Bellrock Offshore Wind Farm

Offshore Transmission Development Area

Scoping Report – Volume 1

Appendix D: Approach to Underwater Noise Modelling

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Glossary of Terminology

Term	Definition
Applicant	Bellrock Offshore Wind Farm Limited, the legal entity submitting a Marine Licence application for the Bellrock Offshore Transmission Development Area.
Bellrock Offshore Wind Farm (or the Bellrock Project)	An offshore wind farm capable of exporting up to 1.8 GW of renewable energy to the National Electricity Transmission System. The Wind Farm Development Area is located 120 km east of Stonehaven, and will connect to the National Electricity Transmission System at the proposed SSEN Transmission Hurlie substation, west of Stonehaven in Aberdeenshire. The Bellrock Offshore Wind Farm comprises of the following Development Areas: ▪ Wind Farm Development Area; ▪ Offshore Transmission Development Area; and ▪ Onshore Transmission Development Area.
Construction works	Works to install the Offshore Transmission Infrastructure as authorised by the Offshore Transmission Development Area Marine Licence, such as: ▪ Pre-installation surveys (intrusive and/or non-intrusive); ▪ Offshore substation/offshore reactive compensation station installation and associated vessel activities; fixed foundation installation; scour protection installation; topside lifting, installation and integration; offshore lifting operations and testing and commissioning; ▪ Offshore export cable installation and associated vessel activities, landfall installation (seaward of Mean High Water Springs), cable lay and burial, installation of cable crossings, cable installation at offshore substation/offshore reactive compensation station, installation of terminations at the offshore substation/offshore reactive compensation station, installation of subsea joints, post-lay burial and cable protection installation; ▪ Final commissioning following cable connections and snagging; and ▪ Post-installation surveys.
Offshore reactive compensation station	A fixed bottom substructure offshore platform located within the offshore export cable corridor that accommodates reactive compensation equipment used to control reactive power flows and maintain acceptable voltage levels in the high voltage alternating current transmission system.
Offshore substation	A fixed bottom substructure offshore platform which houses electrical equipment such as transformers, switchgear, and protection and control systems, enabling the wind farm's renewable electricity to be received via inter-array cables and exported via the offshore export cables.
Offshore Transmission Development Area	The boundary within which the Offshore Transmission Infrastructure will be constructed, operated and maintained, and decommissioned seaward of Mean High Water Springs (and overlaps the whole of the Wind Farm Development Area and partially overlaps with the Onshore Development Area at landfall).
Offshore Transmission Infrastructure	Infrastructure located within the Offshore Transmission Development Area including fixed bottom offshore substation(s), fixed bottom offshore reactive compensation station(s) and associated scour protection; interconnector cable(s) and associated cable protection; landfall (seaward of Mean High Water Springs), and offshore export cables and associated cable protection (including activities associated with the Offshore Transmission Infrastructure construction, operation and maintenance, and decommissioning).
Wind Farm Development Area	The boundary within which the Wind Farm Infrastructure will be constructed, operated and maintained, and decommissioned.

Glossary of Abbreviations

Term	Definition
dB	Decibels
EIA	Environmental Impact Assessment
FBSS	Fixed bottom substructure
iPCoD	Interim Population Consequences of Disturbance
JNCC	Joint Nature Conservation Committee
NMFS	National Marine Fisheries Service
OfRCS	Offshore reactive compensation stations
OfSS	Offshore substation
OfTDA	Offshore Transmission Development Area
ORJIP	Offshore Renewables Joint Industry Programme
PTS	Permanent threshold shift
RaDIN	Range dependent nature of impulsive noise
SNH	Scottish National Heritage
Subacoustech	Subacoustech Environmental Limited
TTS	Temporary threshold shift
UK	United Kingdom
UWN	Underwater noise
UXO	Unexploded ordnance
WFDA	Wind Farm Development Area

1 Overview

1. This **Bellrock Approach to Underwater Noise (UWN) Report** is an Appendix to **Chapter 8: Marine Mammals** of the **Bellrock Offshore Transmission Development Area (OfTDA) Scoping Report (Volume 1).** This Appendix sets out the approach to UWN modelling for marine mammals and covers the following:

- Approach to UWN modelling; and
- Approach to assessment for disturbance from UWN for marine mammals.

2. This Appendix should be read in conjunction with **Chapter 8: Marine Mammals** of the **Bellrock OfTDA Scoping Report (Volume 1)** and has been prepared by Haskoning.

2 Approach to Underwater Noise Modelling

3. UWN modelling is required to provide a robust assessment of UWN associated with the construction, operation and maintenance, and decommissioning of the Bellrock Offshore Transmission Infrastructure. The modelling will be used to inform the assessment of potential impacts from UWN on marine mammal (see **Chapter 8: Marine Mammals** of the **Bellrock OfTDA Scoping Report (Volume 1)**). It will also be used to inform the fish and shellfish ecology impact assessment for UWN, with the proposed assessment approach set out in **Chapter 7: Fish and Shellfish Ecology** of the **Bellrock OfTDA Scoping Report (Volume 1)**.

4. The UWN modelling will include the following activities, with the focus of the modelling report being impact piling:

- Impact piling of the fixed bottom substructures (FBSSs) for the offshore substations (OfSS(s)) and offshore reactive compensation stations (OfRCS(s));
- Other non-piling activities:
  - Cable laying and burial/protection;
  - Drilling; and
  - Seabed preparation (such as boulder clearance);
- Unexploded ordnance (UXO) clearance;
- Geophysical survey equipment; and
- Vessel noise.

5. The UWN modelling for piling was previously undertaken for the Bellrock Wind Farm Development Area (WFDA) Environmental Impact Assessment (EIA), applying thresholds for auditory injury from Southall et al. (2019) and the National Marine Fisheries Service (NMFS) (2018) and Popper et al. (2014) for fish species. This included modelling for the FBSS OfSS(s) within the Bellrock WFDA, as well as scenarios involving concurrent piling from both the OfSS(s) and floating offshore units. Additional modelling will be carried out for the OfRCS(s). To maintain consistency, the same thresholds will be applied in the current assessment. However, for the Piling Noise Mitigation Plan, UWN modelling will be refined using final design parameters and the most up-to-date marine mammal thresholds for auditory injury (e.g. NMFS, 2024).

6. Existing data from previous measurements of (other) offshore wind farm construction noise will be used along with detailed acoustic propagation models to predict the possible sound levels as a function of distance around the sound source. Knowledge of the local seabed properties and bathymetry will be incorporated to provide realistic propagation scenarios for the area. Where necessary, information obtained from noise data measured for existing United Kingdom (UK) and other European offshore wind farm projects will be included.

7. A suitable range of frequencies will be modelled to allow the transmission loss to be predicted for potential sources. This will include the primary frequency ranges of interest for each source which overlap with the hearing sensitivity frequency range for key marine species.

8. Subacoustech Environmental Limited (Subacoustech) will undertake the UWN modelling, using the latest version of their INSPIRE model.

9. The following recent publications on UWN modelling will be considered within the UWN modelling report submitted alongside the Bellrock OfTDA EIA Report, although it should be noted that the INSPIRE model used by Subacoustech does not use an energy conversion factor, as per the focus of Wood et al. (2023)[1]:

- Energy Conversion Factors in Underwater Radiated Sound from Marine Piling: Review of the method and recommendations (Wood et al., 2023); and
- Reducing Uncertainty in UWN Assessments for Offshore Wind (Offshore Renewables Joint Industry Programme (ORJIP) Offshore Wind, 2023).

10. In addition, the ORJIP project on the range dependent nature of impulsive noise (RaDIN) (ORJIP, 2024) which includes analysis of existing data and development of a method for incorporation into noise impact assessments, will be referenced to inform the Bellrock OfTDA EIA Report.

11. It is anticipated the UWN modelling will incorporate the following:

- A number of impact piling scenarios to be considered:
  - Jacket pile:
    - Maximum pile diameter;
    - Maximum hammer energy;
    - Starting hammer energy (e.g. 10% maximum hammer energy); and
    - A single pile per day, multiple piles per day (sequential piling), and multiple pile locations at the same time (concurrent piling).
- Source levels for the required hammer energies[2];
- Transmission loss/propagation which includes the effects of bathymetry, frequency-dependent absorption, and frequency dependent interaction with the surface and seabed based on specific site characteristics (e.g. substrate type);
- Received levels relative to estimated ambient noise levels;
- A number of piling locations for the OfSS(s) within the Bellrock OfTDA;

[1] NatureScot's consultation response for the Scoping Opinion for the Buchan Offshore Wind Farm noted that the Wood et al., 2023 report is likely to be less relevant to the INSPIRE model (MD-LOT, 2023).

[2] Subacoustech's approach to source level modelling correlates blow energy, along with water depth and pile diameter, with a large dataset of field measurements to estimate apparent source levels.

- An indicative assessment for UXO clearance for permanent threshold shift (PTS) and temporary threshold shift (TTS) based on a desk-based review of potential ordnance present within the Bellrock OfTDA;
- Cumulative (i.e. more than a single sound impulse) weighted sound exposure criteria (SEL_{cum}) scenarios will be completed assuming a fleeing receptor. Swim speeds will be based on best practice, and are expected to include:
  - 1.4 m/s for harbour porpoise (Scottish Natural Heritage (SNH) [now NatureScot], 2016);
  - 1.52 m/s for dolphin species (Bailey and Thompson, 2006);
  - 2.1 m/s for minke whale (SNH, 2016); and
  - 1.8 m/s for seal species (SNH, 2016).
- The piling soft-start and ramp-up for the SEL_{cum} scenarios will be defined and agreed prior to the commencement of the UWN modelling.

12. The UWN modelling will result in noise maps around the source, over an area sufficient to demonstrate decay of the sound level such that it is not deemed to have an adverse effect on marine fauna based on the relevant hearing thresholds. This will be presented in terms of the chosen acoustic metrics and will show noise contours indicating zones of impact where thresholds for injury or behavioural response may be exceeded. In addition to the results for each threshold, 5 decibel (dB) contours will be used to inform the dose-response curve assessment, as described in **Section 3.1**.

2.1 Underwater Noise Thresholds

13. Southall et al. (2019) published updates on their original recommended marine mammal noise criteria, based on research that was presented by NMFS (2018), updating criteria on auditory weighting thresholds for onset PTS and TTS.

14. Southall et al. (2019) presents unweighted peak sound pressure level (L_p) criteria ($L_{p\text{-pk}}$) for single strike, weighted SEL criteria for single strike ($L_{E,p,ss}$) and $L_{E,p,t}$ for PTS, where unrecoverable reduction in hearing sensitivity may occur (**Table 2.1**). The weighted thresholds take account of the differences in hearing range of each species group.

15. Southall et al. (2019) also include criteria based on $L_{p\text{-pk}}$, which are unweighted and do not take species sensitivity into account. It is important to note that they are different criteria and as such they should not be compared directly. All decibel L_p values are referenced to 1 µPa and all SEL values are referenced to 1 µPa^{2}s. Assessments will be based on the criteria with the greatest predicted impact ranges.

16. The impact ranges calculated for $L_{E,p,t}$ tend to give the greatest ranges as they account for exposure to the noise for the full period of the activity. For the cumulative noise criteria ($L_{E,p,t}$ the calculations assume that a marine mammal flees from the noise source at a constant speed and the resultant contours give the position that a receptor must be from the pile at the start of the piling process, in order to just avoid receiving the relevant exposure criterion.

17. Noise sources (and the thresholds) are categorised as either impulsive or non-impulsive (Southall et al., 2019):

- Impulsive (single or multiple pulsed) - high peak sound pressure, short, intense burst, almost instantaneous and broad frequency content at source (e.g. explosives, impact piling and seismic airguns are considered impulsive noise sources); or
- Non-impulsive - continuous non-pulsed sound, remaining constant and stable over time. (e.g. vessel noise (propellor), vibro-piling, dredging drilling and other low-level continuous noises are considered non-impulsive). However, a non-impulsive noise does not necessarily have to have a long duration.

18. When reviewing the results of the UWN modelling for impulsive noise sources (e.g. impact piling), it is important to note that as sound propagates through the water column, interactions with the seafloor, spreading and absorption means that the sound waves will lose their 'impulsivity' over distance. Within a few kilometres, the sound waves would lose their impulsive shape (and act as a non-impulsive source of noise) (e.g. Hastie et al., 2019). Therefore, for any of the results under the impulsive criteria that are in the tens of kilometres, the results are an overestimation.

19. There are currently no universally agreed thresholds or criteria for modelling the disturbance of dolphin, whale and seal species from UWN (Southall et al., 2021; Southall, 2024).

Table 2.1: Southall et al. (2019) Thresholds and Criteria for PTS used in the Underwater Noise Modelling and Assessments

Species	Species Group	Impact	SPL_{peak} Unweighted (dB re 1 µPa) Impulsive	SEL_{ss} and SEL_{cum} Weighted (dB re 1 µPa²s)	
				Impulsive	Non-impulsive
Harbour porpoise	Very High Frequency (VHF) cetacean	PTS	202	155	173
Bottlenose dolphin White-beaked dolphin Common dolphin Killer whale	High Frequency (HF) cetacean	PTS	230	185	198
Minke whale Fin whale Humpback whale	Low Frequency (LF) cetacean	PTS	219	183	199
Grey seal Harbour seal	Phocid Carnivores in Water (PCW)	PTS	218	185	201

3 Approach to Assessments for Disturbance from Underwater Noise

20. The Marine Scotland (2020) guidance specifies disturbance as occurring if the activity is likely "*to significantly affect the local distribution or abundance of the species to which it belongs*". The relevant European Commission guidance (2007), suggests that a disturbance must significantly impact the local distribution or abundance of a species, including temporary impacts. The Joint Nature Conservation Committee (JNCC) et al. (2010), guidance proposes that "*any action that is likely to increase the risk of long-term decline of the population(s) of (a) species could be regarded as disturbance under the Regulations*."

21. To assess the potential for disturbance it is necessary to consider the likelihood that exposure of the animal(s) elicits a response which could generate a significant population-level effect. Assessment of population-level impacts from a temporary disturbance is made complicated by the highly variable nature of the introduced disturbance (e.g. the complex nature of sound and its propagation in the marine environment), the variability of behavioural response in different species, individuals and contexts, and the fitness consequences of disturbance for affected individuals.

3.1 Dose-response Curves

22. Where sufficient scientific evidence exists, current practice is to apply a species-specific dose-response assessment rather than the fixed behavioural threshold approach (Southall, 2024).

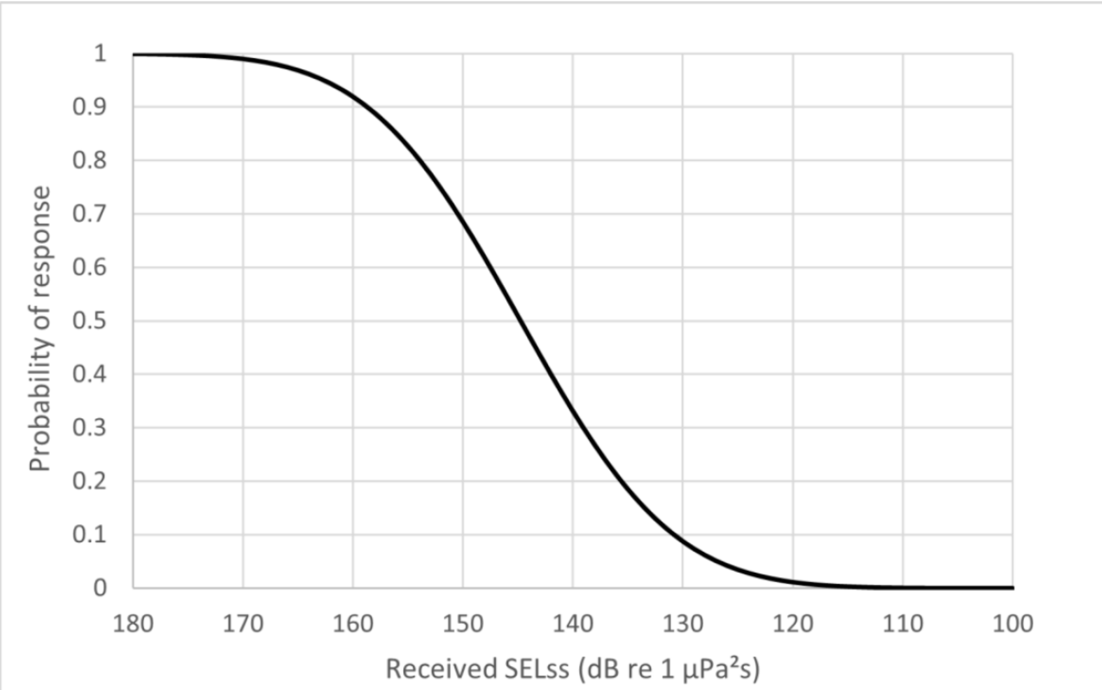
23. The application of a dose-response curve allows for an evidence-based estimate which accounts for the fact that the likelihood of an animal exhibiting a response to a stressor or stimulus will vary according to the dose of stressor or stimulus received (Dunlop et al., 2017). Therefore, unlike the traditional threshold assessments, a dose-response analysis assumes that not all animals in an impacted area will respond (with a behavioural disturbance response in this case). For the purposes of this assessment, the dose is the $L_{E,p,ss}$. The use of $L_{E,p,ss}$ s in a dose-response analysis, where possible, is considered to be best practice.

24. To estimate the number of animals disturbed by piling, $L_{E,p,ss}$ contours at 5 dB increments (generated by the noise modelling) will be overlain on the relevant species density surfaces (such as Carter et al., 2022 for both grey and harbour seal, Waggitt et al., 2019 or Gilles et al., 2023 for cetaceans) to quantify the number of animals receiving each 5 dB $L_{E,p,ss}$ contour, and subsequently the number of animals potentially disturbed based on the corresponding dose-response curve.

25. The dose-response relationship used for harbour porpoise was developed by Graham et al. (2017), using data collected on harbour porpoises during Phase 1 of piling at the Beatrice Offshore Wind Farm. This dose-response relationship is displayed in **Plate 3.1**. Following the development of this dose-response relationship, further study revealed that the responses of harbour porpoises to piling

noise diminishes over the construction period (Graham et al., 2019) and were lower during the construction of Moray East and Moray West Offshore Wind Farms (Thompson et al., 2026a). Therefore, the use of the dose-response relationship related to an initial piling event for all piling events in this assessment can be considered conservative. This has been demonstrated by comparing monitoring data from Moray West Offshore Wind Farm with the EIA predictions made using the Graham et al. 2017 dose-response relationship (see Thompson et al., 2026b). A deterrence function has been developed using monitoring data from Moray West, Offshore Wind Farm and is considered to provide a more realistic representation of harbour porpoise responses to piling noise than traditional dose-response approaches. The function reflects the tendency of animals to temporarily avoid the area around piling activity and has been shown to better align with observed behavioural responses during construction monitoring. Further details on the derivation and application of the deterrence function are provided in **Section 3.1.1**.

Plate 3.1: Dose-response Relationship to be used for Harbour Porpoise in the Bellrock OfTDA EIA Report



26. While it would be possible to use the harbour porpoise dose-response curve for other cetacean species (such as minke, fin and humpback whales, and dolphin species), due to the differences in hearing abilities of these species' groups, and due to harbour porpoise being a more sensitive species to UWN disturbance, the use of this dose-response curve for other species groups is likely to result in even greater conservatism. However, as there is an absence of species-specific dose-response data for dolphins or whale species, while over-precautionary, the Graham et al. (2019) dose-response curve will be applied to all cetacean species. The Bellrock OfTDA EIA Report will highlight the over-precautionary nature of this dose-response curve and will look to utilise new data (if available) to reduce the conservatism in consultation with NatureScot and MD-LOT.

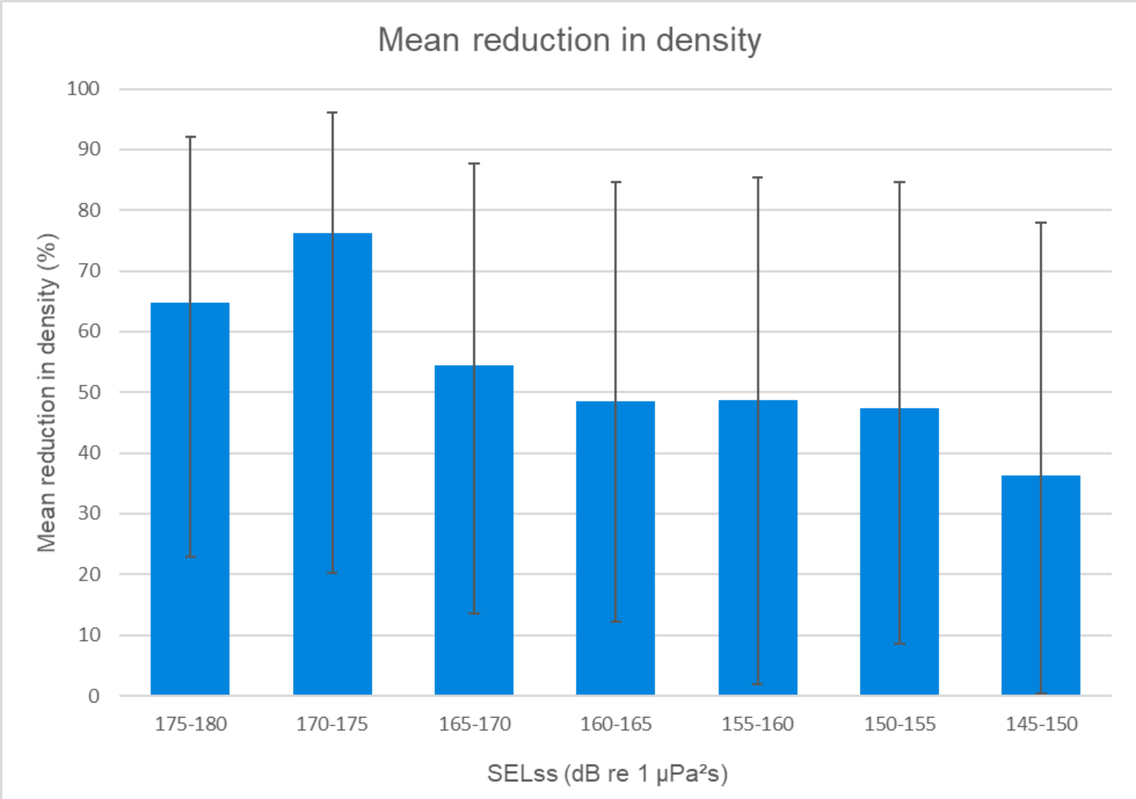
27. For both harbour seal and grey seal, a dose-response relationship derived from harbour seal telemetry data collected during several months of pile driving at the Lincs Offshore Wind Farm will be used (Whyte et al., 2020). The study demonstrated that pile driving can result in significant reductions in harbour seal density. As shown in **Plate 3.2**, the highest $L_{E,p,ss}$ considered by Whyte et al. (2020) was 180 dB re 1 μPa²s; therefore, the assessment will conservatively assume that all seals are disturbed at $L_{E,p,ss}$ values exceeding 180 dB re 1 μPa²s.

28. Subsequent analysis presented in Whyte (2022) provides further insight into harbour seal behavioural responses to pile driving noise. Rather than simply moving away from construction areas, seals were found to exhibit a range of behavioural changes, including shorter and shallower dives, increased time spent at the surface, and greater variability in dive behaviour. Behavioural responses were detected at distances of up to approximately 33 km from piling activity, with a 50% probability of response occurring at received sound levels of around 175 dB $L_{E,p,ss}$. Together, the studies demonstrate that responses to pile driving may comprise both displacement and more subtle behavioural changes that could influence foraging efficiency, energy expenditure and individual fitness. They also highlight substantial inter-individual variability in response and the importance of considering behavioural disturbance as a continuum rather than relying solely on fixed thresholds.

29. Whyte et al. (2020) provides the most directly applicable evidence for assessing potential displacement of harbour seals from pile-driving activities, whereas Whyte (2022) provides additional evidence of individual-level behavioural disturbance and should be considered when evaluating potential effects on behaviour, activity budgets and iPCoD.

30. It is therefore proposed that the harbour seal dose-response relationship presented in Whyte et al. (2020) is applied in the assessment and, in the absence of species-specific information for grey seals, is also applied to grey seals given the similarity in hearing sensitivity between the two species. However, if the updated dose-response curves become available from Whyte (2022), prior to preparation of the Bellrock OfTDA EIA Report, they will be adopted in place of the dose-response relationship presented in Whyte et al. (2020).

Plate 3.2: Dose-response Behavioural Disturbance Data for Harbour Seal



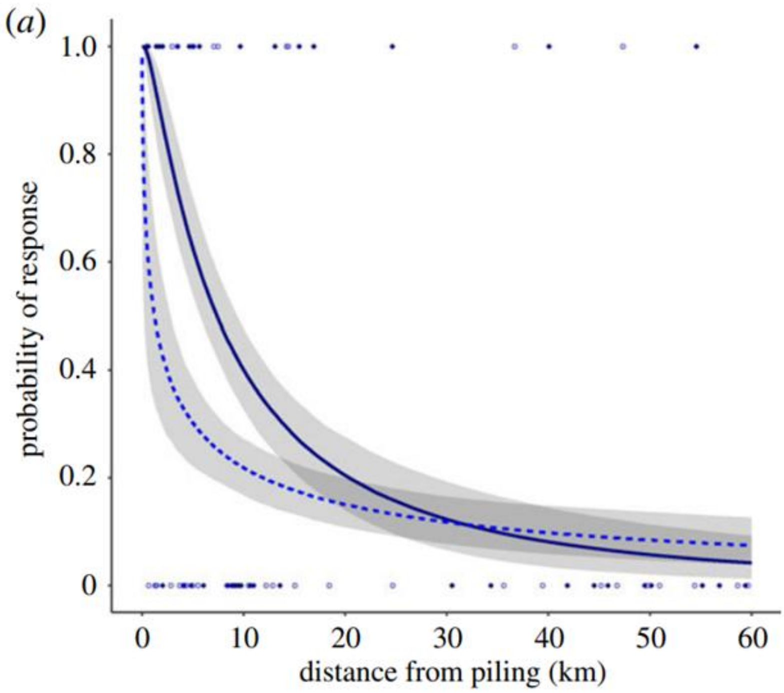
3.1.1 Deterrence Function

31. Recent findings indicate that use of the Graham et al. (2017) dose-response predictions at other sites is overly precautionary, leading assessments to be unrealistic (Thompson et al. 2026b). The PrePARED project compared responses of harbour porpoises to pile driving noise at the Moray West wind farm with predictions made during earlier regulatory assessments (Thompson et al., 2025, 2026b). The comparisons indicated that the Graham et al. (2017) dose-response function resulted in highly conservative predictions of disturbance. In the Moray West regulatory assessments, over 4,500 harbour porpoises were predicted to be disturbed by a single piling event (Moray Offshore Wind Farm (West) Ltd, 2023). However, construction monitoring at Moray West indicated disturbance of harbour porpoise was more likely to have affected less than 100 individuals (Thompson et al. 2025). Observations made at Moray West across the 35 km range of overlap also highlighted that observations were better predicted by the Graham et al. (2017) deterrence function than the recommended dose-response function. Further analysis integrating data from monitoring at Beatrice, Moray East and Moray West Offshore Wind Farms highlight that there is greater similarity in deterrence functions than dose-response functions during these three piling campaigns (Thompson et al., 2026a).

32. Therefore, this new evidence indicates assessments are likely to be more realistic if based on a deterrence function rather than the Graham et al. (2017) dose-response function. . The deterrence function estimates harbour porpoise disturbance by assuming animals temporarily avoid the area surrounding piling activity, and provide a comparison against the predictions using the dose-

response model. This deterrence function will be based upon Beatrice Offshore Wind Farm monitoring data in Graham et al. (2019), using the more conservative prediction for responses during the first location piled (**Plate 3.3**). The use of alternative deterrence functions using data from multiple sites, thereby representing a wider variety of hammer energies (see Thompson et al. 2026b), will be considered in consultation with NatureScot and MD-LOT.

Plate 3.3: Deterrence Function Based upon Analysis of the Full Beatrice Construction Monitoring Data (Solid Navy Line = First Location Piled; Dotted Line = Final Location Piled)



3.2 Population Modelling

33. Population modelling will be undertaken to determine the population level consequences of disturbance due to piling at the Bellrock OfTDA. This will also be used to determine whether the number of animals disturbed (as assessed in the methods described in Section 3.1 and Section 8.7 of **Chapter 8: Marine Mammals** in the **Bellrock OfTDA Scoping Report (Volume 1)**) would cause a population level effect.

34. Population modelling for the Bellrock OfTDA will be carried out according to best practice, using the best available scientific information, and the latest expert elicitation results (e.g. Booth and Heinis, 2018).

35. The Interim Population Consequences of Disturbance (iPCoD) model will be used to undertake population modelling in the event the quantitative assessment shows a potential significant effect. iPCoD modelling will be undertaken for harbour porpoise, bottlenose dolphin, minke whale, harbour seal and grey seal, to determine whether there is a significant, long-term disturbance, and consequently effects on the population level. It is currently not possible to undertake iPCoD modelling for other species.

36. The demographic parameters for each species will be based on the latest available information and will follow best practice for iPCoD modelling (e.g. Sinclair et al., 2020). The populations of marine mammal species will be based on the reference populations for each species, as set out in **Appendix C: Marine Mammals Existing Environment (Volume 1)**.

3.2.1 Determination of Significance

37. There are currently no specific potential biological removal limits in place for population modelling. Therefore, there are no specific thresholds to determine whether a population level effect would be significant in EIA terms.

38. Evans and Arvela (2012) advise that an annual population decline of more than 1% on average over a 12-year period represents unfavourable conservation status. Booth et al. (2016) undertook a study into the use of the iPCoD model for assessing population level effects of offshore wind farm piling in the North Sea. The study assumed that the harbour porpoise population could already be experiencing an annual decline of 1% (in reference to the Evans and Arvela (2012) threshold noted above), and therefore a threshold of an additional 1% annual decline could be used to determine whether the construction works of offshore wind would result in a disturbed population.

39. Recent Natural Resources Wales guidance on this topic concluded that a significant population level of effect would be present in the case of a continued 1% annual decline within a population (Natural Resources Wales, 2023) for a six-year period (in line with Favourable Conservation Status reporting periods).

40. If, as a result of PTS, a population shows a continued decline of >1% per year (versus a modelled un-impacted reference population) over a set period of time (e.g. the first six years, based on the former Favourable Conservation Status reporting period), then there is a high likelihood that a significant effect cannot be ruled out (Natural Resources Wales, 2023). In the absence of agreed guidance for UK waters, the Natural Resources Wales guidance will be used to inform the potential for a significant population level effect when considering the context on the wider population and all other supporting information. Therefore, this approach has been applied to the assessments and if a decline is predicted by the population modelling, then the significance of this decline will be considered on a case-by-case, species-by-species basis. It should also be noted that the results of the population modelling inform the significance of a population level of effect, rather than a magnitude.

41. Full details on the approach to impact assessment and determining significance is provided in **Chapter 8: Marine Mammals** in the **Bellrock OfTDA Scoping Report (Volume 1)**.

3.3 Summary of Marine Mammal Disturbance Assessments

42. The approach to the assessment to disturbance effects would be as follows:

- For impact piling:
  - The dose-response curve from Graham et al. (2017) would be used to determine the potential for disturbance for harbour porpoise, dolphin species and minke whale; and
  - The dose-response curve from Whyte et al. (2020) would be used to determine the potential for disturbance for grey and harbour seal.
- For UXO clearance:
  - TTS impact ranges from the UWN modelling and a literature review of disturbance responses of marine mammal species (where relevant) would be used to determine the potential for disturbance for harbour porpoise, dolphin species and minke whale.
- For other noise impacts:
  - For noisy activities other than piling, the disturbance assessments would be based on a literature review of responses of marine mammal species to certain activities (e.g. Benhemma-Le Gall et al.*,* 2021; Frankish et al., 2023).
- Killer whale, fin whale and humpback whale will be assessed qualitatively.

43. The current approach for the disturbance assessments is to use the Graham et al. (2017) dose-response curve for all cetacean species, and to use the Whyte et al. (2020) curve for seal species. However, the EIA will also consider emerging data from other sources, either to further contextualise the conservative nature of this approach or, where possible, replace this proxy with species-specific data if they become available. The Bellrock OfTDA EIA Report will identify where this has been the case and justify the use of such data.

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