Inch Cape Offshore Wind Farm

New Energy for Scotland

Offshore Environmental Statement:
VOLUME 2E
Appendix 14D: Harbour Seal Assessment Framework

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14D Harbour Seal Assessment Framework

14D.1 Summary

This document describes outputs from an assessment of the potential effects of piling noise on the Firth of Tay and Eden Estuary Special Area of Conservation (SAC) harbour seal[1] population. The 'Framework for assessing the impacts of pile-driving noise from offshore wind farm construction on the Moray Firth harbour seal population' (hereafter referred to as the Moray Firth Seal Assessment Framework) has thoroughly described a method for assessing potential impacts on the harbour seal population within the Moray Firth. Inch Cape Offshore Limited (ICOL) has applied this method to the Firth of Forth and Tay harbour seal population, but amendments are required because the population in this area is declining.

14D.2 Background

The Firth of Tay and Eden Estuary SAC population of harbour seals has undergone a rapid and persistent decline since 2000 (Lonergan and Thompson, 2012). Counts in the SAC ranged from between 575 and 773 individuals in the period 1991 to 2000, but have decreased of late to just 77 individuals counted in 2011, which is the latest available count (Duck and Morris, 2012). The population is reported to be declining by around 18 per cent per annum (Lonergan and Thompson, 2012). It is unclear whether the population trend in the East Coast Management Area (ECMA) is also declining in a similar manner, as counts of the ECMA have been irregular (just three complete counts in the last two decades; Figure 14D.1).

There is no clear trend in numbers of grey seals in the ECMA from counts made outside the breeding season (in August; Figure 14D.1). However, pup production at grey seal breeding colonies in the ECMA (the Isle of May, Fast Castle and Inchkeith) has been increasing since surveys began in the late 1970s (Figure 14D.2).

[1] Harbour seals may also be known as common seals. The name common seal tends to be used when e.g. talking about qualifying species for SACs.

Figure 14D.1: Decline in Harbour Seal Numbers in the Firth of Tay and Eden Estuary SAC, Along with Counts of Harbour and Grey Seals within the East Coast Management Area (ECMA). Counts have been Corrected for the Proportion of Animals at Sea

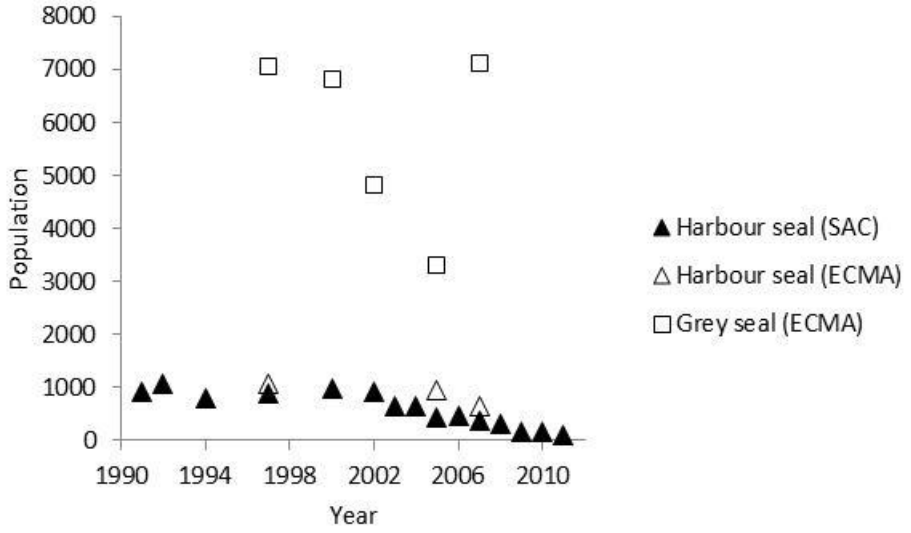
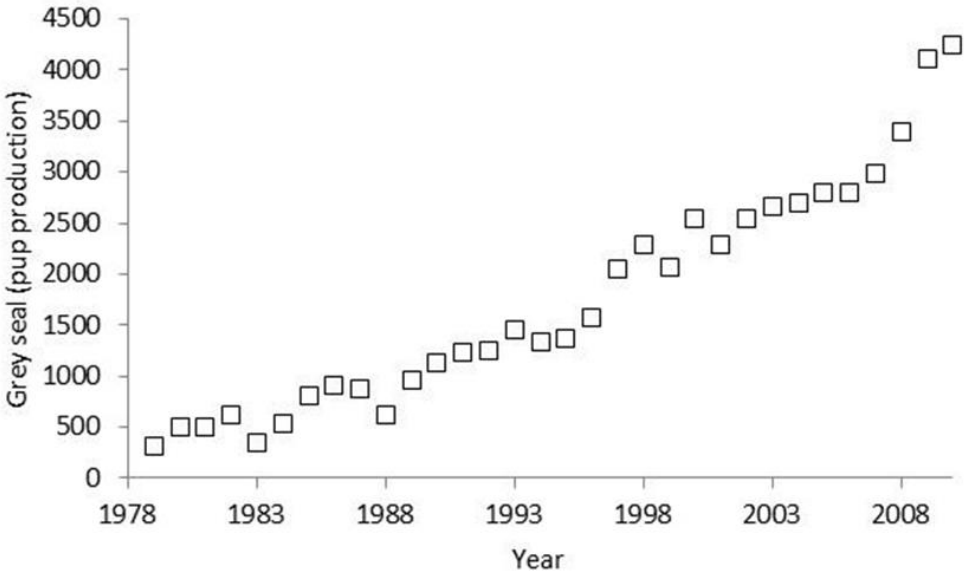


Figure 14D.2: Increase in Grey Seal Pup Production at Colonies in the East Coast Management Area (the Isle of May, Fast Castle and Inchkeith)



There are three offshore wind farm developments proposed within the Firth of Forth and Tay area (Inch Cape, Firth of Forth Phase 1, Neart na Gaoithe) which are likely to cause the production of increased levels of anthropogenic noise during their construction, in particular due to any piling during foundation installation.

In order to gain consent, the Developer of any renewable energy proposal is required, under the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000, to assess the potential impacts that the proposal may have on environmental receptors. In this

case, these receptors include the Firth of Tay and Eden Estuary SAC harbour seal population. The environmental legislative framework in Scotland, against which the competent authority will assess potential impacts on European sites such as the Firth of Tay and Eden Estuary SAC, is primarily driven by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) through the Habitats Regulations Appraisal (HRA) process. This process is summarised below.

A habitats regulations appraisal (HRA) involves three steps/tests as follows:

- Is the proposal directly connected with or necessary for site management for nature conservation?
- Is the proposal likely to have a significant effect on the site?
- Can it be ascertained that the proposal will not adversely affect the integrity of the site?

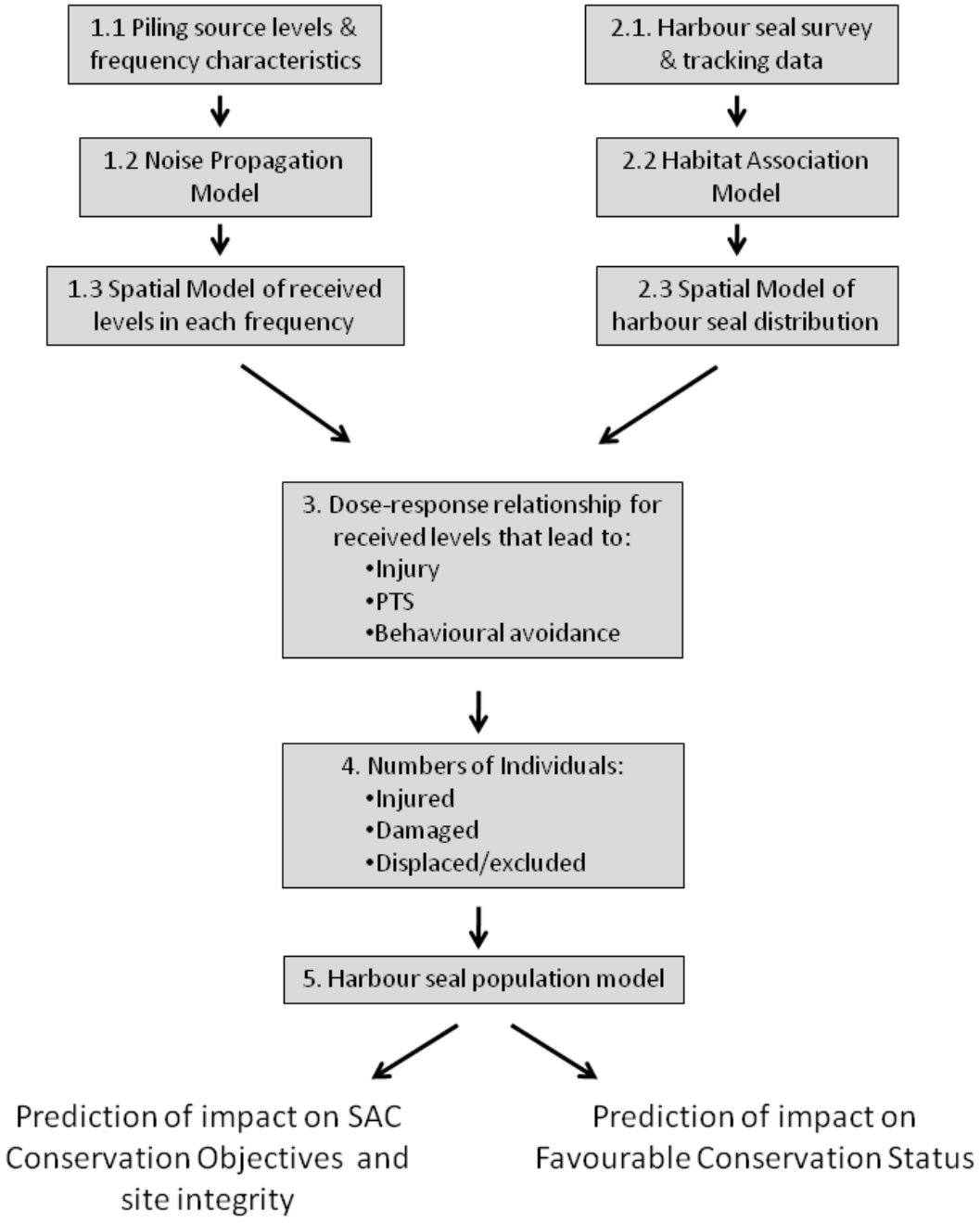
The third step is called an "Appropriate Assessment" and will be required if the development is not connected with or necessary for the conservation management of the site and if the proposal could have a likely significant effect on the site.

Also of note is that a new offence (of harassment of seals at designated haul-out sites) is being introduced under the Marine (Scotland) Act 2010[2]. This may be relevant if pile-driving activity has the potential to disturb harbour seals at their haul-out sites. In addition to the Firth of Tay and Eden Estuary SAC, another East Coast harbour seal haul out site (Kinghorn Rocks, on the north side of the Firth of Forth) was included in the consultation[3] on potential sites for designation. If these proposed haul-out sites are designated it will be an offence (under section 117 of the Marine (Scotland) Act 2010) to recklessly or intentionally disturb seals at these locations. The term "reckless or intentional disturbance" has not been defined within the legislation.

The Moray Firth Seal Assessment Framework (Appendix 7.3B of the Moray Offshore Renewables Limited, Moray Firth R3 Zone 1 (Eastern Development Area) Environmental Statement (MORL ES); Thompson *et al.*, In Press) proposes the following process (Figure 14D.3) in order to assess potential impacts on harbour seals. This general framework has been used in order to assess the impact of piling on harbour seals in the Firth of Forth and Tay area. However, where the assessment in the Moray Firth was undertaken against a stable or possibly increasing population, the assessment in the Firth of Forth and Tay area, in particular at the Firth of Tay and Eden Estuary SAC, will be undertaken against a severely declining, or possibly even extinct, population.

[2] http://www.scotland.gov.uk/Topics/marine/seamanagement/marineact/Seals
[3] http://www.scotland.gov.uk/Publications/2011/03/22093944/0

Figure 14D.3: Schematic of the Approach Proposed for Assessing the Impact of Wind Farm Construction on Harbour Seals (Taken from Appendix 7.3B of the MORL ES)



14D.3 Inch Cape Offshore Wind Farm Assessment Outputs

The Figures and Tables below illustrate the outputs at each stage of the Moray Firth Seal Assessment Framework (Figure 14D.3) when it has been applied to the Inch Cape Offshore Wind Farm.

14D.3.1 Step 1: Mapping Received Noise Levels

As described in detail in Appendix 14B: Marine Mammals Piling Impact Assessment, the INSPIRE model (Subacoustech Environmental Ltd) was used to predict noise levels received by harbour seals as a result of piling events occurring within the Firth of Forth and Tay offshore wind farm sites. Both Sound Exposure Level (SEL) (which indicates the area over which there is the potential for onset of Permanent Threshold Shift (PTS)) and dB_{ht} (which indicates the area over which there is the potential for displacement due to audibility) levels were modelled. This work was carried out by Subacoustech Environmental Ltd.

Figure 14D.4 illustrates the modelled zones of potential auditory injury (PTS onset) for harbour seals under the Inch Cape Offshore Wind Farm 'most likely' piling scenario (Scenario 1b; two piles in a 24 hour window with a piling duration of 2.1 hours per pile[4]). One of the reasons these zones of potential onset of auditory injury are large is because, following regulatory advice, the 186 dB criteria has been used for assessing potential impacts on seals as opposed to the 198 dB criteria which has been used for cetaceans. Using the 186 dB criteria is considered likely to be a conservative approach.

Figure 14D.5 illustrates the predicted received sound levels at different distances from piling using the dB_{ht} (harbour seal) criteria – shown as noise impact contours – for the same piling scenario (1b; two piles in a 24 hour window with a piling duration of 2.1 hours per pile). The Figure also shows the noise doses per 5x5 km grid cell which can then be related to a dose response curve (see Appendix 7.3B of the MORL ES and Section 14B.3.3 of Appendix 14B – Marine Mammals Piling Impact Assessment) that predicts the level of displacement in relation to received levels.

[4] Full details of the scenarios used for predicting the impacts of piling noise on marine mammals are given in Table 14B.6 of Appendix 14B: Marine Mammals Piling Impact Assessment.

Figure 14D.4: Modelled Zones of Potential Auditory Injury (PTS onset) for Harbour Seals from Piling at the Inch Cape Offshore Wind Farm

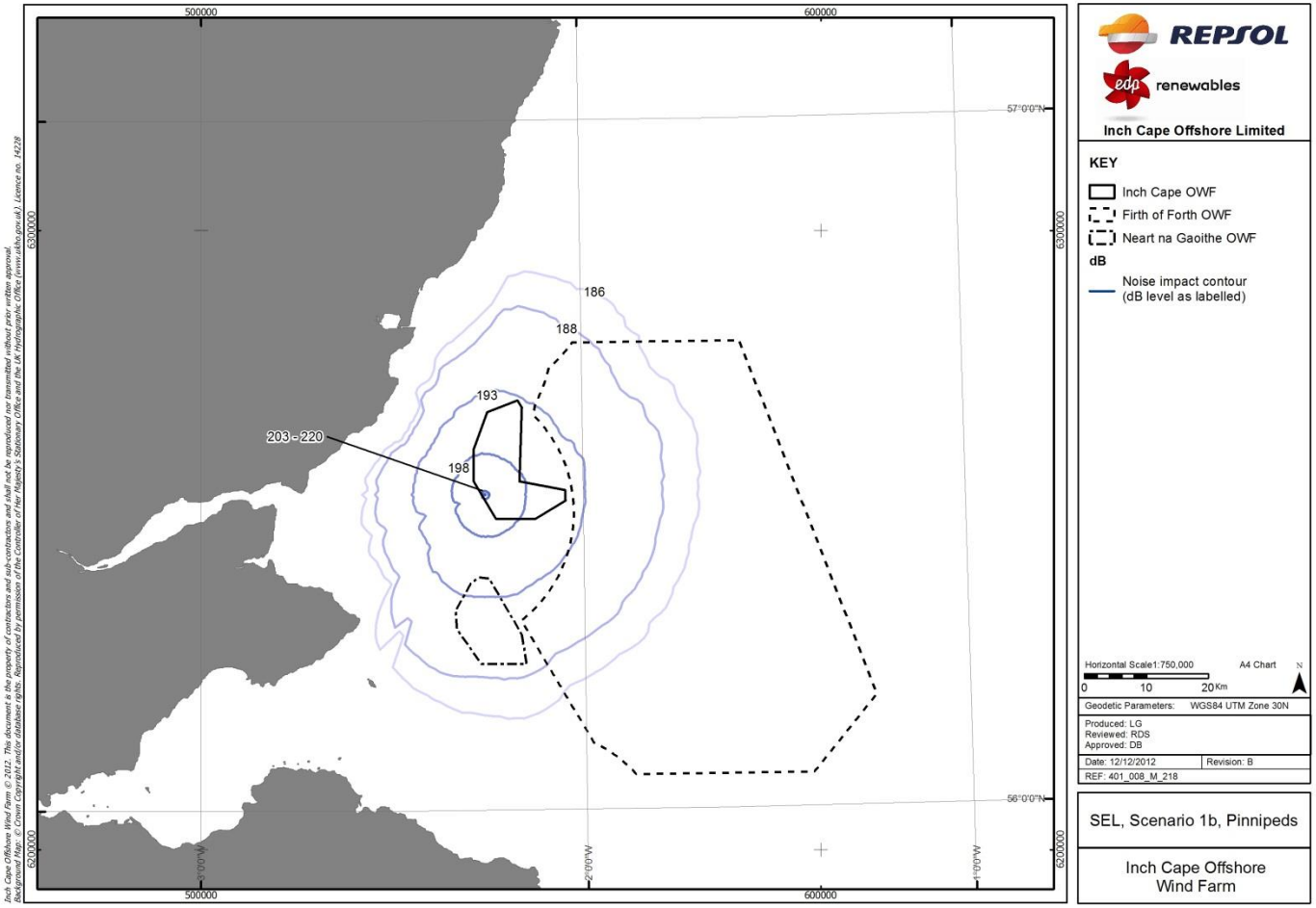
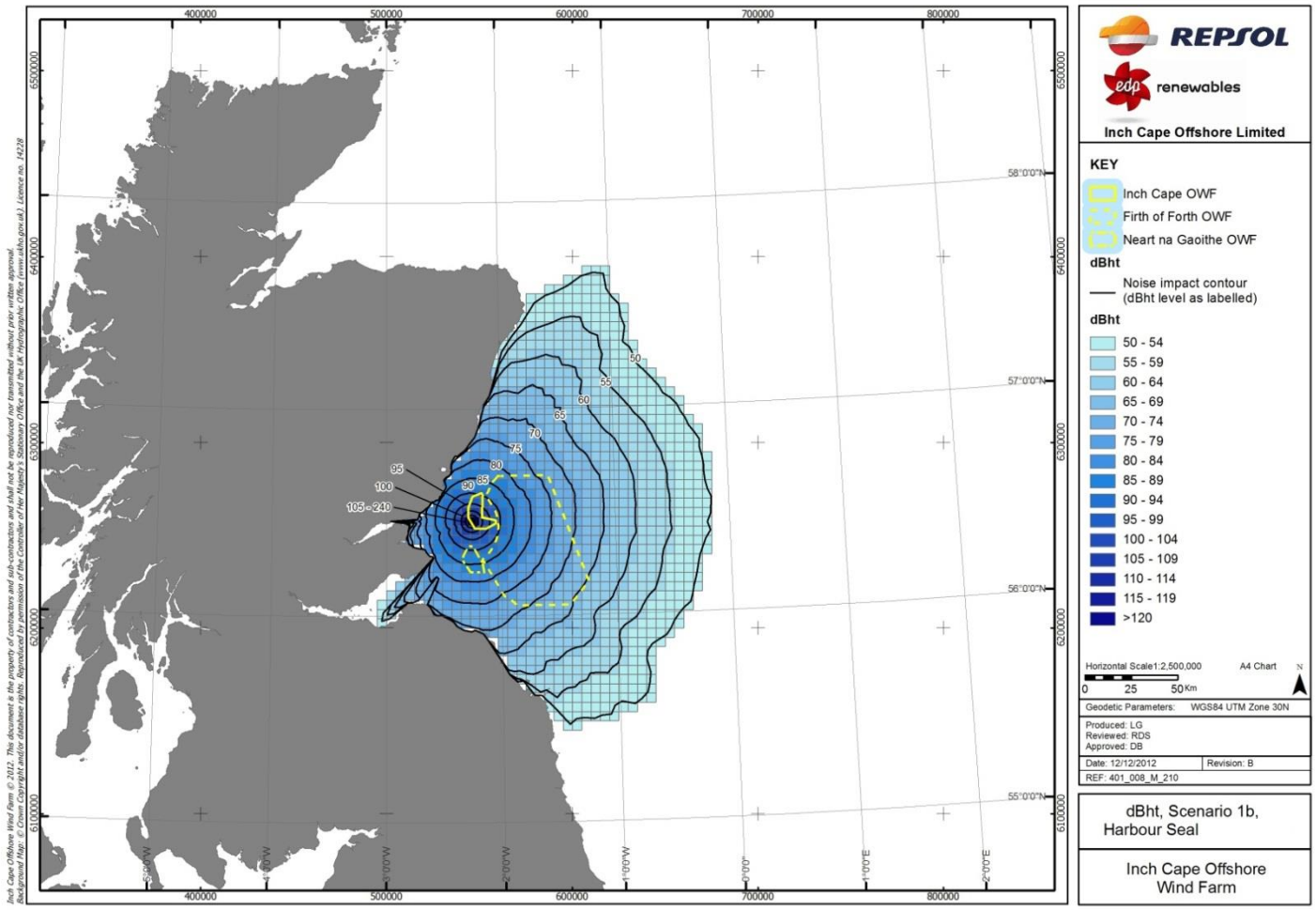


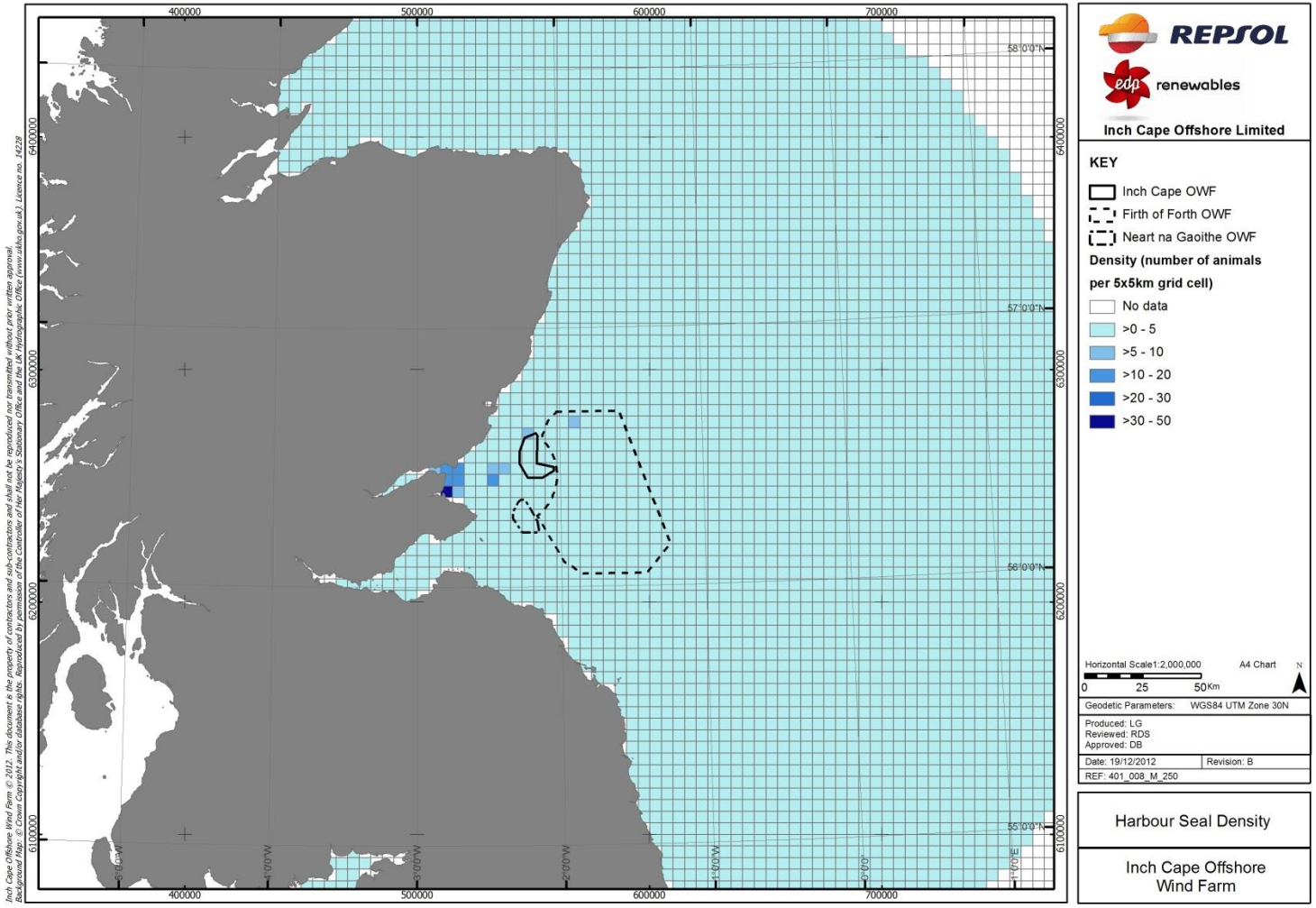
Figure 14D.5: Modelled Zones of Potential Behavioural Displacement for Harbour Seals from Piling at the Inch Cape Offshore Wind Farm. Modelled Noise Impact Contours (out to 50 dB_{ht}) and Noise Doses (per 5x5 km grid cell) are Shown



14D.3.2 Step 2: Mapping Harbour Seal Distribution

Sea Mammal Research Unit (SMRU) telemetry and haul out count data were used to produce spatially explicit estimates of the density of harbour seals in the Forth and Tay area (Sparling *et al*., 2012). This work was carried out by Esther Jones at SMRU who developed Matthiopoulos *et al.*'s (2004) method. Figure 14D.6 shows the estimated density of harbour seals (number of animals per 5x5 km grid cell) across the Forth and Tay area. Care was taken to ensure that the same 5x5 km grid cells were used for estimated animal densities and predicted noise fields.

Figure 14D.6: Estimated Density of Harbour Seals in Each 5x5 km Grid Cell



14D.3.3 Step 3: Applying the Dose-response Relationship for Received Levels that Lead to Potential Auditory Injury or Behavioural Displacement

It is very unlikely that marine mammals will be exposed to noise levels which have the potential to cause lethal effects or physical injury because a mitigation protocol has been developed by the Statutory Nature Conservation Agencies in order to reduce this risk to negligible levels (Joint Nature Conservation Committee, 2010). Therefore, for the purpose of this Appendix, lethal effects and physical injury have not been assessed further.

Auditory Injury

The SAFESIMM (Statistical Algorithm For Estimating the Sonar Influence on Marine Megafauna) algorithm was used to estimate the number of harbour seals that could have the potential to experience the onset of PTS due to increased anthropogenic noise from piling. This approach combines three key pieces of quantitative information to estimate the number of animals likely to be affected;

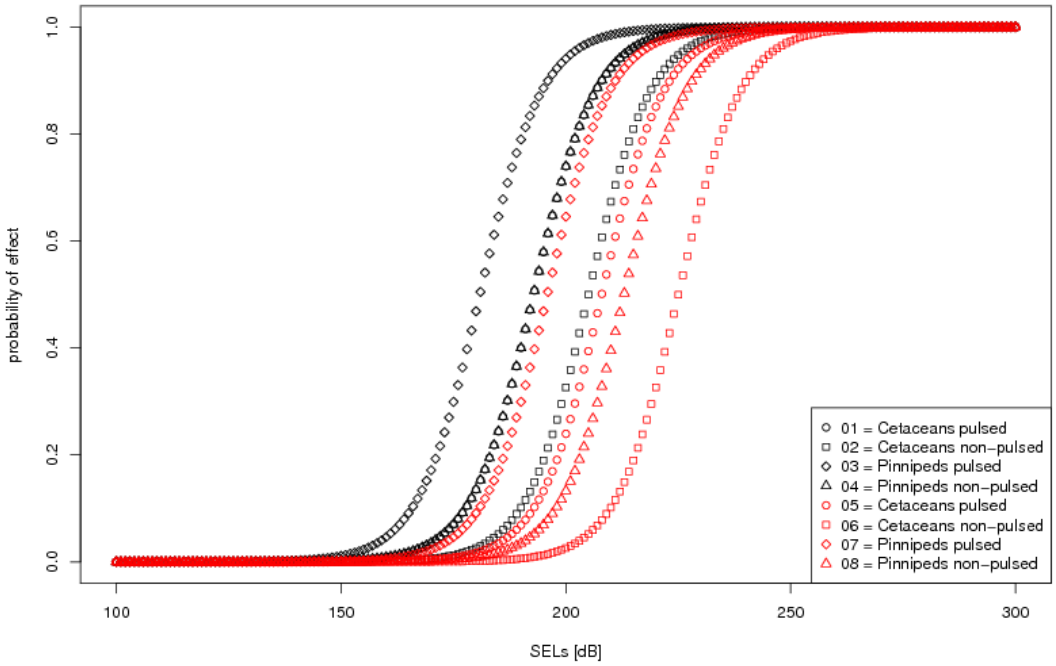
a) The predicted spatial pattern and extent of underwater noise produced by piling activities (Figure 14D.4). The modelling in this element of the assessment was carried out by Subacoustech Environmental Ltd through the use of INSPIRE;

b) The spatial pattern of abundance of marine mammals (harbour seals) across the area of potential impact (Figure 14D.6). The modelling in this element of the assessment was carried out by SMRU through use of Matthiopoulos et al.'s (2004) method; and

c) The way in which animals are predicted to move in response to sound. The modelling in this element of the assessment was carried out by SMRU Ltd through the use of SAFESIMM.

Figure 14D.7 illustrates the series of dose-response relationships used by SAFESIMM to determine the likely effect of sound exposure on the different marine mammal groups. This work was carried out by SMRU Ltd.

Figure 14D.7: Dose-response Curves used within SAFESIMM to Relate the Probability of Temporary Threshold Shift (black curves) and PTS (red curves) to M-weighted SEL for Cetaceans and Pinnipeds Exposed to Pulsed and Non-Pulsed Sounds (taken from King *et al.*, 2012)



Behavioural Displacement

As with the potential for auditory injury described above, the numbers of seals predicted to have the potential to show behavioural displacement was examined by combining three key pieces of quantitative information;

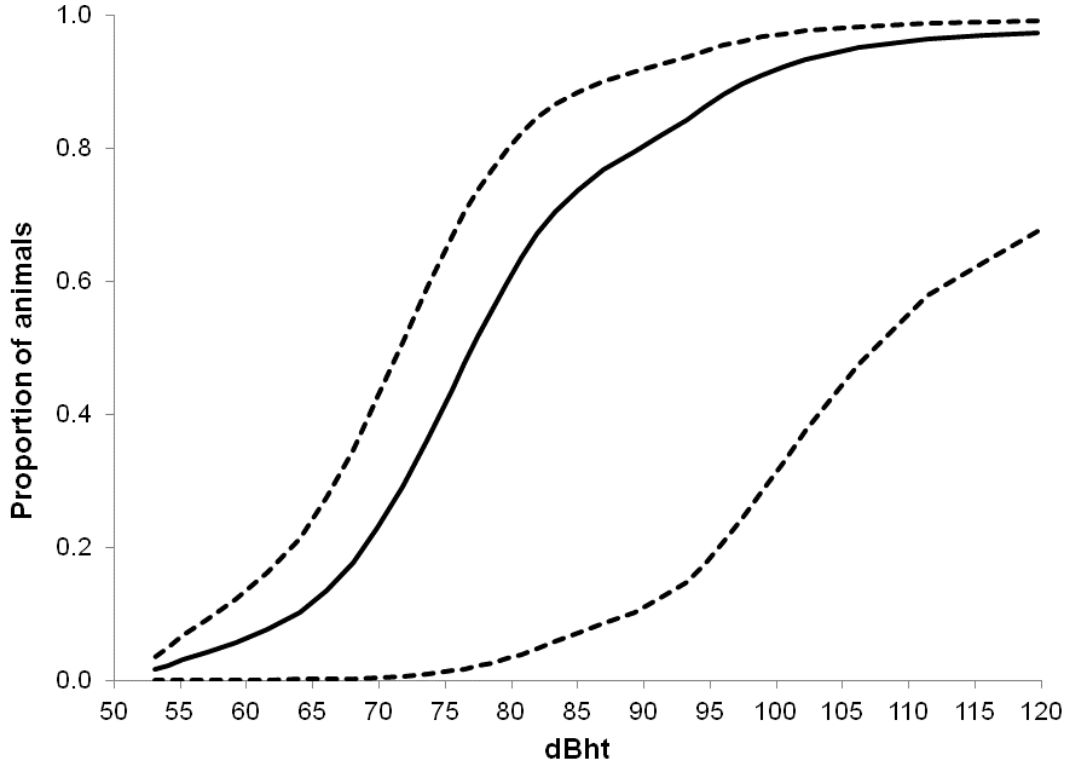
a) The predicted spatial pattern and extent of underwater noise produced by piling activities (Figure 14D.5). The modelling in this element of the assessment was carried out by Subacoustech Environmental Ltd through the use of INSPIRE;

b) The spatial pattern of harbour seal abundance across the area of potential impact (Figure 14D.6). The modelling in this element of the assessment was carried out by SMRU through use of Matthiopoulos et al.'s (2004) method; and

c) The relationship between dBht (harbour seal) and the predicted proportion of animals excluded from the area (Figure 14D.8). This work was carried out by Natural Power Consultants and the methodology used detailed in Appendix 14B: Marine Mammals Piling Impact Assessment.

SAFESIMM was not used to predict the numbers of animals potentially displaced by piling noise because it uses an M-weighted SEL dose response curve (rather than a perceived noise dose) to examine behavioural criteria, which is not considered appropriate. In addition, SAFESIMM records the likelihood of an individual animal responding to EACH noise pulse in a series, rather than recording the likelihood of a general movement away from a noise source over a period of time.

Figure 14D.8: The Relationship Between dB_{ht} (Harbour Porpoise) and the Predicted Proportion of Animals Excluded from the Area (Produced Using Data from Appendix 7.3B of the MORL ES) Using the Best Estimate (—) and the Upper and Lower Estimates (---)



14D.3.4 Step 4: Potential Numbers of Individuals Affected

Table 14D.1 details the numbers of animals that are predicted to experience the potential onset of PTS and behavioural displacement from both 'worst case' and 'most likely' piling scenarios at the Inch Cape Offshore Wind Farm (details of the Inch Cape Offshore Wind Farm piling scenarios are provided in Table 14B.7 of Appendix 14B – Marine Mammals Piling Impact Assessment) and at the Inch Cape Offshore Wind Farm and the other offshore wind farm developments in the Firth of Forth and Tay area (Firth of Forth Phase 1, Neart na Gaoithe). Details of the cumulative piling scenarios are provided in Table 14B.32 of Appendix 14B – Marine Mammals Piling Impact Assessment. If the reader has not already read Appendix 14B – Marine Mammals Piling Impact Assessment, it is recommended that they do so in order to fully understand the methodologies adopted here in estimating the numbers of individuals which have the potential to experience PTS onset or displacement as a result of piling related noise.

As described in Appendix 14B – Marine Mammals Piling Impact Assessment, numbers of individuals which have the potential to be displaced due to piling at the Inch Cape Offshore Wind Farm have been calculated using 5 dB_{ht} contours from 240 to 50 dB_{ht} (species) for each species. However, these 5 dB_{ht} (species) contours were not available for the FoF and NnG piling scenarios. For these two cumulative projects, 75 and 90 dB_{ht} (species) contours (equivalent approximately 40 per cent and 75 per cent of animals displaced respectively, see Figure 14D.8) were supplied through a FTOWDG scope of works. In order to undertake

cumulative assessments, equivalent contours were therefore utilised for the Inch Cape only estimation, and compared to those numbers calculated using 5 dB_{ht} (species) contours. Numbers potentially displaced in the cumulative scenarios (90 dB_{ht} (standardised) and 75 dB_{ht} (standardised)) are likely to be an underestimate. The contours for the Firth of Forth Phase 1 and Neart na Gaoithe developments only go out to 75 dB_{ht} and intermediate 5 dB_{ht} contours are not available, therefore the proportion displaced at 75 dB_{ht} has been applied to dB_{ht} values up to 90 dB_{ht} and the proportion predicted to be displaced between 75 dB_{ht} (species) and 50 dB_{ht} (species) is not represented.

The predicted numbers of impacted harbour seals (Table 14D.1) are large compared to the current likely size of the ECMA harbour seal population because they were scaled using a population size based on a count made in 2007. Although 2007 is the most recent count of the ECMA, it is likely that the population has followed the same trend as that in the Firth of Tay and Eden Estuary SAC in the intervening five years and continued to decline. If the numbers (shown in Table 14D.1) were scaled using a population size based on a contemporary count they would be smaller. In order to put these numbers of animals into context, they have also been presented (in Table 14D.1) as percentages of the ECMA population. These proportions are likely to remain constant regardless of the size of the harbour seal population within the ECMA.

Table 14D.1: The Number of Harbour Seals (n) which have the Potential to Experience PTS Onset or be Displaced from the Firth of Forth and Tay Area Under the Different Piling Scenarios Based on the Latest (2007) East Coast Management Area Population Levels. Percentages of the East Coast Management Area Population (638 Harbour Seals) are Shown and Can be Used to Estimate Predicted Impact Upon Current Population Sizes

Scenario		PTS (186 dB)		Displacement									
				50 dB_{ht}		75 dB_{ht}		75 dB_{ht} (standardised)[5]		90 dB_{ht}		90 dB_{ht} (standardised)	
		n	%	n	%	n	%	n	%	n	%	n	%
Inch Cape Project only													
1b	2 piles at 1 location at IC (ML)	47	7.4	322 (32 - 416)	50.5	278 (32 - 329)	43.6	239 (22 - 299)	37.5	127 (20 - 134)	19.9	125 (17 - 1598)	19.6
2b	4 piles at 1 location at IC (WC)	59	9.2										
3	2 piles at each of the 2 locations at IC (4 piles; ML)	65	10.2	340 (49 - 435)	53.3	298 (49 - 344)	46.7	257 (34 - 316)	40.3	160 (39 - 166)	25.1	156 (29 - 162)	24.5
4	4 piles at each of the 2 locations at IC (8 piles; WC)	78	12.2										
Cumulative													
5b	2 piles at 1 location at IC, 1 pile at NnG, 1 pile at FoF	72	11.3	n/a	n/a	307 (39 - 363)	48.1	287 (32 - 348)	45.0	208 (32 - 220)	32.6	206 (29 - 218)	32.3
6	2 piles at each of the 2 locations at IC, 1 pile at each of the 2 locations at NnG, 1 pile at each of the 2 locations at FoF	90	14.1	n/a	n/a	320 (56 - 378)	50.2	298 (47 - 363)	46.7	230 (52 - 243)	36.1	226 (42 - 239)	35.4

[5] See Section 14B.3.3 for an explanation of the difference between 75/90 dB_{ht} and 75/90 dB_{ht} (standardised). In summary, only the 75, 90 and 130 dB_{ht} contours were used to calculate the numbers of animals predicted to be displaced at 75 dB_{ht} (standardised) in order to achieve consistency among the three sites. The intermediate (5 dB_{ht}) Inch Cape noise contours were not used. This means that fewer animals are predicted to be displaced for 75 dB_{ht} (standardised) compared to 75 dB_{ht} (because in the standardised calculation, Inch Cape contours of 75 dB_{ht}, 80 dB_{ht} and 85 dB_{ht} are all treated as 75 dB_{ht} yet the difference in the proportion of animals displaced at these different dB_{ht} levels according to the dose response curve is relatively high).

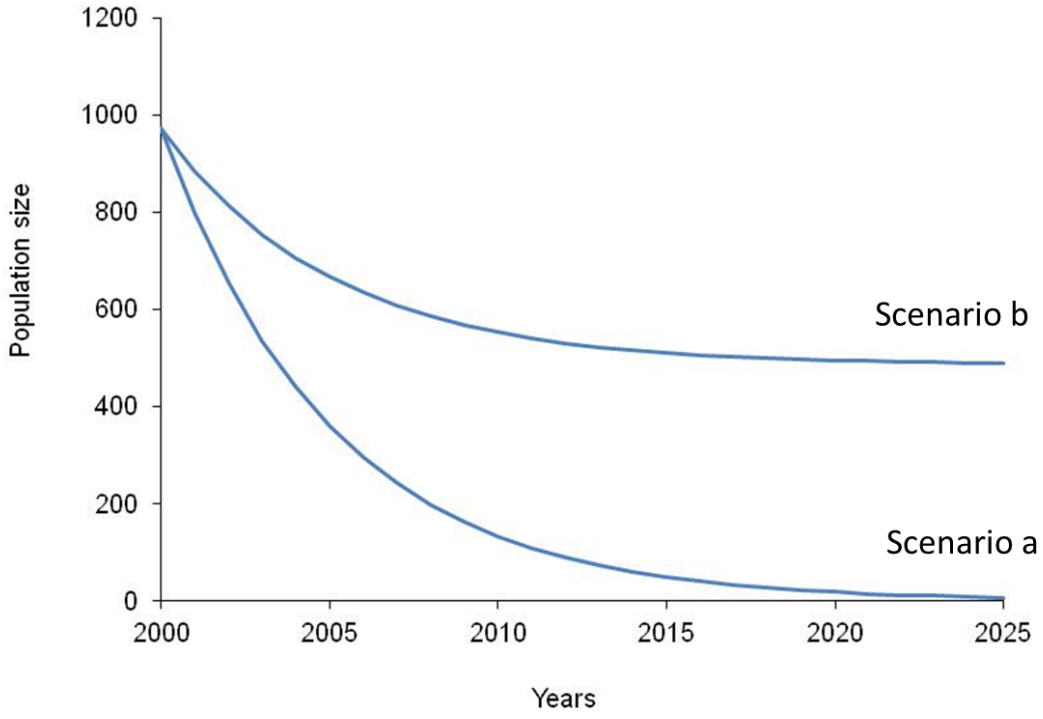
14D.3.5 Step 5: Population Modelling

In 2000, the population in the ECMA was estimated to number 972 individuals. This was calculated by correcting the ECMA count (700 individuals) for the proportion of the population that was at sea when the count was made (using a multiplier of 1.4; Lonergan *et al.*, 2011).

Since 2000, the ECMA and the Firth of Tay and Eden Estuary SAC have both been counted in only two years. In 2005 47 per cent of the animals in the ECMA were in the SAC; in 2007 57 per cent of the animals in the ECMA were in the SAC.

Two alternative baseline scenarios for the ECMA harbour seal population were modelled by adjusting vital rates to mimic the 18 per cent decline identified by SMRU (Lonergan and Thompson, 2012) (Figure 14D.9). In Scenario 'a' it was assumed that the population trend in the Firth of Tay and Eden Estuary SAC (a decline of 18 per cent per annum; Lonergan and Thompson, 2012) was similar across the whole ECMA. In Scenario 'b' it was assumed that the population in the SAC was declining (at 18 per cent per annum) but that the trend was stable across the rest of the ECMA. Scenario 'a', the most conservative of the two scenarios, was used as the baseline scenario for the population modelling.

Figure 14D.9: Alternative Baseline Scenarios for the ECMA Harbour Seal Population. Scenario a was Modelled Assuming that the trend in the Firth of Tay and Eden Estuary SAC was Similar Across the ECMA. Scenario b was Modelled Assuming that the SAC Population was Declining but that the Trend Across the Rest of the ECMA was Stable



The baseline scenario (Scenario a – Figure 14D.9) was developed by imposing an eight seal per annum mortality from unexplained traumatic deaths[6] (Figure 14D.10). However, to attempt to avoid imminent extinction prior to the onset of modelled impact from piling noise, the modelling approach adopted was to assume that this issue was solved in 2013 (Figure 14D.11). Despite making this assumption, due to the continued decrease in population size over and above the annual mortality of eight seals due to unexplained traumatic deaths, the size of the population is still likely to be negligible by the time piling commences in 2016. Therefore, a hypothetical two year construction (piling) period of 2008-2009, rather than 2016-2017, was used for population modelling (Figure 14D.12).

The numbers of harbour seals which have the potential to experience PTS onset or be displaced due to piling from Scenario 4 (two construction vessels requiring worst case piling durations; PTS and 50 dB_{ht} columns in Table 14D.1) were appropriately scaled for the lower population sizes predicted to be present in the modelled scenario and used in the population model to predict impacts upon overall population size. The impacts to individuals modelled to experience PTS onset and behavioural displacement were as described in Section 14B.3.5, Appendix 14B – Marine Mammals Piling Impact Assessment. Potential impacts of displacement were implemented by harvesting calves from the population to simulate a reduction in breeding success, and potential impacts of PTS onset were implemented by harvesting adults from the population to simulate effects of age related increase in mortality. This population modelling work was carried out by the University of Aberdeen.

[6] Unexplained traumatic deaths suffered mainly by harbour seals and first reported in the area in 2008 (Thompson *et al*., 2010). Up to eight carcasses are reported per annum with a bias towards adult females. The cause is not known but is suspected to be related to the use of ducted propellers.

Figure 14D.10: Harbour Seal Population Baseline Scenario Modelling Assuming that the Corkscrew Seal Death Issue is not Solved in 2013

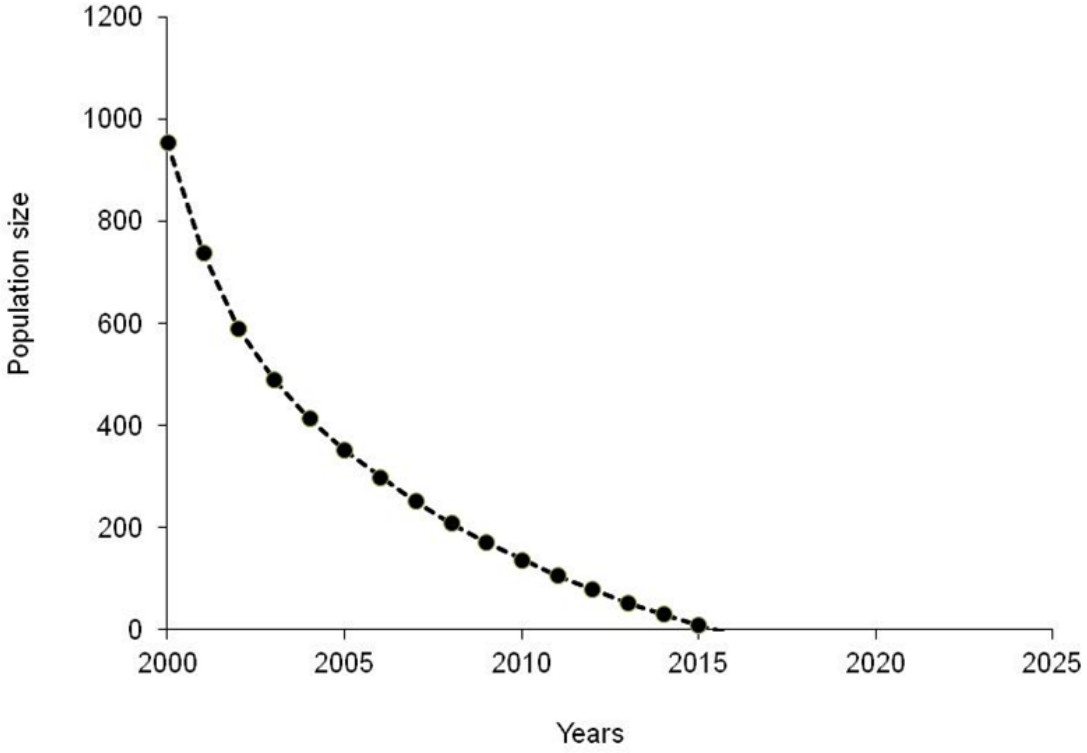


Figure 14D.11: Harbour Seal Population Baseline Scenario Modelling Assuming that the Corkscrew Seal Death Issue is Solved in 2013 (and Therefore There is no Further Removal from the Population Due to Mortality from this Cause)

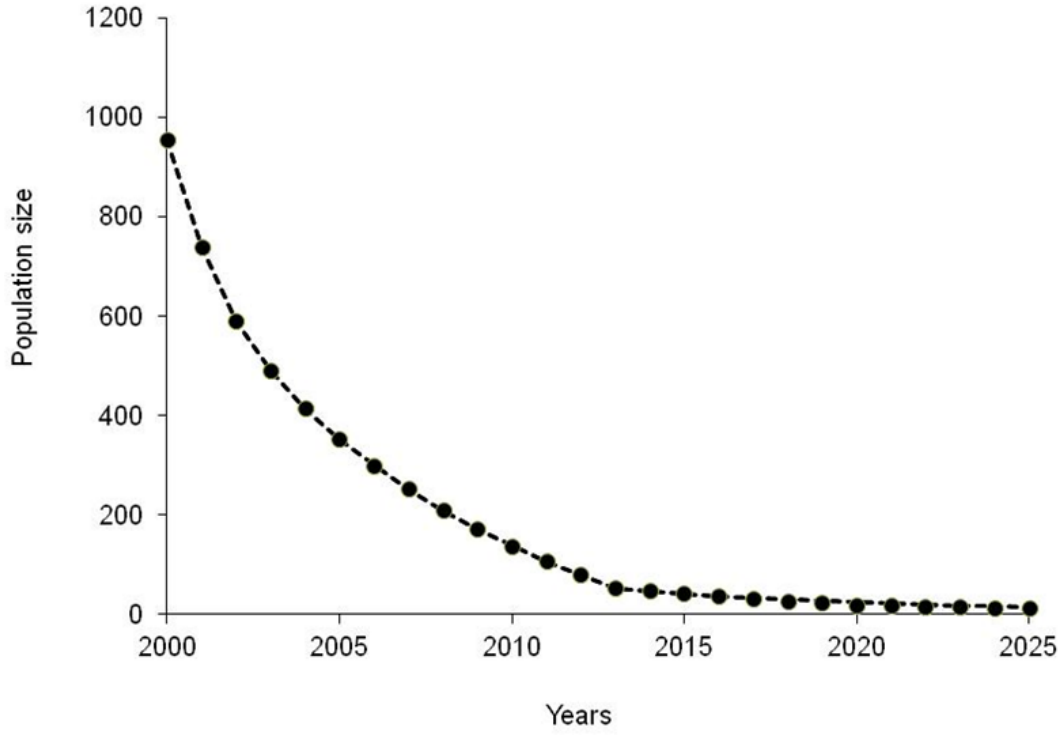
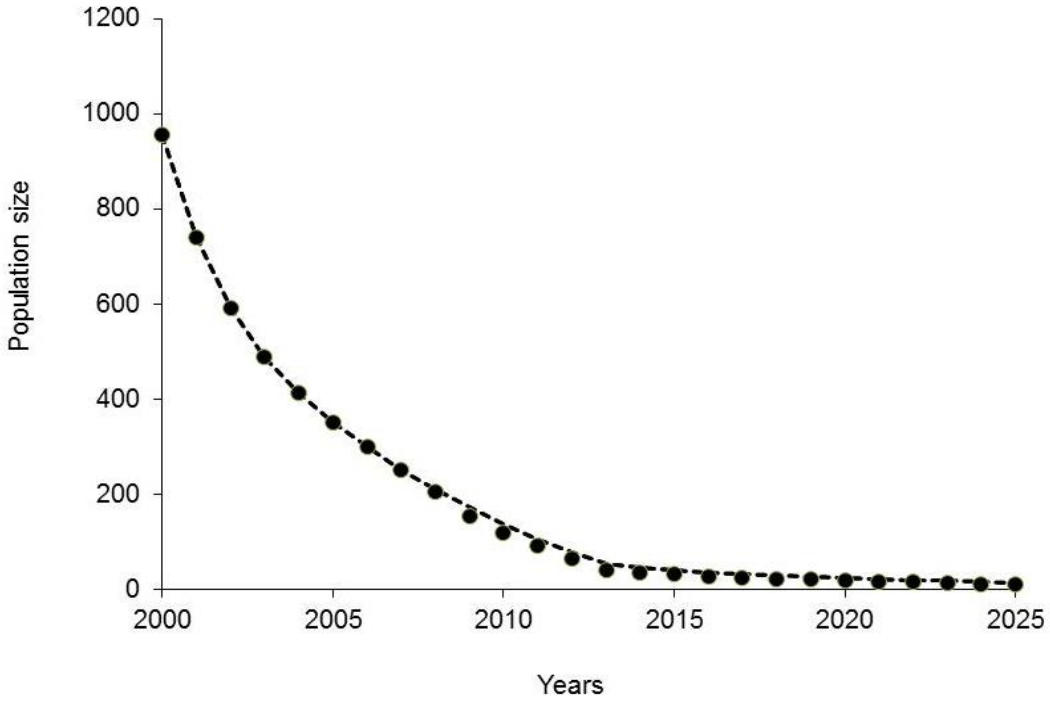


Figure 14D.12: Comparison of Baseline (---) and Construction (●●●) Scenario for a Hypothetical Construction (Piling) Period of 2008-2009



14D.4 Harbour Seals at the Firth of Tay and Eden Estuary SAC – Assessment Against SAC Conservation Objectives

The steps outlined in the Moray Firth Seal Assessment Framework (shown in Figure 14D.3) have been used to predict the number of harbour seals which have the potential to be affected by either PTS onset or behavioural displacement as a result of piling at the Inch Cape Offshore Wind Farm, as well as cumulatively with the other offshore wind farm sites in the Firth of Forth and Tay area. However, given the severely declining population in the Firth of Tay and Eden Estuary SAC, an agreement on an approach to assessing impacts at the population level was required with the regulators and their statutory advisors.

A workshop with regulators and their statutory advisors was held on 29 November 2012. The aim of this workshop was to discuss the outputs to date and potential approaches for how the conservation objectives for the Firth of Tay and Eden Estuary SAC might be addressed.

The conservation objectives against which the HRA assessment will be undertaken by the competent authority (in this case Marine Scotland) are detailed below. Any decision (on licensing an operation for which there is connectivity with the Firth of Tay and Eden Estuary SAC) must be made in relation to the site's conservation objectives through the HRA process set out in section 14D.2 – Background.

Conservation Objectives for Firth of Tay & Eden Estuary Special Area of Conservation

To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and

To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

Qualifying Species:

- **Common seal**

The over-arching objective for any SAC is 'maintaining site integrity' thereby contributing to achieving favourable conservation status for the species concerned. Both favourable conservation status and conservation objectives are assessed in the long term. The analysis above (Figure 14D.10), and that of Lonergan and Thompson (2012; Figure 14D.9 Scenario a), shows, the local harbour seal population associated with the Firth of Tay and Eden Estuary SAC is likely to be extinct, or nearly extinct, within the next few (< 20) years and possibly within 2-3 years. Therefore, it is clear that the integrity of the Firth of Tay and Eden Estuary SAC is currently not maintained (due to factors not currently understood, and not in relation to marine construction works).Given this, and the very small current population size predicted in the ECMA and SAC, it is highly unlikely that will be possible to measure any added loss that activities associated with the Project might have on the species-related conservation objectives.

The over-arching conservation objective for any SAC is 'maintaining site integrity' in the long term. As the analysis above (Figure 14D.10), and that of Lonergan and Thompson (2012; Figure 14D.9 Scenario a), shows, the local harbour seal population associated with the Firth of Tay and Eden Estuary SAC is likely to be extinct, or nearly extinct, within the next few (< 20) years and possibly within 2-3 years. Therefore, it is clear that the integrity of the Firth of Tay and Eden Estuary SAC is already not being maintained (without impacts relating to the construction of any offshore wind farms). Also, given the very small current population size predicted in the ECMA and SAC, it is not considered to be possible to measure, in any meaningful way, any added loss that activities at the Inch Cape Offshore Wind Farm might have on the species-related conservation objectives.

The following proposes an assessment against the Conservation Objectives for the Firth of Tay and Eden Estuary SAC – notified interest feature 'common seal':

- **Population of the species as a viable component of the site** – this is currently not achieved due to the very small (and diminishing) size of the harbour seal population in the SAC. See Figures 14D.10 and 14D.11 – baseline scenarios.

  Piling activity over a period of two years is considered highly unlikely to delay the timescale for the potential recovery of the population.

- **Distribution of the species within site** – this is currently not achieved as there are too few seals to maintain the distribution of the species at the time of designation (2005).

- **No significant disturbance of the species** – piling at the Inch Cape Offshore Wind Farm is likely to occur over a period of up to two years, which means that there is likely to be disturbance of the species in the medium (construction phase) but not the long (i.e. operation phase) term. However, whether disturbance of the species is significant or not is currently considered to be immeasurable against the SAC population as there are so few animals with the potential to be disturbed. This means that any impact at the population level is highly likely to be undetectable or will be within levels of natural variation.

It will potentially, however, be possible to measure the effects of piling activities at the Inch Cape Offshore Wind Farm on the habitat-related conservation objectives which are as follows:

- **Distribution and extent of habitats supporting the species** – the distribution and extent of supporting habitats, which include the sea area of the SAC, are likely to be affected for up to two years of piling (piling noise could potentially influence movements and use of foraging areas by animals using the SAC). The distribution and extent of supporting habitats will not be affected in the long term as impacts will be removed upon cessation of piling with the SAC habitat being unaffected. This conservation objective relates only to habitats within the SAC boundary itself.

- **Structure, function and supporting processes of habitats supporting the species** – this is very unlikely to be affected in the long term but will potentially not be met for the two years of piling through potential impacts on some prey species. Noise impact contours for known harbour seal prey in St Andrews Bay and the Firth of Tay (sandeel, *Ammodytidae*, herring, *Clupea harengus*, whiting, *Merlangius merlangus*, dab, *Limanda limanda*, flounder, *Platichthys flesus*, plaice, *Pleuronectes platessa*, and salmonids (salmon, *Salmo salar*, sea trout, *Salmo trutta* and smelt, *Osmerus eperlanus*); Sharples *et al*., 2009) vary in size but those for herring and other hearing specialists are particularly pertinent. Herring are likely to be displaced from the Development Area and immediate surrounds, which includes the SAC, as a result of noise produced by piling (see Chapter 13: Natural Fish and Shellfish). Dab and salmon may also be displaced, but from a smaller area than herring. Noise impact contours for trout and sandeel, the other fish species for which noise impact modelling was carried out, are local to the Development

Area and these species are unlikely to be displaced. This conservation objective relates only to habitats within the SAC boundary itself.

The information presented above details the outcome of the noise impact assessment (due to piling) on harbour seals, and presents a potential assessment against the Firth of Tay and Eden Estuary SAC conservation objectives relating to the notified interest feature 'common seal'. The over-arching objective of the SAC "maintaining site integrity" is currently not met for reasons at present unknown, but other than those associated with construction of an offshore wind farm.

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