-00014), RIAA Part 3: Special Protection Areas and Ramsar Sites (TWP-BOW-RPS-ENV-RPT-00015)). To calculate seasonal estimates, the seasonal definitions (Table 2.8) have been used, and in cases of seasons spanning partial months (e.g. gannet) the monthly estimates have been halved. Seasonal and annual collision estimates were calculated for gannet (Section 3.2), kittiwake (Section 3.3), great black-backed gull (Section 3.4), herring gull (Section 3.5) and Arctic tern (Section 3.6) separately with the results for Band CRM and sCRM presented in Table 3.3 to Table 3.7.

Table 3.1: Predicted Monthly Number of Collisions Using Band CRM (Band, 2012) for WCS and MLS

Species	Model Option	Scenario	Nocturnal activity[6]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gannet	2	WCS	-	0.00	0.07	0.14	4.46	3.78	3.87	1.68	2.62	5.97	0.94	0.03	0.19
		MLS	-	0.00	0.06	0.11	3.46	2.93	3.00	1.30	2.03	4.64	0.73	0.03	0.15
	2 (70% reduction[7])	WCS	-	0.00	0.02	0.04	-	-	-	-	-	-	0.28	0.01	0.06
		MLS	-	0.00	0.02	0.03	-	-	-	-	-	-	0.22	0.01	0.05
Kittiwake	1	WCS	-	0.09	0.14	0.30	0.87	0.52	2.10	1.39	0.61	0.11	0.06	0.08	0.13
		MLS	-	0.12	0.18	0.38	1.11	0.67	2.68	1.78	0.78	0.14	0.07	0.10	0.17
	2	WCS	-	0.60	0.89	1.88	5.55	3.33	13.34	8.83	3.87	0.70	0.36	0.48	0.82
		MLS	-	0.76	1.13	2.37	7.02	4.22	16.89	11.19	4.90	0.88	0.45	0.61	1.04
Great black-backed gull	2	WCS	Lower	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	1.12
			Upper	0.18	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	1.56
		MLS	Lower	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.87
			Upper	0.14	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	1.21
Herring gull	2	WCS	Lower	0.00	0.23	0.00	0.00	1.86	19.34	3.30	0.80	0.00	0.00	0.22	0.76
			Upper	0.00	0.29	0.00	0.00	2.05	20.90	3.59	0.90	0.00	0.00	0.29	1.05
		MLS	Lower	0.00	0.18	0.00	0.00	1.44	14.99	2.55	0.62	0.00	0.00	0.17	0.59
			Upper	0.00	0.23	0.00	0.00	1.59	16.20	2.78	0.70	0.00	0.00	0.23	0.81
Arctic tern	2	WCS	-	0.00	0.00	0.00	0.12	0.00	0.00	0.07	1.47	0.00	0.00	0.00	0.00
		MLS	-	0.00	0.00	0.00	0.10	0.00	0.00	0.05	1.18	0.00	0.00	0.00	0.00

[6]As advised by JNCC *et al.* (2024), Band CRM is carried out with the upper and lower nocturnal activity levels for great black-backed gull and herring gull.
[7]A 70% reduction has been applied to non-breeding season months (October to mid-March) to account for macro-avoidance.

Table 3.2: Mean Monthly Number of Collisions Using sCRM (Masden, 2015) for WCS and MLS. SD are Provided in Parentheses

Species	Model Option	Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gannet	2	WCS	0.00 (0.00)	0.08 (0.05)	0.16 (0.12)	4.70 (2.83)	3.98 (2.41)	4.06 (2.08)	1.77 (1.04)	2.71 (1.57)	6.34 (3.60)	0.99 (0.68)	0.05 (0.04)	0.21 (0.16)
		MLS	0.00 (0.00)	0.06 (0.04)	0.12 (0.09)	3.64 (2.18)	3.08 (1.86)	3.14 (1.60)	1.37 (0.80)	2.09 (1.21)	4.91 (2.78)	0.77 (0.53)	0.04 (0.03)	0.16 (0.12)
	2 (70% reduction[8])	WCS	0.00 (0.00)	0.02 (0.02)	0.05 (0.04)	-	-	-	-	-	1.90 (1.08)	0.30 (0.20)	0.02 (0.01)	0.06 (0.04)
		MLS	0.00 (0.00)	0.02 (0.01)	0.04 (0.03)	-	-	-	-	-	1.47 (0.83)	0.23 (0.16)	0.01 (0.01)	0.05 (0.04)
Kittiwake	1	WCS	0.11 (0.05)	0.17 (0.08)	0.35 (0.11)	1.04 (0.28)	0.63 (0.27)	2.46 (0.54)	1.64 (0.31)	0.74 (0.33)	0.13 (0.05)	0.07 (0.03)	0.09 (0.04)	0.15 (0.06)
		MLS	0.09 (0.04)	0.13 (0.06)	0.27 (0.09)	0.81 (0.22)	0.49 (0.21)	1.92 (0.42)	1.29 (0.24)	0.58 (0.26)	0.10 (0.04)	0.05 (0.03)	0.07 (0.03)	0.12 (0.05)
	2	WCS	0.70 (0.35)	1.07 (0.55)	2.19 (0.8)	6.52 (2.04)	3.94 (1.81)	15.45 (4.28)	10.30 (2.51)	4.64 (2.24)	0.81 (0.33)	0.43 (0.22)	0.56 (0.27)	0.96 (0.42)
		MLS	0.55 (0.28)	0.85 (0.43)	1.73 (0.64)	5.15 (1.61)	3.11 (1.43)	12.20 (3.38)	8.12 (1.97)	3.66 (1.77)	0.64 (0.26)	0.34 (0.18)	0.44 (0.21)	0.76 (0.34)
Great black-backed gull	2	WCS	0.21 (0.14)	0.16 (0.03)	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)	0.00 (0.00)	0.41 (0.27)	1.52 (0.84)
		MLS	0.16 (0.11)	0.12 (0.03)	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)	0.00 (0.00)	0.32 (0.21)	1.18 (0.65)
Herring gull	2	WCS	0.00 (0.00)	0.25 (0.14)	0.00 (0.00)	0.00 (0.00)	8.17 (6.60)	19.7 (7.25)	3.44 (1.66)	0.84 (0.37)	0.00 (0.00)	0.00 (0.00)	0.26 (0.13)	0.95 (0.53)
		MLS	0.00 (0.00)	0.20 (0.11)	0.00 (0.00)	0.00 (0.00)	6.32 (5.11)	15.26 (5.63)	2.66 (1.29)	0.65 (0.28)	0.00 (0.00)	0.00 (0.00)	0.20 (0.10)	0.74 (0.41)
Arctic tern	2	WCS	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.19 (0.27)	0.00 (0.00)	0.00 (0.00)	0.12 (0.17)	2.12 (2.68)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
		MLS	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.15 (0.21)	0.00 (0.00)	0.00 (0.00)	0.09 (0.13)	1.68 (2.12)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)

[8]A 70% reduction has been applied to non-breeding season months (October to mid-March) to account for macro-avoidance.

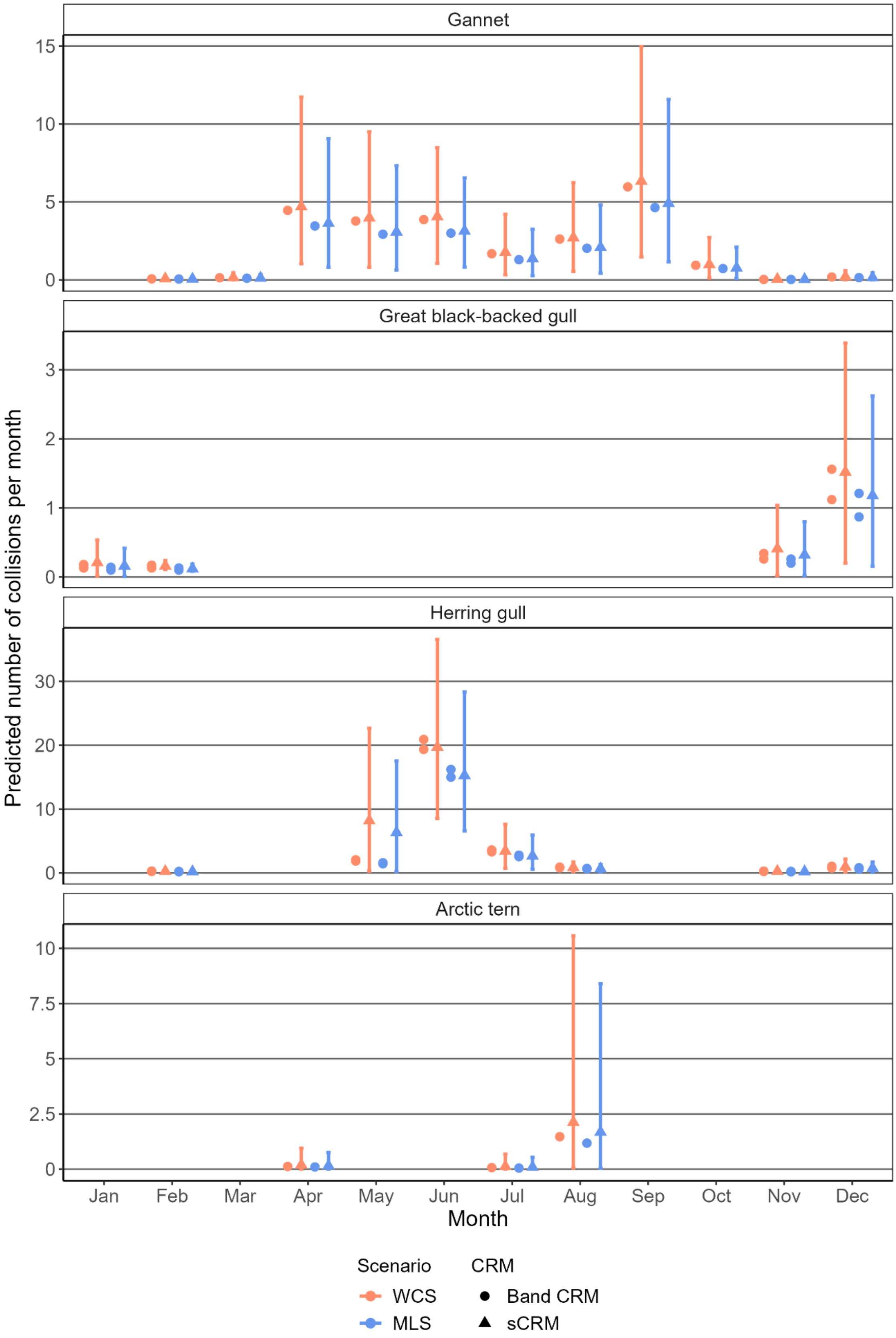

Figure 3.1: Mean Monthly Number of Collisions per Species for Band CRM and sCRM for WCS and MLS (Option 2 of the model only). Error Bars Denote ± SD for sCRM. Band CRM was Undertaken for the Highest and Lowest Nocturnal Activity Levels of Great Black-backed Gull and Herring Gull (JNCC *et al.*, 2024)

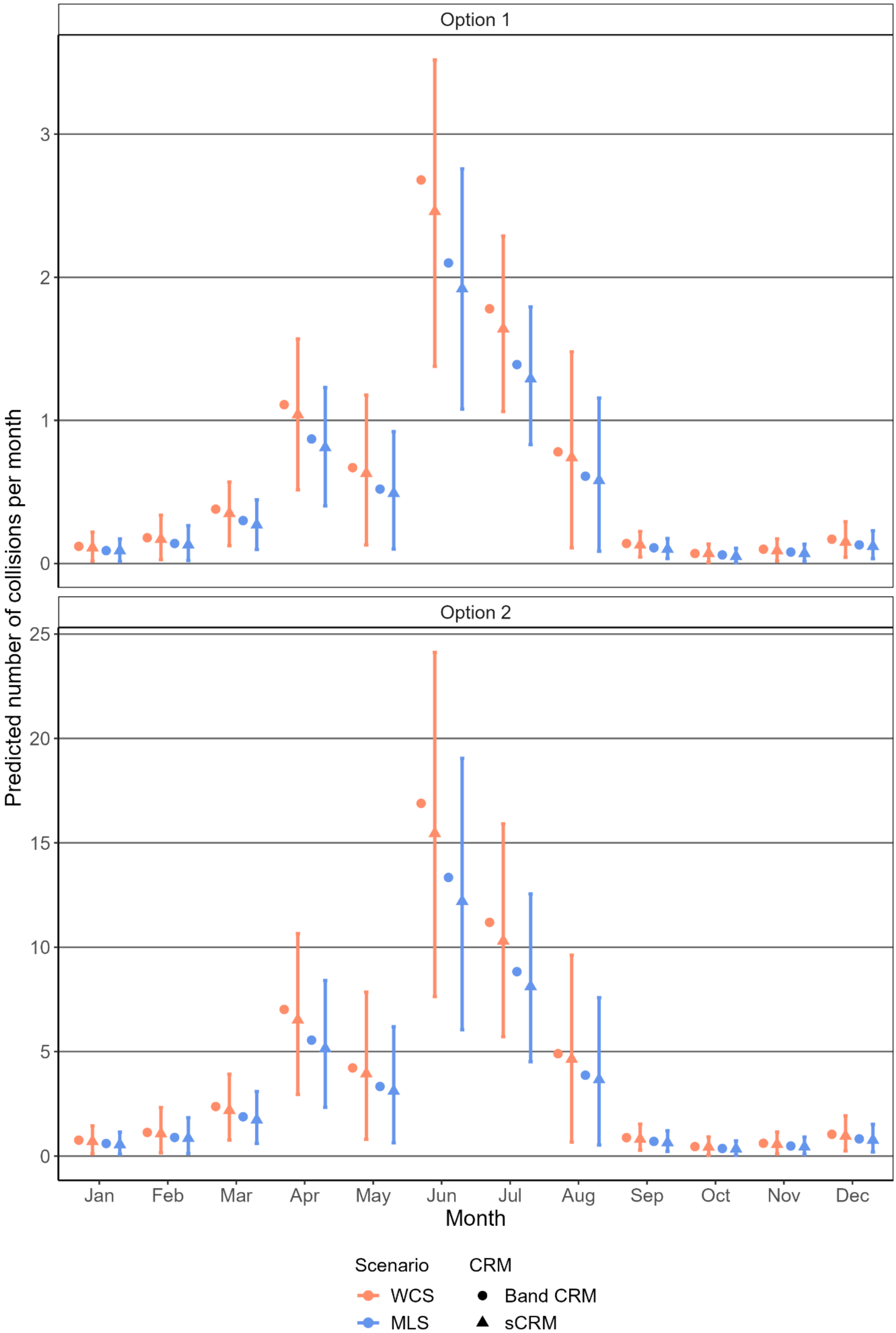

Figure 3.2: Mean Monthly Number of Collisions for Band CRM and sCRM for WCS and MLS for Kittiwake. Error Bars Denote ± SD for sCRM

3.2 Gannet

3.2.1 Monthly gannet collision estimates for Band CRM and sCRM are presented in Table 3.1 and Table 3.2 respectively. The estimated number of collisions were highest in the breeding season (Table 3.3), with the highest number of monthly collisions in September for all models (Table 3.1 and Table 3.2; Figure 3.1).

3.2.2 Seasonal and annual collision estimates for the gannet are provided in Table 3.3. The total estimated annual number of collisions of gannet were 24.06 and 18.62 for the WCS and MLS respectively for sCRM including the 70% reduction during the non-breeding season. For the Band CRM, it was estimated that 22.84 and 17.73 collisions would occur annually for the WCS and MLS respectively.

Table 3.3: Gannet Seasonal and Annual Collision Estimates for Band CRM and sCRM for WCS and MLS. For sCRM, Upper and Lower Estimates are Calculated Using the Upper and Lower Variability Measures (mean ± SD)

Season	Scenario	Band CRM	sCRM		
			Lower	Mean	Upper
Breeding (mid-March to September)	WCS	22.45	5.32	23.64	55.34
	MLS	12.42	4.16	18.29	42.74
Non-breeding (October to mid-March)	WCS	1.30	0.16	1.41	3.90
	MLS	1.03	0.14	1.09	3.01
Non-breeding (70 % reduction)	WCS	0.39	0.05	0.42	1.17
	MLS	0.31	0.04	0.33	0.90
Annual	WCS	23.75	5.45	25.05	59.23
	MLS	18.44	4.27	19.38	45.74
Annual (including 70 % reduction in non-breeding)	WCS	22.84	5.35	24.06	56.51
	MLS	17.73	4.18	18.62	43.64

3.3 Kittiwake

3.3.1 Monthly kittiwake collision estimates for Band CRM and sCRM are presented in Table 3.1 and Table 3.2 respectively. The estimated number of kittiwake collisions were highest in the breeding season (Table 3.4), with the highest number of monthly collisions in June for all models and both model options (Figure 3.2).

3.3.2 Seasonal and annual collision estimates for the kittiwake are provided in Table 3.4. The total estimated annual number of collisions of kittiwake were 47.57 and 37.55 for the WCS and MLS respectively when using sCRM (Option 2). For Band CRM (Option 2), the total estimated annual number of collisions of kittiwake increased to 51.46 and 40.65 individuals for the WCS and MLS respectively.

3.3.3 Using LiDAR data (Option 1), the number of collisions were found to noticeably decrease. Using the sCRM, annual collisions were estimated to be 7.58 and 5.92

for the WCS and MLS respectively. For the Band CRM the number of collisions were estimated to increase to 8.18 and 6.40 for the WCS and MLS respectively.

Table 3.4: Kittiwake Seasonal and Annual Collision Estimates for Band CRM and sCRM for WCS and MLS. For sCRM, Upper and Lower Estimates are Calculated Using the Upper and Lower Variability Measures (mean ± SD)

Season	Model Option	Scenario	Band CRM	sCRM		
				Lower	Mean	Upper
Breeding (mid-April to August)	1	WCS	6.47	2.94	5.99	9.26
		MLS	5.06	2.30	4.69	7.25
Non-breeding (September to mid-April)		WCS	1.72	0.54	1.59	2.74
		MLS	1.35	0.41	1.24	2.14
Annual		WCS	8.18	3.47	7.58	11.99
		MLS	6.40	2.71	5.92	9.38
Breeding (mid-April to August)	2	WCS	40.71	16.31	37.59	62.80
		MLS	32.15	12.90	29.67	49.57
Non-breeding (September to mid-April)		WCS	10.75	3.18	9.98	18.53
		MLS	8.51	2.51	7.89	14.64
Annual		WCS	51.46	19.48	47.57	81.32
		MLS	40.65	15.40	37.55	64.20

3.4 Great Black-Backed Gull

3.4.1 Monthly great black-backed gull collision estimates for Band CRM and sCRM are presented in Table 3.1 and Table 3.2 respectively. All collisions were predicted to occur within the non-breeding season (i.e. none during the breeding season) (Table 3.5), with the highest number of monthly collisions in December for all models (Table 3.1 and Table 3.2; Figure 3.1)

3.4.2 Seasonal and annual collision estimates for great black-backed gull are provided in Table 3.5. The total estimated annual number of collisions of great black-back gull were 2.30 and 1.78 for the WCS and MLS respectively for sCRM.

3.4.3 For Band CRM, two collision estimates were calculated for the lower and upper range of nocturnal activity as advised by JNCC *et al.* (2024). The estimated annual number of collisions of great black-backed gull was higher when the upper range of nocturnal activity was used, with 2.25 and 1.74 collisions for the WCS and MLS respectively. The estimated annual number of collisions of great black-backed gull were 1.64 and 1.27 when the lower nocturnal activity for Band CRM was used.

Table 3.5: Great Black-Backed Gull Seasonal and Annual Collision Estimates for Band CRM and sCRM for WCS and MLS. For sCRM, Upper and Lower Estimates are Calculated Using the Upper and Lower Variability Measures (mean ± SD)

Season	Scenario	Band CRM[9]		sCRM		
		Lower	Upper	Lower	Mean	Upper
Breeding (April to August)	WCS	0.00	0.00	0.00	0.00	0.00
	MLS	0.00	0.00	0.00	0.00	0.00
Non-breeding (September to March)	WCS	1.64	2.25	0.34	2.30	5.21
	MLS	1.27	1,74	0.27	1.78	4.02
Annual	WCS	1.64	2.25	0.34	2.30	5.21
	MLS	1.27	1.74	0.27	1.78	4.02

[9]As advised by JNCC *et al.* (2024), Band CRM is carried out with the upper and lower nocturnal activity levels for great black-backed gull.

3.5 Herring Gull

3.5.1 Monthly herring gull collision estimates for Band CRM and sCRM are presented in Table 3.1 and Table 3.2 respectively. The estimated number of collisions were highest in the breeding season (Table 3.5), with the highest number of monthly collisions in June for both Band CRM and sCRM (Table 3.1 and Table 3.2; Figure 3.1).

3.5.2 Seasonal and annual collision estimates for herring gull are provided in Table 3.6. The total estimated annual number of collisions of herring gull were 33.61 and 26.03 for the WCS and MLS respectively for sCRM.

3.5.3 For Band CRM, two collision estimates were calculated for the lower and upper range of nocturnal activity as advised by JNCC *et al.* (2024). The estimated annual number of collisions of herring gull was higher when the upper range of nocturnal activity was used, with 29.07 and 22.54 collisions for the WCS and MLS respectively. The estimated annual number of collisions of herring gull were 26.51 and 20.54 when the lower nocturnal activity for Band CRM was used.

Table 3.6: Herring Gull Seasonal and Annual Collision Estimates for Band CRM and sCRM for WCS and MLS. For sCRM, Upper and Lower Estimates are Calculated Using the Upper and Lower Variability Measures (mean ± SD)

Season	Scenario	Band CRM[10]		sCRM		
		Lower	Upper	Lower	Mean	Upper
Breeding (April to August)	WCS	25.30	27.44	9.72	32.15	68.53
	MLS	19.60	21.27	7.53	24.89	53.11
Non-breeding (September to March)	WCS	1.21	1.63	0.21	1.46	3.28
	MLS	0.94	1.27	0.16	1.14	2.54
Annual	WCS	26.51	29.07	9.93	33.61	71.81
	MLS	20.54	22.54	7.69	26.03	55.65

[10]As advised by JNCC *et al.* (2024), Band CRM is carried out with the upper and lower nocturnal activity levels for herring gull.

3.6 Arctic Tern

3.6.1 Monthly Arctic tern collision estimates for Band CRM and sCRM are presented in Table 3.1 and Table 3.2 respectively. The estimated number of collisions were highest in August for both models (Table 3.1 and Table 3.2; Figure 3.1).

3.6.2 Seasonal and annual collision estimates for herring gull are provided in Table 3.7. The total estimated annual number of collisions of Arctic tern were 2.43 and 1.92 for the WCS and MLS respectively for sCRM. For Band CRM, the total estimated annual number of collisions of Arctic tern decreased to 1.66 and 1.33 collisions for the WCS and MLS respectively.

Table 3.7: Arctic Tern Breeding Collision Estimates for Band CRM and sCRM for WCS and MLS. For sCRM, Upper and Lower Estimates are Calculated Using the Upper and Lower Variability Measures (mean ± SD)

Season	Scenario	Band CRM	sCRM		
			Lower	Mean	Upper
Breeding (May to August)	WCS	1.54	0.05	2.24	11.25
	MLS	1.23	0.04	1.77	8.94
Non-breeding (Sept to April)	WCS	0.12	0.00	0.19	0.95
	MLS	0.10	0.00	0.15	0.76
Annual	WCS	1.66	0.05	2.43	12.20
	MLS	1.33	0.04	1.92	9.70

4 Conclusion

4.1.1 For this Technical Report, the estimated collisions were modelled from monthly outputs of the Band CRM and sCRM for five species:

- gannet;
- kittiwake;
- great black-backed gull;
- herring gull; and
- Arctic tern.

4.1.2 The WCS and MLS scenarios modelled differed in the number of Wind Turbines and dimensions (maximum chord width and maximum rotor radius), as well as the maximum rotation speed (Table 2.3). Moreover, the WCS is expected to have a lower downtime (Table 2.4).

4.1.3 The highest number of collisions occurred in the WCS for all species, with the highest number of mortalities estimated for kittiwake with 51.46 (8.18 for LiDAR-based estimates) and 47.57 (7.58 for LiDAR-based estimates) mortalities estimated in the Band CRM (Option 2) and sCRM (Option 2) respectively (Table 4.1).

Table 4.1: Summary of CRM Results for Both sCRM (Mean Number of Mortalities) and Band CRM (Number of Mortalities) for the Key Seabird Species. Difference (%) is the Comparison Between MLS and WCS

Species	Model (Option)	Nocturnal Activity Level	Annual mortalities		Difference (%)
			MLS	WCS	
Gannet[11]	Band CRM (Option 2)	-	17.73	22.84	28.82
	sCRM (Option 2)	-	18.62	24.06	29.22
Kittiwake	Band CRM (Option 1)	-	6.40	8.18	27.81
	sCRM (Option 1)	-	5.92	7.58	28.04
	Band CRM (Option 2)	-	40.65	51.46	26.59
	sCRM (Option 2)	-	37.55	47.57	26.68
Great black-backed gull	Band CRM (Option 2)	Lower	1.27	1.40	10.24
		Upper	1.74	2.25	29.31
	Band CRM (Option 2)	-	1.78	2.30	29.21
Herring gull	Band CRM (Option 2)	Lower	20.54	26.51	29.07
		Upper	22.54	29.07	28.97
	sCRM (Option 2)	-	26.03	33.61	29.12
Arctic tern	Band CRM (Option 2)	-	1.33	1.66	24.81
	sCRM (Option 2)	-	1.92	2.43	26.56

[11]A 70% reduction has been applied to the non-breeding season to account for macro-avoidance.

4.1.4 Estimates of the sCRM are not directly comparable to the Band CRM as the outputs are distributions rather than single estimates for collisions. However, the estimates of the Band CRM always fell within the lower and upper estimates of the sCRM (mean ± SD).

5 Summary

5.1.1 DAS were flown over 24 months (March 2022 to February 2024) to provide baseline data on seabirds in the DAS Survey Area. Monthly estimates of flying birds within the Array Area were used in this technical report (excluding the 12 km buffer).

5.1.2 Collision risk estimates were presented for five seabird species identified as potentially at risk of collision due to their recorded abundance in the Array Area Study Area and their high vulnerability to collision: gannet, kittiwake, great black-backed gull, herring gull and Arctic tern.

5.1.3 sCRM and Band CRM were conducted with the Option 2 model framework (Masden 2015; NatureScot, 2023), as advised in the Bowdun Offshore Scoping Opinion (MD-LOT, 2024), using generic flight height distributions from Johnston *et al.* (2014).

5.1.4 LiDAR surveys only recorded a sufficient number of observations of kittiwake (Volume 3, Technical Appendix 11.1: Offshore Ornithology Baseline Characterisation Report, Annex E) for site-specific data to be incorporated into modelling using the Option 1 model framework (Masden, 2015). Therefore, both Option 1 and Option 2 have been presented for kittiwake.

5.1.5 The collision risk estimates were calculated for two scenarios (NatureScot, 2023):

- **WCS:** assumes fixed foundations, maximum rotation speed, and reduced downtime due to no predicted curtailment; and
- **MLS:** assumes fixed foundations, maximum rotation speed and increased downtime due to predicted curtailment.

5.1.6 Estimated number of collisions annually, and during the breeding and non-breeding seasons were compiled from monthly estimates. Species-specific timings of the breeding and non-breeding season were based on definitions provided by NatureScot (2020).

5.1.7 The WCS reported higher collisions than the MLS for all species as expected, for both Band CRM and sCRM. LiDAR-based results for kittiwake were about six times lower than the generic results, mainly because a larger proportion of kittiwake flew below the flight risk zone than in generic flight height data (Johnston *et al.* 2014).

5.1.8 Estimates of the sCRM are not directly comparable to the Band CRM as the outputs are distributions rather than point estimates for collisions. However, the point estimates of the Band CRM always fell within the lower and upper estimates of the sCRM (mean ± SD).

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ANNEX A. DENSITIES OF FLYING BIRDS PER SURVEY

Table A1.1: Mean Monthly Densities and SD of Flying Birds for Five Seabird Species in the Array Area (Figure 1.1) Estimated from 24 Months of DAS Data.

Species		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gannet	**Mean** **SD**	0.00 0.00	0.02 0.01	0.03 0.02	0.87 0.28	0.65 0.21	0.64 0.11	0.28 0.10	0.48 0.14	1.25 0.31	0.22 0.10	0.01 0.01	0.06 0.03
Kittiwake	**Mean** **SD**	0.17 0.08	0.26 0.13	0.46 0.14	1.30 0.34	0.72 0.32	2.84 0.60	1.88 0.34	0.87 0.41	0.17 0.06	0.09 0.05	0.14 0.06	0.24 0.09
Great black-backed gull	**Mean** **SD**	0.01 0.01	0.01 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 0.00	0.00 0.00	0.02 0.02	0.09 0.05
Herring gull	**Mean** **SD**	0.00 0.00	0.02 0.01	0.00 0.00	0.00 0.00	0.11 0.54	1.11 0.32	0.19 0.08	0.05 0.02	0.00 0.00	0.00 0.00	0.02 0.01	0.07 0.04
Arctic tern	**Mean** **SD**	0.00 0.00	0.00 0.00	0.00 0.00	0.22 0.14	0.00 0.00	0.00 0.00	0.10 0.10	2.43 0.86	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00

Table A1.2: Monthly Densities of Flying Birds per Survey (Also See Volume 3, Appendix 11.1: Offshore Ornithology Baseline Characterisation Report, Annex C: Attributed Abundances of Seabirds in Digital Aerial Surveys)

Survey	Gannet	Kittiwake	Great black-backed gull	Herring gull	Arctic tern
2022-03	0.06 (0.01 to 0.17)	0.40 (0.15 to 0.84)	-	-	-
2022-04	1.26 (0.65 to 2.11)	1.07 (0.41 to 2.09)	-	0.00 (0.00 to 0.00)	0.44 (0.00 to 1.08)
2022-05	0.84 (0.42 to 1.42)	0.24 (0.01 to 1.61)	-	0.20 (0.00 to 4.26)	-
2022-06	0.66 (0.43 to 0.94)	1.92 (1.00 to 3.14)	-	0.06 (0.03 to 0.11)	-
2022-07	0.26 (0.11 to 0.47)	3.55 (2.40 to 4.83)	-	0.37 (0.13 to 0.74)	-
2022-08	0.10 (0.02 to 0.25)	1.30 (0.44 to 2.74)	-	0.09 (0.03 to 0.19)	4.73 (2.08 to 8.58)
2022-09	1.82 (1.11 to 2.71)	0.33 (0.16 to 0.59)	-	-	-
2022-10	0.06 (0.02 to 0.14)	0.15 (0.04 to 0.34)	-	0.00 (0.00 to 0.00)	-

Survey	Gannet	Kittiwake	Great black-backed gull	Herring gull	Arctic tern
2022-11	0.02 (0.01 to 0.05)	0.23 (0.10 to 0.43)	0.04 (0.00 to 0.14)	0.03 (0.00 to 0.06)	-
2022-12	0.11 (0.03 to 0.30)	0.42 (0.18 to 0.79)	0.11 (0.02 to 0.31)	0.13 (0.03 to 0.36)	-
2023-01	-	0.31 (0.10 to 0.65)	-	-	-
2023-02	0.03 (0.01 to 0.06)	0.51 (0.16 to 1.15)	-	-	-
2023-03	-	0.51 (0.32 to 0.76)	0.00 (0.00 to 0.00)	-	-
2023-04	0.48 (0.19 to 0.92)	1.53 (1.07 to 2.12)	-	0.00 (0.00 to 0.01)	-
2023-05	0.45 (0.19 to 0.87)	1.19 (0.77 to 1.74)	-	0.01 (0.00 to 0.02)	-
2023-06	0.62 (0.44 to 0.84)	3.76 (2.58 to 5.17)	0.00 (0.00 to 0.01)	2.16 (1.10 to 3.67)	-
2023-07	0.30 (0.12 to 0.56)	0.21 (0.12 to 0.35)	-	0.00 (0.00 to 0.00)	0.19 (0.02 to 0.80)
2023-08	0.85 (0.45 to 1.36)	0.44 (0.12 to 1.06)	-	0.00 (0.00 to 0.00)	0.12 (0.03 to 0.31)
2023-09	0.68 (0.34 to 1.17)	0.01 (0.00 to 0.02)	-	-	-
2023-10	0.37 (0.13 to 0.77)	0.03 (0.00 to 0.11)	-	-	-
2023-11	0.00 (0.00 to 0.00)	0.04 (0.01 to 0.14)	0.00 (0.00 to 0.01)	0.00 (0.00 to 0.00)	-
2023-12	-	0.06 (0.03 to 0.10)	0.07 (0.03 to 0.12)	-	-
2024-01	-	0.02 (0.00 to 0.05)	0.02 (0.00 to 0.07)	0.00 (0.00 to 0.02)	-
2024-02	-	0.00 (0.00 to 0.02)	0.01 (0.00 to 0.02)	0.03 (0.00 to 0.10)	-