NORTH FALLS

Offshore Wind Farm

Further Information Regarding Marine Mammals

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Glossary of Acronyms

ADD	Acoustic Deterrent Device
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas
BEIS	Department for Business, Energy and Industrial Strategy
CEA	Cumulative Effect Assessment
CGNS	Celtic and Greater North Seas
CSIP	Cetacean Strandings Investigation Programme
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
EIA	Environmental Impact Assessment
EMODnet	European Marine Observation and Data Network
EPS	European Protected Species
ES	Environmental Statement
EU	European Union
EUNIS	European Nature Information System
FCS	Favourable Conservation Status
ipCOD	interim Population Consequences of Disturbance
HRA	Habitats Regulations Assessment
JNCC	Joint Nature Conservation Committee
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
MU	Management Units
NE	North-east
NS	North Sea
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OWF	Offshore Wind Farm
PEMP	Project Environmental Management Plan
PTS	Permanent Threshold Shift
RIAA	Report to Inform Appropriate Assessment
RWE	Renewables UK Swindon Limited
SAC	Special Area of Conservation
SCANS	Small Cetaceans in the European Atlantic and North Sea
SE	South-east
SEL	Sound Exposure Level
SEL_{cum}	Cumulative Sound Exposure Level
SEL_{ss}	Sound Exposure Level (single strike)
SIP	Site Integrity Plan
SMASS	Scottish Marine Animal Stranding Scheme
TTS	Temporary Threshold Shift
USBL	Ultra-Short Base Line
UXO	Unexploded Ordnance

1. Introduction

1. This document provides further information, where required (see Table 1-1) in relation to marine mammals, in response to the Relevant Representations (RR) of Natural England [RR-243] and the Marine Management Organisation (MMO) [RR-216].
2. Responses to the full suite of comments from Natural England and the MMO are provided in the following documents, respectively:
    - 9.1 Applicant's Responses to Relevant Representations Received from Natural England
    - 9.2 Applicant's Responses to Relevant Representations Received from Statutory Consultees and Non Prescribed Consultees

Table 1-1 Relevant Representation comments addressed in this document

Comments addressed	Section comment is addressed
NE RR-E1 NE RR-E13 NE RR-P15	Further metrics (including the mean of the ratio of impacted:unimpacted population sizes), explanation and clarifications are provided in Section 2.5
NE RR-E7 NE RR-E17	These comments have been addressed for the ES assessment in Section 2.6 and for the RIAA in Section 3.1
NE RR-E10 NE RR-E11	Further clarification to these comments have been provided in Section 2.1 and Section 2.2
NE RR-E12	This comment has been addressed in Section 2.1
NE RR-E14	Further clarification to this comment has been provided in Section 2.4
NE RR-E37	Further clarification this comment has been provided in Section 3.2
NE RR-E2 NE RR-P16	Further clarifications for the RIAA provided in Section 3
NE RR-E5 NE RR-E33 NE RR-E36 NE RR-P19	These comments have been addressed in Section 3.13.1
MMO RR-198 MMO RR-199 MMO RR-200	These comments have been addressed in Section 2.3

2. Further Information Regarding the Marine Mammal Assessment (ES Chapter 12, [APP-026])

2.1 Further information for receptor sensitivities

2.1.1 Seal disturbance sensitivity

3. This section provides an update to seal sensitivity to disturbance effects in response to Natural England's comment ([RR-243], E12);

> "*Natural England does not agree that sensitivity of seal species to disturbance effects is low. Whilst there may not be as much evidence for this species group, it would be precautionary to consider them as having medium sensitivity.*
>
> *We consider that seals can be disturbed by piling over similar ranges to harbour porpoise (~25km), therefore it is appropriate to assign a similar level of sensitivity i.e. medium.*
>
> *We advise the Applicant should change the sensitivity of seal species to disturbance to Medium and revise the assessment*."

4. The Applicant has taken note of Natural England's comment regarding the sensitivities used in the ES. The sensitivity assigned to seal species for disturbance effects has been re-assessed as 'medium', to show a more precautionary approach. The assessments are updated for Section 12.6.1.1.4 Impact 1c: disturbance effects due to impact piling for Project-alone and Section 12.9.3 for cumulative effects in ES Chapter 12 [APP-026].

5. Table 2-1 presents a summary of all re-assessments for the disturbance of grey and harbour seals caused by underwater noise from the Project-alone and cumulative effects based on 'medium' rather than 'low' sensitivity.

6. The Project-alone significance of effect for seals for all disturbance effects assessed are minor adverse, therefore remain not significant in Environmental Impact Assessment (EIA) terms.

7. The cumulative significance of effect is minor adverse for most potential effects, and therefore remain not significant in EIA terms. With the exception of grey seal, cumulative disturbance due to other OWFs piling at the same time as North Falls based on dose response, which has increased to moderate adverse. With the implementation of management measures for the Southern North Sea SAC through the SIP, the potential impacts could be reduced. Mitigation measures to reduce the disturbance of harbour porpoise in the project specific SIP could also reduce the potential disturbance of grey seal.

8. The updated significance of effect from the cumulative effects of underwater noise caused by piling and other OWF noisy activities (including piling), have been applied to the revised cumulative assessment in Section 2.6.

Table 2-1 Updates for disturbance of grey and harbour seals from underwater noise [updates to ES [APP-026] in blue)

Species/ receptor	Impact	Sensitivity (updated from low*)	Magnitude	Significance of effect (as presented in ES Chapter 12 Marine Mammals [APP-026])	Significance of effect (based on the updated sensitivity levels)
Construction – project alone effects					
Grey seal and harbour seal	Impact 1c: Potential for disturbance based on known effect ranges for monopiles or jacket pin piles	Medium	Negligible	Negligible	Minor adverse
	Impact 1c: Potential for disturbance based on a dose-response curve for monopiles or jacket pin piles	Medium	Negligible	Negligible	Minor adverse
	Impact 1c: Potential for disturbance based on iPCoD modelling for monopiles	Medium	Negligible	Negligible	Minor adverse
	Impact 1c: Reduction in foraging due to noise disturbance	Medium	Low	Negligible	Minor adverse
	Impact 1d: Potential for disturbance due to ADD activation	Medium	Negligible	Negligible	Minor adverse

Species/ receptor	Impact	Sensitivity (updated from low*)	Magnitude	Significance of effect (as presented in ES Chapter 12 Marine Mammals [APP-026])	Significance of effect (based on the updated sensitivity levels)
	Impact 2c: Disturbance due to other construction activities	Medium	Negligible	Negligible	Minor adverse
	Impact 3c: Disturbance due to construction vessels	Medium	Negligible	Negligible	Minor adverse
	Impact 6: Potential for disturbance at seal haul-out sites	Medium	Low	Minor adverse	Minor adverse
Construction – cumulative effects					
Grey and harbour seal	Impact 1a: Cumulative disturbance due to other OWFs piling at the same time as North Falls based on dose response	Medium	Medium (grey seal) Low (harbour seal)	Minor adverse	Moderate adverse (grey seal) Minor adverse (harbour seal)
	Impact 1a: Cumulative disturbance due to other OWFs piling at the same time as North Falls based on iPCoD modelling	Medium	Negligible	Minor adverse	Minor adverse
	Impact 1b: Cumulative disturbance due to other OWFs constructing at the same time as North Falls	Medium	Negligible	Minor adverse	Minor adverse

Species/ receptor	Impact	Sensitivity (updated from low*)	Magnitude	Significance of effect (as presented in ES Chapter 12 Marine Mammals [APP-026])	Significance of effect (based on the updated sensitivity levels)
	Impact 1c: Cumulative disturbance due to noisy activities (other than OWF)	Medium	Low	Minor adverse	Minor adverse
	Impact 1: Cumulative disturbance effect due to all other noisy projects and activities	Medium	Low	Minor adverse	Minor adverse

2.1.2 Risk of collision sensitivity

9. This section reviews the assigned sensitivity of minke whale, harbour porpoise, grey seal and harbour seal to collision risk in response to Natural England's comment ([RR-243, E10);

> *"Natural England notes the discrepancy in the assigned sensitivity to collision risk i.e. minke whale has been assigned medium compared to low sensitivity for other marine mammals. There is not a sufficient justification for this approach. We advise that sensitivity to collision risk should be medium for all species due to the potential severity of the impact resulting in injury or death of the animal.*
>
> *We advise that the Applicant changes the sensitivity of all species to collision risk to medium and updates the assessment."*

10. The Applicant maintains its position regarding the risk of collision sensitivities used in the ES. This section provides further justification and relates to ES Chapter 12 [APP-026] Section 12.6.1.5 Impact 5: Increased risk of collision with vessels during construction and Section 12.6.2.5 Impact 5: Increased risk of collision with vessels during operation.

11. Larger whale species, such as minke whales, could be at a greater risk of vessel collisions compared to smaller cetaceans. As indicated in the 2022 International Whaling Commission (IWC) analysis of global number of vessel strikes (Winkler *et al*. 2022), 62.8% of cetacean species involved in ship strikes were identified as mysticetes (baleen whales), compared to 25.4% recorded as odontocetes. With minke whales the seventh most recorded cetacean species globally.

12. Minke whales, being less agile, may not demonstrate the same avoidance capabilities and as a result could be more prone to ship strikes, compared to harbour porpoise and seals. Given their size, behaviour, and the documented increase in collisions among baleen whales, such as minke whales (Winkler *et al*. 2022), they were considered to have a higher sensitivity to potential vessel strikes.

13. The sensitivity of minke whales was assigned as 'medium' in Sections 12.6.1.5 and 12.6.2.5 of ES Chapter 12 [APP-026]. Medium sensitivity is defined as 'individual receptor has limited capacity to avoid anticipated impact' as outlined in Section 12.4.3.1 of ES Chapter 12 [APP-026]. Further review of available information supports this approach and as such no changes have been made to the sensitivity classification of minke whales as 'medium'.

14. The recent paper by Pigeault *et al*. (2024), indicates that the number of harbour porpoise sightings decreased with increased number of vessels. The modelling results showed that in the North Sea harbour porpoises avoided areas with numerous vessels or frequent vessel movements, within a radius of up to 9km (Pigeault *et al*. 2024).

15. This is supported by another recent study of tagged harbour porpoises (Frankish *et al*. 2023), which found harbour porpoises regularly reacted to vessel noise by moving away during daytime and diving deeper at night.

Porpoises were able to detect and react to vessel over 2km away (Frankish *et al*. 2023).

16. This avoidance harbour porpoise would therefore reduce the collision risk with vessels during the wind farm construction and operation, when there will be an increase in the number of vessels within the array area and along the offshore cable corridor. Also, when moving to and from the site, as vessels would use established shipping routes, which already have frequent vessel movements.

17. Low sensitivity is defined as 'individual receptor has some tolerance to avoid anticipated impact' as outlined in Section 12.4.3.1 of ES Chapter 12 [APP-026]. The additional information from recent studies supports the 'low' sensitivity of harbour porpoise to potential collision risk with vessels, as they are able to detect and avoid vessels, especially in areas with increased number of vessels and frequent vessel movements. Therefore, this remains unchanged to the approach used in the assessments in Sections 12.6.1.5 and 12.6.2.5 of Chapter 12 in the ES [APP-026].

18. As outlined in Section 12.6.1.5 of ES Chapter 12 [APP-026], there is no relationship between areas of high vessel and harbour seal occurrence and incidences of injury (Onoufriou *et al*. 2016). In addition, recent studies (Montabaranom *et al.* 2025), indicate that seals exhibit localised avoidance of operational tidal turbines. Therefore, based on the definition of 'low' sensitivity that 'individual receptor has some tolerance to avoid anticipated impact', the classification of harbour and grey seal sensitivity as 'low' is justified.

2.2 Further information for risk of collision with vessels (NE RR-E10 & E11)

19. This section provides clarification on how the number of marine mammals at risk due to increase in vessel number has been calculated in response to Natural England's comment (RR-243, E11);

> *"We consider that it is unclear how the number of marine mammals at risk of collision with North Falls' vessels was calculated.*
>
> *We request that clarification be provided on how the number of marine mammals at risk due to increase in vessel number has been calculated."*

20. The Applicant maintains its position regarding the methods used in the ES for calculating risk of collision, this section provides further justification.

21. Section 2.1.2 2.1.2provides further information on the sensitivity used for marine mammal species in assessments in relation to increased risk of collision.

22. This relates to ES Chapter 12 [APP-026] Section 12.6.1.5 Impact 5: Increased risk of collision with vessels during construction and Section 12.6.2.5 Impact 5: Increased risk of collision with vessels during operation.

23. In response to these comments an updated review has been undertaken into the methodology used to assess increased risk of collision with vessels in Sections 12.6.1.5 and 12.6.2.5 of ES Chapter 12 [APP-026].

24. As outlined in Section 12.4.3.1 of ES Chapter 12 [APP-026], to determine the magnitude of an impact, the number of individuals that could be impacted is put into the context of the relevant reference population.

25. There is currently no agreed or recommended approach to assessing the potential risk from vessel collision. The approach used in the ES Chapter 12 [APP-026] is based on available data from strandings records, number of vessels in UK waters and the additional number of vessels during the construction of North Falls, to estimate the potential increased collision risk.

26. In Section 12.6.1.5 of ES Chapter 12 [APP-026], strandings data from the UK Strandings Investigation Programme (CSIP) and Scottish Marine Animal Stranding Scheme (SMASS) between 2003 and 2020, available at the time of writing the ES, was used to quantify the number of animals for each species that could have died as a result of physical trauma that could have resulted from a collision with a vessel. Since the ES submission there has been no further data published from CSIP, however, there have been new reports published from SMASS therefore the 2021 – 2023 data has been added to the assessment alongside the existing data used in the ES. The same methods applied in the ES have been used here in Table 2-2 and Table 2-3.

27. The collision risk rate (Table 12.66 in ES Chapter 12) was calculated as the number of animals that had stranded and cause of death had been attributed to vessel strike or other physical trauma as a proportion of the number of animals stranded where cause of death had been determined. For example, for minke whale cause of death had been determined for 70 animals, of which four were attributed to physical trauma, as such the collision risk rate was calculated as 0.057, in the ES [APP-026]. With the new additional SMASS data, for minke whale cause of death had been determined for 90 animals, of which four were attributed to physical trauma, as such the collision risk is calculated as 0.044 (Table 2-2).

28. This is a precautionary approach as it includes cause of death from physical trauma of unknown cause, not just animals where cause of death has been a result of probable impact with ship or boat.

29. The number of animals at risk of collision per vessel in UK waters was calculated based on collision risk rate and number of individuals that could be at risk in UK waters and the number of vessel transits in UK waters (Table 12.67 of the ES Chapter 12; Table 2-3).

30. The number of individuals for each species that could be at risk of collision per vessel in UK waters was then used to quantify the number of animals that could be at risk based on the number of vessels and annual vessel transits during construction and operation at North Falls.

31. The magnitude for each species was calculated based on the percentage of the reference population that could be at risk with increased number of vessels during North Falls construction.

32. Based on the percentage of reference populations affected, the same magnitudes are assessed here as in the ES [APP-026]. During construction the magnitude is defined as 'low' for harbour porpoise, minke whale and grey seal and as 'medium' for harbour seal with up to 0.02% of the reference population at possible risk. Based on the quantitative magnitude definitions for permanent effects in Table 12.9 of ES Chapter 12 [APP-026].

33. This approach and calculations has been reviewed and updated based on new data. However, there have been no changes to the method or assessment compared to those presented in the ES Chapter 12 [APP-026].

Table 2-2 Further information to Table 12.66 [APP-026] Summary of UK cetacean stranding's and causes of death from physical trauma of unknown cause and physical trauma following probable impact from a ship or boat [updated assessment based on new data in blue]

Species	Number of stranding's SMASS 2009 – 2023 & CSIP 2003 – 2015 (in ES, SMASS 2009 – 2020 & CSIP 2003 – 2015)	Number of necropsies where cause of death established	Cause of death: physical trauma of unknown cause	Cause of death: physical trauma following probable impact from a ship or boat	Collision risk rate (number attributed to vessels strike / other physical trauma as proportion of total number necropsied)
Harbour porpoise	SMASS = 1,633 (was 1,198) CSIP = 3,598 Total = 5,231 (was 4,796)	SMASS = 404 (was 350) CSIP = 815 Total = 1,219 (was 1,165)	SMASS = 4 CSIP = 45 Total = 49	SMASS = 2 CSIP = 17 Total = 19	0.056 at risk of collision (was 0.058 at risk of collision)
Minke whale	SMASS = 201 (137) CSIP = 162 Total = 363 (was 299)	SMASS = 65 (was 45) CSIP = 25 Total = 90 (was 70)	SMASS = 0 CSIP = 0 Total = 0	SMASS = 2 CSIP = 2 Total = 4	0.044 at risk of collision (was 0.057 at risk of collision)
Grey seal	SMASS = 3,005 (was 1,909)	SMASS = 547 (was 470)	SMASS = 0	SMASS = 4	0.007 at risk of collision (was 0.009 at risk of collision)
Harbour seal	SMASS = 917 (was 624)	SMASS = 216 (was 180)	SMASS = 6 (was 5)	SMASS = 0	0.028 at risk of collision

Table 2-3 Further information to Table 12.67 [APP-026] Predicted number of marine mammals at risk of collision with North Falls' construction vessels, based on current UK collision rates and vessel presence [blue = updated assessment]

Marine mammal species	Collision risk rate (number attributed to vessels strike / other physical trauma as proportion of total number necropsied)	Estimated total number of individuals in UK waters	Estimated number of individuals at risk within UK waters	Annual number of vessel transits in UK and ROI for 2015	Number of marine mammals at risk of collision per vessel in UK waters	Number annual vessel transits associated with construction	Additional marine mammals at risk due to increase in vessel number (collision rate * vessel increase)	% reference population
Harbour porpoise	0.056 at risk of collision (was assessed as 0.058 in ES)	159,632	8,905 (was assessed as 9,318 in ES)	3,852,030	0.002 (was assessed as 0.003 in ES)	2,532	Up to 6 at risk per year (was assessed as up to 7 at risk per year (n=6.1) in ES)	0.002%
Minke whale	0.044 at risk of collision (was assessed as 0.057 in ES)	10,288	458 (was assessed as 588 in ES)	3,852,030	0.0001 (was assessed as 0.0002 in ES)	2,532	Up to one at risk every two years (n=0.3) (Was assessed as up to one at risk every two years (n=0.4) in ES)	0.001% (was assessed as 0.002% in ES)

Marine mammal species	Collision risk rate (number attributed to vessels strike / other physical trauma as proportion of total number necropsied)	Estimated total number of individuals in UK waters	Estimated number of individuals at risk within UK waters	Annual number of vessel transits in UK and ROI for 2015	Number of marine mammals at risk of collision per vessel in UK waters	Number annual vessel transits associated with construction	Additional marine mammals at risk due to increase in vessel number (collision rate * vessel increase)	% reference population
Grey seal	0.007 at risk of collision (was assessed as 0.009 in ES)	162,000	1,185 (was assessed as 1,379 in ES)	3,852,030	0.0003 (was assessed as 0.0004 in ES)	2,532	Up to one at risk every year (n=0.8) (Was assessed as up to one at risk every two years (n=0.9) in ES)	0.003% SE MU population; or 0.001% wider reference population (was assessed as 0.003% SE MU population; or 0.002% wider reference population in ES)
Harbour seal	0.028 at risk of collision	42,900	1,192	3,852,030	0.0003	2,532	Up to one every year (n=0.8)	0.02% SE MU

Table 2-4 Further information for Table 12.86 [APP-026] Predicted number of marine mammals at risk of collision with North Falls' operation and maintenance vessels, based on current UK collision rates and vessel presence

Marine mammal species	Collision risk rate (number attributed to vessels strike / other physical trauma as proportion of total number necropsied)	Estimated total number of individuals in UK waters	Estimated number of individuals at risk within UK waters	Annual number of vessel transits in UK and ROI for 2015	Number of marine mammals at risk of collision per vessel in UK waters	Number annual vessel transits associated with operation and maintenance	Additional marine mammals at risk due to increase in vessel number (collision rate * vessel increase)	% reference population
Harbour porpoise	0.056 at risk of collision (was assessed as 0.058 in ES)	159,632	8,905 (was assessed as 9,318 in ES)	3,852,030	0.002 (was assessed as 0.003 in ES)	2,444	Up to 6 at risk per year (was assessed as up to 6 at risk per year (n=5.9) in ES)	0.002%
Minke whale	0.044 at risk of collision (was assessed as 0.057 in ES)	10,288	458 (was assessed as 588 in ES)	3,852,030	0.0001 (was assessed as 0.0002 in ES)	2,444	Up to one at risk every two years (n=0.3) (Was assessed as up to one at risk every two years (n=0.4) in ES)	0.001% (was assessed as 0.002% in ES)

Marine mammal species	Collision risk rate (number attributed to vessels strike / other physical trauma as proportion of total number necropsied)	Estimated total number of individuals in UK waters	Estimated number of individuals at risk within UK waters	Annual number of vessel transits in UK and ROI for 2015	Number of marine mammals at risk of collision per vessel in UK waters	Number annual vessel transits associated with operation and maintenance	Additional marine mammals at risk due to increase in vessel number (collision rate * vessel increase)	% reference population
Grey seal	0.007 at risk of collision (was assessed as 0.009 in ES)	162,000	1,185 (was assessed as 1,379 in ES)	3,852,030	0.0003 (was assessed as 0.0004 in ES)	2,444	Up to one at risk every year (n=0.8) (Was assessed as up to one at risk every two years (n=0.9) in ES)	0.003% SE MU population; or 0.001% wider reference population (was assessed as 0.003% SE MU population; or 0.002% wider reference population in ES)
Harbour seal	0.028 at risk of collision	42,900	1,192	3,852,030	0.0003	2,444	Up to one every year (n=0.8)	0.02% SE MU

34. Given that there is currently no agreed or recommended approach to assessing the potential risk from vessel collision, this approach to quantify the potential magnitude of effect for increased collision risk to vessels during construction and operation is deemed appropriate.

2.2.1 Mitigation

35. Vessel good practice measures will be in place to reduce any risk of collisions with marine mammals. Vessel movements, where possible, would follow set vessel routes where available and hence areas where marine mammals are accustomed to vessels. These measures are detailed within the Outline PEMP [APP-241].

2.3 Magnitude levels used in assessments ([RR-216], MMO-199)

36. This section provides further justification and responds to the Marine Management Organisation's comment ([RR-216], MMO-199);

> *"The MMO would question the 'Medium' rating for harbour porpoises, especially when 1,981 individuals are predicted to be at risk of PTS (refer to Table 1.7).*
>
> *Similarly, for TTS, the assessment concludes that for the high-order detonation of the maximum potential UXO with an NEQ of 750kg plus donor charge, the magnitude for TTS is assessed as a worst-case scenario (Table 1.8) to be 'Low' for harbour porpoises and minke whales, 'Negligible' for grey seals, and 'Negligible to low' for harbour seals. For harbour porpoises, a total of 6,832 individuals are at risk of TTS, which casts doubt on the 'Low' magnitude rating."*

37. The Applicant maintains its position regarding the magnitudes used in the ES.

38. As outlined in Section 12.4.3 of ES Chapter 12 [APP-026], the thresholds for defining the potential magnitude of impact that could occur from a particular impact are determined using expert judgement, current scientific understanding of marine mammal population biology, and Joint Nature Conservation Committee (JNCC) *et al*. (2010) draft guidance on disturbance to European Protected Species (EPS) species. The JNCC *et al.* (2010) EPS draft guidance suggests definitions for a 'significant group' of individuals or proportion of the population for EPS species. As such this guidance has been considered in defining the thresholds for magnitude of impacts.

39. The JNCC *et al.* (2010) draft guidance provides some indication on how many animals may be removed from a population without causing detrimental effects to the population at Favourable Conservation Status (FCS). The JNCC *et al.* (2010) draft guidance also provides limited consideration of temporary effects, with guidance reflecting consideration of permanent displacement.

40. Temporary effects are considered to be of medium magnitude at greater than 5% of the reference population. JNCC *et al*. (2010) draft guidance considered 4% as the maximum potential growth rate in harbour porpoise, and the 'default' rate for cetaceans. Therefore, beyond natural mortality, up to 4% of the

population could theoretically be permanently removed before population growth could be halted. In assigning 5% to a temporary impact in this assessment, consideration is given to uncertainty of the individual consequences of temporary disturbance.

41. Permanent effects with a greater than 1% of the reference population being affected within a single year are considered to be high in magnitude in this assessment. This is based on Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) and Defra advice (Defra, 2003; ASCOBANS, 2015) relating to impacts from fisheries by-catch (i.e., a permanent effect) on harbour porpoise. A threshold of 1.7% of the relevant harbour porpoise population above which a population decline is inevitable has been agreed with Parties to ASCOBANS, with an intermediate precautionary objective of reducing the impact to <1% of the population (Defra, 2003; ASCOBANS, 2015).

42. To determine the magnitude of an impact for any quantitative impact assessments, the number of individuals that could be impacted is put into the context of the relevant reference population (based on the definitions of magnitude shown in Table 12.9, [APP-026]. For all assessments where the results show more than one individual is at risk, the number has been rounded up to a whole number to ensure the result of the assessment is biologically relevant.

43. There is currently no agreed approach to determine magnitude levels. However, this approach has been used previously in ES assessments for UK offshore wind farms (such as the Sheringham and Dudgeon Extension Projects) and other developments and activities that could impact marine mammals. Given that there is currently no agreed or recommended approach to determine potential magnitude of effect, this approach is deemed by the Applicant to be appropriate.

2.4 Clarification on disturbance assessments (NE RR-E1)

44. This section provides further clarification in response to Natural England's comment ([RR-243], E1);

"Natural England does not agree with the project-alone assessment of disturbance impacts from piling as we have concerns with how the results of the interim Population Consequences of Disturbance (iPCoD) modelling are presented. We also advise that the impact significance is presented based on each approach taken to assessing disturbance, not just based on the iPCoD modelling. We cannot agree with the assessment conclusions of the project-alone disturbance effects at this stage.

Natural England recommends that the Applicant update how the iPCoD modelling results are presented in line with our comments and present impact significance for all approaches used to assess impact.

We further recommended that they commit to further mitigation of project-alone impacts, should they be significant."

45. This section also provides additional information in response to Natural England's comment ([RR-243], E14);

"Natural England advises that the significance of the disturbance impact must be presented for each of the approaches used to determine cumulative disturbance, dose-response, and population modelling (iPCoD) in this case. Each approach and subsequent assessment of impact significance provides necessary information for Natural England to inform its advice.

For example, the magnitude of impact to harbour porpoise using the dose-response approach is Medium, which when combined with a Medium sensitivity, leads to a Moderate impact significance (Table 12.10) which is significant in EIA terms. Information such as this is currently missing in the table.

It is not appropriate, nor it is in line with EIA assessment methodology principles to only present the significance of the disturbance impact after population modelling has been undertaken i.e. less precautionary outcomes.

We advise that the Applicant should not present the iPCoD modelling results alone, and that an assessment of cumulative impacts to cetacean species is presented using the approach that generates the worst-case numbers disturbed.

We recommend that that the Applicant present the cumulative impact significant for each species using the worst-case numbers disturbed i.e. not only the iPCoD modelling results."

46. The Applicant maintains its position regarding the disturbance assessments used in the ES.

47. The assessment methods used in the ES Chapter 12 Section 12.6.1.1.4 [APP-026] to assess for potential disturbance to harbour porpoise from piling, includes the Effective Deterrence Range (EDR) approach, the dose-response curve (DRC) approach, and the population modelling (iPCoD) approach.

48. The cumulative assessment has been revised (as of January 2025) to include more up to date data in Section 2.6.

49. The significance of effect for both the dose response and iPCoD methods of assessment for disturbance from piling at North Falls and other wind farms have been presented. Further results and clarification in regard to the iPCoD modelling approach is detailed in Section 2.5.

50. For the EDR approach, the significance of effect is moderate adverse (significant in EIA terms). Whereas for the other two methods, the DRC and the iPCoD population modelling shows that there is minor adverse effect (not significant in EIA terms) for the potential of disturbance to harbour porpoise.

51. Brown *et al.* (2023) highlights the approach used to produce the current 26km EDR likely overestimates the response because it does not account for underlying seasonal variation during baseline and piling periods. In addition, findings in the latest report looking at harbour porpoise response to piling at Ocean Winds Moray West OWF found evidence of an EDR of 10km, providing a strong case for reducing the current 26km EDR for unabated impact piling of monopiles (Benhemma-Le Gall *et al.* 2024).

52. As stated by NE within their Phase III Best Practice guide “a dose-response curve is recommended to assess behavioural responses as a matter of best practice, where possible and relevant. This is the most recent approach, is a more realistic representation of animal response, and is based on empirical at-sea monitoring data”.

53. Therefore, the resultant significance level using the DRC approach is considered the most realistic assessment for harbour porpoise and based on the latest research and knowledge, while the EDR approach, as outlined above, can be considered to be over-precautionary. Regardless, the resultant iPCoD modelling used the results from the EDR approach to investigate the validity of the indicated significant effect on the harbour porpoise population. The modelling indicated no population level effect expected, even using the over-precautionary EDR approach.

2.5 Clarification for iPCoD modelling (NE RR-E1 & E13)

54. This section provides additional information in response to Natural England's comment ([RR-243, E1):

> *"Natural England does not agree with the project-alone assessment of disturbance impacts from piling as we have concerns with how the results of the interim Population Consequences of Disturbance (iPCoD) modelling are presented. We also advise that the impact significance is presented based on each approach taken to assessing disturbance, not just based on the iPCoD modelling. We cannot agree with the assessment conclusions of the project-alone disturbance effects at this stage."*

55. This section also provides additional information in response to Natural England's comment ([RR-243], E13):

> *"Natural England has concerns over the values presented in Table 12.99. The values in the median impacted as a percentage of unimpacted column of this table do not correspond to the difference between the un-impacted population mean and the impacted population mean. For example, 334,311 as a percentage of 338,403 is 98.79%, not 99.26%, which is not reflected in Table 12.99.*
>
> *We advise that the difference between the two presented means is included in the table, alongside the median values. The Applicant should provide information to support the value they consider to be most appropriate.*
>
> *Note this comment applies to all tables which present the iPCoD modelling results.*
>
> *We advise that the Applicant should present the difference between the two means in each table that presents iPCoD modelling results. The Applicant can provide information to support the value they consider to be most appropriate."*

56. The Applicant maintains its position regarding the use of the iPCoD model used in the ES.

57. In relation to the assessment of the population consequences of pile driving noise disturbance on marine mammal receptors, further information and clarification is provided below.

58. The iPCoD modelling results presented in the ES Chapter 12 Marine Mammals [APP-026] and Report to Inform Appropriate Assessment (RIAA) [APP-176] considered the median of the ratio of impacted: unimpacted population sizes for the relevant marine mammal populations as the key metric to determine effect significance using the iPCoD method. This is due to the fact that the median of the ratio of impacted: unimpacted population sizes is considered more robust to the effects of extreme outliers than the mean value, particularly with lower sample sizes. In addition, this metric is considered least sensitive to mis-specification of demographic parameters, therefore enabling more robust assessment of offshore renewable effects (Jital *et al.,* 2017; Sinclair *et al*.,

2019). This rationale, developed by the authors of the iPCoD code, has resulted in this metric being used and accepted by the Secretary of State for other recent offshore windfarm Environmental Impact Assessments (EIAs), such as the Sheringham and Dudgeon Extension Projects.

59. It is important to note that iPCoD runs 1,000 permutations of a population growth projection for impacted and unimpacted populations. This results in 1,000 impacted: unimpacted population pairs for each time-point in the modelling period (often 25 years). Calculating the ratio between each pair and then taking the median of all ratios results in the "median of the ratio of impacted: unimpacted population sizes", which is expressed in percentage terms in the iPCoD results tables of the ES Chapter 12 Marine Mammals [APP-026] and RIAA [APP-176]. Crucially, this is not the same process as taking the median of the 1,000 impacted populations at a given time point, the median of the unimpacted population, and then comparing their ratio. In short, one method results in the median of all modelled population differences, the other method results in the difference between the medians of all modelled impacted and unimpacted populations. Therefore, it is not possible to use the average (mean or median) population values presented within iPCoD tables to calculate the median of the ratio of impacted: unimpacted population sizes which is also presented in the same tables and is the primary metric for assessing effect significance.

60. In line with Natural England's comment ([RR-243], E1 and E13), the mean and median ratios of impacted: unimpacted population sizes are presented for the iPCoD simulation runs conducted for the Project alone (Section 12.6.1) and cumulatively (Section 12.9.3) in relation to reference populations used in the ES. Once again, it is important to note that it should not be expected that calculating the percentage difference between the mean impacted and unimpacted population sizes at a given timepoint presented in the result tables, will result in the same value as the mean ratio of impacted: unimpacted population sizes presented in the same tables.

61. In terms of the Project-alone, the modelled impact of piling from the Project falls below the threshold of a 1% annual decline in population (regardless of whether median or mean values are used) which was considered not significant in the ES Chapter 12 Marine Mammals [APP-026].

62. For the cumulative assessment, for all species assessed, the modelled impact of piling from the Project fell below the threshold of a 1% annual decline in population (regardless of whether median or mean values are used) which was considered insignificant. The greatest impact of cumulative disturbance using median values occurs for minke whale, with a predicted 7.78% decline in population size over a 25-year period. When considering the mean values presented here, the greatest impact of cumulative disturbance for minke whale is a predicted 6.52% decline in population size over a 25-year period (Table 2-14) which is not materially different to the median values presented in the ES Chapter 12 Marine Mammals Table 12.100 [APP-026].

63. For the reasons set out above, comparison of the median ratio of impacted: unimpacted populations is considered to be a measure more robust to the influence of outliers and mis-specification of demographic parameters than the mean. However, the additional information presented here in this section demonstrates that the choice of using median or mean values to compare population sizes does not materially affect the outcomes of the assessment presented in ES Chapter 12 Marine Mammals [APP-026], with all modelling results showing less than 1% annual decline for the first six years, whether the mean or median values are used.

2.5.1 Clarifications to the project-alone from underwater noise due to piling

2.5.1.1. Harbour porpoise

64. For harbour porpoise, iPCoD results were presented for Project-alone effects in Section 12.6.1.1.4 in the ES Chapter 12 Marine Mammals [APP-026]. The results have been presented again here, with both median and mean population sizes, and the mean and median ratios of impacted:unimpacted population sizes (Table 2-5). The results show a less than 1% annual decline in both the mean and median, therefore there is no significant impact, in line with the results presented within the ES Chapter 12 Marine Mammals Table 12.36 [APP-026].

Table 2-5 Results of the iPCoD modelling for the Project, giving the mean population size of the harbour porpoise population (NS MU) for years up to 2055 for both impacted and un-impacted populations, in addition to the mean and median ratio between their population sizes [clarifications to Table 12.36 of the ES Chapter 12 Marine Mammals [APP-026]]

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	338,918	338,918	100.00	338,918	338,918	100.00
End of 2031	338,485	338,468	99.99	339,900	339,897	100.00
End of 2032	338,770	338,719	99.98	339,107	339,054	100.00
End of 2035	340,101	340,054	99.99	338,467	338,429	100.00
End of 2040	339,347	339,297	99.99	339,932	339,867	99.99
End of 2050	339,372	339,322	99.99	335,786	335,763	99.99

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
End of 2055	337,661	337,611	99.99	336,711	336,694	99.99

2.5.1.2. Minke whale

65. For minke whale, iPCoD results were presented for Project-alone effects in Section 12.6.1.1.4 in the ES Chapter 12 Marine Mammals [APP-026]. The results have been presented again here, with both median and mean population sizes, and the mean and median ratios of impacted:unimpacted population sizes (Table 2-6). The results show a less than 1% annual decline in the first six years and over the 25 years period for both the mean and median, assessed as negligible magnitude, therefore minor adverse significance of effect, which is not significant in EIA terms, in line with the results presented within ES Chapter 12 Marine Mammals Table 12.37 [APP-026].

Table 2-6 Results of the iPCoD modelling for the Project, giving the mean population size of the minke whale population (CGNS MU) for years up to 2055 for both impacted and un-impacted populations in addition to the mean and median ratio between their population sizes [clarifications to Table 12.37 of ES Chapter 12 Marine Mammals [APP-026]]

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	20,120	20,120	100.00	20,120	20,120	100.00
End of 2031	20,138	20,133	99.98	20,184	20,176	99.99
End of 2032	20,130	20,113	99.91	20,228	20,208	99.94
End of 2035	20,158	20,119	99.81	20,113	20,071	99.86
End of 2040	20,162	20,103	99.71	19,924	19,879	99.77
End of 2050	20,098	20,030	99.66	19,868	19,794	99.72
End of 2055	20,077	20,009	99.66	19,755	19,683	99.72

2.5.1.3. Grey seal

66. For grey seal, iPCoD results were presented for Project-alone effects in Section 12.6.1.1.4 in the ES Chapter 12 Marine Mammals [APP-026]. The results have been presented again here, for both the SE MU population (Table 2-7) and for the wider reference population (SE and NE MU) (Table 2-8), with both median and mean population sizes, and the mean and median ratios of impacted:unimpacted population sizes. The results show no annual decline in the first six years and over the 25 years period for both the mean and median, assessed as negligible magnitude, therefore negligible significance of effect, which is not significant in EIA terms, in line with the results presented within ES Chapter 12 Marine Mammals Table 12.39 and Table 12.38 [APP-026].

Table 2-7 Results of the iPCoD modelling for the Project, giving the mean population size of the grey seal population (SE MU population) for years up to 2055 for both impacted and un-impacted populations in addition to the median and mean ratio between their population sizes [clarifications to Table 12.39 of the ES Chapter 12 Marine Mammals [APP-026]]

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	30,594	30,594	100.00	30,594	30,594	100.00
End of 2031	30,931	30,931	100.00	31,040	31,040	100.00
End of 2032	31,196	31,196	100.00	31,294	31,294	100.00
End of 2035	32,051	32,051	100.00	32,266	32,266	100.00
End of 2040	33,737	33,737	100.00	33,785	33,785	100.00
End of 2050	37,174	37,174	100.00	37,001	37,001	100.00
End of 2055	38,919	38,919	100.00	38,880	38,880	100.00

Table 2-8 Results of the iPCoD modelling for the Project, giving the mean population size of the grey seal population (wider population) for years up to 2055 for both impacted and un-impacted populations in addition to the median and mean ratio between their population sizes [clarifications to Table 12.38 of the ES Chapter 12 Marine Mammals [APP-026]]

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	56,502	56,502	100.00	56,502	56,502	100.00

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
End of 2031	57,094	57,094	100.00	57,332	57,332	100.00
End of 2032	57,666	57,666	100.00	57,627	57,627	100.00
End of 2035	59,445	59,445	100.00	59,495	59,495	100.00
End of 2040	62,692	62,692	100.00	62,413	62,413	100.00
End of 2050	69,134	69,134	100.00	68,729	68,729	100.00
End of 2055	72,487	72,487	100.00	71,890	71,890	100.00

2.5.1.4. Harbour seal

67. For harbour seal, iPCoD results were presented for Project-alone effects in Section 12.6.1.1.4 in the ES Chapter 12 Marine Mammals [APP-026], the results have been presented again here for the SE MU (Table 2-9), with both median and mean population sizes, and the mean and median ratios of impacted:unimpacted population sizes. The results show no annual decline in in the first six years and over the 25 years period for both the mean and median, assessed as negligible magnitude, therefore minor adverse significance of effect, not significant in EIA terms, in line with the results presented within ES Chapter 12 Marine Mammals Table 12.40 [APP-026].

Table 2-9 Results of the iPCoD modelling for the Project, giving the mean population size of the harbour seal population (SE MU) for years up to 2055 for both impacted and un-impacted populations in addition to the median and mean ratio between their population sizes [clarifications to Table 12.40 of the ES Chapter 12 Marine Mammals [APP-026]]

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
START	**4,866**	**4,866**	**100.00**	**4866**	**4866**	**100.00**
END OF 2031	**3,995**	**3,995**	**100.00**	**3995**	**3995**	**100.00**
END OF 2032	**3,277**	**3,277**	**100.01**	**3261**	**3263**	**100.00**
END OF 2035	**1,811**	**1,811**	**100.02**	**1784**	**1784**	**100.00**
END OF 2040	**674**	**674**	**100.02**	**660**	**660**	**100.00**
END OF 2050	**92**	**92**	**100.02**	**88**	**88**	**100.00**
END OF 2055	**33**	**33**	**100.02**	**32**	**32**	**100.00**

2.5.2 Clarifications to cumulative effects from underwater noise due to piling

68. Section 12.9.3.1.1 in ES Chapter 12 Marine Mammals [APP-026] presents the assessment of the potential cumulative effects of other projects that could occur at the same time as the Project. Population modelling was deemed the best tool to use to assess the potential impacts of cumulative disturbance as it considers the consequences of disturbance and hearing damage (worst-case numbers) that might result from the construction of the Project and other projects.

69. The results have been presented again here, with both median and mean population sizes, and the mean and median ratios of impacted:unimpacted population sizes. A greater than 1% annual decline is not found for any species, regardless of whether mean or median metric are used, and therefore the conclusions within ES Chapter 12 Marine Mammals [APP-026] remain valid. The cumulative iPCoD modelling results are presented in Section 2.6 below as the cumulative assessments have been amended to include more up to date data as of January 2025.

2.6 Amendments to CEA (NE RR-E7 & E17)

70. The Applicant has taken Natural England's comments into consideration position regarding the cumulative assessment used in the ES. This section provides a response to Natural England's comment ([RR-243], E7);

"Natural England has concerns with the chosen cut-off date for inclusion of other Offshore Wind Farms (OWFs) into the Cumulative Effect Assessment (CEA) which is currently the end of January 2024. Natural England highlights that this cut-off date is too far back since new data has been produced by other developments in recent months.

We recommend that the Applicant extends the cut-off date to include up-to-date information from other OWFs into the CEA."

71. This section also provides a response to Natural England's comment ([RR-243, E17);

"Natural England does not agree that all projects with unknown construction timelines should be screened out. We consider that it would be conservative to assume that construction for consented projects could overlap with the project if an operational date is known (as presented in Table 1.2 and is similar to the North Falls project's operational date).

Natural England advises that the Applicant should include the projects with similar operational dates in the CEA."

72. In line with Natural England's comments, the CEA has been updated. The assessment has been extended to now includeinformation, as of January 2025, from other OWFs for all other project activity that could be occurring at the same time as North Falls.

2.6.1 Updates to Section 12.9.3.1.1 Cumulative impact 1a: Assessment of underwater noise from piling at other OWFs [APP-026]

73. For UK and European OWFs screened in for having a potentially overlapping construction period with the Project, 33 OWFs have been included. Of these, eleven OWFs could be piling at the same time. Currently, piling activities for North Falls are estimated to take place from 2030 to 2031.

- Bowdun (for harbour porpoise and minke whale);
- Buchan (for harbour porpoise and minke whale);
- Caledonia (for harbour porpoise and minke whale);
- Dogger Bank D (for all marine mammal species);
- Dogger Bank South (East and West) (for all marine mammal species);

- Dudgeon Extension (for all marine mammal species);
- Five Estuaries (for all marine mammal species);
- Normandie (for harbour porpoise and minke whale)
- Outer Dowsing (for all marine mammal species);
- Sheringham Shoal Extension (for all marine mammal species); and
- Rampion 2 (for harbour porpoise and minke whale).

74. This more realistic short list of OWF projects that could be piling at the same time as North Falls could change as projects develop, but this is the best available information at the time of writing.

75. When the cumulative assessment was undertaken for the ES [APP-026], Section 12.9.3.1.1), at the time of writing, 20 UK and European OWFs were screened in for having a potentially overlapping construction period with the Project, with six OWFs potentially piling at the same time.

76. Table 2-10 below provides an update to the quantitative assessment for harbour porpoise, for all OWF projects that maybe be piling at the same time as North Falls (or those with unknown construction dates, but similar to North Falls operational dates). Table 2-10 updates Table 12.96 of the ES [APP-026]. This updated assessment shows that while the list of projects has changed, the overall number of harbour porpoise is similar to that as assessed within the ES, with the same magnitude of medium.

Table 2-10 Further information to Table 12.96 [APP-026] Quantitative assessment for cumulative disturbance for harbour porpoise due to piling at other OWFs (magnitude levels based on the percentage of the reference population affected) [number of individuals at risk of disturbance is based on project specific reporting, and rounded up to nearest whole number] [updates to Table 12.96 [APP-026] shown in blue]

Projects	Approach to disturbance assessment	Maximum number of individuals potentially disturbed during single piling
North Falls	*Based on dose response*	*1,072*
~~Berwick Bank (Seagreen Charlie Delta Echo)~~	~~Based on underwater noise contours~~	~~1,754~~
Bowdun	No ES, used SCANS IV and 26km EDR	1,271
Buchan	No ES, used SCANS IV and 26km EDR	598
Caledonia[1]	ES	598

[1] Assessments are based on the relevant SCANS-IV survey block (Gilles et al. 2023) for the project

Projects	Approach to disturbance assessment	Maximum number of individuals potentially disturbed during single piling
Dogger Bank D	No ES, used SCANS IV and 26km EDR	1,703
Dogger Bank South (East and West) [2]	Based on dose response	12,208
Dudgeon Extension	Based on dose response	804
Five Estuaries	Based on dose response	7,031
Normandie	No ES, used SCANS IV and 26km EDR	222
Outer Dowsing[3]	ES	3,981
Sheringham Shoal Extension	Based on dose response	582
Rampion 2[4]	ES (Rev F)	752
Total number of harbour porpoise		30,822
Percentage of NS MU		9.09%
Magnitude of cumulative impact		Medium

77. Table 2-11 below provides an update to the quantitative assessment for minke whale, for all OWF projects that maybe be piling at the same time as North Falls (or those with unknown construction dates, but similar to North Falls operational dates). Table 2-11 updates Table 12.97 of the ES [APP-026]. This updated assessment shows that while the list of projects has changed, the overall number of minke whale is similar to that as assessed within the ES, with the same magnitude of low.

[2] RWE Renewables UK Dogger Bank South (West) Limited and RWE Renewables UK Dogger Bank South (East) Limited (2024)
[3] Outer Dowsing Offshore Wind (2024)
[4] Rampion 2 Wind Farm (2024)

Table 2-11 Further information to Table 12.97 [APP-026] Quantitative assessment for cumulative disturbance for minke whale from piling at other OWFs (magnitude levels based on the percentage of the reference population affected) [number of individuals at risk of disturbance is based on project specific reporting, and rounded up to nearest whole number] [updates to Table 12.97 [APP-026] shown in blue]

Project	Approach to disturbance assessment	Maximum number of individuals potentially disturbed during single piling
NORTH FALLS	***BASED ON TTS AS A PROXY FOR DISTURBANCE***	***37***
~~**BERWICK BANK (SEAGREEN CHARLIE DELTA ECHO)**~~	~~**BASED ON UNDERWATER NOISE CONTOURS**~~	~~**82**~~
BOWDUN	**NO ES, USED SCANS IV AND 30KM EDR**	**119**
BUCHAN	**NO ES, USED SCANS IV AND 30KM EDR**	**33**
CALEDONIA	**ES**	**33**
DOGGER BANK D	**NO ES, USED SCANS IV AND 30KM EDR**	**44**
DOGGER BANK SOUTH (EAST AND WEST)	**ES, BASED ON TTS ASSESSMENT**	**148**
DUDGEON EXTENSION	**ES, BASED ON TTS ASSESSMENT**	**11**
FIVE ESTUARIES	**NOT ASSESSED BY PROJECT**	**-**
NORMANDIE	**NO ES, USED SCANS IV AND 30KM EDR**	**9**
OUTER DOWSING	**BASED ON DOSE RESPONSE**	**17**
SHERINGHAM SHOAL EXTENSION	**ES**	**11**
RAMPION 2	**ES (REV F)**	**8**
TOTAL NUMBER OF MINKE WHALE		**470**
PERCENTAGE OF CGNS MU		**2.34%**
MAGNITUDE OF CUMULATIVE IMPACT		**LOW**

78. Table 2-12 below provides an update to the quantitative assessment for seals, for all OWF projects that maybe be piling at the same time as North Falls (or those with unknown construction dates, but similar to North Falls operational dates). Table 2-12 updates Table 12.98 of the ES [APP-026]. This updated assessment shows that while the list of projects has changed, the overall number of seals is similar to that as assessed within the ES, with the same magnitude of medium for grey seals and low for harbour seals.

Table 2-12 Further information to Table 12.98 [APP-026] Quantitative assessment for cumulative disturbance for grey seal and harbour seal from piling at other OWFs (magnitude levels based on the percentage of the reference population affected) [number of individuals at risk of disturbance is based on project specific reporting, and rounded up to nearest whole number] [updates to Table 12.98 [APP-026] shown in blue]

Project	Approach to disturbance assessment	Maximum number of grey seal potentially disturbed during single piling	Maximum number of harbour seal potentially disturbed during single piling
North Falls	*Based on dose response*	*112*	*7*
Dogger Bank D	No ES, based on Carter *et al*., 2022 and 25km EDR	157	0.022
Dogger Bank South (East and West)	Based on dose response	1,968	4
Dudgeon Extension	Based on dose response	374	43
Five Estuaries	Based on dose response	112	2
Outer Dowsing	Based on dose response	377	25
Sheringham Shoal Extension	Based on dose response	338	84
Total number of seals		3,438	165
Percentage of wider reference population		6.08%	3.39%
Magnitude of cumulative impact		Medium	Low

79. The above quantitative assessment for cumulative disturbance from piling at other OWFs, uses the dose response method for harbour porpoise and seals and the TTS ranges for minke whale. With a medium sensitivity and medium magnitude for harbour porpoise and grey seal a moderate adverse effect has been assessed. With a medium sensitivity and low magnitude of effect, minke whale and harbour seal have been assessed as having a minor adverse effect.

80. It should be noted that the potential areas of disturbance assume that there is no overlap in the areas of disturbance between different projects and are therefore highly conservative.

81. This assessment is very precautionary, as it is unlikely that all projects could be simultaneously piling at exactly the same time as piling at North Falls and all other OWF projects.

82. In practice, the potential temporary impacts would be less than those predicted in this assessment as there is likely to be a great deal of variation in timing, duration, and hammer energies used throughout the various OWF project construction periods.

2.6.2 Population modelling further information

2.6.2.1. Harbour porpoise

83. Based on the updates to the CEA screening as outlined above, for harbour porpoise, taking into account the cumulative scenario assessed and using the

reference population (338,918) of the NS MU, the iPCoD model predicts there to be a negligible effect on the harbour porpoise population over time due to piling (Plate 2.1 and Table 2-13), in line with the conclusions presented in paragraph 739 of the ES [APP-026].

84. The median population size was predicted to be 99.99% of the un-impacted population size at the end of 2031 (1 year after the piling from all cumulative projects has commenced in the wider area). By the end of 2032 (the year piling ends for all cumulative projects) the median population size for the impacted population is predicted to be 99.90% of the un-impacted population size. Beyond 2032, the impacted population is expected to maintain the same stable trajectory as the un-impacted population (as far as 2055 which is the end point of the modelling, at which point the median impacted to un-impacted ratio is 99.64%; Table 2-13).

85. For harbour porpoise, the potential magnitude of impact for the CEA for disturbance from underwater noise from piling is assessed as negligible, due to there being less than a 1% population level impact on average per year over both the first six years and 25 year modelled periods.

Table 2-13 Further information to Table 12.99 [APP-026] Results of the iPCoD modelling for the cumulative assessment, giving the mean population size of the harbour porpoise population (wider reference population) for years up to 2055 for both impacted and un-impacted populations in addition to the median ratio between their population sizes.

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	338,920	338,920	100.00	338,920	338,920	100.00
End of 2031	338,913	338,837	99.98	341,763	341,716	99.99
End of 2032	338,080	337,215	99.75	339,669	338,754	99.90
End of 2035	338,341	336,199	99.38	338,304	336,379	99.68
End of 2040	338,708	336,301	99.30	337,315	334,409	99.64
End of 2050	337,773	335,401	99.31	332,740	330,623	99.64
End of 2055	338,411	336,038	99.31	329,557	327,944	99.64

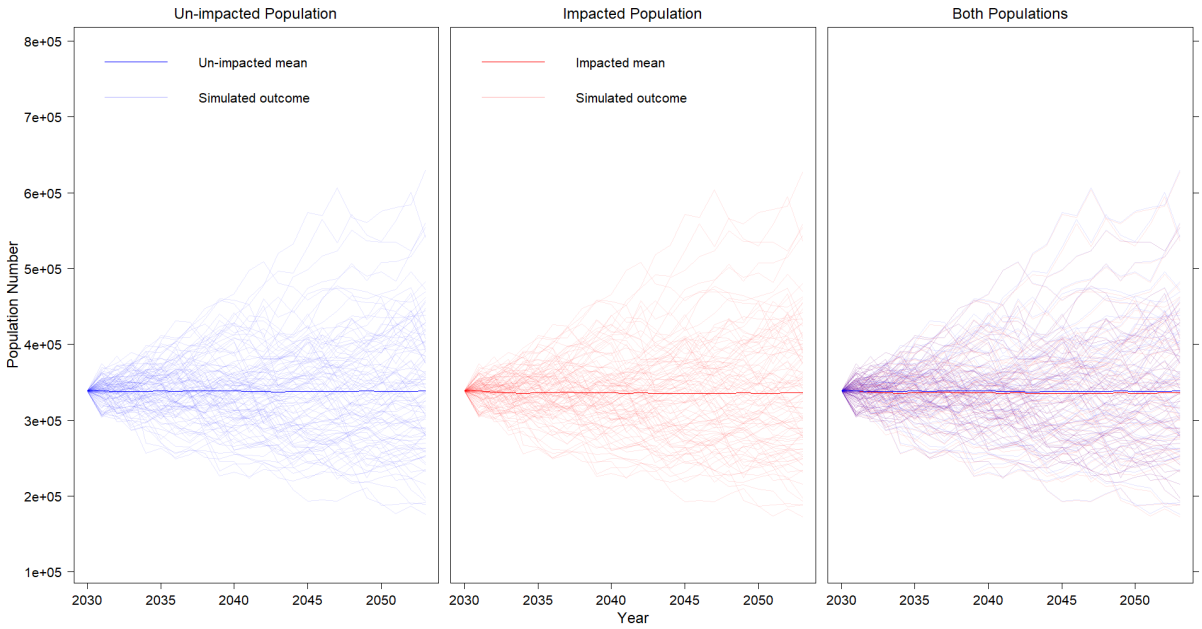


Plate 2.1 Update to Plate 12.13 [APP-026] Simulated worst-case harbour porpoise population sizes for both the un-impacted and the impacted populations for the cumulative assessment

2.6.2.2. Minke whale

86. Based on the updates to the CEA screening as outlined above, for minke whale, taking into account the cumulative scenario assessed and using the reference population (20,118) of the CGNS MU, the iPCoD model predicts there to be a low effect on the minke whale population over time due to piling (Plate 2.2 and Table 2-14), in line with the conclusions presented in paragraph 742 of the ES [APP-026].

87. The median population size was predicted to be 99.97% of the un-impacted population size at the end of 2031 (1 year after the piling from all cumulative projects has commenced in the wider area). By the end of 2032 (the year piling ends for all cumulative projects) the median population size for the impacted population is predicted to be 99.53% of the un-impacted population size. Beyond 2032, the impacted population is expected to maintain the same stable trajectory as the un-impacted population (as far as 2055 which is the end point of the modelling, at which point the median impacted to un-impacted ratio is 93.48%; Table 2-14).

88. For minke whale, the potential magnitude of impact for the CEA for disturbance from underwater noise from piling is assessed as low, due to there being less than a 1% population level impact on average per year over the first six years, with a total predicted decline of 6.52% over the full 25 year modelled period.

Table 2-14 Further information to Table 12.100 [APP-026] Results of the iPCoD modelling for the cumulative assessment, giving the mean population size of the minke whale population (wider reference population) for years up to 2055 for both impacted and un-impacted populations in addition to the median ratio between their population sizes.

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	20,120	20,120	100.00	20,120	20,120	100.00
End of 2031	20,162	20,151	99.95	20,278	20,270	99.97
End of 2032	20,190	20,050	99.30	20,205	20,064	99.53
End of 2035	20,134	19,435	96.51	20,087	19,495	97.17
End of 2040	20,204	19,033	94.18	20,096	18,953	94.96
End of 2050	20,173	18,727	92.82	20,055	18,496	93.64
End of 2055	20,137	18,659	92.65	19,930	18,458	93.48

Plate 2.2 Update to Plate 12.14 [APP-026] Simulated worst-case minke whale population sizes for both the un-impacted and the impacted populations for the cumulative assessment

2.6.2.3. Grey seal

89. Based on the updates to the CEA screening as outlined above, for grey seal, with the cumulative project scenario assessed and using the wider reference

population (of 56,505 for both the SE and NE MUs), the iPCoD model predicts there would be no effect on the grey seal population over time due to piling (Table 2-15 and Plate 2.3), in line with the conclusions presented in paragraph 744 of the ES [APP-026].

90. The median population size was predicted to be 100% of the un-impacted population size at the end of 2031, and by the end of 2032, the median population size for the impacted population is predicted to be 100% of the un-impacted population size. Beyond 2032, the impacted population is expected to maintain the same stable trajectory as the un-impacted population (as far as 2055 which is the end point of the modelling, at which point the median impacted to un-impacted ratio is 100%; Table 2-15).

91. For grey seal, the potential magnitude of impact for the CEA for disturbance from underwater noise from piling is assessed as negligible, due to there being less than a 1% population level impact on average per year over both the first six years and 25 year modelled periods.

Table 2-15 Further information to Table 12.101 [APP-026] Results of the iPCoD modelling for the cumulative assessment, giving the mean population size of the grey seal population (wider reference population) for years up to 2055 for both impacted and un-impacted populations in addition to the median ratio between their population sizes.

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	56,502	56,502	100.00	56,502	56,502	100.00
End of 2031	56,972	56,972	100.00	57,182	57,182	100.00
End of 2032	57,554	57,556	100.00	57,854	57,856	100.00
End of 2035	59,209	59,207	100.00	59,301	59,302	100.00
End of 2040	62,243	62,240	99.99	62,018	62,012	100.00
End of 2050	68,820	68,816	99.99	68,309	68,271	100.00
End of 2055	72,425	72,421	99.99	71,852	71,859	100.00

Plate 2.3 Update to Plate 12.15 [APP-026] Simulated worst-case grey seal (based on wider reference population) population sizes for both the un-impacted and the impacted populations for the cumulative assessment

92. Additional population modelling was undertaken for grey seal, for just the SE MU reference population (30,592). Again, the iPCoD model predicts no effect on the grey seal population over time due to piling (Plate 2.4 and Table 2-16), in line with the conclusions presented in paragraph 747 of the ES [APP-026].

93. The median population size was predicted to be 100% of the un-impacted population size at the end of 2031 and by the end of 2032, the median population size for the impacted population is predicted to be 100% of the un-impacted population size. Beyond 2032, the impacted population is expected to maintain the same stable trajectory as the un-impacted population (as far as 2055 which is the end point of the modelling, at which point the median impacted to un-impacted ratio is 100%;Table 2-16).

94. For grey seal, the potential magnitude of the CEA for disturbance from underwater noise from piling on both the SE MU and wider reference population is assessed as negligible, due to there being less than a 1% population level effect on average per year over both the first six years and 25 year modelled periods.

Table 2-16 Further information to Table 12.102 [APP-026] Results of the iPCoD modelling for the cumulative assessment, giving the mean population size of the grey seal population (SE MU) for years up to 2055 for both impacted and un-impacted populations

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	30,594	30,594	100.00	30,594	30,594	100.00
End of 2031	30,913	30,913	100.00	30,981	30,981	100.00
End of 2032	31,159	31,159	100.00	31,314	31,311	100.00
End of 2035	32,070	32,067	99.99	32,118	32,122	100.00
End of 2040	33,754	33,750	99.99	33,716	33,717	100.00
End of 2050	37,579	37,575	99.99	37,628	37,639	100.00
End of 2055	39,414	39,410	99.99	39,367	39,375	100.00

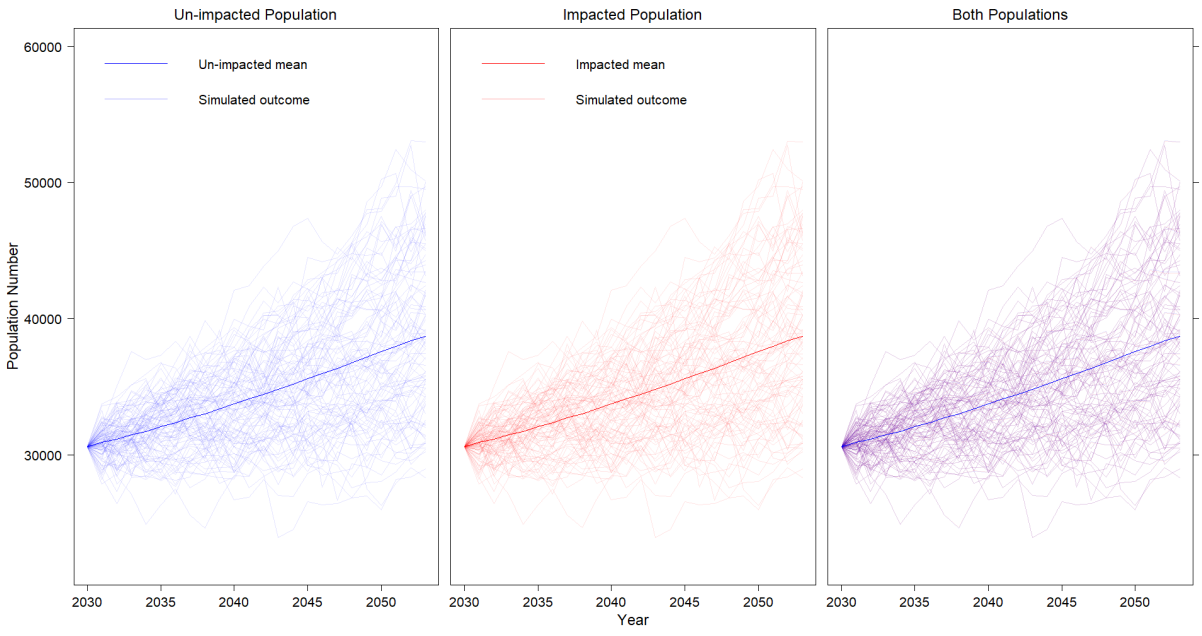


Plate 2.4 Update to Plate 12.16 [APP-026] Simulated worst-case grey seal (based on SE MU) population sizes for both the un-impacted and the impacted populations for the cumulative assessment

2.6.2.4. Harbour seal

95. Based on the updates to the CEA screening as outlined above, for harbour seal, the cumulative scenario assessed and using the reference population of 4,868, the iPCoD model predicts no effect on the harbour seal population over time due to piling (Plate 2.5 and Table 2-17), in line with the conclusions presented in paragraph 749 of the ES [APP-026].

96. The median population size was predicted to be 100% of the un-impacted population size at the end of 2031. By the end of 2032, the median population size for the impacted population is predicted to be 100.06% of the un-impacted population size. Beyond 2032, the impacted population is expected to maintain the same stable trajectory as the un-impacted population (as far as 2055 which is the end point of the modelling, at which point the median impacted to un-impacted ratio is 100%; Table 2-17).

97. For harbour seal, the potential magnitude of the CEA for disturbance from underwater noise from piling is assessed as negligible due to there being less than a 1% population level effect on average per year over both the first six years and 25 year modelled periods.

Table 2-17 Further information to Table 12.103 [APP-026] Results of the iPCoD modelling for the cumulative assessment, giving the mean population size of the harbour seal population for years up to 2055 for both impacted and un-impacted populations in addition to the median ratio between their population size

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	4866	4866	100.00	4866	4866	100.00
End of 2031	3993	3994	100.01	3994	3995	100.00
End of 2032	3276	3279	100.07	3268	3268	100.06
End of 2035	1806	1810	100.24	1794	1798	100.24
End of 2040	670	672	100.27	664	666	100.00
End of 2050	92	92	100.38	88	90	100.00
End of 2055	34	34	100.52	32	32	100.00

Plate 2.5 Update to Plate 12.17 [APP-026] Simulated worst-case harbour seal population sizes for both the un-impacted and the impacted populations for the cumulative assessment

2.6.2.5. Effect significance

98. If all included OWFs were piling at the same time as North Falls, there is the potential for a negligible magnitude of impact for harbour porpoise, grey seal and harbour seal, and low for minke whale, in line with the overall conclusions presented in Table 12.104 of the ES [APP-026].

99. Therefore, taking into account the medium receptor sensitivity for all species the overall cumulative effect for disturbance to marine mammals from piling at other OWFs is minor adverse for harbour porpoise, minke whale, and for grey seal and harbour seal (Table 2-18).

Table 2-18 Further information to Table 12.104 [APP-026] Assessment of effect significance for the potential for cumulative disturbance due to other OWFs piling at the same time as North Falls

Marine mammal species	Sensitivity to potential effect	Magnitude of impact	Likely effect significance	Mitigation	Residual effect
Harbour porpoise	Medium	Negligible	Minor adverse	None required.	Minor adverse
Minke whale	Medium	Low	Minor adverse		Minor adverse
Grey seal and harbour seal	Medium	Negligible	Minor adverse		Minor adverse

2.6.2.6. Mitigation

100. With the implementation of any management measures for the Southern North Sea SAC (such as the SIP), the potential impacts could be reduced. Any mitigation measures to reduce the disturbance of harbour porpoise in the

project specific SIPs could also reduce the potential disturbance of minke whale, grey seal and harbour seal.

101. Updates to Section 12.9.3.1.2 [APP-026] Cumulative impact 1b: Assessment of underwater noise from other activities and vessels at other OWFs

102. All OWFs with construction dates that have the potential to overlap with the construction dates for North Falls have the potential for other construction activities (such as seabed preparation, dredging, trenching, cable installation, rock placement, drilling and vessels) to occur at the same time as other construction activities at North Falls. It is also assumed that these projects would have similar decommissioning programmes to that of North Falls (i.e. they may be undergoing decommissioning at the same time as North Falls).

103. OWFs screened in for other activities that could have a cumulative effect with other construction (or decommissioning) activities at North Falls are (changes to ES [APP-026] are in blue):

- Aspen for harbour porpoise and minke whale;
- Ayre for harbour porpoise and minke whale;
- Beech for harbour porpoise and minke whale;
- Bellrock for harbour porpoise and minke whale;
- Cedar for harbour porpoise and minke whale;
- Cenos for harbour porpoise and minke whale;
- Dunkerque for harbour porpoise and minke whale;
- ~~East Anglia Hub (East Anglia ONE North) for all marine mammal species;~~
- Dylan for minke whale;
- ~~Galatea-Galene for minke whale;~~
- Hornsea Project Four for all marine mammal species;
- Hornsea Project Three for all marine mammal species;
- MaramWind for harbour porpoise and minke whale;
- Morven for harbour porpoise and minke whale;
- Muir Mhor for harbour porpoise and minke whale;
- ~~Nordlicht I for harbour porpoise and minke whale;~~
- ~~Nordlicht II for harbour porpoise and minke whale;~~
- Nordsee Cluster A - N-3.7 for harbour porpoise and minke whale;
- Nordsee Cluster A - N-3.8 for harbour porpoise and minke whale;
- Nordsee Cluster B - N-3.5 for harbour porpoise and minke whale;

- Nordsee cluster B - N-3.6 for harbour porpoise and minke whale;
- Norfolk Vanguard for all marine mammal species;
- Ossian for harbour porpoise and minke whale;
- ~~Rampion 2 for harbour porpoise and minke whale;~~
- Rømø for harbour porpoise and minke whale;
- Salamander (floating) for harbour porpoise and minke whale;
- Seagreen 1A for harbour porpoise and minke whale; and
- West of Orkney for harbour porpoise and minke whale.

104. While the other OWFs that have been assessed under the cumulative piling assessment have the potential for overlapping construction phases, as well as those listed above, they are already assessed under a worst case of piling overlaps.

105. The CEA includes all projects that could have non-piling construction activities during the North Falls construction period.

106. The potential disturbance from OWFs during non-piling construction (or decommissioning) activities, such as vessel noise, seabed preparation, rock placement and cable installation, has been based on project specific data wherever available. For European projects, it has not been possible to obtain project specific data, and therefore a generic approach has been used, with the densities for either the relevant SCANS-IV survey block, or for the relevant area using the Carter *et al.* (2022) density maps for seals. In these cases, the potential area of impact is based on the same as for North Falls alone; 201.1km^2, for up to four activities at once.

107. For harbour porpoise, based on the worst case scenario, for all OWFs that could be constructing (or decommissioning) at the same time as North Falls, the potential magnitude of the temporary impact is assessed as low, with less than 5% of the population at risk of disturbance, compared to a magnitude of negligible as stated in paragraph 760 of the ES [APP-026] (Table 2-19).

Table 2-19 Further information to Table 12.105 [APP-026] Quantitative assessment for cumulative disturbance for harbour porpoise due to construction (or decommissioning) activities at other OWFs (magnitude levels based on the percentage of the reference population affected) [number of individuals at risk of disturbance is based on project specific reporting, and rounded up to nearest whole number] [updates to Table 12.105 [APP-026] shown in blue]

Project	Harbour porpoise density (/km^2)	Impact area (km^2)	Maximum number of individuals potentially disturbed
North Falls	*Based on dose response as worst-case*		*1,072*
Aspen	0.5985	201.1	121
Ayre	0.2813	201.1	57
Beech	1.0398	201.1	210
Bellrock	0.5985	201.1	121

Project	Harbour porpoise density (/km²)	Impact area (km²)	Maximum number of individuals potentially disturbed
Cedar	0.5985	201.1	121
Cenos	0.5985	201.1	121
Dunkerque*	0.1045	201.1	21
~~East Anglia ONE North~~	~~Taken from projects' own assessment~~		~~4~~
Hornsea Project Four	Not quantitively assessed		-
Hornsea Project Three	Not quantitively assessed		-
MaramWind	0.5156	201.1	104
Morven	0.5985	201.1	121
Muir Mhor	Not quantitively assessed		
~~Nordlight I~~	~~0.8034~~	~~201.1~~	~~162~~
~~Nordlight II~~	~~0.8034~~	~~201.1~~	~~162~~
Nordsee Cluster A - N-3.7*	0.6158	201.1	124
Nordsee Cluster A - N-3.8*	0.6158	201.1	124
Nordsee Cluster B – N-3.5	0.6158	201.1	124
Nordsee Cluster B – N-3.6	0.6158	201.1	124
Norfolk Vanguard	Taken from projects' own assessment		906
Ossian	Taken from projects' own assessment		26
Rømø	0.6158	201.1	124
~~Rampion 2~~	~~Not quantitively assessed~~		~~-~~
Salamander	Not quantitively assessed		-
Seagreen 1A	Not quantitively assessed		-
West of Orkney	Not quantitively assessed		-
Total number of harbour porpoise			3,621
Percentage of NS MU			1.07%
Magnitude of cumulative impact			Low

* Project specific assessment unavailable, generic approach used to inform the assessment

108. For minke whale, based on the worst-case scenario, for all OWFs that could be constructing (or decommissioning) at the same time as the North Falls, the magnitude of the temporary impact is assessed as negligible for minke whale, with 0.48% of the reference population at risk of a disturbance impact (Table 2-20), which is of the same magnitude as assessed in the ES [APP-026] Table 12.106.

Table 2-20 Further information to Table 12.106 [APP-026] Quantitative assessment for cumulative disturbance for minke whale due to construction activities (or decommissioning) at other OWFs (magnitude levels based on the percentage of the reference population affected) [number of individuals at risk of disturbance is based on project specific reporting, and rounded up to nearest whole number] [updates to Table 12.106 [APP-026] shown in blue]

Project	Minke whale density (/km^2)	Impact area (km^2)	Maximum number of individuals potentially disturbed
North falls	*Based on dose response as worst-case*		*37*
Aspen	0.0419	201.1	9
Ayre	0.0116	201.1	3
Beech	0.0103	201.1	3
Bellrock	0.0419	201.1	9
Cedar	0.0419	201.1	9
Cenos	0.0419	201.1	9
Dunkerque	0.0 (minke whale not present)	201.1	0
~~East anglia one north~~	~~Minke whale not assessed~~	-	-
~~Galatea galene~~	~~Minke whale not assessed~~	-	-
Hornsea project four	Not quantitively assessed		-
Hornsea project three	Not quantitively assessed		-
Maramwind	0.0121	201.1	3
Morven	0.0419	201.1	9
Muir mhor			
Nordsee cluster a - n-3.7*	0.0 (minke whale not present)	201.1	0
Nordsee cluster a - n-3.8*	0.0 (minke whale not present)	201.1	0
Nordsee cluster b – n-3.5	0.0 (minke whale not present)	201.1	0
Nordsee cluster b – n-3.6	0.0 (minke whale not present)	201.1	0
Norfolk vanguard	Minke whale not assessed		-
Ossian	Taken from projects' own assessment		4
Rømø	0.0 (minke whale not present)	201.1	0
Salamander	Not quantitively assessed		-
Seagreen 1a	Not quantitively assessed		-
West of orkney	Not quantitively assessed		-
Dylan	0.0079	201.1	2
Total number of minke whale			97
Percentage of CGNS MU			0.48%

Project	Minke whale density (/km^2)	Impact area (km^2)	Maximum number of individuals potentially disturbed
Magnitude of cumulative impact			Negligible

109. For grey seal and harbour seal, based on the worst case scenario, for all OWFs that could be constructing (or decommissioning) at the same time as North Falls, the potential magnitude for the cumulative disturbance impact is assessed as negligible for both grey seal and harbour seal, with less than 1% of the reference population temporarily disturbed (Table 2-21), which is of the same magnitude as assessed in the ES [APP-026] Table 12.107.

Table 2-21 Further information to Table 12.107 [APP-026] Quantitative assessment for cumulative disturbance for grey seal and harbour seal due to construction activities (or decommissioning) at other OWFs (magnitude levels based on the percentage of the reference population affected) [number of individuals at risk of disturbance is based on project specific reporting, and rounded up to nearest whole number] [updates to Table 12.107 [APP-026] shown in blue]

Project	Approach to assessment	Maximum number of GS individuals potentially disturbed	Maximum number of HS individuals potentially disturbed
North Falls	Base on dose response	112	7
~~East Anglia ONE North~~	~~Taken from projects' own assessment~~	~~0.07~~	~~0.02~~
Hornsea Project Four	Not quantitively assessed	-	-
Hornsea Project Three	Not quantitively assessed	-	-
Norfolk Vanguard	Taken from projects' own assessment	39	24
Total number of seals		151	31
Percentage of wider reference population		0.27%	0.64%
Magnitude of cumulative impact		Negligible	Negligible

2.6.2.7. Effect significance

110. If all included OWFs were undertaking other construction activities at the same time as North Falls, there is the potential for a negligible magnitude of impact for all marine mammal species other than harbour porpoise which was assessed as a low magnitude.

111. Therefore, taking into account the medium receptor sensitivity for all species, the overall cumulative effect for disturbance to marine mammals from construction activities at other OWFs is minor adverse for all species (Table 2-22). This is deemed to be a conservative assessment based on the worst-case scenario for OWFs constructing at the same time as North Falls. The effect significance for the updated assessment is compared to the ES assessment [APP-026] in Table 2-22.

Table 2-22 Further information to Table 12.108 [APP-026] Assessment of effect significance for the potential for cumulative disturbance due to other OWFs constructing (or decommissioning) at the same time as North Falls [updated assessment shown in blue]

Marine mammal species	Sensitivity to potential effect	Magnitude of impact	Likely effect significance	Mitigation	Residual effect
Harbour porpoise	Medium	Low (was negligible)	Minor adverse	None required.	Minor adverse
Minke whale	Medium	Negligible	Minor adverse		
Grey seal and harbour seal	Medium (was low)	Negligible	Minor adverse (was negligible)		Minor adverse (was negligible)

2.6.2.8. Mitigation

112. With the implementation of any management measures for the Southern North Sea SAC, the potential impacts could be reduced. Any mitigation measures to reduce the disturbance of harbour porpoise in the project specific SIPs could also reduce the potential disturbance of minke whale, grey seal and harbour seal.

113. Updates to Section 12.9.3.1.3 [APP-026] Cumulative impact 1c: Assessment of disturbance from other activities

114. The cumulative assessment undertaken in the ES Chapter 12 [APP-026] for disturbance from geophysical surveys will remain the same, no updates to the assessment are required.

2.6.3 Disturbance from aggregate extraction and dredging

115. As a precautionary approach, a total of seven aggregate extraction and dredging projects are included in the CEA for the potential cumulative disturbance, in comparison to the six assessed as part of the ES [APP-026].

116. These include:

- Greenwich Light East 473/1 (one project area owned by CEMEX UK Marine and one by Hanson Aggregates Marine Ltd.) (screened in for all marine mammal species);
- Greenwich Light East 473/2 (one project area owned by CEMEX UK Marine and one by Hanson Aggregates Marine Ltd.) (screened in for all marine mammal species);
- Inner Dowsing 481/1-2 (screened in for all marine mammal species);
- Inner Owers North 488 (screened in for harbour porpoise and minke whale);

- Thames D 524 (screened in for all marine mammal species);
- West Bassurelle 458 (screened in for all marine mammal species); and
- West Bassurelle 464 (screened in for all marine mammal species).

117. As outlined in the Department for Business, Energy and Industrial Strategy BEIS (2020) RoC HRA for the Southern North Sea SAC, and in line with paragraph 782 of the ES Chapter 12 [APP-026], studies have indicated that harbour porpoise may be displaced by dredging operations within 600m of the activities (Diederichs *et al.,* 2010). As a worst-case assessment, a disturbance range of 600m for up to seven operational aggregate projects at the same time as North Falls construction has been used. A disturbance range of 600m would result in a potential disturbance area of 1.13km^2 for each project, or up to 7.91km^2 for all seven aggregate projects. Only six of those aggregate projects are within the relevant MUs for both seal species, and therefore for seals, the potential disturbance area is 6.8km^2 (Table 2-23).

118. The densities for each marine mammal species are as outlined in Section 12.9.3 [APP-026].

119. For the potential cumulative disturbance from aggregate and dredging projects, the magnitude of impact would be negligible for harbour porpoise, minke whale, grey seal and harbour seal, in line with paragraph 784 of ES Chapter 12 [APP-026] (Table 2-23).(Table 2-23).

Table 2-23 Further information to Table 12.110 [APP-026] Quantitative assessment for cumulative disturbance of marine mammals due to aggregate and dredging projects (magnitude levels based on the percentage of the reference population affected) [updates to Table 12.110 [APP-026] shown in blue]

Potential cumulative effect	Marine mammal species	Marine mammal density (/km^2)	Potential cumulative impact area (km^2)	Maximum number of individuals potentially disturbed (% of reference population)	Potential magnitude of cumulative effect
Aggregate and dredging projects (1.13km^2 disturbance area per project)	Harbour porpoise	0.55	7.91	5 (0.001%)	Negligible
	Minke whale	0.0085		0.1 (0.0003%)	Negligible
	Grey seal	0.296	6.8	2 (0.004%)	Negligible
	Harbour seal	0.065		0.4 (0.009%)	Negligible

120. The cumulative assessment undertaken in the ES Chapter 12 [APP-026] for disturbance from oil and gas seismic surveys will remain the same, no further information is required.

121. The cumulative assessment undertaken in the ES Chapter 12 [APP-026] for disturbance from subsea cables and pipelines will remain the same, no further information is required.

122. The cumulative assessment undertaken in the ES Chapter 12 [APP-026] for disturbance from UXO clearance will remain the same, no further information is required.

2.6.4 Magnitude of impact due to the disturbance from all potential noise sources (other than construction of OWF)

123. Each of the other noise sources are quantitively assessed together in Table 2-24.

124. For harbour porpoise, for noisy activities (other than OWF) with the potential for cumulative disturbance impacts together with piling at North Falls, the magnitude of impact is negligible, with up to 0.86% of the population at risk of disturbance. Which is in line with the conclusions presented in paragraph 802 of the ES [APP-026].

125. For minke whale, for noisy activities (other than OWF) with the potential for cumulative disturbance impacts together with piling at North Falls, the magnitude of impact is low, with 2.06% of the population at risk of disturbance. Which is in line with the conclusions presented in paragraph 803 of the ES [APP-026].

126. For noisy activities (other than OWF) with the potential for cumulative disturbance impacts together with piling at North Falls, the magnitude of impact is low for grey seal, with 1.97% of the population at risk of disturbance, and for harbour seal, the magnitude of impact is low, with up to 4.4% of the reference population at risk. Which is in line with the conclusions presented in paragraph 804 of the ES [APP-026].

Table 2-24 Further information to Table 12.114 [APP-026] Quantitative assessment for all noisy activities with the potential for cumulative disturbance impacts for marine mammals (magnitude levels based on the percentage of the reference population affected) [updates to Table 12.114 [APP-026] shown in blue]

Impact	Number of individuals			
	Harbour porpoise	Minke whale	Grey seal	Harbour seal
Worst case disturbance at North Falls	1,072	37	112	7
Up to two geophysical surveys (Table 12.109 [APP-026])	87	2	47	11
Aggregates and dredging (TABLE 2-23)	5 (was 4)	0.1 (was 1)	2	0.4 (was 1)
Up to two oil and gas seismic surveys (table 12.111 [APP-026])	1,570	49	476	89
Subsea cables and pipelines (Table 12.112 [APP-026])	54	0.8	24	6
UXO clearance (Table 12.113 [APP-026])	1,212	325	452	100
Total number of individuals	2,928 (was 2,927)	414	1,113	214
Percentage of MU	0.86%	2.06%	1.97%	4.4%
Magnitude of cumulative impact	Negligible	Low	Low	Low

2.6.5 Effect significance for disturbance from all underwater noise sources (other than OWF)

127. If all included noisy activities (other than those associated with OWF construction) were taking place at the same time as piling at North Falls, there is the potential for a negligible to low magnitude of impact, for all marine mammal species.

128. Therefore, taking into account the medium receptor sensitivity for harbour porpoise and minke whale, and medium sensitivity for grey seal and harbour seal, the overall cumulative effect for disturbance to marine mammals from construction activities at other OWFs is minor adverse for harbour porpoise, minke whale and grey seal, and harbour seal (Table 2-25), the only difference

between this and the ES [APP-026] is the sensitivity assessed for seals as shown below.

Table 2-25 Further information to Table 12.115 [APP-026] Assessment of effect significance for the potential for cumulative disturbance due to noisy activities (other than OWF) [updates to Table 12.115 [APP-026] shown in blue]

Marine mammal species	Sensitivity to potential effect	Magnitude of impact	Likely effect significance	Mitigation	Residual effect
Harbour porpoise	Medium	Negligible	Minor adverse	None required.	Minor adverse
Minke whale	Medium	Low	Minor adverse		
Grey seal and arbour seal	Medium (Low)	Low	Minor adverse (Negligible)		Minor adverse (Negligible)

2.6.6 Mitigation

The North Falls SIP for the Southern North Sea SAC will manage and reduce the potential for significant disturbance of harbour porpoise from cumulative underwater noise during OWF piling. This could also reduce the potential for disturbance for all other marine mammal species. It is highly likely that other OWFs within the Southern North Sea SAC would also require a SIP to manage the effect of cumulative disturbance, further reducing the potential for significant disturbance.

2.6.7 Summary of cumulative effect 1: assessment of disturbance from all noisy activities associated with offshore industries

129. Each of the sound sources described above are quantitively assessed together in Table 2-26Table 2-26Table 2-26.

130. For harbour porpoise, for all noisy activities with the potential for cumulative disturbance effects, the magnitude of impact is low, with up to 2.3% of the population at risk of disturbance. This magnitude of impact is in line with what was assessed in the ES [APP-026] Table 12.116.

131. For minke whale, for all noisy activities with the potential for cumulative disturbance effects, the magnitude of impact is low, with less than 5% of the population at risk of disturbance. This magnitude of impact is in line with what was assessed in the ES [APP-026] Table 12.116.

132. For all noisy activities with the potential for cumulative disturbance effects, the magnitude of impact is low for grey seal, with less than 1.9% of the population at risk of disturbance, and for harbour seal, the magnitude of impact is low, with up to 4.75% of the reference population at risk. This magnitude of impact is in line with what was assessed in the ES [APP-026] Table 12.116.

Table 2-26 Further information to Table 12.116 [APP-026] Quantitative assessment for all noisy activities with the potential for cumulative disturbance effects for marine mammals (magnitude levels based on the percentage of the reference population affected) [updates to Table 12.115 [APP-026] shown in blue]

Impact	Number of individuals			
	Harbour porpoise	Minke whale	Grey seal	Harbour seal
Worst case disturbance at North Falls Piling at other OWFs	<1% population level impact over first six years (Table 2-13)	0.47% (3.06%) population level impact over first six years (Table 2-14)	0% population level impact over first six years (Table 2-15; Table 2-16)0% population level impact over first six years (Table 2-15; Table 2-16)	0% population level impact over first six years (Table 2-17)
Construction (or decommissioning) activities at other OWFs	2,549 (1,503)	60 (8)	39 (40)	24 (25)
Up to two geophysical surveys (Table 12.109 [APP-026])	87	2	47	11
Aggregates and dredging (Table 2-23)	5 (4)	0.1	2	0.4
Up to two oil and gas seismic surveys (Table 12.111 [APP-026])	1,570 (498)	49	476	89
Subsea cables and pipelines (Table 12.112 [APP-026])	54	0.8	24	6
UXO clearance (Table 12.113 [APP-026])	1,212	325	452	100
Total number of individuals	4,405 (3,358)	437 (385)	1,040 (1,041)	231 (232)
Percentage of MU	2.3% (including 1% population effect from piling) (1.99% (including 1% population effect from piling))	2.64% (including 0.47% population effect from piling) (4.8% (including 2.63% population effect from piling))	1.84%	4.75%
Magnitude of cumulative impact	Low	Low	Low	Low

2.6.8 Effect significance

133. If all included potentially noisy activities were undertaken at the same time as North Falls, there is the potential for a low magnitude of impact for all species, which is in line with what was assessed for the ES [APP-026] paragraph 812.

134. Therefore, taking into account the medium receptor sensitivity for harbour porpoise, minke whale, grey seal and harbour seal, the overall cumulative effect for disturbance to marine mammals from other noisy industries, including North Falls, is minor adverse for all species (Table 2-27). This is deemed to be a conservative assessment based on the worst-case scenario for OWFs constructing at the same time as North Falls. The only difference seen in Table 2-27 compared to the ES [APP-026] Table 12.117 is the updated sensitivity for seals.

135. It should be noted that while the projects included within the cumulative assessment for disturbance from other projects and activities taking place at the same time were based on the current knowledge of their possible construction or activity windows, and it is very unlikely that all activities would be taking place on the same day or in the same season, and therefore this likely represents an over-precautionary and worst case estimate of the marine mammals that could be at risk of disturbance during the two year construction of North Falls.

Table 2-27 Further information for Table 12. 117 [APP-026] Assessment of effect significance for the potential of a cumulative disturbance effect due to all other noisy projects and activities

Marine mammal species	Sensitivity to potential effect	Magnitude of impact	Likely effect significance	Mitigation	Residual effect
Harbour porpoise	Medium	Low	Minor adverse	None required.	Minor adverse
Minke whale	Medium	Low	Minor adverse		
Grey seal and arbour seal	Medium	Low	Minor adverse		

2.6.9 Mitigation

136. The North Falls SIP for the Southern North Sea SAC could manage and reduce the potential for significant disturbance of harbour porpoise from cumulative underwater noise during OWF piling. This could also reduce the potential for disturbance for all other marine mammal species.

3. Further Information Regarding the RIAA Marine Mammal Assessment (PART 3, [APP-176])

3.1 Further information for in-combination assessment for RIAA [APP-176]

137. The Applicant has considered Natural England's comments regarding the in-combination assessment used in the RIAA. This section provides additional information in response to Natural England's comment ([RR-243], E7);

"Natural England has concerns with the chosen cut-off date for inclusion of other Offshore Wind Farms (OWFs) into the Cumulative Effect Assessment (CEA) which is currently the end of January 2024. Natural England highlights that this cut-off date is too far back since new data has been produced by other developments in recent months.

We recommend that the Applicant extends the cut-off date to include up-to-date information from other OWFs into the CEA."

138. This section also provides additional information in response to Natural England's comment ([RR-243], E17);

"Natural England does not agree that all projects with unknown construction timelines should be screened out. We consider that it would be conservative to assume that construction for consented projects could overlap with the project if an operational date is known (as presented in Table 1.2 and is similar to the North Falls project's operational date).

Natural England advises that the Applicant should include the projects with similar operational dates in the CEA."

139. This section also provides additional information in response to Natural England's comment ([RR-243], E5);

"Natural England notes that the incorrect approach has been used for the in-combination assessment whereby dose response method was applied to calculate the number of animals disturbed instead of using the Effective Deterrent Radius (EDR) approach as outlined in the Natural England Best Practice Guidelines Phase III and the Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs.

Natural England recommends that the Applicant revises the in-combination assessment and applies the EDR approach as per the Best Practice Guidelines, Phase III and the Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs."

140. In line with Natural England's comments, the in-combination assessment for the RIAA [APP-176] has been updated. The assessment has been extended to now include information, as of January 2025, from other OWFs for all other project activity that could be occurring at the same time as North Falls. The assessment has also been updated to use EDRs rather than dose response results.

3.1.1 Updates to SNS SAC Section 3.4.3.4.1 [APP-176] In-combination impact 1: Disturbance from underwater noise

141. A list of UK and European OWF projects that may have the potential for overlapping piling with North Falls is provided (Section 2.6), and has been used to inform the assessment for in-combination effects due to piling at other OWFs.

142. Of the 33 UK and European OWFs screened in for having a construction period that could potentially overlap with the construction of the Project, eleven UK OWFs could be piling at the same time, which is currently estimated to take place in 2030/31 and are within the North Sea MU for harbour porpoise;

- Bowdun;
- Buchan;
- Caledonia;
- Dogger Bank D;
- Dogger Bank South (East and West);
- Dudgeon Extension;
- Five Estuaries;
- Normandie;
- Outer Dowsing;
- Sheringham Shoal Extension; and
- Rampion 2.

143. Of these, Dogger Bank South, Dudgeon Extension Project, Five Estuaries, Outer Dowsing and Sheringham Shoal Extension Project are within 26km of the SNS SAC, and Five Estuaries, Dudgeon Extension Project and Sheringham Shoal Extension Project are within (or within 26km of) the Southern North Sea SAC winter area, as seen in the RIAA Figure 3.3 [APP-176].

144. The commitment to the mitigation agreed through the MMMP for piling would reduce the risk of physical injury or permanent auditory injury (PTS) for all marine mammals, and therefore this assessment focuses on the potential for disturbance only.

145. The assessment for harbour porpoise for the North Falls project against the NS MU population has been based on the same approach as described in the ES [APP-026] paragraph 88.

3.1.1.1. Assessment against the North Sea MU population

146. For harbour porpoise, the potential worst-case scenario of other OWFs piling at the same time as North Falls is assessed in Table 3-1. Up to 7% of the reference population could potentially be disturbed, however this is very precautionary, as it is unlikely that all other OWF projects could be piling at exactly the same time as piling at North Falls. The conclusion of this re-assessment is in line with what was assessed within the RIAA [APP-176].

Table 3-1 Further information to Table 3.29 [APP-176] Quantitative assessment for in-combination disturbance for harbour porpoise due to piling at other OWFs (number of individuals at risk of disturbance is based on project specific reporting, and rounded up to nearest whole number) [updates to Table 3.29 [APP-176] shown in blue]

Project	Density (/km^2)	Approach to disturbance assessment	Maximum number of individuals potentially disturbed during single piling
North Falls	*Based on EDR*		*6,832*
~~Berwick Bank (Seagreen Charlie Delta Echo)~~	~~Based on underwater noise contours~~		~~1,754~~
Bowdun	0.5985	2123.7	1,271.0
Buchan	0.2813	2123.7	598.0
Caledonia		ES	598
Dogger Bank D	0.8034	2123.7	1,706.2
Dogger Bank South (East and West)		EDR for E&W combined	2,680.0
Dudgeon Extension	0.888	2123.7	1,886.0
Five Estuaries	1.820	RIAA max overlap using EDR (2100km^2)	3,822.0
Normandie	0.1045	2123.7	222
Outer Dowsing		RIAA refers back to ES	2,012.0
Sheringham Shoal Extension	0.888	2123.7	1,886.0
Rampion 2		Based on ES as not in RIAA	752.0
Total number of harbour porpoise			**24,266**
Percentage of NS MU			**7%**

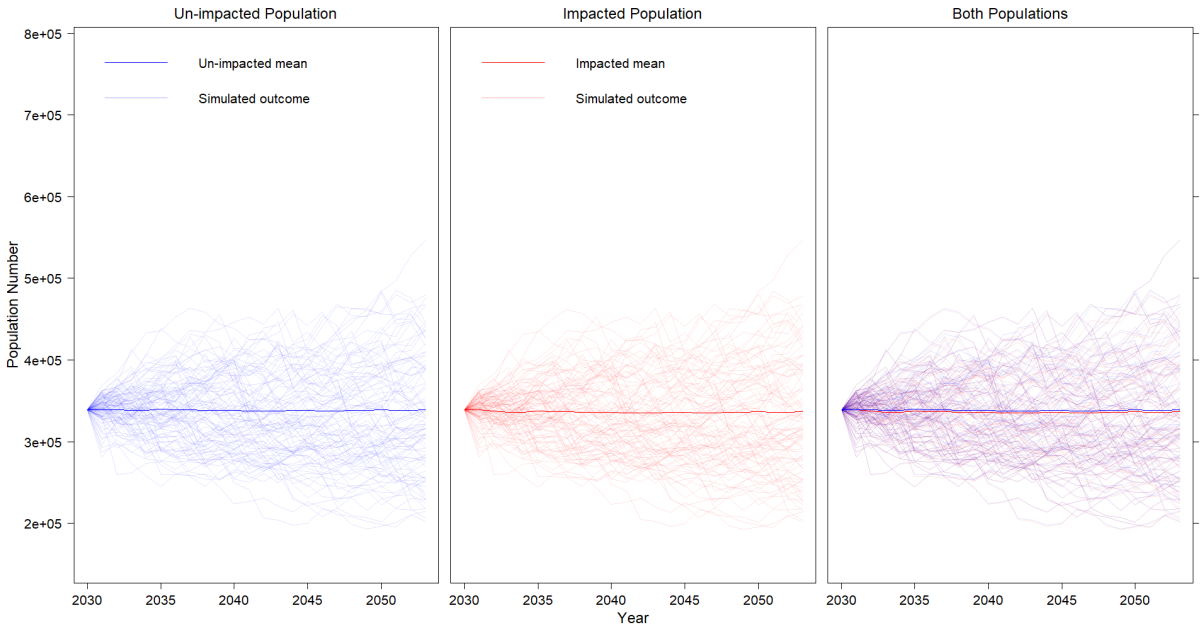
147. Additional assessments using iPCoD modelling were undertaken to predict the harbour porpoise population effect due to cumulative disturbance from piling, using the number at risk of disturbance from each project as provided in Table 3-2.

148. The median population size was predicted to be 100% of the un-impacted population size at the end of 2031 (one year after the piling has commenced in the wider area). By the end of 2032 (the year piling ends) the median population size for the impacted population is predicted to be 99.88% of the un-impacted population size. Beyond 2032, the impacted population is expected to maintain the same stable trajectory as the un-impacted population (as far as 2055 which is the end point of the modelling, at which point the median impacted to un-impacted ratio is 99.62%).

149. The modelling indicates there would be no adverse effect on the integrity of the SNS SAC due to cumulative disturbance from piling, due to there being less than a 1% population level effect on average per year over both the first six years and 25 year modelled periods. The conclusion of this re-assessment is in line with what was assessed within the RIAA [APP-176].

Table 3-2 Further information to Table 3.30 [APP-176] Results of the iPCoD modelling for the cumulative assessment, giving the mean population size of the harbour porpoise population (wider reference population) for years up to 2055 for both impacted and un-impacted populations in addition to the median ratio between their population sizes.

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	338,920	338,920	100.00	338,920	338,920	100.00
End of 2031	339,453	339,375	99.98	341,838	341,745	99.99
End of 2032	338,860	337,854	99.70	340,273	339,632	99.88
End of 2035	339,564	337,279	99.33	339,643	336,348	99.66
End of 2040	338,198	335,631	99.25	335,479	332,666	99.61
End of 2050	338,902	336,382	99.26	332,158	329,836	99.62
End of 2055	339,544	337,045	99.26	331,860	329,673	99.62



150. The spatial and seasonal assessment undertaken in the RIAA [APP-176] Section 3.4.3.4.1 will not change as all the projects included are still screened in. No additional projects that overlap with the SNS SAC have been screened in either.

3.1.2 Updates to SNS SAC In-combination impact 1b: Assessment of underwater noise from construction activities (other than piling) and vessel presence at other OWFs

151. For any projects where project specific information is not available, the potential disturbance from OWFs during non-piling construction activities, such as vessel noise, seabed preparation, rock placement and cable installation, has been based on the disturbance area for multiple construction activities taking place at North Falls (as for the approach for North Falls alone), and the relevant SCANS-IV density. Project specific information has been used wherever practicable.

152. For harbour porpoise, based on the worst-case scenario, for all OWFs that could be constructing at the same time as North Falls (Table 3-1), up to 2.71% of the reference population could be potentially disturbed (Table 3-3). Table 3-3 The potential reference population affected by disturbance is higher than what was assessed for in the RIAA [APP-176], however, this is as expected due to the increase in projects screened in. The overall conclusion of this re-assessment are still in line with what was assessed within the RIAA [APP-176].

Table 3-3 Further information to Table 3.34 [APP-176] Quantitative assessment for in-combination disturbance for harbour porpoise due to construction activities (including vessels) at other OWFs

Project	Harbour porpoise density (/km^2)	Impact area (km^2)	Maximum number of individuals potentially disturbed
North Falls	*Based on EDR*		*6,832*

Project	Harbour porpoise density (/km²)	Impact area (km²)	Maximum number of individuals potentially disturbed
Aspen	0.5985	201.1	121
Ayre	0.2813	201.1	57
Beech	1.0398	201.1	210
Bellrock	0.5985	201.1	121
Cedar	0.5985	201.1	121
Cenos	0.5985	201.1	121
Dunkerque*	0.1045	201.1	21
Hornsea Project Four	Not quantitively assessed		-
Hornsea Project Three	Not quantitively assessed		-
MaramWind	0.5156	201.1	104
Morven	0.5985	201.1	121
Muir Mhor	Not quantitively assessed		
Nordsee Cluster A - N-3.7*	0.6158	201.1	124
Nordsee Cluster A - N-3.8*	0.6158	201.1	124
Nordsee Cluster B – N-3.5	0.6158	201.1	124
Nordsee Cluster B – N-3.6	0.6158	201.1	124
Norfolk Vanguard	Taken from projects' own assessment		906
Ossian	Taken from projects' own assessment		26
Rømø	0.6158	201.1	124
Salamander	Not quantitively assessed		-
Seagreen 1A	Not quantitively assessed		-
West of Orkney	Not quantitively assessed		-
Total number of harbour porpoise			9,381
Percentage of NS MU			2.71%

3.1.3 Updates to SNS SAC RIAA [APP-176] in-combination impact 1c: Assessment of disturbance from other activities

153. The in-combination assessment undertaken in the RIAA Part 3 [APP-176] for disturbance from geophysical surveys will remain the same, no further information is required.

3.1.3.1. Disturbance from aggregate extraction and dredging

154. As a precautionary approach, a total of seven aggregate extraction and dredging projects are included in the in-combination assessment for the potential cumulative disturbance.

155. These include:

- Greenwich Light East 473/1 (one project area owned by CEMEX UK Marine and one by Hanson Aggregates Marine Ltd.) (screened in for all marine mammal species);
- Greenwich Light East 473/2 (one project area owned by CEMEX UK Marine and one by Hanson Aggregates Marine Ltd.) (screened in for all marine mammal species);
- Inner Dowsing 481/1-2 (screened in for all marine mammal species);
- Inner Owers North 488 (screened in for harbour porpoise and minke whale);
- Thames D 524 (screened in for all marine mammal species);
- West Bassurelle 458 (screened in for all marine mammal species); and
- West Bassurelle 464 (screened in for all marine mammal species).

156. As outlined in the Department for Business, Energy and Industrial Strategy BEIS (2020) RoC HRA for the Southern North Sea SAC, studies have indicated that harbour porpoise may be displaced by dredging operations within 600m of the activities (Diederichs *et al.,* 2010). As a worst-case assessment, a disturbance range of 600m for up to seven operational aggregate projects at the same time as North Falls construction has been used. A disturbance range of 600m would result in a potential disturbance area of 1.13km^2 for each project, or up to 7.91km^2 for all seven aggregate projects. The conclusion of this re-assessment is in line with what was assessed within the RIAA [APP-176].

Table 3-4 Further information to Table 3.40 [APP-176] Quantitative assessment for in-combination disturbance of harbour porpoise due to aggregate and dredging projects

Potential cumulative effect	Marine mammal density (/km^2)	Potential cumulative impact area (km^2)	Maximum number of individuals potentially disturbed (% of reference population)
Aggregate and dredging projects (1.13km^2 disturbance area per project)	0.55	7.91	5 (0.001%)

157. The in-combination assessment undertaken in the RIAA Part 3 [APP-176] for disturbance from oil and gas seismic surveys will remain the same, no further information is required.

158. The in-combination assessment undertaken in the RIAA Part 3 [APP-176] for disturbance from subsea cables and pipelines will remain the same, no further information is required.

159. The in-combination assessment undertaken in the RIAA Part 3 [APP-176] for disturbance from UXO clearance will remain the same, no further information is required.

3.1.4 Summary of in-combination effect 1: assessment of disturbance from all noisy activities associated with offshore industries

160. Each of the sound sources described above are quantitively assessed together in Table 3-5.

161. For harbour porpoise, for all noisy activities with the potential for cumulative disturbance effects, up to 2.75% of the population is at risk of disturbance. The conclusion of this re-assessment is in line with what was assessed within the RIAA [APP-176].

Table 3-5 Further information to Table 3.50 [APP-176] Quantitative assessment for all noisy activities with the potential for in-combination disturbance effects for harbour porpoise [updates to Table 3.50 [APP-176] shown in blue]

Impact	Number of individuals
Worst case disturbance at North Falls	<1% population level impact over first six years (Table 3-2Table 3-2)
Piling at other OWFs	
Construction (or decommissioning) activities at other OWFs	2,549
Up to two geophysical surveys (Table 12.109 [APP-026])	282
Aggregates and dredging (Table 3-4)	5
Up to two oil and gas seismic surveys (Table 12.111 [APP-026])	1,935
Subsea cables and pipelines (Table 12.112 [APP-026])	98
UXO clearance (Table 12.113 [APP-026])	1,212
Total number of individuals	6,081
Percentage of NS MU	2.75% (including 1% population effect from piling)

162. This in-combination assessment will be refined and updated during the SIP process post-consent, to take account of the latest information on project programmes and any detail on project-level mitigation commitments or marine licence conditions from the in-combination projects. The final assessment will also take account of the potential for overlaps in the disturbance areas of all activities, and whether they are likely to take place on the same day or within the same season to refine the assessments. The assessment will also take into account the number of days of each activity included. It is expected that taking these points into consideration would reduce the overlaps.

163. Potential mitigation and management measures for North Falls are presented in the Outline SIP [APP-243]. NFOW will seek to ensure that there would be no adverse effect on the integrity of the SNS SAC in relation to the conservation objectives for harbour porpoise as a result of North Falls in-combination with other plans and projects, by ensuring both the spatial (20%) and seasonal (10%) thresholds are not breached.

3.1.5 Updates to Humber Estuary SAC Section 3.5.3.4.1 [APP-176] In-combination impact 1: Disturbance from underwater noise

164. A list of UK and European OWF projects that may have the potential for overlapping piling with North Falls is provided (Section 2.6), and has been used to inform the assessment for in-combination effects due to piling at other OWFs.

165. Of the 33 UK and European OWFs screened in for having a construction period that could potentially overlap with the construction of the Project, six UK OWFs could be piling at the same time, which is currently estimated to take place in 2030/31 and are within the South-east England and North-east England MUs for grey seal;

- Dogger Bank D;
- Dogger Bank South (East and West);
- Dudgeon Extension;
- Five Estuaries;
- Outer Dowsing; and
- Sheringham Shoal Extension.

166. The commitment to the mitigation agreed through the MMMP for piling would reduce the risk of physical injury or permanent auditory injury (PTS) for all marine mammals, and therefore this assessment focuses on the potential for disturbance only.

167. The assessment for grey seal for the North Falls project against the Humber Estuary SAC population has been based on the same approach as described in the RIAA [APP-176] Section 3.5.3.4.1, the assessment has just been updated to incorporate the new cumulative screening list (Section 2.6).

168. For grey seal, the potential worst-case scenario of other OWFs piling at the same time as North Falls is assessed in Table 3-6. Up to 9.69% of the reference population could potentially be disturbed, however, this is very precautionary, as it is unlikely that all other OWF projects could be piling at exactly the same time as piling at North Falls. The conclusion of this re-assessment is in line with what was assessed within the RIAA [APP-176].

Table 3-6 Further information to Table 3.29 [APP-176] Quantitative assessment for in-combination disturbance for grey seal due to piling at other OWFs (number of individuals at risk of disturbance is based on project specific reporting, and rounded up to nearest

Project	Density (/km^2)	Approach to disturbance assessment	Maximum number of individuals potentially disturbed during single piling
North Falls	*Based on dose response*		*9*
Dogger Bank D	0.019	2123.7	41
Dogger Bank South (East and West)	Based on dose response		346
Dudgeon Extension	Based on dose response		166
Five Estuaries	Based on dose response		168
Outer Dowsing	0.29	2123.7	615
Sheringham Shoal Extension	Based on dose response		157
Total number of grey seal			**1,502**
Percentage of HE SAC			**9.69%**

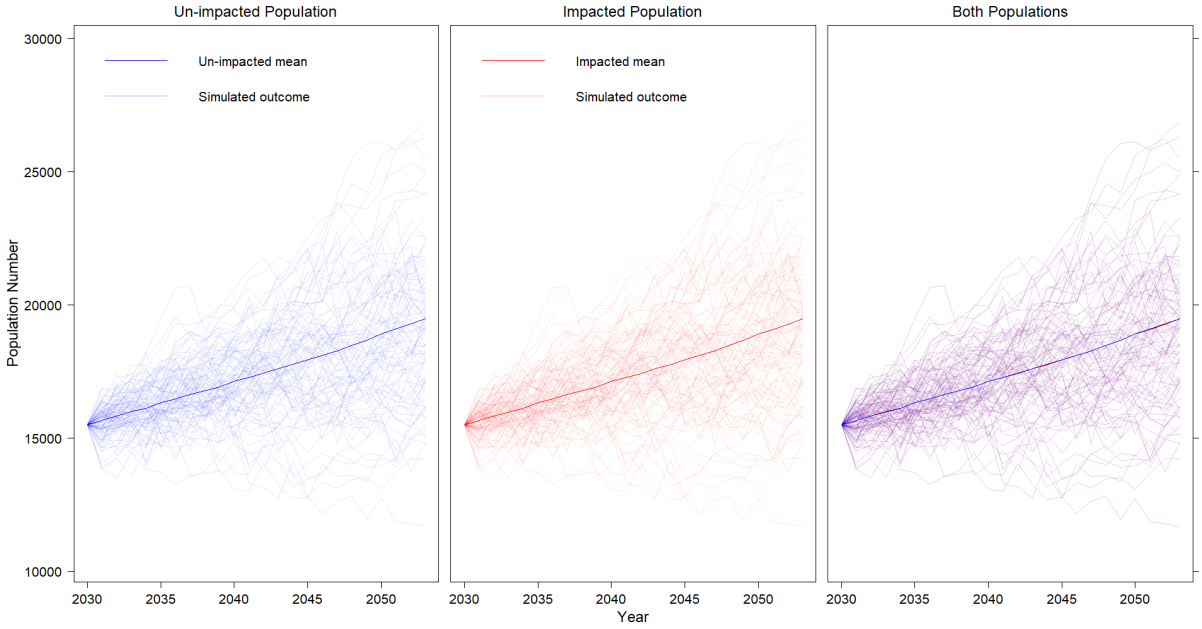
169. Additional assessments using iPCoD modelling were undertaken to predict the grey seal population effect due to cumulative disturbance from piling, using the number at risk of disturbance from each project as provided in Table 3-6.

170. The median population size was predicted to be 100% of the un-impacted population size at the end of 2031 (one year after the piling has commenced in the wider area). By the end of 2032 (the year piling ends) the median population size for the impacted population is predicted to be 100.01% of the un-impacted population size. Beyond 2032, the impacted population is expected to maintain the same stable trajectory as the un-impacted population (as far as 2055 which is the end point of the modelling, at which point the median impacted to un-impacted ratio is 100%).

171. The modelling indicates there would be no adverse effect on the integrity of the HE SAC due to cumulative disturbance from piling, due to there being less than a 1% population level effect on average per year over both the first six years and 25 year modelled periods. The conclusion of this re-assessment is in line with what was assessed within the RIAA [APP-176].

Table 3-7 Further information to Table 3.68 [APP-176] Results of the iPCoD modelling for the cumulative assessment, giving the mean population size of the grey seal population (HE SAC reference population) for years up to 2055 for both impacted and un-impacted populations in addition to the median ratio between their population sizes.

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	15,496	15,496	100.00	15,496	15,496	100.00
End of 2031	15,657	15,657	100.00	15,710	15,710	100.00
End of 2032	15,835	15,835	100.00	15,895	15,894	100.01
End of 2035	16,326	16,323	99.98	16,370	16,368	99.99
End of 2040	17,129	17,126	99.98	17,105	17,102	100.00
End of 2050	18,911	18,907	99.98	18,802	18,804	100.00
End of 2055	19,905	19,900	99.98	19,718	19,716	100.00



3.1.6 Updates to HE SAC In-combination impact 1b: Assessment of underwater noise from construction activities (other than piling) and vessel presence at other OWFs

172. For grey seal, based on the worst-case scenario, for all OWFs that could be constructing at the same time as North Falls (Table 3-6), up to 0.31% of the reference population could be potentially disturbed (Table 3-8). The conclusion

of this re-assessment is in line with what was assessed within the RIAA [APP-176].

Table 3-8 Further information to Table 3.34 [APP-176] Quantitative assessment for in-combination disturbance for grey seal due to construction activities (including vessels) at other OWFs

Project	Grey seal density (/km^2)	Impact area (km^2)	Maximum number of individuals potentially disturbed
North Falls	*Based on dose response*		*9*
~~East Anglia ONE North~~	~~Based on projects' own assessment~~		~~10~~
~~Dunkerque~~	~~0.003~~	~~201.1~~	~~0.6~~
Hornsea Project Four	Not quantitively assessed		-
Hornsea Project Three	Not quantitively assessed		-
Norfolk Vanguard	Taken from projects' own assessment		39
Total number of grey seal			**48**
Percentage of HE SAC			**0.31%**

3.1.7 Updates to HE SAC RIAA [APP-176] in-combination impact 1c: Assessment of disturbance from other activities

173. The in-combination assessment undertaken in the RIAA Part 3 [APP-176] for disturbance from geophysical surveys will remain the same, no further information is required.

174. The in-combination assessment undertaken in the RIAA Part 3 [APP-176] for disturbance from aggregate extraction and dredging will remain the same, no further information is required.

175. The in-combination assessment undertaken in the RIAA Part 3 [APP-176] for disturbance from oil and gas seismic surveys will remain the same, no further information is required.

176. The in-combination assessment undertaken in the RIAA Part 3 [APP-176] for disturbance from subsea cables and pipelines will remain the same, no further information is required.

177. The in-combination assessment undertaken in the RIAA Part 3 [APP-176] for disturbance from UXO clearance will remain the same, no further information is required.

3.1.8 Summary of in-combination effect 1: assessment of disturbance from all noisy activities associated with offshore industries

178. Each of the sound sources described above are quantitively assessed together in Table 3-9.

179. For grey seal, for all noisy activities with the potential for cumulative disturbance effects, up to 2.59% of the population is at risk of disturbance, which is in line with what was assessed within the RIAA [APP-176]. The conclusion of this re-assessment is in line with what was assessed within the RIAA [APP-176].

Table 3-9 Further information to Table 3.75 [APP-176] Quantitative assessment for all noisy activities with the potential for in-combination disturbance effects for grey seal [updates to Table 3.75 [APP-176] shown in blue]

Impact	Number of individuals
Worst case disturbance at North Falls	<1% population level impact over first six years (Table 3-7)
Piling at other OWFs	
Construction (or decommissioning) activities at other OWFs	48
Up to two geophysical surveys (Table 3.70 [APP-176])	9
Aggregates and dredging (Table 3.71 [APP-176])	0.4
Up to two oil and gas seismic surveys (Table 3.72 [APP-176])	97
Subsea cables and pipelines (Table 3.73 [APP-176])	10
UXO clearance (Table 12.113 [APP-026])	81
Total number of individuals	246
Percentage of HE SAC	2.59% (including 1% population effect from piling)

3.1.9 Updates to The Wash and North Norfolk Coast SAC Section 3.6.3.4.1 [APP-176] In-combination impact 1: Disturbance from underwater noise

180. A list of UK and European OWF projects that may have the potential for overlapping piling with North Falls is provided (Section 2.6), and has been used to inform the assessment for in-combination effects due to piling at other OWFs.

181. Of the 33 UK and European OWFs screened in for having a construction period that could potentially overlap with the construction of the Project, six UK OWFs could be piling at the same time, which is currently estimated to take place in 2030/31 and are within the South-east England MU;

- Dogger Bank D;
- Dogger Bank South (East and West);
- Dudgeon Extension;
- Five Estuaries;
- Outer Dowsing; and
- Sheringham Shoal Extension.

182. The commitment to the mitigation agreed through the MMMP for piling would reduce the risk of physical injury or permanent auditory injury (PTS) for all marine mammals, and therefore this assessment focuses on the potential for disturbance only.

183. The assessment for harbour seal for the North Falls project against the WNNC SAC population has been based on the same approach as described in the RIAA [APP-176] Section 3.6.3.4.1, the assessment has just been updated to incorporate the new cumulative screening list (Section 2.6).

184. For harbour seal, the potential worst-case scenario of other OWFs piling at the same time as North Falls is assessed in Table 3-10. Up to 3.4% of the reference population could potentially be disturbed, however, this is very precautionary, as it is unlikely that all other OWF projects could be piling at exactly the same time as piling at North Falls. The conclusion of this re-assessment is in line with what was assessed within the RIAA [APP-176].

Table 3-10 Further information to Table 3.92 [APP-176] Quantitative assessment for in-combination disturbance for harbour seal due to piling at other OWFs (number of individuals at risk of disturbance is based on project specific reporting, and rounded up to nearest whole number) [updates to Table 3.92 [APP-176] shown in blue]

Project	Density (/km^2)	Approach to disturbance assessment	Maximum number of individuals potentially disturbed during single piling
North Falls	*Based on dose response*		*0.11*
Dogger Bank D	0.000001	2123.7	0.002
Dogger Bank South (East and West)	Based on dose response		2
Dudgeon Extension	Based on dose response		31
Five Estuaries	Based on dose response		3
Outer Dowsing	Based on dose response		35
Sheringham Shoal Extension	Based on dose response		62
Total number of harbour seal			**134**
Percentage of WNNC SAC			**3.4%**

185. Additional assessments using iPCoD modelling were undertaken to predict the harbour seal population effect due to cumulative disturbance from piling, using the number at risk of disturbance from each project as provided in Table 3-10.

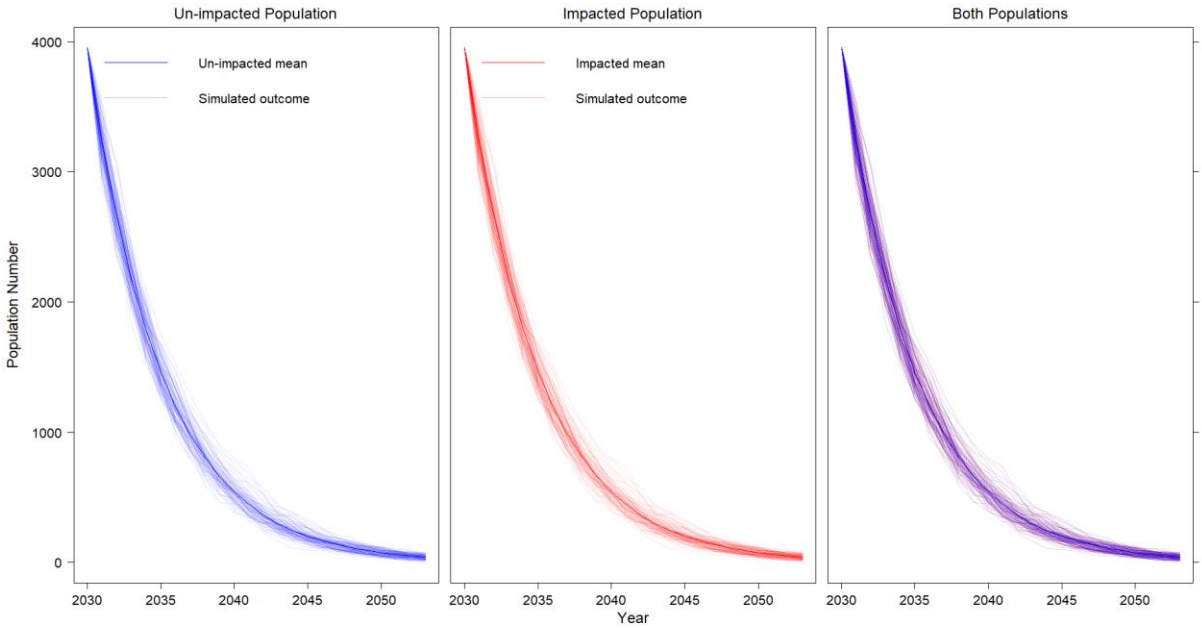
186. The median population size was predicted to be 100% of the un-impacted population size at the end of 2031 (one year after the piling has commenced in the wider area). By the end of 2032 (the year piling ends) the median population size for the impacted population is predicted to be 100% of the un-impacted

population size. Beyond 2032, the impacted population is expected to maintain the same stable trajectory as the un-impacted population (as far as 2055 which is the end point of the modelling, at which point the median impacted to un-impacted ratio is 99.97%).

187. The modelling indicates there would be no adverse effect on the integrity of the WNNC SAC due to cumulative disturbance from piling, due to there being less than a 1% population level effect on average per year over both the first six years and 25 year modelled periods. The conclusion of this re-assessment is in line with what was assessed within the RIAA [APP-176].

Table 3-11 Further information to Table 3.93 [APP-176] Results of the iPCoD modelling for the cumulative assessment, giving the mean population size of the harbour seal population (WNNC SAC reference population) for years up to 2055 for both impacted and un-impacted populations in addition to the median ratio between their population sizes.

Year	Un-impacted population mean	Impacted population mean	Mean impacted as % of un-impacted	Un-impacted population median	Impacted population median	Median impacted as % of un-impacted
Start	3954	3954	100.00	3954	3954	100.00
End of 2031	3237	3237	100.00	3240	3240	100.00
End of 2032	2657	2657	100.00	2656	2656	100.00
End of 2035	1464	1465	100.13	1452	1454	100.12
End of 2040	542	543	100.00	538	540	100.11
End of 2050	74	74	100.00	74	74	100.08
End of 2055	27	27	100.00	26	26	99.97



3.1.10 Updates to WNNC SAC In-combination impact 1b: Assessment of underwater noise from construction activities (other than piling) and vessel presence at other OWFs

188. For harbour seal, based on the worst-case scenario, for all OWFs that could be constructing at the same time as North Falls (Table 3-10), up to 0.63% of the reference population could be potentially disturbed (Table 3-12). The conclusion of this re-assessment is in line with what was assessed within the RIAA [APP-176].

Table 3-12 Further information to Table 3.94 [APP-176] Quantitative assessment for in-combination disturbance for harbour seal due to construction activities (including vessels) at other OWFs

Project	Harbour seal density (/km^2)	Impact area (km^2)	Maximum number of individuals potentially disturbed
North Falls	*Based on dose response*		*0.11*
~~East Anglia ONE North~~	~~Based on projects' own assessment~~		~~2.7~~
~~Dunkerque~~	~~0.00002~~	~~201.1~~	~~0.004~~
Hornsea Project Four	Not quantitively assessed		-
Hornsea Project Three	Not quantitively assessed		-
Norfolk Vanguard	Taken from projects' own assessment		24
Total number of harbour seal			**25**
Percentage of WNNC SAC			**0.63%**

3.1.11 Updates to WNNC SAC RIAA [APP-176] in-combination impact 1c: Assessment of disturbance from other activities

189. The in-combination assessment undertaken in the RIAA Part 3 [APP-176] for disturbance from geophysical surveys will remain the same, no further information is required.

190. The in-combination assessment undertaken in the RIAA Part 3 [APP-176] for disturbance from aggregate extraction and dredging will remain the same, no further information is required.

191. The in-combination assessment undertaken in the RIAA Part 3 [APP-176] for disturbance from oil and gas seismic surveys will remain the same, no further information is required.

192. The in-combination assessment undertaken in the RIAA Part 3 [APP-176] for disturbance from subsea cables and pipelines will remain the same, no further information is required.

193. The in-combination assessment undertaken in the RIAA Part 3 [APP-176] for disturbance from UXO clearance will remain the same, no further information is required.

3.1.12 Summary of in-combination effect 1: assessment of disturbance from all noisy activities associated with offshore industries

194. Each of the sound sources described above are quantitively assessed together in Table 3-13.

195. For harbour seal, for all noisy activities with the potential for cumulative disturbance effects, up to 4.1% of the population is at risk of disturbance, which is in line with what was assessed within the RIAA [APP-176]. The conclusion of this re-assessment is in line with what was assessed within the RIAA [APP-176].

Table 3-13 Further information to Table 3.100 [APP-176] Quantitative assessment for all noisy activities with the potential for in-combination disturbance effects for harbour seal [updates to Table 3.100 [APP-176] shown in blue]

Impact	Number of individuals
Worst case disturbance at North Falls	<1% population level impact over first six years (Table 3-11)
Piling at other OWFs	
Construction (or decommissioning) activities at other OWFs	24
Up to two geophysical surveys (Table 3.95 [APP-0176))	5
Aggregates and dredging (Table 3.96 [APP-176])	0.2
Up to two oil and gas seismic surveys (Table 3.97 [APP-176])	50

Impact	Number of individuals
Subsea cables and pipelines (Table 3.98 [APP-176])	0.16
UXO clearance (Table .99 [APP-176])	42
Total number of individuals	122
Percentage of WNNC SAC	4.1% (including 1% population effect from piling)

3.2 Corrections to RIAA Part 3 [APP-176]

196. The Applicant has noted the minor corrections required for the RIAA. This section provides corrections in response to Natural England's comment (E37; RR-198);

"We note that it is not clear why SNS SAC summer area has been mentioned in the table title, while the table itself only refers to winter area. Also, the paragraph below refers to the seasonal threshold of 10% for winter area as relevant to this project given the location in the SNS SAC. Natural England notes that his happens in other tables too (see Table 3.43).

We request that clarification or correction is provided."

197. Corrections to the text or table captions in the RIAA Part 3 [APP-176] are listed below:

- Caption for Table 3.24 should read "*Maximum potential overlap with SNS SAC ~~Summer and~~ Winter Area based on the potential disturbance range of 4km for North Falls*".

- Paragraph 140 should read "*Disturbance of harbour porpoise has no potential to exceed 20% of the seasonal component of the SNS SAC ~~summer or~~ winter area on any given day due to other construction activity at North Falls, based on the worst-case scenario (Table 3.24)*."

- Paragraph 266 should read "*The estimated maximum, minimum and average overlap with the SNS SAC ~~summer and~~ winter areas are outlined in Table 3.31 for single location piling at North Falls, on the same day as single location monopiling at other OWF, and in Table 3.32 for multiple location piling at North Falls, on the same day as multiple location monopiling at other OWF.*"

- Caption for Table 3.43 should read "*Estimated seasonal averages with the SNS SAC ~~summer and~~ winter area from seismic surveys on the same day as single piling at North Falls*".

198. Caption for Table 3.49 should read "*Estimated seasonal averages with the SNS SAC ~~summer and~~ winter area from UXO clearance on the same day as single piling at North Falls*".

4. References

ASCOBANS (2015). Recommendations of ASCOBANS on the Requirements of Legislation to Address Monitoring and Mitigation of Small Cetacean Bycatch. October 2015.Benhemma-Le Gall et al. 2021
BEIS (2020). Record of the Habitats Regulations Assessment undertaken under Regulation 5 of the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (As Amended). ION Southern North Sea Seismic Survey. 103pp. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/985175/ION_Southern_North_Sea_Seismic_Survey_2021_HRA_Rev_3.0.pdf.
Benhemma-Le Gall, A., Hastie, G.D., Brown, A.M., Booth, C.G., Graham, I.M., Fernandez-Betelu, O., Iorio-Merlo, V., Bashford, R., Swanson, H., Cheney, B.J., Abad Oliva, N. and Thompson, P.M. (2024). Harbour porpoise responses to the installation of XXL monopiles without noise abatement; implications for noise management in the Southern North Sea. PrePARED Report, No. 004. August 2024.
Brandt, M.J., Dragon, C.A., Diederichs, A., Bellmann, M.A., Wahl, V., Piper, W., Nabe-Nielsen, J. and Nehls G. (2018). Disturbance of harbour porpoises during construction of the first seven offshore wind farms in Germany. Marine Ecology Progress Series, 596: 213-232.
Conn, P.B. and Silber, G.K. (2013). Vessel speed restrictions reduce risk of collision-related mortality for North Atlantic right whales. Ecosphere, 4(4), pp.1-16.
Defra (Department for Environment, Food and Rural Affairs) (2003). UK small cetacean bycatch response strategy. Department for Environment, Food and Rural Affairs. March 2003. Diederichs et al. (2010)
Diederichs, A., Brandt, M. and Nehls, G. (2010). Does sand extraction near Sylt affect harbour porpoises? Wadden Sea Ecosystem, 26: 199–203.
Dyndo, M., Wiśniewska, D.M., Rojano-Doñate, L. and Madsen, P.T. (2015). Harbour porpoises react to low levels of high frequency vessel noise. Scientific reports, 5(1), p.11083.
Evans, P. G., Baines, M.E., and Anderwald. P. (2011). Risk Assessment of Potential Conflicts between Shipping and Cetaceans in the ASCOBANS Region. 18th ASCOBANS Advisory Committee Meeting AC18/Doc.6-04 (S) rev.1 UN Campus, Bonn, Germany, 4-6 May 2011 Dist. 2 May 2011.
Frankish, C.K., von Benda-Beckmann, A.M., Teilmann, J., Tougaard, J., Dietz, R., Sveegaard, S., Binnerts, B., de Jong, C.A. and Nabe-Nielsen, J. (2023). Ship noise causes tagged harbour porpoises to change direction or dive deeper. Marine Pollution Bulletin, 197, p.115755.
Gilles, A., Authier, M., Ramirez-Martinez, N.C., Araújo, H., Blanchard, A., Carlström, J., Eira, C., Dorémus, G., Fernández-Maldonado, C., Geelhoed, S.C.V., Kyhn, L.,

Laran, S., Nachtsheim, D., Panigada, S., Pigeault, R., Sequeira, M., Sveegaard, S., Taylor, N.L., Owen, K., Saavedra, C., Vázquez-Bonales, J.A., Unger, B. and Hammond, P.S. (2023). Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys.

Graham, I.M., Merchant, N.D., Farcas, A., Barton, T.R., Cheney, B., Bono, S. and Thompson, P.M. (2019). Harbour porpoise responses to pile-driving diminish over time. R. Soc. Open sci. 6: 190335. [redacted]

Heinänen, S. and Skov, H. (2015). The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area, JNCC Report No.544 JNCC, Peterborough.

JNCC, Natural England and CCW (2010). Draft EPS Guidance - The protection of marine European Protected Species from injury and disturbance. Guidance for the marine area in England and Wales and the UK offshore marine area. Joint Nature Conservation Committee, Natural England and Countryside Council for Wales. October 2010.

JNCC, DAERA (Department of Agriculture, Environment and Rural Affairs) and Natural England (2020). Guidance for assessing the significance of noise disturbance against Conservation Objectives of harbour porpoise SACs (England, Wates and Northern Ireland). Dated June 2020

Jones, E.L., Hastie, G.D., Smout, S., Onoufriou, J., Merchant, N.D., Brookes, K.L. and Thompson, D. (2017). Seals and shipping: quantifying population risk and individual exposure to vessel noise. Journal of applied ecology, 54(6), pp.1930-1940.

Keen, E.M., Mahony, É.O., Nichol, L.M., Wright, B.M., Shine, C., Hendricks, B., Meuter, H., Alidina, H.M. and Wray, J. (2023). Ship-strike forecast and mitigation for whales in Gitga'at First Nation territory. Endangered Species Research, 51, pp.31-58.

Laist, D.W., Knowlton, A.R., Mead, J.G., Collet, A.S. and Podesta, M. (2001). Collisions between ships and whale'. Marine Mammal Science 17 (1) 30-75.

Laist, D.W., Knowlton, A.R. and Pendleton, D., 2014. Effectiveness of mandatory vessel speed limits for protecting North Atlantic right whales. Endangered Species Research, 23(2), pp.133-147.

Leaper, R. (2019). The role of slower vessel speeds in reducing greenhouse gas emissions, underwater noise and collision risk to whales. Frontiers in Marine Science, 6, p.505.

Lusseau, D. (2003). Male and female bottlenose dolphins Tursiops spp. have different strategies to avoid interactions with tour boats in Doubtful Sound, New Zealand. Marine Ecology Progress Series 257:267-274.

Lusseau, D. (2006). The short-term behavioural reactions of bottlenose dolphins to interactions with boats in Doubtful Sound, New Zealand. Marine Mammal Science 22:802-818.National Oceanic and Atmospheric Administration (NOAA), 2021).

Sparling, C. and Hastie, G. (2025). Seals exhibit localised avoidance of operational tidal turbines. Journal of Applied Ecology.

Montabaranom, J., Gillespie, D., Longden, E., Rapson, K., Holoborodko, A., Nowacek, S.M., Wells, R.S. and Solow, A.R. (2001). Short-term effects of boat traffic on bottlenose dolphins, Tursiops truncatus, in Sarasota Bay, Florida. Marine Mammal Science 17:673-688.

Oakley, J.A., Williams, A.Y. and Thomas, T. (2017). Reactions of harbour porpoise (Phocoena phocoena) to vessel traffic in the coastal waters of South West Wales. Ocean and Coastal Management Volume 138, 15 March 2017, Pages 158-169.

Outer Dowsing Offshore Wind (2024). Environmental Statement Chapter 11 Marine Mammals Volume 1. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010130/EN010130-000353-6.1.11%20Chapter%2011%20Marine%20Mammals.pdf

Onoufriou, J., Jones, E., Hastie, G. and Thompson, D. (2016). Investigations into the interactions between harbour seals (*Phoca vitulina*) and vessels in the inner Moray Firth. Marine Scotland Science.

Pigeault, R., Ruser, A., Ramírez-Martínez, N.C., Geelhoed, S.C., Haelters, J., Nachtsheim, D.A., Schaffeld, T., Sveegaard, S., Siebert, U. and Gilles, A. (2024). Maritime traffic alters distribution of the harbour porpoise in the North Sea. Marine pollution bulletin, 208, p.116925.

Polacheck, T. and Thorpe, L. (1990). The swimming direction of harbour porpoise in relation to a survey vessel. Report of the International Whaling Commission, 40: 463-470.

Rampion 2 Wind Farm. (2024). Environmental Statement Volume 2, Chapter 11: Marine mammals (clean), Revision F. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010117/EN010117-002324-C1-038%206.2.11%20Environmental%20Statement%20Volume%202%20-%20Chapter%2011%20Marine%20Mammals%20(clean).pdf

RWE Renewables UK Dogger Bank South (West) Limited and RWE Renewables UK Dogger Bank South (East) Limited (2024)

Robbins, J.R. (2022). Vessel collisions with cetaceans: areas and times of risk in the North-east Atlantic (Doctoral dissertation, University of Portsmouth).

Schoeman, R.P., Patterson-Abrolat, C. and Plön, S. (2020). A global review of vessel collisions with marine animals. Frontiers in Marine Science, 7, p.292.

Scottish Marine Animal Stranding Scheme (SMASS) (2024). Accessed at: [redacted]

Sinclair, R. R., Sparling, C. E., & Harwood, J. (2020). Review Of Demographic Parameters and Sensitivity Analysis To Inform Inputs And Outputs Of Population

Consequences Of Disturbance Assessments For Marine Mammals. Scottish Marine and Freshwater Science, 11(14), 74.

Thomsen, F., Lüdemann, K., Kafemann, R. and Piper, W. (2006). Effects of offshore windfarm noise on marine mammals and fish, on behalf of COWRIE Ltd.

UK Strandings Investigation Programme (CSIP). Accessed at: [redacted]

Vanderlaan, A.S.M. and Taggart, C.T. (2007). Vessel Collisions with Whales: the Probability of Lethal Injury Based on Vessel Speed. Marine Mammal Science, 23(1), pp.144–156.

Van Waerebeek, K.O.E.N., Baker, A.N., Félix, F., Gedamke, J., Iñiguez, M., Sanino, G.P., Secchi, E., Sutaria, D., van Helden, A. and Wang, Y. (2007). Vessel collisions with small cetaceans worldwide and with large whales in the Southern Hemisphere, an initial assessment. Latin American Journal of Aquatic Mammals, pp.43-69.

Waggitt, J.J., Evans, P.G., Andrade, J., Banks, A.N., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Camphuysen, C.J., Durinck, J. and Felce, T. (2019). Distribution maps of cetacean and seabird populations in the North-East Atlantic. Journal of Applied Ecology, 57(2), pp.253-269.

Winkler, C., Panigada, S., Murphy, S. and Ritter, F. (2020). Global numbers of ship strikes: an assessment of collisions between vessels and cetaceans using available data in the IWC ship strike database. IWC B, 68

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