



## Technical Appendix 12.7

Method Review Paper – Applicability of SeabORD for  
Green Volt

Offshore EIA Report: Volume 2

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Green Volt Offshore Wind Farm Ltd

# Method Review Paper – Applicability of SeabORD for Green Volt

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1.2	16/12/2022	All	All	Review prior to client issue	SS
2.1	21/12/2022	All	All	Internal revisions following client review for second draft	RC

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## 1. Introduction

Green Volt Offshore Windfarm Limited (the ‘Applicant’) is proposing to develop the Green Volt Offshore Wind Farm (OWF) (here on in referred to as ‘Green Volt’) as a proposed floating offshore wind farm, approximately 80 km northeast of the Aberdeenshire coast in Scottish waters. The Green Volt Scoping Report was issued to stakeholders and the Marine Scotland Licensing Operations Team (MS-LOT) in November 2021 (Green Volt, 2021<sup>1</sup>), with stakeholder consultation responses collated into the formal MS-LOT Scoping Opinion (MS-LOT, 2022<sup>2</sup>) received by the Applicant in April 2022. This stated that modelling tools for displacement impact analysis for seabirds should be agreed following further discussion of the recommendations presented by NatureScot and the Royal Society for the Protection of Birds (RSPB).

Following this advice and discussion, APEM Ltd (APEM), as lead advisor on offshore and intertidal ornithology for Green Volt, were requested to review the applicability of the SeabORD model for this project. This topic was raised with stakeholders through the Green Volt Ornithology Working Group meeting on the 27<sup>th</sup> April 2022 and it was agreed that a position paper would be drafted and circulated by APEM, on behalf of the Applicant, to NatureScot, MS-LOT and the Royal Society for the Protection of Birds (RSPB) on the appropriateness of each modelling tool for Green Volt. This method review paper replaces the position paper<sup>3</sup> previously issued regarding SeabORD.

APEM requested additional guidance and information from stakeholders and the model authors to inform possible approaches to the use of the SeabORD model. MS-LOT issued meeting notes to the Applicant on 2<sup>nd</sup> December 2022, detailing a workshop held in February 2022 by a working group consisting of the SeabORD model developers and stakeholders. Queries on the model and other tools related to offshore wind consenting processes were discussed at this meeting. Further advice was received from NatureScot to review the recently

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<sup>1</sup> Green Volt (2021) Green Volt Offshore Windfarm - Offshore Environmental Impact Assessment Scoping Report. Royal HaskoningDHV, Ref PC2483-RHD-ZZ-XX-RP-Z-0001, November 2021.

<sup>2</sup> Marine Scotland – Licensing Operations Team. Scoping Opinion adopted by the Scottish Ministers for Green Volt Offshore Windfarm. Scottish Government, April 2022.

<sup>3</sup> Green Volt Position Paper - APEM Review of MRSea & SeabORD\_2.1\_draft\_issued\_02\_08\_2022e

released Pentland Floating Offshore Wind Farm Volume 3: Appendix A.12.4<sup>1</sup>, which provided an analysis of displacement using SeabORD.

This method review paper provides an update to the initial position paper following reviews of the meeting notes received from the SeabORD working group, relevant documentation on displacement analysis undertaken for the Pentland Floating OWF (PFOWF), and other documentation which has considered the utility of SeabORD. This method review paper highlights outstanding queries regarding the applicability of SeabORD, if used for the Project, based on the accessible information available at present.

## 1.1 What is SeabORD?

SeabORD is an Individual-Based Model (IBM) approach to estimating the impact of displacement for a range of seabird species limited to black-legged kittiwake (*Rissa tridactyla*) common guillemot (*Uria aalge*) razorbill (*Alca torda*) and Atlantic puffin (*Fratercula arctica*). As a brief summary, Searle *et al.*, (2018) stated SeabORD is a simulation model that aims ‘to predict the time/energy budgets of breeding seabirds during the chick-rearing period and translates these into projections of adult annual survival and productivity for each individual and at the population level. The model simulates foraging decisions of individual seabirds under the assumption that they are acting in accordance with optimal foraging theory, minimising time away from offspring whilst maximising energy gain. In the model, foraging behaviour of individual seabirds is driven by prey availability, travel costs, provisioning requirements for offspring, and at-sea density of conspecifics. The model estimates productivity and adult survival, the latter resulting from estimates of adult mass at the end of the breeding season. To determine ORD [Offshore Renewable Device] effects, baseline scenarios are compared with scenarios containing one or more ORDs.’

SeabORD was developed using the Forth and Tay region for demonstration purposes. The Forth and Tay region was chosen because it is a data rich environment, with extensive research having been carried out on the seabird colonies on the Isle of May for over 50 years, which provides site-specific estimates of demographic parameters such as age-specific survival and productivity. The research also provides a wealth of data on the foraging

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<sup>1</sup> Pentland Floating Offshore Wind Farm Volume 3: Appendix A.12.4  
[https://marine.gov.scot/sites/default/files/appendix\\_12.4\\_marine\\_ornithology\\_displacement\\_analysis1\\_redacted.pdf](https://marine.gov.scot/sites/default/files/appendix_12.4_marine_ornithology_displacement_analysis1_redacted.pdf)



distribution of seabirds from the Isle of May during the breeding season from GPS and other tracking data for several seabird species.

There are options within SeabORD to determine how the model is used, either using known 'at-sea' distribution data, which allows inference on prey distributions, or using a distance-decay approach which requires additional parameterisation of a uniform prey map, with prey values set to return recommended energetic budgets. Ideally, SeabORD is run using locally derived tagging data which would inform on colony specific foraging areas. Where this is not possible, utilisation distributions or distance decay approaches can be used with appropriate parameterisation. Advice received through the Green Volt Ornithology Working Group included that it is possible to use SeabORD with the simplified distance-decay approach. However, there is currently limited testing on the sensitivity of either of these approaches outwith the Forth and Tay region for which the model is predominantly parameterised for.

## 1.2 The Green Volt Project Area

The Project Area is situated in the northern North Sea, approximately 80 km off the northeast coast of Aberdeenshire, Scotland. It is located 72.5 km, 87 km and 131 km from the three nearest Special Protection Areas (SPAs) on the northeast coast of Scotland designated for breeding seabird colonies. These are the Buchan Ness to Collieston Coast SPA, Troup, Pennan and Lion's Head SPA and Fowlsheugh SPA, respectively. The Project Area is within the mean max foraging range for some seabird species and the maximum foraging range for all seabird species available for modelling in SeabORD from these three SPAs (Woodward *et al.*, 2019<sup>1</sup>). The Project Area is also within the maximum foraging range of a limited number of seabird species from colonies within the Forth and Tay region as well as being within maximum foraging range of several seabird colonies in the Moray Firth region, north coast of Scotland and the Northern Isles. This indicates that the origin of foraging birds within the area of the northern North Sea that the Project Area resides may be from a diverse range of colonies. This is highly relevant to the set up and running of SeabORD in relation to Green Volt, see Section 2.5.

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<sup>1</sup> Woodward, I. et al. (2019) Desk-based revision of seabird foraging ranges used for HRA screening. BTO research report number 724. Thetford.

## 2. Review of stakeholder meeting notes and uses of SeabORD within consenting

### 2.1 Scotwind - Marine Scotland Ornithology Impact Assessment Workshop (MSOIA)

The provision of the notes from the Scotwind - Marine Scotland Ornithology Impact Assessment Workshop meeting in February 2022<sup>1</sup> is welcomed by the Applicant. The workshop notes provide a clear statement of recent viewpoints from the model author on several areas of uncertainty around the applicability of SeabORD to locations outwith the Forth and Tay region, although they do not provide full clarification regarding the application of SeabORD to the Project development specifically.

Confirmation that the model authors consider the basic version of SeabORD (i.e. using distance decay from colony and simulated uniform prey distribution) the most defensible method to use, due to biological realism, is helpful clarification for the Applicant. This provides clear guidance that the simpler approach is acceptable. However, in the meeting minutes the model author highlights that parameterisation of the current model is focused around the Forth and Tay region. There is little guidance or published information regarding to what extent this may affect the use of SeabORD for locations in the northern North Sea, such as the Green Volt Project Area, therefore the approaches to the use of distance decay based outputs needs to be carefully considered.

In response to prey field parameterisation queries, the model author highlights that *'the model is not developed to run for multiple colonies at wider spatial scales (e.g. at the regional level, such as the east coast of Scotland), as it depends on the utilisation functions for each colony (i.e. the prey values will be colony specific), and the same calibration won't work for multiple colonies necessarily, but runs for local colonies (e.g. the five colonies in the Forth and Tay) shouldn't be an issue.'* This raises concerns regarding the distance between colonies that could be considered as local, and therefore use the same parameterised prey fields for separate colonies. The relevance to Green Volt is highlighted in Section 3.

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<sup>1</sup> Scotwind - Marine Scotland Ornithology Impact Assessment Workshop - Meeting minutes - Session 1 - 22 February 2022

## 2.2 Review of the recommended documentation produced for Pentland Floating OWF (PFOWF)

The PFOWF is a comparatively simple example of the use of SeabORD. In this example, the distance decay version of SeabORD was used to model displacement and barrier effects on kittiwake, guillemot, razorbill and puffin at a single SPA, which is made up of five colonies with less than 40 km between them. The PFOWF report highlights that there are consistent differences between the SeabORD outputs for guillemot baseline mortalities in comparison to the PVA baseline mortalities<sup>1</sup>. These differences highlight the complexities of model validation and areas of uncertainty in how the outcomes of SeabORD modelling may be interpreted for the Project, as there is no clear guidance on how to parameterise SeabORD for developments located further offshore and displaying connectivity with multiple colonies at wider spatial scales.

If SeabORD modelling outputs are to be produced in relation to the Project, comparison of the SeabORD outputs with the standard displacement matrix outputs will be needed in a similar way to the PFOWF reports, however accessible guidance is required on how to consider this uncertainty in the assessment. SeabORD results on their own indicating potential impacts may be questionable in their robustness given the uncertainty demonstrated for PFOWF. Given the location of the Project Area and the number of SPAs and colonies scoped into the EIA (53 SPAs were screened in for assessment of likely significant effects in the Habitat Regulations Assessment screening report), clearer guidance on the applicability of the SeabORD modelling tool for assessment of seabird displacement in the Green Volt study area is needed.

## 2.3 SeabORD's use of colony-specific data

It is well demonstrated that there is significant regional variation in key seabird demographic parameters (reviewed in Horswill & Robinson, 2015<sup>2</sup>), which influences the productivity and survival rates of different species from different colonies. This is potentially linked to the colonies foraging areas and associated energetics, which due to a lack of tagging information

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<sup>1</sup> Pentland appendix 12.4 marine ornithology displacement analysis (redacted) Document number: HC0057-004-12.4

<sup>2</sup> Horswill, C. & Robinson R. A. 2015. Review of seabird demographic rates and density dependence. JNCC Report No. 552. Joint Nature Conservation Committee, Peterborough.

is largely unknown for many of the colonies scoped in for consideration within the Offshore EIA. With SeabORD outputs potentially affecting subsequent PVA analysis on the protected sites, the lack of testing and parameterisation of SeabORD outwith the Forth and Tay region leads to concerns that the differences, such as those noted within PFOWF report on displacement rates compared to the standardised displacement matrix approach, may have overly negative effects on the subsequent population assessments. **Guidance on how to consider this within the PVA analysis will be required if the use of SeabORD was to go forward.**

Similarly, the distance decay option available within SeabORD is a simplified method of overlapping potential colony usage and subsequent energetics interpretations. For many of the colonies that may be potentially assessed for the Project using SeabORD, there is little tagging data available and therefore a large number of the colonies may be assessed under SeabORD purely based on a maximum foraging distance assumption. The known high variation in prey distributions in this area is likely to impact on the robustness of this approach<sup>1</sup>. Due to the location of the Project, colonies from the Firth of Forth to the Northern Isles have the potential to be included in for assessment under SeabORD. The run time of SeabORD to allow appropriate parameterisation of the energetic models as recommended by the model guidance documents (Searle et al., 2018) may lead this to a lengthy piece of work, with a significant portion of the colonies assessed receiving likely negligible effects as the development is at the maximum distance of the colonies' foraging range. Combined with the parameterisation of energetics models for the Forth and Tay region with no published work on calibrating the model for areas comparable to the Project, the applicability and justification for use of SeabORD is unclear. **Discussion on the limitations of SeabORD and its robustness for assessment purposes when used across highly dispersed colonies is therefore needed with the model author.**

## 2.4 Spatial distribution information

A key part of the SeabORD model is the estimation of the distribution of foraging birds. Ideally, this would be supplied based on GPS tracking data of birds from all the relevant colonies. Such tracking data is not available for all colonies relevant to the Project and in some instances, despite a colony being within mean max or maximum foraging distance, no tracks have been recorded over the Project Area from the GPS data (Seabird Tracking Database). Appropriate

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<sup>1</sup> Olin, A. B., Banas, N. S., Wright, P. J., Heath, M. R., & Nager, R. G. (2020). Spatial synchrony of breeding success in the black legged kittiwake *Rissa tridactyla* reflects the spatial dynamics of its sandeel prey. *Marine Ecology Progress Series*, 638, 177-190. <https://doi.org/10.3354/meps13252>

tracking data is required to inform the more complex set up of the SeabORD model for seabird distribution, which is in turn used to provide estimations of prey locations. With the lack of tagging data at each colony, the approach would therefore be to use the simpler distance-decay function for seabird distribution with uniform prey distribution (with appropriate testing of prey quality parameters), as advised by the model authors<sup>1</sup>. This distance decay version of SeabORD was the method used for displacement analysis in the PFOWF EIA. However, the location of the Green Volt Offshore Windfarm and the available data suggest that abundances at and near the site are likely to be low and that the birds observed are non-breeders and come from multiple colonies, unlike the PFOWF area which is located only 7.5 km from the shore with the colonies scoped in for assessment being located within 40 km of each other. Assessment and validation of the model is therefore required to enable thorough understanding of the implications of uncertainties when using SeabORD in this set up. **To proceed with any use of SeabORD for the development, the Applicant requests agreement with the distance decay approach as well as dialogue with the model authors.**

## 2.5 SeabORD model analytics of spatial extents

Minuted in the MSOIA meeting notes on the SeabORD model is that '*the model is not developed to run for multiple colonies at wider spatial scales*' (i.e. the Scottish east coast). The locations of the colonies screened in for displacement assessment for the Project are significant distances apart, and there is no current guidance from NatureScot, Marine Scotland and the SeabORD model authors on the spatial range of an acceptable uniform prey value to be used across colonies. For example, the published online examples use the same parameterisation for the Forth and Tay colonies over a range of 150 km (Buchan Ness to Isle of May). The distance from Buchan Ness to North Caithness is a similar distance in the opposite direction. However, it is implied from the SeabORD working group meeting notes<sup>2</sup> that it is not recommended to assume the same prey parameterisation for the whole of the Scottish east coast. If the colonies were to be broken up into regions to allow varying prey/energetics information to be tested and appropriate scales (as is suggested by the response in the meeting notes), then this requires a full report to cover all the colonies potentially considered for the Project. However, there is no published guidance on how to best partition colonies into groups for assessment as would be needed for the Project. **Guidance and discussion with model authors are required on the grouping of colonies for**

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<sup>1</sup> Scotwind - Marine Scotland Ornithology Impact Assessment Workshop - Meeting minutes - Session 1 - 22 February 2022e

**model runs to ensure that any potential issues of prey map values and subsequent parameterisation being used between unsuitable areas is avoided.**

For these reasons, the use of SeabORD for the Project is significantly different to its application for assessment of seabird displacement compared with PFOWF. SeabORD may be appropriate with some of the SPAs currently screened into the Green Volt Offshore Environmental Impact Assessment Report (EIAR), however its use for all SPA/colonies is uncertain due to the issues outlined above. Additionally, there is no clear guidance available on how to set up the model appropriately when dealing with disparate colonies. **Guidance on the appropriate spatial/regional groupings for SPA/colonies for uniform prey distributions is therefore necessary for calibrating the model in the context of the Project.**

### 3. Conclusion

The Applicant is supportive of efforts to improve the modelling approaches and resolve uncertainties around the displacement of seabirds from offshore wind farms, including the proposed Green Volt OWF. The SeabORD model is a significant step forward in using updated science and evidence-based approaches to assessing the displacement and barrier effect issues faced by some seabird species. However, the applicability of the SeabORD model and recommended model set up is currently uncertain for its application to the Project due to the lack of guidance on the calibration process required for different bird and prey areas outside the Forth and Tay region to determine acceptable input parameter values, a concern raised during the MSOIA workshop in February 2022. Furthermore, model authors confirmed that outputs would be sensitive to calibration, especially if a smooth distance decay function was not achieved, which although discussed at the MSOIA workshop, provided no advice on how to validate this in the model guidance for users.

A compounding issue for the Project is that the model has not been developed for running multiple colonies (more than five) at wider spatial scales, as conveyed by the model author during the MSOIA workshop in February 2022. This would be required to be run for the Project, for example, guillemot modelling which requires the least number of colonies to be considered would need to cover colonies from Buchan Ness and Collieston Coast SPA to Fair Isle SPA, involving multiple runs and calibrations to incorporate these different colonies into partitioned localised areas. The model authors reported at the MSOIA workshop that updates to the model were in progress and the key difference was to incorporate an automated calibration step, which would make a significant difference for use within the Project, ensuring correct calibration set up and confidence in outputs generated.

Additionally, the issues highlighted in this paper are backed by an assessment published by JNCC<sup>1</sup> comparing the displacement matrix and SeabORD, suggesting that SeabORD may not be overly suited for areas outside the Forth and Tay in its current format. The latest published SNCB guidance<sup>2</sup> on displacement assessment is being adhered to and the matrix approach used for the Project is therefore suitably precautionary.

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<sup>1</sup> Report on Ornithological Assessments (Displacement section), 2021. JNCC Report number 677. <https://data.jncc.gov.uk/data/aa5176f2-8f24-4be1-8a78-520fa4405482/JNCC-Report-677-REVISED-WEB.pdf>

<sup>2</sup> Joint Interim Displacement Advice Note. [Joint SNCB Interim Displacement Advice Note \(jncc.gov.uk\)](https://www.jncc.gov.uk/data/aa5176f2-8f24-4be1-8a78-520fa4405482/JNCC-Report-677-REVISED-WEB.pdf)

The Applicant are aware that the Green Volt OWF development is an outlier with regards to the initial design of SeabORD due to its location being outside of the Forth and Tay and subsequent potential for interactions with a spatially wide range of colonies. The Applicant would consider contributing to the further development of the SeabORD model through a joint industry project or equivalent collaboration to consider the model's applicability for use in locations such as the Project Area. This could be part of an enabling action under the SCOTMER ornithology working group and include data from SCOTWIND projects, for example, to allow comparison and therefore improved validation of the model for locations outwith the Forth & Tay region and with connectivity to multiple colonies. The Applicant would support the use of Project data and information to allow the appropriate consultation with model authors and potentially support resourcing the modelling, subsequent analysis and reporting.



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