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Marine Scotland - Licensing Operations Team Scoping Opinion

Addendum: Marine Mammals

THE ELECTRICITY WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) (SCOTLAND) REGULATIONS 2017 (AS AMENDED)

THE MARINE WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) (SCOTLAND) REGULATIONS 2017 (AS AMENDED)

SCOPING OPINION FOR THE PROPOSED SECTION 36 CONSENT AND ASSOCIATED MARINE LICENCE APPLICATION FOR THE REVISED INCH CAPE OFFSHORE WINDFARM AND REVISED INCH CAPE OFFSHORE TRANSMISSION WORKS – MARINE MAMMALS ASPECTS ONLY

Contents

1 Executive Summary

This is the Scottish Ministers Scoping Opinion in respect of the marine mammals aspects of the Scoping Report for the revised design parameters proposed for the Inch Cape Offshore Windfarm.

This document sets out the Scottish Ministers' opinion on the basis of the information relating to marine mammals provided in the Scoping Report of 28 April 2017. The first version of the Scoping Opinion (issued 28 July 2017) includes the Scottish Ministers' opinion and advice on all receptors included in the Scoping Report except marine mammals and ornithology. Two addendums are provided, one on marine mammals (this document) and one on ornithology. These should be read in conjunction with the scoping opinion provided on 28 July 2017.

The scoping request relates to the Inch Cape Offshore Windfarm - Revised Design ("Revised Development") to be situated off the east coast of Angus, in the same area as the previously consented Inch Cape offshore windfarm. The approach taken in the Scoping Report is to use the Environmental Statement ("ES") submitted in relation to the Inch Cape Offshore Windfarm (hereafter, "the Original Development") in 2012 as an evidence base. The 2012 ES is used to scope factors out of the forthcoming EIA Report where significant effects were not previously identified and where the baseline characterisation remains valid.

This opinion can only reflect the proposal as currently described by Inch Cape Offshore Limited ("ICOL"). The matters addressed by ICOL in the Scoping Report have been carefully considered and use has been made of professional judgment (based on expert advice from stakeholders and Marine Scotland in-house expertise) and experience in order to adopt this opinion. It should be noted that when it comes to consider the Environmental Impact Assessment Report ("EIA Report"), the Scottish Ministers will take account of relevant legislation and guidelines (as appropriate). The Scottish Ministers will not be precluded from requiring additional information if it is considered necessary in connection with the EIA Report submitted with the application for section 36 consent and associated marine licence.

This scoping opinion has a shelf life of 12 months from the date of issue. If an application is not received within 12 months then ICOL must contact the Scottish Ministers to determine whether this scoping opinion requires updating.

The Scottish Ministers have consulted on the Scoping Report and the responses received have been taken into account in adopting this opinion. A marine mammal scoping meeting and a workshop have been held with Scottish Natural Heritage ("SNH"), Marine Scotland Science ("MSS"), Whale and Dolphin Conservation ("WDC") and ICOL to discuss the Scoping Report further.

The Scottish Ministers draw attention to the general points and those made specifically in respect of marine mammals in this opinion. Where significant effects were identified in the Original Development ES, and the assessment remains relevant, these matters must still be reported in the forthcoming EIA Report, but may be scoped out of further assessment work. Matters are not scoped out unless specifically addressed and justified by ICOL and confirmed as being scoped out by the Scottish Ministers.

2 Introduction

2.1 Background to this scoping opinion

2.1.1 We refer to your letter of 28 April 2017 requesting a scoping opinion from the Scottish Ministers under Regulation 7 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (as amended) and Regulation 13 and Schedule 4 of the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended). The request was accompanied by a Scoping Report containing a plan sufficient to identify the site which is the subject of the proposed development and a description of the nature and purpose of the proposed development and of its possible effects on the environment. The Scoping Report used the Original Development ES to provide an evidence base for scoping certain topics out where all of the following three criteria were met: (i) no significant effects were identified in the Original Development ES; (ii) the baseline remains valid (iii) there have been no significant changes to the assessment methodology. The Scoping Report was accepted on 05 May 2017.

2.1.2 This document is an addendum to the scoping opinion issued on 28 July 2017, which contained the Scottish Ministers' view on the Scoping Report supplied by ICOL. For the sake of brevity the background text is not repeated here and readers are advised to read both documents together.

2.1.3 This addendum deals only with the aspects relating to marine mammals included within the Scoping Report.

2.2 The content of the scoping opinion

2.2.1 With regard to your request for a scoping opinion on the proposed content of the required EIA Report, the Scottish Ministers have, in accordance with the 2017 EIA Regulations, considered the documentation provided to date and consulted with the appropriate consultation bodies (see Appendix I) in reaching their scoping opinion.

2.2.2 Please note that the EIA process is vital in generating an understanding of the biological, chemical and physical processes operating in and around the proposed development site and those that may be impacted by the proposed activities. We would however state that references made within the scoping document with regard to the significance of impacts should not prejudice the outcome of the EIA process. It is therefore expected that these processes will be fully assessed in the EIA Report.

2.3 Duration of consent

2.3.1 The consent granted for the Original Development had an operational period of 25 years, the Revised Development is proposed to be 50 years. On the basis of expert opinion received, the Scottish Ministers consider that, in the majority of cases, the Original Development ES assessment of the effects of a 25 year consent duration is likely to be acceptable. However, the Scottish Ministers are aware that there are inherent uncertainties of modelling population effects which increase with time, and it may not be possible to have confidence in predicted impacts over a 50 year period for some receptors e.g. marine mammals.

2.3.2 ICOL is advised to identify and, if possible, quantify, the uncertainties associated with modelling population effects over different timescales.

3 Aim of this Scoping Opinion

3.1 The scoping process

3.1.1 Scoping provides the first identification, and likely significance, of the environmental impacts of the proposal and the information needed to enable their assessment. The scoping process is designed to identify which impacts will, or will not, need to be addressed in the ES. This includes the scope of impacts to be addressed and the method of assessment to be used. The scoping process also allows consultees to have early input into the EIA process, to specify their concerns and to supply information that could be pertinent to the EIA process. In association with any comments herein, full regard has been given to the information contained within the scoping opinion request documentation submitted.

3.1.2 This addendum is the Scottish Ministers' scoping opinion in relation to the potential impact of the ICOL development on marine mammal receptors.

4 Consultation

4.1 The consultation process

4.1.1 On receipt of the scoping opinion request documentation, the Scottish Ministers, in accordance with The Electricity Works 2000 and The Marine Works 2007 regulations, initiated a 28 day consultation process, which commenced on 13 March 2017. Advice was also sought from Marine Scotland Science ("MSS") on certain points. Full details of this consultation process are included in the scoping opinion for other receptors (issued 28 June 2017). A separate addendum on ornithological aspects of the Scoping Report will follow on 14 August 2017.

4.1.2 The full consultation response from SNH is attached in Appendix I, WDC did not provide a formal written response to the consultation. A full copy of the written advice received from MSS is included in Appendix II to this opinion.

4.1.3 A marine mammals scoping meeting was held on 26 May 2017 and a workshop to discuss the baseline and impact assessment methodology further was held for 27 July 2017. The discussion paper for this workshop is included at Appendix III to this Opinion. A second workshop will be organised by ICOL to discuss the initial outputs of the noise modelling.

4.1.4 The Scottish Ministers are satisfied that the requirements for consultation have been met in accordance with the Environmental Impact Assessment ("EIA") Regulations.

5 Marine Mammal Interests to be Considered Within the ES

5.1 Introduction

5.1.1 The Scoping Report contained a series of questions posed by ICOL and these are used to inform the structure of this opinion. Each question is addressed in turn below and the Scottish Ministers answers or advice provided. Where necessary, consultee comments or MSS advice have been incorporated to provide further relevant information. The outcomes of the stakeholder meeting on 26 May 2017 and workshop on 27 July 2017 have also informed this scoping opinion. The page and table numbers contained within the boxes refer to the Scoping Report.

5.1.2 This section contains a summary of main points raised by consultees and the Scottish Ministers opinion on whether EIA topics should be scoped in or out. The consultation responses are contained in Appendix I and ICOL is advised to carefully consider these responses and use the advice and guidance contained within them to inform the EIA Report.

5.1.3 ICOL has used an ES undertaken for the Original Development for much of the baseline information in their Scoping Report and this is referred to as the 'Original Development ES' in this opinion. The EIA Report to be submitted for the Revised Development should be a standalone document without the need for users to refer back to the Original Development ES to understand the information contained within the 2017 EIA report. The Scottish Ministers consider that, where relevant, it would be appropriate for data or other information being relied on from Original Development ES to be contained in appendices so that the main text of the EIA Report for the current project is concise.

5.1.4 To ensure that all potential significant impacts are considered as part of the consent determination they will be reported within the EIA Report for the Revised Development. Relevant conditions attached to the consent for the Original Development will also be reported in the EIA Report. A schedule of mitigation should also be included in the EIA Report.

5.2 Scoping Questions

5.2.1 In the Scoping Report, ICOL stated that they considered that the likely impacts on Marine Mammals for the Revised Development, apart from piling impact during construction, will be less than those assessed for the Original Development and therefore should be scoped out of the EIA Report due to the following:

- Changes in the revised design envelope
- Baseline data remaining valid
- No material change to data collection
- No material change to assessment best practice
- No significant effects concluded in the Original Development ES

5.2.2 The tables below contain the Scottish Minister's answers to the specific questions asked by ICOL. The Scottish Ministers also agree the following:

- **The Scottish Ministers agree that bottlenose dolphin, harbour seal, grey seal, harbour porpoise, minke whale and white beaked dolphin should be included in the EIA.**
- **The Scottish Ministers agree that there is connectivity between the project and the Moray Firth Special Area of Conservation ("SAC") for bottlenose dolphins, the Firth of Tay and Eden Estuary SAC for harbour seals, the Isle of May SAC for grey seals and Berwickshire and North Northumberland Coast SAC for grey seals and that these species and sites should be included in the Habitats Regulation Appraisal ("HRA").**

Scoping Question	Question
8.3.9. (Page 192)	Are you satisfied that the EIA should only concentrate on those receptors which may be subject to significant effects from the proposed development?
The Scottish Ministers agree that the EIA should only concentrate on those receptors which may be subject to significant effects from the Revised Development.	

Scoping Question	Question
8.3.9. (Page 192)	Are you satisfied that the existing marine mammal baseline survey data (including proposed updates) are appropriate for the

	assessment of impacts arising from the Revised Development?

Other sources of data were suggested at the stakeholder meeting on 26 May 2017. These were:

- the CPoD data from the MSS funded survey of the east coast of Scotland (see reference below)
- the Sea Mammal Research Unit ("SMRU") photo identification project, which could be used for assessing the proportion of bottlenose dolphin from the Moray Firth SAC which can be expected to be utilising the Firth of Tay at any one time (see Quick *et al*. (2014) reference below).

It was noted in the meeting on 26 May 2017 that the baseline of the Original Development ES is likely to prove conservative with respect to the number of animals likely to be in the coastal regions that are exposed to higher levels of piling related noise. There was a general consensus at the meeting that the approach in the Original Development ES was based on conservative assumptions and as there are now improved methods and a better understanding of impacts this should result in a more realistic assessment for the Revised Development EIA. ICOL have suggested holding two workshops, one to agree the methodology for noise impact assessment (held on 27 July 2017) and one to discuss the initial outputs from the updated noise modelling and agree approaches to investigate any population level effects.

The Scottish Ministers agree that the existing baseline and proposed updates are appropriate. ICOL should take into account the other sources of data discussed at the stakeholder meeting and ensure that the information they are using is the most up to date. The Scottish Ministers welcome the suggestion for workshops.

Quick et al. 2014. The east coast of Scotland bottlenose dolphin population: Improving understanding of ecology outside the Moray Firth SAC. DECC SEA programme Report 14D/086

Further details on the East Coast Marine Mammal Acoustic Survey (ECOMMAS) are available from: http://www.gov.scot/Resource/0050/00507404.pdf

Scoping Question	Question
8.3.9. (Page 192)	Previously, the cetacean reference populations for assessment of the Original Development were those detailed in Chapter 14 of the Original Development ES. However, the IAMMWG has since agreed final Management Units for the seven most common

	cetacean species in UK waters (IAMMWG, 2015). Should these 2015 figures be used instead?

Bottlenose dolphin (*Tursiops truncates*)
SNH advise that the reference population estimates in the statutory nature conservation bodies ("SNCB") guidance on management units for cetaceans should be used, this guidance is based on the Inter Agency Marine Mammal Working Group ("IAMMWG") 2015 figures (IAMMWG, 2015). For bottlenose dolphin this is the coastal east Scotland population and SNH advise referring to Cheney *et al*. (2013) for the most up to date population estimate. MSS agree with the management unit and population size recommended by SNH.

During the workshop on 27 July 2017, which included SNH and MSS, a further discussion was had regarding distribution for bottlenose dolphin. An approach to update the distribution used in the Original Development ES was agreed. This is recorded in the minutes of the workshop (Appendix III) and noted below:

Agreement reached to assume, as per the assessment for the Original Development, the reference bottlenose dolphin population (195 individuals) should be split 50:50 between the east coast and the Moray Firth, and that 98 dolphins would be present at the time of piling activities off the east coast.

Agreement reached that the 98 individuals assumed to be present off the east coast should be spread evenly across the area inside the 20 m depth contour as defined in the Original Development EIA, excluding areas in the Forth and Inner Tay where bottlenose dolphin are known not to be present (shaded red in Figure 1 in workshop). These 98 animals will be spread evenly across the remaining grid cells (thereby increasing the density per grid cell).

Cheney B, Thompson PM, Ingram SN, Hammond PS, Stevick PT, Durban JW, Culloch RM, Elwen SH, Mandleberg l, Janik VM, Quick NJ, Islas-Villanueva V, Robinson KP, Costa M, Eisfeld SM, Walters A, Phillips C, Weir CR, Evans PGH, Anderwald P, Reid RJ, Reid JB and Wilson B (2013) Integrating multiple data sources to assess the distribution and abundance of bottlenose dolphins *Tursiops truncatus* in Scottish waters. *Mammal Review*, **43**, 71-88.

IAMMWG (2015) Management Units for cetaceans in UK waters. JNCC Report number 547. http://jncc.defra.gov.uk/pdf/Report_547_webv2.pdf

The Scottish Ministers agree that the IAMMWG 2015 figures for the cetacean reference populations and the additional references suggested by SNH should be used. The Scottish Ministers confirm that the approach agreed at the workshop on 27 July 2017 with regard to bottlenose dolphin distribution should be used.

Harbour porpoise (*Phocoena phocoena*), Minke whale (*Balaenoptera acutorostrata*) and White beaked dolphin (*Lagenorhynchus albirostris*)

SNH and MSS agree that the management unit for these species should be based on IAMMWG (2015) and the relevant management units are North Sea (harbour porpoise) and Celtic and Greater North Seas (minke whale and white beaked dolphin). For abundance estimates for these management unit MSS advise that the SCANS-III are the most up to date and should be used if available. If these are not available MSS agree with SNH that the IAMMWG (2015) guidance can be used. SNH and MSS agree that the estimate of abundance within the SCANS-III survey results for block R can be used to consider impacts at a regional scale. MSS note that if further information becomes available from SCANS-III in time to be used in the EIA Report then ICOL should make reference to this. MSS note distribution data for these species can be taken from the Original Development ES unless other more recently published data are available.

The Scottish Ministers agree that:

- **The management units based on the IAMMWG (2015) guidance should be used**
- **If available, the SCANS-III surveys should be used for abundance estimates as these are the most up to date, if not available then the IAMMWG (2015) guidance should be used**
- **The most up to date SCANS-III survey results for block R should be used to provide a regional abundance estimate for use within the assessment**
- **Distribution data for these species can be taken from the Original Development ES, unless other more recently published data are available**

Scoping Question	Question
8.3.9. (Page 192)	Previously, the seal reference populations for assessment of the Original Development were those detailed in Chapter 14 of the Original Development ES. However, the IAMMWG has since agreed final Management Units for both seal species in UK waters (IAMMWG, 2013). Should these 2013 figures be used instead?
Harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) For these two species SNH advise that the population present in the east coast seal management unit should be used as the reference population for assessment and	

SNH take this as equivalent of the SAC population, these can be obtained from the Special Committee on Seals ("SCOS"). MSS agree and note that the 2016 population sizes will be available in the SCOS 2017 report, which will be available in draft in September 2017. MSS recommend that, until this report is published, the 2015 population sizes as published in the SCOS 2016 report should be used. MSS advise that the seal usage maps produced by SMRU should be used for distribution data on both species. These are currently available directly from SMRU but will be updated and made available on NMPi in the next few months.

SCOS (2016) Scientific Advice on Matters Related to the Management of Seal Populations: 2016. http://www.smru.st-andrews.ac.uk/files/2017/04/SCOS-2016.pdf

http://www.smru.st-andrews.ac.uk/research-policy/scos/

The Scottish Ministers agree that the SCOS seal management units and population estimates as described above are used and that the seal usage maps produced by SMRU are used for distribution data on both species.

Scoping Question	Question
8.3.9. (Page 192)	Are you satisfied that the EIA for the Revised Development should focus only on those issues identified above (i.e. disturbance from increased noise (geophysical survey systems) and disturbance/PTS from piling)?

SNH note that they are satisfied that offshore wind farm piling activity and geophysical surveys are scoped in. SNH note that the installation of the export cable is scoped in to take account of alterations to the cable works but do not anticipate any likely significant effects.

MSS agree with SNH and ICOL that the assessment will only need to cover the impact of increasing the power of the hammer used to install the piled foundations. MSS advise, when updating the assessments from the Original Development ES for this impact, that refining the design envelope to account for the smaller number of turbines that ICOL intend to install, and the associated reduced construction time, will be likely to decrease the overall impact. Engineering requirements were discussed at the workshop on 27 July 2017 and it was agreed that a worst case and most likely case should be presented in the Revised Development EIA Report, with detailed explanation contextualising where and how frequently the worst case might be encountered within the site. A description should be provided to explain the conservatism built into the worst case scenario.

MSS agree it would be helpful to include geophysical surveys in EIA Report although they note that it may be necessary to undertake geophysical surveys prior to a

licence or consent being granted e.g. to inform consideration of such a licence or consent. There is therefore potential for geophysical surveys to be considered as part of a stand alone process.

The Scottish Ministers agree that the EIA should focus on disturbance from increased noise (geophysical survey systems) and disturbance/permanent threshold shift ("PTS").

SNH and MSS both provided advice on the assessments to be undertaken and the methodology was discussed in more detail at the workshop on 27 July 2017. The main points are summarised below:

Underwater noise modelling and assessment
SNH and MSS agree that an update to the noise propagation modelling will be required and that both instantaneous and cumulative permanent threshold shift ("PTS") should be presented, modelled for each of the species noted above. SNH and MSS agree that ICOL should provide the total number of individuals from each species that may suffer PTS and the number that may be displaced through disturbance.

The outcome from the workshop on 27 July 2017 was that PTS thresholds from both Southall *et al*. (2007) and the NOAA (2016) should be used. This is to allow comparability with the Original Development ES (which used Southall *et al*. (2007)) but takes into account that the NOAA criteria are the most up to date scientific information. ICOL should note that the NOAA criteria are currently under review (refer to http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm for more information).

Flee speeds and startle responses for PTS modelling were discussed at the workshop and agreement was reached to use the mean swim speeds details in SNH guidance note (2016) *Assessing collision risk between underwater turbines and marine wildlife*. This provides mean swim speeds for minke whale, harbour porpoise and grey and harbour seal. It does not contain a mean swim speed for bottlenose dolphin and it was agreed that further information should be obtained from researchers at SMRU (see workshop minutes). Any mean swim speed agreed for bottlenose dolphin will be used as a proxy for white beaked dolphin. There was also discussion regarding how to take account of the use of ADDs as a mitigation (see comments below in relation to embedded mitigation also). It was agreed that fleeing starts from the start of the ADD use i.e. 20 minutes before piling starts, and the PTS impacts from ADDs do not need to be considered as the ADDs will not be sufficiently loud to cause PTS for the period of time that they will be used for.

SNH and MSS agree that a dose responses curve should be used to determine the proportion of animals likely to be disturbed sufficiently to displace them by piling noise. Discussions at the workshop on 27 July 2017 noted that there should be a re-

interpretation of the data from the harbour porpoise acoustic signal detection during piling operations at Horns Rev II. It was also noted that data from the Moray Firth seismic survey work should also be examined to establish whether reaction to air-gun noise can be considered informative in the generation of a dose response curve. MSS also noted that they had some concerns regarding using the data from the Horns Rev II development relating to the small sample size and the very shallow water depths at the study site which may have an effect on noise propagation. Both SNH and MSS note that there are other data and approaches that could be used to improve this assessment and recommend ICOL make use of these where possible (Dähne *et al*., 2013, Brandt *et al*., 2016, Thompson et al., 2013a and b). MSS consider that in the absence of similar data for species other than harbour porpoise, that it is acceptable to use the same dose-response function for all species.

Brandt *et al*. (2016) Effects of offshore pile driving on harbour porpoise abundance in the German Bight. Assessment of Noise Effects. Final Report. Prepared for Offshore Forum Windenergie. http://bioconsult-sh.de/site/assets/files/1573/1573.pdf

Dähne *et al*. (2013) Effects of pile-driving on harbour porpoises (Phocoena phocoena) at the first offshore wind farm in Germany. Environ. Res. Lett. 8, doi:10.1088/1748-9326/8/2/025002

SNH (2016) Assessing collision risk between underwater turbines and marine wildlife. Guidance note.

Southall *et al*. (2007) Marine mammal noise exposure criteria**.** Aquatic. Mammals., 33, pp. 411-521, 10.1578/AM.33.4.2007.411

Thompson *et al*. (2013a) Short-term disturbance by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises. Proc Roy Soc B 280: 20132001. http://dx.doi.org/10.1098/rspb.2013.2001

Thompson *et al*. (2013b) Framework for assessing impacts of pile-driving noise from offshore wind farm construction on a harbour seal population. Environmental Impact Assessment Review, 43, 73–85.

The Scottish Ministers advise that ICOL take into account the summary above, consultation responses and the minutes of the scoping meeting on 26 May 2017 and the workshop on 27 July 2017. The Scottish Ministers consider that the following should be used for the underwater noise modelling and assessment:

- **both instantaneous and cumulative permanent threshold shift ("PTS") should be presented, modelled for each of the species**

noted above. ICOL should provide the total number of individuals from each species that may suffer PTS and the number that may be displaced through disturbance.

- **Swim speeds as outlined by SNH in the guidance note referenced above should be used along with information provided by SMRU in relation to bottlenose dolphin swim speeds (which can be used as a proxy for white beaked dolphin)**
- **Fleeing should be considered to begin from the start of ADD use**
- **PTS thresholds from both Southall *et al*. (2007) and the NOAA (2016) should be presented**
- **A dose response curve should be used to determine the proportion of animals likely to be disturbed sufficiently to displace them by piling noise. ICOL should take into account the concerns noted above about the use of the Horns Rev II and make use of other relevant data as noted above.**

Species impact assessment

For bottlenose dolphin, MSS consider it will be necessary to assess the impacts of ICOL alone on the East Scotland management unit population, as well as cumulatively with other developments. SNH and MSS each suggest a different approach for this assessment. SNH consider that if the impact of the project alone is the same or less that the impact of the Original Development then there would not be a requirement for a cumulative assessment. MSS have concerns that this could compromise the Appropriate Assessment that will be conducted in relation to the Moray Firth SAC.

The approach agreed at the workshop on 27 July 2017 for harbour porpoise, minke whale, white beaked dolphin, harbour seal and grey seal was that ICOL should assess whether the new parameters of the Revised Development result in any greater impact to these species. If the Revised Development does not result in increased impact then no further assessment would be required. This approach aligns with the advice provided by SNH. MSS agree with this approach for these species but caution that there will also be a need to consider the information requirements for EPS licensing and, where needed, for an HRA and Appropriate Assessment. Although EPS is not part of the EIA process MSS recommend that information presented in the EIA Report can be readily transferred into the EPS process.

The Scottish Ministers advise that, for bottlenose dolphin, an assessment of the impacts of the Revised Development alone on the East Scotland management unit population as well as cumulatively with other developments that may impact on the same population is required. ICOL should ensure that the information provided can be used for an Appropriate Assessment in

relation to the Moray Firth SAC.

The Scottish Ministers advise for harbour porpoise, minke whale, white beaked dolphin, harbour seal and grey seal that further assessment is only carried out if the effects of the Revised Development are found to be greater than those assessed for the Original Development. The Scottish Ministers request that, where necessary, the information is provided in a form that means it can be used for the EPS process or, where needed, to inform the Appropriate Assessment as part of an HRA.

Population level effect assessment

SNH welcome that ICOL will have a second workshop to discuss the initial noise modelling outputs and are happy to participate. SNH anticipate that it will be possible to review these outputs for the Revised Development and broadly compare them against those for the Original Development.

For species where population level impact assessments are undertaken, MSS recommend using the Interim Population Consequences of Disturbance ("iPCOD") framework. The software for this model is available on the Marine Scotland website, along with a report which suggests appropriate parameters for each species. MSS note that a new version of the software will shortly be available (also on the Marine Scotland website), which will allow for the use of a dose-response function for the displacement of animals as a result of exposure to noise.

MSS note the interim nature of the iPCOD framework. This is because there are currently insufficient data on the consequences of disturbance to individual animals, and hence to populations. MSS flag this as an important knowledge gap. The iPCOD framework utilises formal expert elicitation to produce statistical distributions of responses to disturbance, and to estimate the effects on vital rates of individuals (e.g. survival probability, reproductive rate), including the uncertainty in these predictions. An alternative framework, the DEPONS model, is available and uses measured responses of tagged harbour porpoise to impulsive noise sources to understand the effects of disturbance. However, this framework is currently only parameterised for harbour porpoise and so does not represent a viable assessment method for this development.

In the previous ES, a Population Viability Analysis ("PVA") was used for population level assessments. This also used expert opinion on the responses to disturbance and their effect to vital rates. However, this was not a formally elicited expert opinion and did not include uncertainty around the responses or impacts to individuals. The framework for developing this model is also unsophisticated and cannot accommodate scenarios with variable numbers of developments in subsequent years (see advice on the Aberdeen Harbour Expansion Project Appropriate

Assessment for further details). MSS recommend iPCOD over this PVA for these reasons.

In providing iPCOD outputs, MSS request that the EIA Report (or an appendix) provides a comprehensive list of the parameters input. This should be sufficiently detailed such that MSS staff would be able to replicate the analysis. As a minimum this will include the piling schedule, the demographic parameters, and starting population size. MSS request that the developer provides a copy of the code used to run the model and any QA/QC outputs that the software produces.

MSS have provided guidance on the presentation of the assessed change using the results of PVA (see Appendix V). They advise that the results of an assessment using iPCOD should also be presented using these metrics.

The Scottish Ministers advise that the iPCOD framework is used for species where population level impact assessments are undertaken. The Scottish Ministers request that a comprehensive list of the parameters input and other relevant information to allow MSS to be able to replicate the analysis is provided. As a minimum this must include:

- **The piling schedule**
- **The demographic parameters**
- **Starting population size**
- **Copy of the code used to run the model**
- **Any quality assurance/quality control outputs that the software produces**

The Scottish Ministers advise that the results of the assessment using iPCOD should be presented using the metrics provided in the MSS guidance note.

Scoping Question	Question
8.3.9. (Page 192)	Are you satisfied that the embedded mitigation (including that specified within the consent conditions of the Original Development) is appropriate to the potential impact from the Revised Development?

The Scottish Ministers agree that the embedded mitigation and the consent conditions of the Original Development are appropriate to the potential impact from the Revised Development. There may be a need for further mitigation and associated consent conditions if the increased hammer energy is assessed to have a greater effect than the Original Development.

At the scoping meeting on 26 May 2017 and at the workshop on 27 July 2017 there was discussion about using acoustic deterrent devices (”ADDs”) for mitigation purposes. These are not listed in the Scoping Report as embedded mitigation within the consent conditions of the Original Development. MSS note that as ADDs are a mitigation tool, it may be more appropriate to undertake the assessment process without them and then include them as a mitigation at a later stage. This would be the standard approach for EIA and would have the advantage of providing good evidence regarding the efficacy of the proposed mitigation.

The Scottish Ministers advise that ICOL consider including the use of ADDs as a mitigation after undertaking the initial assessment. This would provide evidence by which to judge the efficacy of the proposed mitigation.

Scoping Question	Question
8.3.9. (Page 192)	Do you agree that the cumulative impacts on marine mammals should be scoped out of EIA for the Revised Development (with the exception of disturbance from increased noise (geophysical survey systems) and disturbance/PTS from piling) based on the assumptions set out and the conclusions reached in the CIA for the Original Development?
The Scottish Ministers agree that the cumulative impacts on marine mammals, with the exception of disturbance from increased noise (geophysical survey systems) and disturbance/PTS from piling, should be scoped out of the EIA for the Revised Development.	

Scoping Question	Question
8.3.9. (Page 192)	Do you agree on the proposed projects to be included within the CIA?
SNH suggest any requirements for cumulative impact assessment can be discussed at the second workshop proposed by ICOL (see above). A cumulative impact assessment will only be necessary if the piling (underwater noise) impacts are greater than previously assessed. As noted above MSS consider that this approach would not provide the information that will be required for the Appropriate Assessment in relation to the Moray Firth SAC. SNH suggest that if ICOL wish to further develop their approach to cumulative impact assessment they recommend ICOL review the marine mammals Appropriate Assessment for the Aberdeen Harbour Expansion Project.	

MSS agree with the list of projects to be included in a cumulative assessment that is provided in the Scoping Report and agree with SNH that the Aberdeen Harbour Expansion Project should also be included.

The Scottish Ministers consider the following projects should be considered for inclusion in the cumulative impact assessment (for consistency the names are presented as they are found on the Marine Scotland webpage (where relevant)):

- **Worst case scenario of Neart na Gaoithe (2014 as consented) or Neart na Gaoithe (2017 scoping report)**
- **Worst case scenario of Seagreen Alpha and Bravo (2014 as consented) or Seagreen (2017 scoping report)**
- **Worst case scenario of Moray Offshore East Development or Moray East Offshore Windfarm – Alternative Design**
- **Beatrice Offshore Windfarm**
- **Moray Offshore East Development**
- **Moray East Offshore Windfarm – Alternative Design**
- **Moray West Offshore Windfarm**
- **Aberdeen Harbour Expansion project**

ICOL included the following projects in their initial application. The Scottish Ministers do not have details of the status of all these proposals. Consideration should be given to the following projects depending on the potential for overlap in construction activities, or the potential for the construction times to be close to those proposed by ICOL:

- **Rosyth International Container Terminal**
- **Firth of Forth Phase 1 Meteorological Mast**
- **Grangemouth Renewable Energy Plant**
- **Rosyth Renewable Energy Plant**
- **Dundee Renewable Energy Plant**
- **Cockenzie Combined Cycle Gas Turbine Power Station**
- **Captain Clean Energy Project (Caledonia Clean Energy Project)**
- **Coastal Improvement Works at the mouth of the Barry Burn**
- **Victoria and Albert Museum at Dundee (Dundee Waterfront Development)**
- **Port of Dundee Expansion**
- **Edinburgh Harbour Master Plan (Edinburgh Waterfront Development)**

The CIA is likely to benefit from discussion during the second workshop to discuss the initial results of the noise modelling, therefore the list of projects

to be included may be refined following this.

Scoping Question	Question
8.3.9. (Page 192)	Do you agree on the Natura sites proposed, which include marine mammals as qualifying features, and for which there is potential connectivity with an impact from the Revised Development?
SNH agree that the Moray Firth SAC, the Firth of Tay and Eden Estuary SAC, Isle of May SAC and the Berwickshire and North Northumberland Coast SAC have potential connectivity with the Revised Development. **The Scottish Ministers agree that there is connectivity between the Revised Development and the Moray Firth SAC for bottlenose dolphin, the Firth of Tay and Eden Estuary SAC for harbour seals, the Isle of May SAC for grey seals and the Berwickshire and North Northumberland Coast SAC for grey seals and that these sites and species should be included in the HRA.**	

Scoping Question	Question
8.3.9. (Page 192)	Do you agree that the potential impacts to be considered in the HRA report relate to disturbance from increased noise and displacement/PTS from piling operations? No other potential impacts will be considered in the HRA report.
The Scottish Ministers agree that the potential impacts of disturbance from increased noise (geophysical surveys) for both the windfarm and the export cable corridor and disturbance/PTS from piling for the windfarm during the construction (and decommissing) phase for each.	

Signed

Gayle Holland
02/08/2017
Authorised by the Scottish Ministers to sign in that behalf

Appendix I: Consultee Responses

Consultee Comments relating to the marine mammal aspects of the revised Inch Cape Offshore Windfarm

Please note, the full SNH response (including appendices A, C and D) is included in the Scottish Ministers initial Scoping Opinion, dated 28 July 2017. Only the relevant portions of their response has been reproduced here.

Scottish Natural Heritage

Thank you for this scoping consultation, requesting advice from SNH on natural heritage interests to be addressed under Environmental Impact Assessment (EIA) and Habitats Regulations Appraisal (HRA) for the Inch Cape offshore wind farm. The applicant is scoping for a new application in respect of the wind farm (proposing use of larger turbines) and confirming the location of the cable landfall. This scoping relates to the marine elements and the onshore works will be scoped separately under planning.

SNH's previous advice (7 March 2014 and 4 July 2014) raised significant issues in relation to the cumulative impacts of the Forth & Tay wind farm proposals – Inch Cape alongside Neart na Gaoithe and Seagreen (alpha and bravo) – in relation to ornithology and seascape, landscape and visual interests. These responses are important context for any reapplications now being made for the Forth & Tay wind farms. Our new advice will also reflect discussions at the recent scoping meetings for landscape and biological receptors.

We advise that the EIA of Inch Cape's new application should update the assessment for the following receptors:

- **ornithology** – please see **Appendices A(i) – A(iv)**
- **marine mammals** – please see **Appendix B**
- **seascape, landscape and visual interests** – please see **Appendix C**

We also provide our advice on the receptors we consider can be scoped out of any reassessment – please see **Appendix D**.

This scoping response provides our recommendations on the approach to impact assessment for each receptor. We also recommend that pre-application dialogue continues after scoping in order to address any queries or points of clarification and to confirm final methodological details. We strongly recommend that this is co-ordinated, as far as possible given uncertain time-scales for resubmission, across all three Forth & Tay developers. We therefore welcome the proposal for a meeting, post-scoping of all three proposals, to review the ornithology advice.

Our advice anticipates new Section 36 and marine licence applications from Inch Cape early in 2018. We therefore highlight that this scoping advice is limited to the same time-frame. We expect substantial advances in methodology over the next 12 months so that if the application is significantly delayed we may wish to update our advice in some respects.

There are four key areas for reassessment where we highlight that further discussion may be helpful, to agree the approach and ensure consistent application across the Forth & Tay wind farm proposals:

- Displacement modelling for seabirds
- Addressing non-breeding season seabird impacts
- Population modelling for seabirds
- Underwater noise modelling for marine mammals

Please see the relevant appendices for further advice in this regard.

Inch Cape are applying for a consent duration of 50 years, whereas their existing consent is for a period of 25 years, with all supporting assessments undertaken on this basis. If there is to be a change to the period of consent it will need further discussion as it has particular implications for population modelling in respect of seabird interests and marine mammals – please see **Appendix A(i)** and **Appendix B**.

APPENDIX B

MARINE MAMMALS

Marine mammals are addressed in section 8.3 and Appendix B (HRA screening) of Inch Cape's scoping report. Changes to proposed piling activity and associated underwater noise impacts will be the key issue for the marine mammals reassessment – please see the summary of changes in Table 4-2 (p36) of the scoping report and further discussion in section 8.3.6 and Table 8-24 (p172-176).

In this regard, we welcome Inch Cape's suggestion at the scoping meeting (held 26 May 2017) that they'd find it helpful to hold two further pre-application workshops (post-scoping):

(i) to agree the methodology for noise impact assessment; and

(ii) to discuss initial outputs from the updated noise modelling and agree approaches to investigate any population level effects.

We address these aspects in our advice below.

SPECIES FOR REASSESSMENT

Based on previous advice and discussion at the Forth & Tay offshore wind developers' group (FTOWDG), we advise that reassessment focuses on the following marine mammal interests:

- **Bottlenose dolphin**
  Bottlenose dolphin are a qualifying interest of the Moray Firth Special Area of Conservation (SAC) and we have advised that there is connectivity between Inch Cape and this protected area. The reference population for assessment is that given in guidance from the statutory nature conservation bodies (SNCBs) on management units for cetaceans in UK waters (2015)[1]. For bottlenose dolphin this is the coastal east Scotland population and we advise referring to Cheney *et al* (2013) for the most up-to-date population estimate[2].

- **Harbour seal / Grey seal**
  Harbour seal are a qualifying interest of the Firth of Tay and Eden Estuary SAC and we have advised that there is connectivity between Inch Cape and this protected area. Grey seal are a qualifying interest of the Isle of May SAC and

[1] Guidance on cetacean management units from: http://jncc.defra.gov.uk/pdf/Report_547_webv2.pdf

[2] Cheney, B., Thompson, P.M., Ingram, S.N., Hammond, P.S., Stevick, P.T., Durban, J.W., Culloch, R.M., Elwen, S.H., Mandleberg, l., Janik, V.M., Quick, N.J., Islas-Villanueva, V., Robinson, K.P., Costa, M., Eisfeld, S.M., Walters, A., Phillips, C., Weir, C.R., Evans, P.G.H., Anderwald, P., Reid, R.J., Reid, J.B. & Wilson, B. 2013. Integrating multiple data sources to assess the distribution and abundance of bottlenose dolphins *Tursiops truncatus* in Scottish waters. *Mammal Review*, **43**, 71-88.

Berwickshire and North Northumberland Coast SAC and we have advised that there is connectivity between Inch Cape and these two protected areas.

For each species, the population present in the east coast seal management unit[3] should be used as the reference population for assessment and we take this as equivalent to the SAC population. The most up-to-date population estimates can be obtained from the Special Committee on Seals (SCOS)[16] as discussed in the scoping report (para. 326).

- **Harbour porpoise**
  For harbour porpoise, we advise that the reference population against which to judge impacts is that for the North Sea management unit. We advise using the population estimate in SNCB guidance[14] unless any more up-to-date information becomes available before assessment commences. In addition, the estimate of abundance within SCANS III block R can be used to consider impacts at a regional scale.

- **Minke whale**
  For minke whale, we advise that the reference population against which to judge impacts is that for Celtic and Greater North Seas management unit. We advise using the population estimate in SNCB guidance[14] unless any more up-to-date information becomes available before assessment commences. In addition, the estimate of abundance within SCANS III block R can be used to consider impacts at a regional scale.

- **White beaked dolphin**
  For white beaked dolphin, we advise that the reference population against which to judge is that for Celtic and Greater North Seas management unit. We advise using the population estimate in SNCB guidance[14] unless any more up-to-date information becomes available before assessment commences. In addition, the estimate of abundance within SCANS III block R can be used to consider impacts at a regional scale.

- **European protected species (EPS)**
  All cetaceans (species of whale, dolphin and porpoise) are classed as European protected species (EPS) for which Government has published guidance on licensing requirements[4]. Table 8-20 (p158) of the scoping report lists the range of EPS that could occur in the Forth & Tay region. These will need consideration in relation to EPS licensing requirements and we advise referring to the joint SNCB guidance[14] to determine the reference populations against which to judge favourable conservation status.

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[3] Seal management areas are determined by the Special Committee on Seals (SCOS): http://www.smru.st-andrews.ac.uk/documents/SCOS.pdf

[4] EPS licensing guidance available from: www.gov.scot/Resource/0044/00446679.pdf

KEY IMPACTS TO CONSIDER

We have reviewed Inch Cape's scoping tables in relation to potential impacts on marine mammals arising from the offshore wind farm (Table 8-24) and transmission works (Table 8-25). We are satisfied with what's been done here and agree with the outcomes from this scoping as summarised in Tables 8-29 and 8-30 (p191-192). This identifies that the following impacts are **scoped in** to reassessment:

- **Offshore wind farm piling activity**
  We agree that the greatest potential effect on marine mammals is likely to be disturbance resulting from piling work to install the turbine foundations. In this regard, we request that the relevant underwater noise modelling is updated for the key species of concern – bottlenose dolphin, harbour seal, grey seal, harbour porpoise, minke whale and white beaked dolphin – in order to consider the proposed design changes (see next section).

- **Geophysical survey**
  The applicant plans to address this matter in the reassessment which we consider helpful.

- **Installation of the export cable**
  While we do not anticipate any likely significant effects we note the applicant plans to address the slight alterations to these cable works in the reassessment.

APPROACH TO UNDERWATER NOISE MODELLING

Marine mammal densities

Knowledge of marine mammal densities in the study area (or zone of impact) is required in order to predict the numbers of individuals which might be impacted by underwater noise.

The Inch Cape scoping report identifies most of the key data sources for marine mammal densities for the Forth & Tay area – see Table 8-21 and paragraphs 319 - 326. However, we advise that there is more recent work which may help determine the bottlenose dolphin densities in this area. Quick *et al* (2014)[5] provide an estimate for the Forth & Tay based on data up to 2013, but there may be even more recent information than this.

We also note that Marine Scotland's passive acoustic monitoring network on the Scottish east coast may give some background context in relation to dolphin species

[5] Quick, N.J., Arso, M., Cheney, B., Islas-Villanueva, V., Janik, V.M., Thompson, P.M. & Hammond, P.S. 2014. The east coast of Scotland bottlenose dolphin population: Improving understanding of ecology outside the Moray Firth SAC. Report to the UK Department of Energy and Climate Change's Offshore Energy Strategic Environmental Assessment Programme (14D/086).

and harbour porpoise[6].

Methodology

At the scoping meeting (26 May 2017), Inch Cape indicated that they will work to progress noise impact assessment methodologies, taking accounts of developments in the approach and recommended guidance since the time of previous assessment. We welcome this and are happy to participate in a workshop to discuss and agree the methodological details.

For assessing risk of injury, we recommend that both the instantaneous and cumulative thresholds for permanent threshold shift (PTS) are addressed: the instantaneous PTS threshold will inform the mitigation methods, while the cumulative PTS threshold informs any required assessment of population consequences. In this regard we are happy with the use of single-number thresholds as discussed at the scoping meeting.

For behavioural disturbance, we advise that assessment incorporates a dose-response function (to address the range of individuals' responses to noise), rather than relying on a single-number threshold. We recommend adapting the approach presented in Thompson et al (2013)[7] – based on harbour porpoise data from Brandt et al (2011)[8] – to allow for this more realistic assessment.

POPULATION CONSEQUENCES

Inch Cape suggest a further workshop to discuss the initial noise modelling outputs once these are available. Again we welcome this and are happy to participate. We think it should be possible to review these outputs for the revised proposal and broadly compare them against those for the original application. Despite differences in methodology, each form of underwater noise modelling should give the predicted number of animals suffering hearing loss (permanent threshold shift, PTS) and the predicted number of animals disturbed. So a broad comparison should be possible.

This will inform whether or not the revised predictions are any worse than those previously assessed. If not, we will not require any further consideration of population consequences – these were already assessed as acceptable for the consented development. However, in the meantime, we have no issues if Inch Cape

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6 Further details on the East Coast Marine Mammal Acoustic Survey (ECOMMAS) are available from: http://www.gov.scot/Resource/0050/00507404.pdf

7 Thompson, P.M., Hastie, G.D., Nedwell, J., Barham, R., Brookes, K.L., Cordes, L.S., Bailey, H. & McLean, N. (2013) Framework for assessing impacts of pile-driving noise from offshore wind farm construction on a harbour seal population. Environmental Impact Assessment Review, 43, 73–85.

8 Brandt, M., Diederichs, A., Betke, K. & Nehls, G. (2011) Responses of harbour porpoises to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea. Marine Ecology Progress Series, 421, 205–216.

wish to further develop their approach to population modelling, on the contingency that it may be required if the piling impacts prove greater than what was previously assessed.

CUMULATIVE IMPACTS

Any requirements for cumulative impact assessment can be discussed at the second workshop proposed by Inch Cape. This will only be necessary if the piling (underwater noise) impacts are greater than previously assessed. However, in the meantime, we have no issues if Inch Cape wish to further develop their approach to address cumulative impacts. As a first step, we recommend they review the available marine mammals assessment for Aberdeen Harbour expansion works[9].

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[9] Appropriate assessment for Aberdeen Harbour expansion works, see p40 onwards for the marine mammal assessment: http://www.gov.scot/Resource/0050/00509289.pdf

Appendix II – Advice received from MSS

Marine Scotland Science
Inch Cape Scoping
Marine Mammals
31st July 2017

MSS have had the opportunity to review the scoping document provided by Inch Cape, to attend a meeting with the developer and their consultants, and to review the advice provided by SNH on the scoping report. MSS also had the opportunity to attend a workshop organised be Inch Cape, which took place on 27th July 2017, during which several important technical points were discussed, and which will also influence some of the details provided in the scoping opinion.

SNH have covered most of the issues that MSS would consider to be important and so our advice covers whether we agree with SNH's position, as well as raising other points for consideration, and drawing upon the discussions at the workshop on 27th July.

Species to be included in EIA and HRA
We agree with SNH that bottlenose dolphin, harbour seal, grey seal, harbour porpoise, minke whale and white beaked dolphin should be included in the EIA.

We also agree that there is connectivity between the project and the Moray Firth SAC for bottlenose dolphins, the Firth of Tay and Eden Estuary SAC for harbour seals and the Isle of May SAC for grey seals. These species and sites should be included in the HRA.

Management units, population sizes and distribution information
Bottlenose dolphin (*Tursiops truncatus*)
We agree with the management unit and population size recommended by SNH for bottlenose dolphin. During the workshop on 27th July there was discussion regarding distribution for bottlenose dolphin. An approach was agreed which provided an updated version of the distribution used in the original ES and MSS support this. The text of the notes from the workshop states:

> "*Agreement reached to assume, as per the assessment for the Original Development, the reference bottlenose dolphin population (195 individuals) should be split 50:50 between the east coast and the Moray Firth, and that 98 dolphins would be present at the time of piling activities off the east coast.*
> *Agreement reached that the 98 individuals assumed to be present off the east coast should be spread evenly across the area inside the 20 m depth contour as defined in the Original Development EIA, excluding areas in the*

Forth and Inner Tay where bottlenose dolphin are known not to be present (shaded red in Figure 1). These 98 animals will be spread evenly across the remaining grid cells (thereby increasing the density per grid cell).”

Harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*)

We agree with SNH that the Scottish seal management areas should be used for grey and harbour seals, and advise that the 2016 population sizes will be available in the SCOS 2017 report (which will be available in draft in September 2017). Until that report is published, we recommend using the 2015 population sizes which are published in the SCOS 2016 report. SCOS reports are available from http://www.smru.st-andrews.ac.uk/research-policy/scos/

We advise that the seal usage maps produced by SMRU should be used for distribution data on both species. These are currently available directly from SMRU, but will be updated and made available on NMPI in the next few months.

Harbour porpoise (*Phocoena phocoena*)

We agree with SNH regarding the management unit for harbour porpoise, which is based on the IAMMWG (2015) guidance. The relevant unit is the North Sea.
For an abundance estimate for this management unit, we advise that the SCANS-III surveys are the most up to date and that could usefully be used. Should this not be available, we agree with SNH that the estimate from the IAMMWG (2015) guidance can be used. We also agree with SNH that the SCANS-III survey results for block R can be used to provide a regional abundance estimate for use within the assessment. Should further information from SCANS-III become available in time to be used in the ES, we would recommend making reference to this.

Distribution data on harbour porpoise can be taken from the original ES, unless other more recently published data are available.

Minke whale (*Balaenoptera acutorostrata*)

We agree with SNH that the management unit is the Celtic and Greater North Seas as noted in IAMMWG (2015). We also agree with SNH regarding abundance estimates for minke whale, although, as with harbour porpoise, we advise that it may be feasible to incorporate information from the SCANS-III surveys.

Distribution data on minke whale can be taken from the original ES, unless other more recently published data are available.

White beaked dolphin (*Lagenorhynchus albirostris*)

We agree with SNH that the management unit is the Celtic and Greater North Seas as noted in IAMMWG (2015). We also agree with SNH regarding abundance estimates for minke whale, although, as with harbour porpoise, we advise that it may be feasible to incorporate information from the SCANS-III surveys.

Distribution data on white-beaked dolphin can be taken from the original ES, unless other more recently published data are available.

Impacts for assessment

MSS agree with the developer and SNH that the assessment will need to cover the impact of increasing the power of the hammer used to install the piled foundations. We also agree that since the other potential impacts to marine mammals are the same, or reduced, compared with the original ES, that this is the only area that will require consideration. This will involve updating assessments from the previous ES and we would advise that refining the design envelope to account for smaller number of turbines that the developer now intends to install, and the reduction in construction time as a result, will be likely to decrease the overall impact. This is likely to be of benefit to the developer.

MSS understands that the developer may seek to include geophysical surveys in the ES. We agree with SNH that this would be helpful, and consider that it will allow for better consideration of the whole project. However, we consider that it may be necessary on occasion for the developer to undertake geophysical surveys prior to a licence or consent being granted (for example, to inform consideration of such a licence or consent). We would therefore recommend that MS-LOT does not rule out the potential for geophysical surveys to be licensed through a stand-alone process.

Assessments to be undertaken

Underwater noise modelling and assessment

The maximum hammer energy proposed to be used has increased since the previous ES. We therefore advise that it will be necessary to update the noise propagation modelling to account for this. We agree with SNH that both instantaneous and cumulative PTS thresholds should be presented, modelled for each of the species noted above. We also agree with SNH that the developer should provide the total number of individuals from each species that may suffer PTS and the number that may be displaced through disturbance.

During the workshop there was discussion about including the period in which ADDs are utilised to move mammals away from the piling site, in the calculations of cumulative PTS. MSS would like to clarify that since ADDs are a mitigation tool, it may be more appropriate to undertake the assessment process without them, then include them as a mitigation at a later stage (as would commonly be undertaken in an EIA). Such an assessment would also provide good evidence regarding the efficacy of the proposed mitigation.

Thresholds for PTS are an area which has developed since the original ES. MSS recommend that the developer presents PTS thresholds from the Southall et al. (2007) review, since these were used in the original ES, to allow comparability. We

also advise that the 2016 NOAA criteria are the most up to date scientific information. However, we note that the US Government has decided to review these criteria (refer to http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm for more information). MSS recommend that both sets of thresholds are considered in the ES, to ensure that the best available science is incorporated, and also to allow comparability with the previous ES.

MSS agree that a dose response curve should be used to determine the proportion of animals likely to be disturbed sufficiently to displace them by the piling noise. We note that both SNH and the developer have suggested using the dose response curve used in the original ES, which was based on harbour porpoise responses to pile driving at the Horns Rev II development. MSS advise that this was used in the previous assessment in the absence of any other data, and that there are some potential issues with this limited data set. Our concerns relate to the small sample size and also to the very shallow water depths at the study site which may have an effect on noise propagation. Other data now exist, from pile driving studies (e.g. Dähne et al., 2013; Brandt et al., 2016), as well as from other impulsive sources (e.g. Thompson et al., 2013), and we would encourage the developer to make use of these where possible. MSS consider that in the absence of similar data for species other than harbour porpoise, that it is acceptable to use the same dose-response function for all species. We would, however, flag that this is an important knowledge gap.

Species impact assessment

For bottlenose dolphin, it will be necessary to assess the impacts of the development alone on the East Scotland management unit population, as well as cumulatively with other developments that may impact on the same population. MSS advice here differs from that of SNH. SNH consider that if the impact of the project alone is the same or less than the impact of the original project, that there is not a requirement for a cumulative assessment. MSS are concerned that this strategy may compromise the Appropriate Assessment that will be conducted in relation to the Moray Firth SAC.

MSS agree with the list of projects to be included in a cumulative assessment that is provided in the Scoping Report, but would agree with SNH that Aberdeen Harbour Expansion Project should also be included.

For harbour porpoise, minke whale and white beaked dolphin, discussion at the workshop on 27th July concluded that the developer should assess whether the new parameters of the development result in any greater impact to these species. If the new proposals do not result in increased impact, then no further assessment is required. MSS agree with this strategy, but also consider that there will be a need to put any impacts to these species into a population context, for the purposes of EPS licensing. While the EPS licence will not be part of the EIA process, we recommend

that the need for this is recognised through the process, and that information is presented in a manner which will readily translate into the EPS process.

For harbour seal and grey seal, MSS are content to adopt the approach outlined above for harbour porpoise, minke whale and white-beaked dolphin, whereby further assessment is only carried out if the effects are found to be greater than in the previous ES. However, the developer should note that this will not remove the need for information to be provided in an HRA to inform the Appropriate Assessment for the Firth of Tay and Eden Estuary SAC and the Isle of May SAC.

Population level effect assessment

For species where population level impact assessments are undertaken, MSS recommend using the Interim Population Consequences of Disturbance (iPCOD) framework. The software for this model is available on the Marine Scotland website, along with a report which suggests appropriate parameters for each species. MSS note that a new version of the software will shortly be available (also on the Marine Scotland website), which will allow for the use of a dose-response function for the displacement of animals as a result of exposure to noise.

MSS note the interim nature of the iPCOD framework. This is because there are currently insufficient data on the consequences of disturbance to individual animals, and hence to populations. MSS flag this as an important knowledge gap. The iPCOD framework utilises formal expert elicitation to produce statistical distributions of responses to disturbance, and to estimate the effects on vital rates of individuals (e.g. survival probability, reproductive rate), including the uncertainty in these predictions. An alternative framework, the DEPONS model, is available and uses measured responses of tagged harbour porpoise to impulsive noise sources to understand the effects of disturbance. However, this framework is currently only parameterised for harbour porpoise and so does not represent a viable assessment method for this development.

In the previous ES, a Population Viability Analysis (PVA) was used for population level assessments. This also used expert opinion on the responses to disturbance and their effect to vital rates. However, this was not a formally elicited expert opinion and did not include uncertainty around the responses or impacts to individuals. The framework for developing this model is also unsophisticated and cannot accommodate scenarios with variable numbers of developments in subsequent years (see advice on the Aberdeen Harbour Expansion Project Appropriate Assessment for further details). MSS recommend iPCOD over this PVA for these reasons.

In providing iPCOD outputs, MSS request that the ES (or an appendix) provides a comprehensive list of the parameters input. This should be sufficiently detailed such that MSS staff would be able to replicate the analysis. As a minimum this will include

the piling schedule, the demographic parameters, and starting population size. MSS request that the developer provides a copy of the code used to run the model and any QA/QC outputs that the software produces.

References

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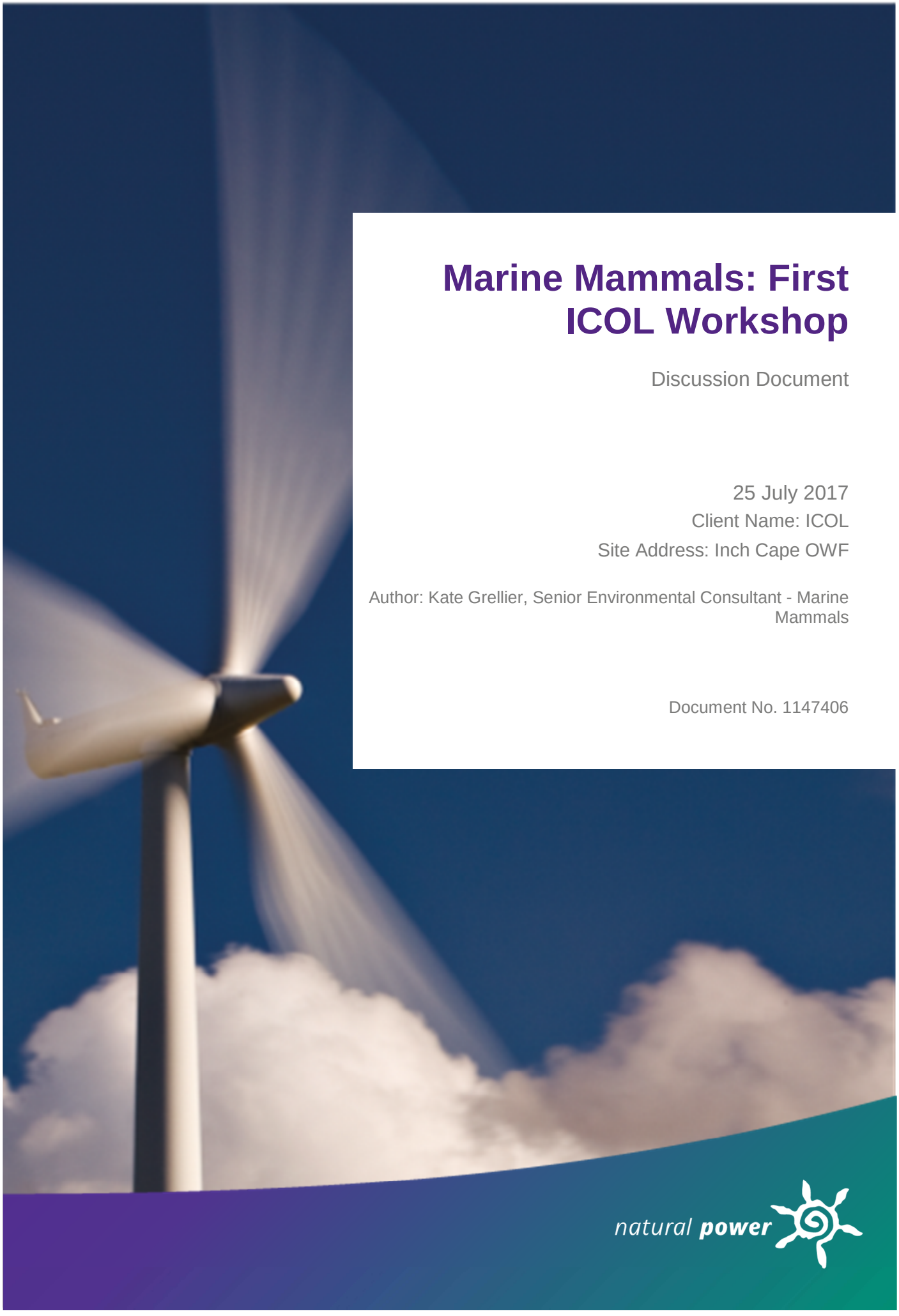

Marine Mammals: First ICOL Workshop

Discussion Document

25 July 2017

Client Name: ICOL

Site Address: Inch Cape OWF

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natural power

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Contents

Introduction and Aims

The aim of the first Inch Cape Offshore Ltd (ICOL) marine mammal workshop on the 27th July 2017 is to reach agreement on issues relating to the baseline and impact assessment methodology. These include (but are not limited to):

1. Bottlenose dolphin baseline update;
2. Reference populations for minke whale, white-beaked dolphin and harbour porpoise;
3. PTS onset: Modelling;
4. PTS onset: Thresholds;
5. Piling noise properties;
6. Calculating displacement;
7. Using worst case vs. most likely for impact assessment (including engineering requirements); and
8. Any other matters including:
    a. assessing the potential use of Acoustic Deterrent Devices (ADDs) for mitigation purposes within the EIA; and
    b. a discussion on the availability of interim PCoD models).

The purpose of this document is to inform these discussions. It should be read in conjunction with the scoping report (which can be downloaded from http://www.gov.scot/Topics/marine/Licensing/marine/scoping/InchCape/InchCapeScoping2017).

1. Bottlenose dolphin baseline update

Following discussions with Barbara Cheney of the University of Aberdeen's Lighthouse Field Station, Cheney *et al*. (2013)[1] remains the current best estimate of the size of the Scottish east coast bottlenose dolphin population at 195 individuals (95% highest posterior density interval: 162-253). This estimate was made using data collected in 2006.

1.1. Abundance of bottlenose dolphins off the east coast

For the Original Project ES, the bottlenose dolphin population (195 individuals; Cheney *et al*., 2013) was assumed to be split 50:50 between the east coast (from Rattray Head south) and the Moray Firth (Cape Wrath to Rattray Head).

Proposed options for the Revised Project ES are as follows:

Option 1: As per the Original Project ES

» Assume the population (195 individuals) is split 50:50 between the east coast and the Moray Firth and that 98 dolphins are present off the east coast

Option 2: Use the number of individuals identified in a given year

The total number of individuals photo-identified in 2015 by researchers carrying out surveys in the Moray Firth and off St Andrews was 202 (the St Andrews data for 2016 were not available at the time of writing). 98 dolphins were identified off St Andrews and 111 dolphins were identified in the Moray Firth. Seven individuals were identified at both locations.

» Assume that 91-98 dolphins are present off the east coast (using 98 as the worst case)

Option 3: Use local abundance estimates

Abundance estimates for the Tayside and Fife area obtained annually for 2009 to 2013 (Quick *et al*., 2014[2]) show a total number of animals using the Tayside and Fife area of between 71 and 91 individuals (Table 1.1).

Abundance estimates for the area between Aberdeen and the Firth of Forth for 2012 and 2013 were 118 and 119 individuals respectively (Table 1.1; Quick *et al*., 2014).

» (Take the worst case and) Assume that 119 dolphins are present off the east coast

[1] Cheney et al. 2013. Integrating multiple data sources to assess the distribution and abundance of bottlenose dolphins Tursiops truncatus in Scottish waters. Mammal Review 43: 71-88.

[2] Quick et al. 2014. The east coast of Scotland bottlenose dolphin population: Improving understanding of ecology outside the Moray Firth SAC. DECC SEA programme Report 14D/086.

Table 1.1: Abundance estimates for different portions of the east coast bottlenose dolphin population outside the Moray Firth SAC

Year	Tayside and Fife	Aberdeen to the Firth of Forth
2009	84 (75-94)	
2010	91 (82-100)	
2011	81 (74-89)	
2012	71 (63-81)	118 (98-143)
2013	89 (72-110)	119 (101-140)

Source: Quick et al. (2014)

1.2. Distribution of bottlenose dolphins off the east coast

For the Original Project ES, the 20 m depth contour was used to differentiate between the 'coastal strip' (where bottlenose dolphins tend to be encountered) and the 'non-coastal strip' (where bottlenose dolphins tend not to be encountered). The choice of the 20 m depth contour as this differentiation was informed by data from the south side of the Moray Firth where > 95 per cent of sightings made were within the 20 m depth contour (Culloch and Robinson, 2008[3]; Robinson *et al*., 2007[4]). The 98 individuals assumed to be present on the east coast (see section 1.1) were spread evenly across the area inside the 20 m depth contour. Zero density was used outwith the 20 m depth contour (the SCANS II Block V density estimate, which could have been applied to area outwith the coastal strip, is made up of just one bottlenose dolphin sighting which was inside the 20 m depth contour in the Firth of Forth; SCANS II, 2006).

Proposed options for the Revised Project ES are as follows:

[3] Culloch, R.M. and Robinson, K.P. 2008. Bottlenose dolphins using coastal regions adjacent to a Special Area of Conservation in north-east Scotland. Journal of the Marine Biological Association of the UK 88(6): 1237-1243.

[4] Robinson, K.P., Baumgartner, N., Eisfeld, S.M., Clark, N.M., Culloch, R.M., Haskins, G.N., Zapponi, L., Whales, A.R., Weare, J.S. and Tetley, M.J. 2007. The summer distribution and occurrence of cetaceans in the coastal waters of the outer southern Moray Firth in northeast Scotland (UK). Lutra 50(1): 19-30.

Option 1: As per the Original Project ES

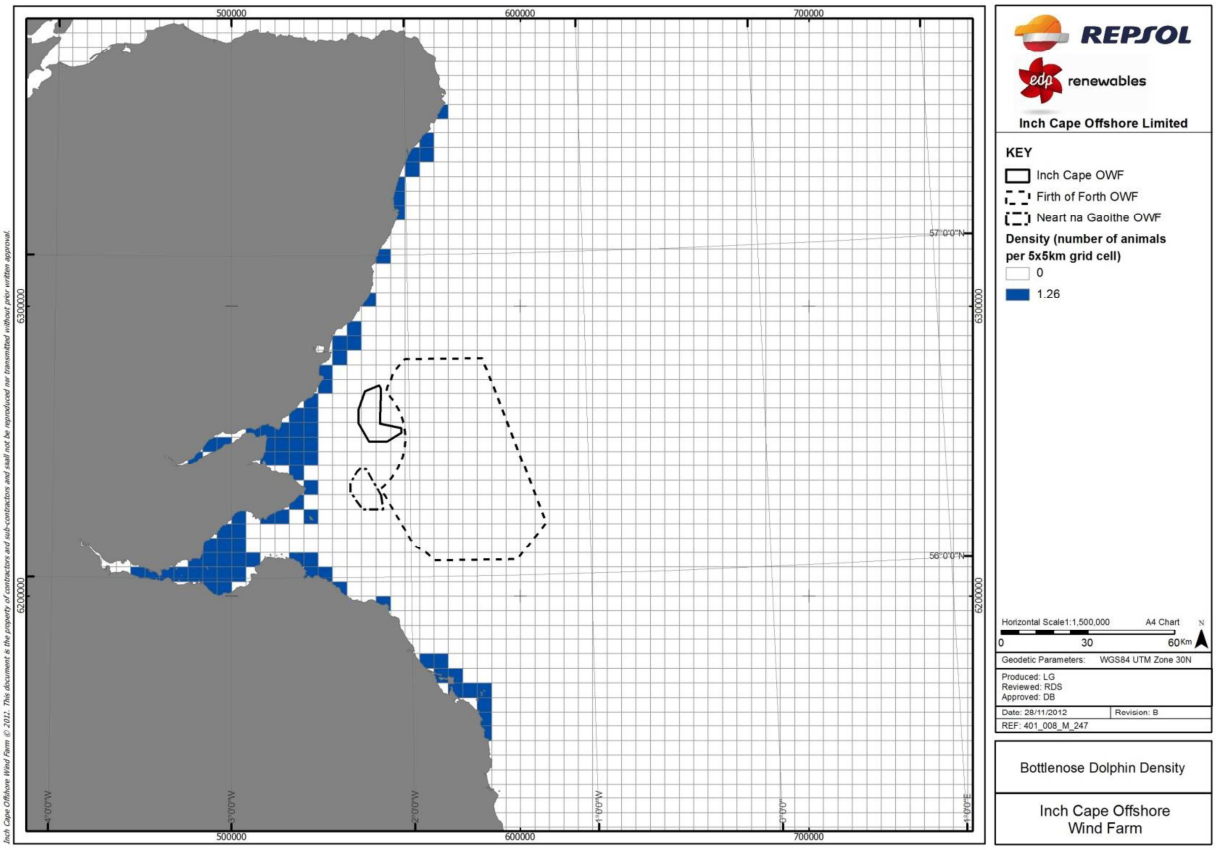

Figure 1.1: Predicted dolphin distribution as per the Original Project ES (Option 1)

Option 2: Draw information from MSS' ECOMMAS C-POD data

Marine Scotland Science (MSS) has kindly given ICOL access to summary data from C-PODs deployed as part of their ECOMMAS study in order to assess whether revision of the baseline distribution for bottlenose dolphins off the east coast is required.

The proportion of days on which dolphins were detected during each year of the study is shown in Figure 1.2 below. It is not currently possible to discriminate between echolocation clicks from different dolphin species (such as bottlenose, white-beaked, common and Risso's dolphin) therefore it has been assumed that all detections were bottlenose dolphins. This represents a worst case.

Dolphins were detected at each of the thirty deployment locations at some point during the first four years of the study. The proportion of days with dolphin detections was almost always greatest at the deployment location nearest to shore for each of the ten locations. C-PODs which logged the greatest proportion of days with dolphin detections were located at Cromarty in each year. Other apparent 'hotspots' (defined here as locations at which the proportion of days with dolphin detections was greater than 0.15[5]) occurred at the following locations in each year (**those outside the Moray Firth are shown in bold**):

[5] i.e. 15% of days with dolphin detections throughout the year. This could be thought to equate to approximately one day a week.

2013: Latheron, Cromarty, Spey Bay, **Cruden Bay**, **Stonehaven, Arbroath, St Andrews**

2014: Cromarty, Spey Bay, Fraserburgh, **Cruden Bay**

2015: Latheron, Cromarty, **Cruden Bay**, **Stonehaven**, **Arbroath**

2016: Latheron, Cromarty, **Stonehaven**, **Arbroath**, **St Andrews**

The distance of each C-POD deployment location from shore is shown in Table 1.2 below. For information, 12 nm is equivalent to 22.224 km.

Table 1.2: The average distance of each C-POD deployment location from shore

Location	Average distance from shore (to the nearest 1/10 of a km)		
	"5"	"10"	"15"
Latheron	1.5	8.1	14.1
Helmsdale	2.4	10.5	15.8
Cromarty	0.3	4.7	7.5
Spey Bay	2.1	7.7	12.4
Fraserburgh	1.2	7.8	16.4
Cruden Bay	2	6.6	12.9
Stonehaven	1	4.6	9
Arbroath	3.7	12.3	19
St Andrews	1.4	5.8	9.6
St Abbs	1.1	4.8	13.5

Source: ECOMMAS data

Source: MSS' ECOMMAS C-POD data

Figure 1.2: MSS' ECOMMAS C-POD data: Proportion of days with dolphin detections

Questions for discussion:

1. Are we better to assume an uneven distribution of dolphins along the coastal strip?
2. If so, are we happy that the 'hotspots' are Latheron, Cromarty, Spey Bay, **Cruden Bay**, **Stonehaven**, **Arbroath**, and **St Andrews** (i.e. locations at which the proportion of days with dolphin detections was greater than 0.15 in two or more years).
3. If so, what dimensions should these 'hotspots' take? The grid cells used in the original ES were 5 x 5 km. Is this still appropriate? If we were to use this resolution for the revised assessment, how many grid cells should the hot-spots cover?
4. Should we assume that there are no dolphins between these hotspots?

Option 3: Assume 195 dolphins (the abundance estimate for the Coastal East Scotland Management Unit; IAMMWG, 2015) are spread evenly from the coast out to 12 nm across the Coastal East Scotland Management Unit

Option 4: Use information from Quick *et al*. (2014)

Using data from 1997-2013, Quick et al. (2014) described the distribution of bottlenose dolphins along the east coast of Scotland and identified high use areas. They found that, although survey effort and encounters varied by year, the majority of dolphin encounters were recorded within the Tay estuary. Encounters were also common in St Andrews Bay, the coastal waters between Arbroath and Montrose, and around Aberdeen. Most of the encounters with bottlenose dolphins occurred in waters less than 30 m deep, generally in waters between 2 and 20 m. The dolphins were encountered close to the coast, generally within 2 km from the coast line, except in St Andrews Bay and the entrance to the Tay Estuary where encounters also occurred further out.

Questions with respect to this option are similar to those listed under Option 2.

In addition, can the information contained within the Quick *et al*. (2014) paper be used to inform the extents of the hot-spots to be modelled in Option 2?

2. Reference populations for minke whale, white-beaked dolphin and harbour porpoise

We understand that stakeholders are happy that abundance estimates associated with (i.e. at the scale of) current Management Units for bottlenose dolphin, grey seal and harbour seal are used as reference populations (Table 2.1). SMRU-derived multipliers have been used to convert counts of seals to proposed reference populations for both species (Table 2.1).

For the purposes of HRA, the most recent August count of harbour seals in the Firth of Tay and Eden Estuary SAC is 60 (Duck *et al*., 2016) [6].

Table 2.1: Proposed reference population parameters for bottlenose dolphin, grey seal and harbour seal

Species	Management Unit	Abundance of animals in Management Unit	Proposed reference population abundance
Bottlenose dolphin	Coastal East Scotland	195 (162-253)	195 (162-253)
Grey seal	East Coast	The most recent August count of grey seals in the East Scotland Management Unit = 2,296 (Duck *et al*., 2016)	9,607 (8,028-11,958) [7]
Harbour seal	East Coast	The most recent August count of harbour seals in the East Scotland Management Unit = 224 (Duck *et al*., 2016)	311 (255-415) [8]

Source: IAMMWG (2015); IAMMWG (2013)

We understand that using the abundance estimates associated with (i.e. at the scale of) current Management Units as reference populations is not deemed to be a suitable approach for those species which have large Management Units (i.e. minke whale, white-beaked dolphin and harbour porpoise; Table 2.2). Indeed, we deem this to be impractical because of the questions it raises with respect to the range for inclusion of cumulative projects.

» Point for discussion: Suitable reference populations for minke whale, white-beaked dolphin and harbour porpoise

Potential options may include:

1. Use the abundance of animals in the UK portion of the Management Units (Table 2.2)
2. Use the abundance of animals estimated to occur within an agreed portion of the Management Unit i.e. within a set radius of Inch Cape. N.B. In order to be able to do this the surface area of the Management

[6] Duck, C.D., Morris, C.D. and Thompson, D. 2016. The status of UK harbour seal populations in 2015, including summer counts of grey seals. SCOS Briefing Paper 16/04.

[7] Calculated using the revised value for this scalar (0.239 (0.192-0.286); Russell et al., 2016 – SCOS Briefing Paper 16/03) in order to account for animals which were at sea when the count was made.

[8] Calculated in order to account for animals which were at sea when the count was made (Lonergan et al., 2011 – SCOS Briefing Paper 11/08). The value of this scalar (0.72 (0.54-0.88)) has not been revised.

Unit would be required so that density can be calculated (although this could be estimated). Alternatively the species-specific density estimates from SCANS III could be used.

3. Would using the Management Unit area for a species that is considered to be relevant be an option? Would, for example, the northern and southern extents of the East Coast seal MU be appropriate? What would the seaward extent be? This is not defined in IAMMWG (2013).

Table 2.2: Potential reference population parameters for species with large Management Units (minke whale, white-beaked dolphin and harbour porpoise)

Species	Management Unit	Abundance of animals in Management Unit	Abundance of animals in UK portion of Management Unit	Proposed reference population abundance
Minke whale	Celtic and Greater North Seas	23,528 (13,989-39,572)	12,295 (7,176-21,066)	?
White-beaked dolphin	Celtic and Greater North Seas	15,895 (9,107-27,743)	11,694 (6,578-20,790)	?
Harbour porpoise	North Sea	227,298 (176,360-292,948)	110,433 (80,866-150,811)	?

Source: IAMMWG (2015)

3. PTS onset: Modelling

ICOL will be using the Cefas noise propagation model which has been validated and optimised using field data of pile driving and bespoke noise propagation measurements undertaken with a seismic source in the North Sea.

Tasks/points for discussion:

- Agree assessment methodology with respect to PTS onset modelling (stationary animal verses fleeing)
- If a fleeing animal model is to be used, should an initial startle response be incorporated within the PTS onset modelling? (Literature values for startle flee speeds and distances are shown in Table 3.1 below (as are average swim speeds)). And if so, what duration of startle response is considered appropriate?
  - Should the initial startle response swim speed be (in the region of) 1.5 m/s?
  - Should the initial startle response duration be (in the region of) 1 hour? (pile duration is likely to be 2-4 hours.) At a speed of 1.5 m/s this equates to approximately 5.4 km.
  - Should the average, non-startle response, swim speed be (in the region of) 1 m/s?
  - Should these speeds be the same for (1) each species? (2) cetaceans and seals?

Table 3.1: Literature values for flee and average swim speeds for different species

Species	Stimulus	Flee Speed	Distance	Duration	Reference	Normal/average swim speed	Reference
Minke whale	Predatory attacks by killer whales (in each case where the initial response of the minke whale was observed, the animal fled at high speed from the killer whales, usually on a highly directional course towards open water)	Such chases often reached speeds of 25–30 km/h (equates to 6.9-8.3 m/s)	15 km or more	In five predatory interactions, the killer whales abandoned the chase after pursuing the fleeing minke whale for 20 min to 1 hour	Ford and Reeves (2008)	5.7-8.3 km/h (equates to 1.6-2.3 m/s)	Rankin and Barlow (2005) and Stern (1992); not seen cited in Ford et al. (2008)
Bottlenose dolphin						6.1 m per s	Wursig and Wursig (1979)[9]
Bottlenose dolphin						Average = 0.8-2 m/s Max speed = 8 m/s	Goodson and Mayo (1995), not seen cited in Harzen (2002)[10] – theodolite tracking
Bottlenose dolphin						1.4-2.7 km/h (equates to 0.4-0.75 m/s)	Tanaka (1987) not seen cited in Connor (2000)11 – satellite tags

[9] Wursig, B. and Wursig, M. 1979. Behaviour and ecology of the bottlenose dolphin in the South Atlantic. Fishery Bulletin 77(2): 399-412.

[10] Harzen, S. 2002. Use of an electronic theodolite in the study of movements of the bottlenose dolphin in the Sado Estuary, Portugal. Aquatic Mammals 28(3): 251-260.

[11] Connor, R.C. 2000. Group living in whales and dolphins. Chapter 8 of Cetacean Societies: Field studies of dolphins and whales. Edited by Mann, J. et al. The University of Chicago Press.

Species	Stimulus	Flee Speed	Distance	Duration	Reference	Normal/average swim speed	Reference
Indo-Pacific hump-backed dolphin (Sousa chinensis) – to inform/use as a proxy for bottlenose dolphin?	Pile driving	Average speed = 2.3 m/s		During active pile driving	Wursig, Greene and Jefferson (2000)[12]	1.1 m/s	
White-beaked dolphin							
Harbour porpoise					Nabe-Neilsen_Effects of noise and by-catch on a Danish harbour porpoise pop_Ecological Modelling 2014 272: 242-251	Up to at least 30–40 km per day for several days (equates to 0.3-0.5 m/s)	J. Teilmann unpubl. data cited in Nabe-Nielsen et al. (2014)
Harbour porpoise						5.3 km per h (equates to 1.5 m/s)	Teilman (2000) not seen cited in Sveegaard et al. (2011)
Harbour porpoise	Fastest speed recorded	4.3 m per s			Otani et al. (2000)	0.9 m per s	Otani et al. (2000)
Grey seal						0.87 to 1.16 m/s for sustained travel (long trips) 0.92 m/s for a male	McConnell et al. (1999)[13] – satellite tags

[12] Wursig, B., Greene, Jr., C.R. and Jefferson, T.A. 2000. Development of an air bubble curtain to reduce underwater noise of percussive piling. Marine Environmental Research 49: 79-93.

[13] McConnell, B.J., Fedak, M.A., Lovell, P. and Hammond, P.S. 1999. Movements and foraging areas of grey seals in the North Sea. Journal of Applied Ecology 36: 573-590.

Species	Stimulus	Flee Speed	Distance	Duration	Reference	Normal/average swim speed	Reference
						seal with meandering tracks	
Harbour seal	Maximum travel speed	2 m per s			McClintock at al. (2013) not seen cited in Russell et al. (2016)		

4. PTS onset: Thresholds

Noise exposure thresholds are indicative noise levels at which certain effects are predicted.

The Southall *et al*. (2007)[14] PTS onset thresholds for pulsed noise (of 198 dB re 1 µPa^2-s for cetaceans and 186 dB re 1 µPa^2-s for seals) were used in the Original Project ES.

Subsequent work (King, 2013)[15] undertaken on behalf of the Department for Energy and Climate Change (DECC) (on the risk of noise disturbance to marine mammals from sub-bottom profile survey activities) reviewed empirical data on noise effects and revised the Southall *et al*. (2007) impact criteria accordingly. In particular, King (2013) found that harbour porpoise appeared to be more sensitive to sound exposure than Southall *et al*. (2007) previously thought, while bottlenose dolphins were likely to be less sensitive. As such, King (2013) used the species dependant SEL range of 177-198 dB re 1 µPa^2-s for PTS onset (and 162–183 dB re 1 µPa^2-s for TTS onset) to indicate significant impacts (for pulsed sound).
More recently, the US National Marine Fisheries Service (NMFS) issued guidance for assessing the effects of anthropogenic sound on marine mammal hearing (NOAA, 2016)[16]. These thresholds, which are different to Southall *et al*.'s (the frequency weighting bands for each hearing group have been refined, and subsequently narrowed), are presented below in Table 4.1 and

[14] Southall et al. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33(4): 411-521.

[15] King, S.L. 2013. Seismic survey licensing: Sub-bottom profile surveys. SMRU Marine Ltd report number SMRUL-DEC_2013-024. September 2013 (unpublished).

[16] NOAA. 2016. Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing: Underwater acoustic thresholds for onset of permanent and temporary threshold shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

Table 4.2.

Table 4.1: Proposed auditory injury criteria for pulsed sound: Sound Pressure Level (SPL; dB re 1 µPa) - used to assess the potential for injury to occur instantaneously. PTS (TTS) onset thresholds are shown. No data are presented for King (2013) because they did not use SPL as a metric

Functional hearing group	Southall *et al*. (2007)	NOAA (2016)
Low frequency cetaceans (minke whale)	230 (224)	219 (213)
Mid frequency cetaceans (bottlenose dolphin, white-beaked dolphin)	230 (224)	230 (224)
High frequency cetaceans (harbour porpoise)	230 (224)	202 (196)
Pinnipeds in water (grey seal, harbour seal)	218 (212)	218 (212)

Table 4.2: Proposed auditory injury criteria for pulsed sound: Sound Exposure Level (SEL; dB re 1 µPa^2-s) – used to assess whether the total energy that an animal receives as it flees the area will cumulatively lead to an effect over the period of time assessed (24 h). PTS (TTS) onset thresholds are shown

Functional hearing group	Southall *et al*. (2007)	King (2013)	NOAA (2016)
Low frequency cetaceans (minke whale)	198 (183)	-	183 (168)
Mid frequency cetaceans (bottlenose dolphin, white-beaked dolphin)	198 (183)	198 (183)	185 (170)
High frequency cetaceans (harbour porpoise)	198 (183)	~177 (162-171)	155 (140)
Pinnipeds in water (grey seal, harbour seal)	186 (171)	-	185 (170)

We are seeking agreement on the thresholds which should be used to assess the potential for PTS onset as a consequence of noise from (1) pile driving and (2) use of geophysical survey systems during construction of the Revised Project.

5. Piling noise properties

Discussion point: Whether we can accommodate the NMFS guidelines with respect to whether impulsive noise changes into noise with properties more similar to a continuous noise source in the noise modelling.

In a presentation at the DECC Strategic Environmental Assessment workshop in London in 2016, Gordon Hastie presented a discussion paper on the changes in the characteristics of impulsive noise waveforms as they propagate away from the noise source. Increased rates of absorption of the higher frequency elements of the waveform by the environment than the lower frequency elements, and the different speed at which the frequencies travelled through the water column, meant the noise profile of piling noise changed from that characteristic of impulsive noise to that of continuous noise over distance. From material presented within the NOAA[17] guidelines, Gordon suggested that it might be appropriate to consider a distance of approximately 6 km from the noise source as the point at which this transition took place.

From Farcas *et al*. (2016)[18]: Two further elements of noise modelling warrant further research in order to reduce the uncertainty associated with underwater noise assessments. First is the application of modelling techniques to predict the propagation of sound in the time domain. Current models used in EIAs are based on modelling the overall sound energy as it spreads away from the noise source. However, the risk of acute auditory injury is closely linked with the temporal structure of sound, and in particular the sharpness of peaks in sound pressure caused by impulsive sources (e.g. impact pile driving or seismic airguns). As these pulses propagate away from the source, the sharp peaks in sound level become more dispersed, and present less of a risk of auditory injury relative to the sound energy contained within them. Techniques developed for time-domain modelling of sonar signals could be applied to this problem to better understand the risk associated with impulsive noise sources.

ICOL would like to discuss the potential to include this alteration in the sound wave properties within the modelling of potential PTS contours, and thus calculation of the number of potentially impacted animals.

[17] NOAA. 2016. Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing: Underwater acoustic thresholds for onset of permanent and temporary threshold shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

[18] Farcas et al. 2016. Underwater noise modelling for environmental impact assessment. Environmental Impact Assessment Review 57: 114-122.

6. Calculating displacement

Due to the development in noise modelling techniques that have occurred since the submission of the ES for the Original Development, ICOL are not proposing to use the Subacoustech Environmental Ltd. model within the assessment of effects for the Revised Project. It will therefore not be possible to utilise the dB_{ht} (species) model to calculate potential displacement for species from the source of piling noise.

It is recognised that estimating to number of animals that have the potential to be disturbed, and thus be potentially displaced from feeding grounds, by the noise produced by piling will still be required. In addition, ICOL are proposing to utilise Interim PCoD to explore the consequences of predicted effects on the viability of Natura designated species. Inputs for Interim PCoD include the number of animals estimated to be displaced and for what duration.

Methods for calculating the number of each species with the potential to be disturbed / displaced during the piling include:

1. Re-interpretation of the data from the harbour porpoise occurrence at locations at distances from Horns Rev II during the piling operations (as presented in Thompson *et al.* 2013)[19].

Within the paper, the authors presented modelled received noise (dB_{ht} (harbour porpoise)) from piling operations at Horns Rev II against porpoise occurrence (mean porpoise positive minutes from C-PODs). This relationship could be re-examined against modelled dB re 1 µPa, and a displacement curve of best fit calculated as in Figure 5 of the Thompson *et al*. 2013 paper. Modelled dB re 1 µPa contours (in 5 dB re 1 µPa increments) could then be calculated for the piling profiles for the Revised Inch Cape Design Envelope, superimposed upon the agreed density surfaces for each species, and estimated numbers of animals to be disturbed calculated in a manner similar to that undertaken in the impact assessment for the Original Development.

2. Utilisation of a metric such as the PTS or TTS criteria used as an approximation of a disturbance contour in some manner.

For example, ICOL could model 100% displacement out to the TTS criteria, and no displacement outside of this contour. For this option to be utlised, agreement on the question posed in Section 3 above, PTS modelling, would be required.

3. Any other proposed method suggested by Stakeholders and Developers that would aid transparency of the cumulative impact assessment.

[19] Thompson *et al.* 2013. Framework for assessing impacts of pile-driving noise from offshore wind farm construction on a harbour seal population. Environmental Impact Assessment Review 43: 73-85

7. Engineering requirements: Using worst case vs. most likely for impact assessment

This is a placeholder for information sharing on engineering parameters (substrate stiffness, pile diameter, hammer size, blow energy etc.) and a subsequent discussion as to whether assessing a worst case or most likely scenario is appropriate.

8. Other discussion points

- Should the potential use of Acoustic Deterrent Devices (ADD) for mitigation purposes be included (and the level of displacement assessed) within the EIA?
- Availability of interim PCoD models
  - Is v1.1 the most recent version?
  - How to assess other species e.g. white-beaked dolphin?
- Any other business?

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Minutes – Inch Cape Marine Mammals Workshop 1

Date: 27 July 2017

Location: Apex Hotel, Edinburgh

Subject: Marine Mammals – baseline and methodology

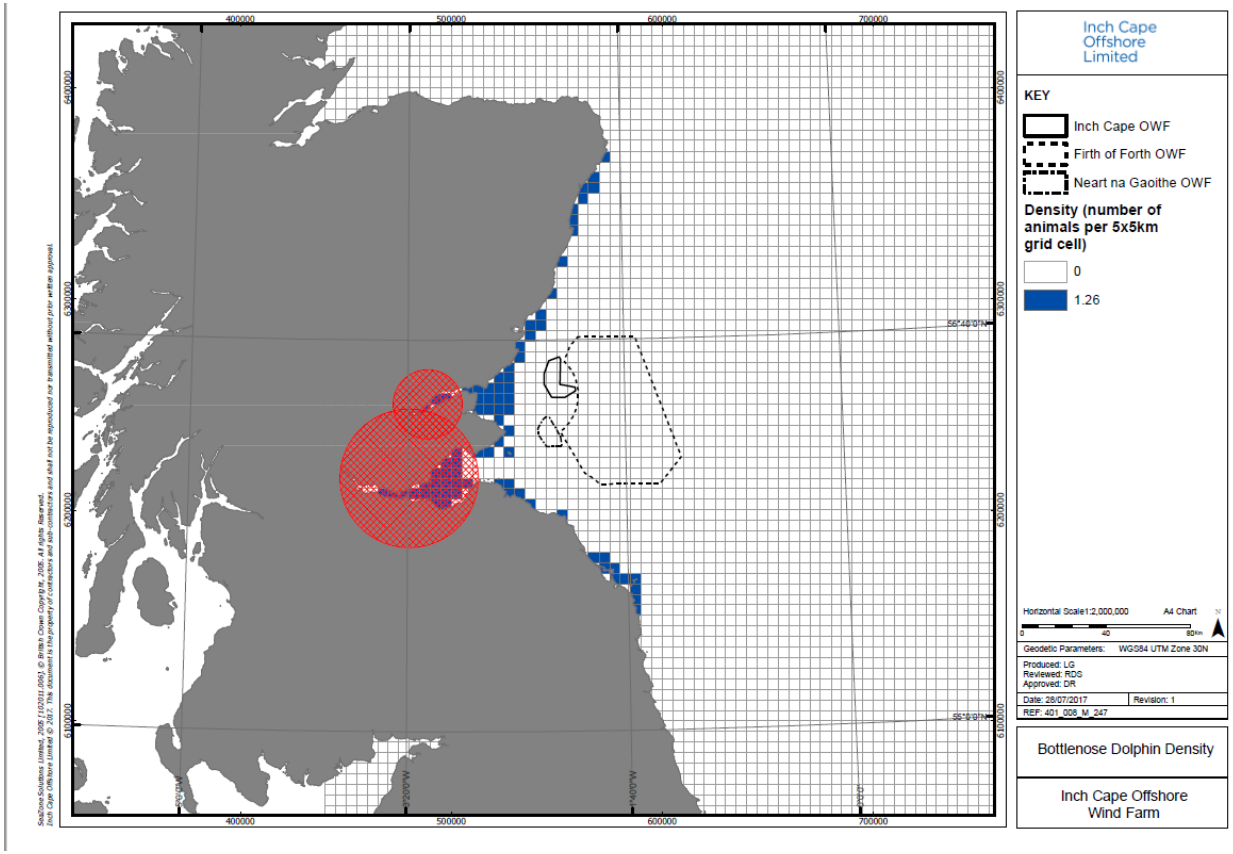
Attendees: Kate Brooks, MSS (KB), Tracy McCollin, MS (TC), Erica Knott, SNH (EK), Catriona Gall, SNH (CG), Fiona Manson, SNH (FM), Caroline Carter, SNH (CC) Fiona Read, WDC (FR), Kate Grellier, NPC (KG), Nancy McLean, NPC (NMc), Nathan Merchant, Cefas (NM) Tom Young, ICOL (TY), Sarah Arthur, ICOL (SA), Richard Copeland, ICOL (RC), John Reddish, ICOL (JR), Mark Finch, ICOL (MF).

ITEM	MINUTE
1.0	**Introduction**
	The aim of the marine mammal workshop was outlined which was to reach agreement on issues relating to the baseline and impact assessment methodology as detailed in the discussion document provided prior to the meeting (25/07/17).
2.0	**Engineering requirements: Using worst case vs. most likely for impact assessment**
	ICOL presented engineering information explaining current understanding of soil zones across site and piling parameters. Explanation provided on difference between worst case and most likely scenario from engineering perspective. ***Agreement reached between all organisations present that a worst case and most likely case should be presented in the Revised Development EIA, with detailed explanation contextualising where and how frequently worst case might be encountered within the site. A description should be provided to explain the conservatism built into the worst case scenario.***
3.0	**Bottlenose Dolphin Baseline Update**
	Discussion held on current understanding of distribution and density of bottlenose dolphins. ***Agreement reached to assume, as per the assessment for the Original Development, the reference bottlenose dolphin population (195 individuals) should be split 50:50 between the east coast and the Moray Firth, and that 98 dolphins would be present at the time of piling activities off the east***

	coast. ***Agreement reached that the 98 individuals assumed to be present off the east coast should be spread evenly across the area inside the 20 m depth contour as defined in the Original Development EIA, excluding areas in the Forth and Inner Tay where bottlenose dolphin are known not to be present (shaded red in Figure 1). These 98 animals will be spread evenly across the remaining grid cells (thereby increasing the density per grid cell).***
4.0	**Reference populations for minke whale, white-beaked dolphin and harbour porpoise**
	Discussion was had on the appropriate reference populations for minke whale, white-beaked dolphin, harbour porpoise and harbour and grey seals. ***Agreement was reached that rather than undertake a wholly new revised impact assessment for the above named species, the EIA for the Revised Development should seek to demonstrate that the EIA carried out for the Original Development is still relevant.***
5.0	**PTS onset: Modelling**
	Discussion was held on relevant flee speeds for PTS modelling, and whether to incorporate a startle response. ***Agreement was reached to use the mean swim speeds detailed in SNH guidance note (2016) 'Assessing collision risk between underwater turbines and marine wildlife'. This guidance document provides mean swim speeds for minke whale, harbour porpoise and grey and harbour seal.*** The SNH Guidance note does not contain a mean swim speed for bottlenose dolphin. It was therefore agreed that SMRU and Gordon Hastie should be approached to provide guidance on an appropriate mean swim speed for bottlenose dolphin – likely from Bailey and Thompson (2006). **ACTION**: ICOL to discuss an appropriate mean swim speed for bottlenose dolphins with Gordon Hastie/ Dave Thompson. ***Agreement that the mean swim speed agreed for bottlenose dolphin will be used as a proxy for white-beaked dolphin.*** ***Agreement was reached that fleeing begins from the start of ADD use (20 minutes before piling starts), and that PTS impacts from ADDs do not need to be considered. The ADDs that will be used for mitigation in this manner will not be sufficiently loud to cause PTS for the period of time that they will be used for.***
6.0	**PTS onset: Thresholds**
	Discussion on use of Southall and NOAA methodology. ***Agreement reached to present outputs from both Southall et al. (2007) and NOAA (2016), and to contextualise results.***

7.0	**Piling noise properties**
	Discussion held on potential to use NMFS guidelines with respect to whether impulsive noise changes into noise with properties more similar to a continuous noise source in the noise modelling. ***Agreement reached not to – the information to inform such a modelling approach was removed from the NOAA document before it was issued.***
8.0	**Calculating displacement**
	Discussion held on methodology to be used for the assessment of displacement. ***Agreement reached to re-interpret the data from the harbour porpoise acoustic signal detection at locations at distances from Horns Rev II during the piling operations. Data from the Moray Firth seismic survey work should also be examined to establish whether reaction to air-gun noise can also be considered informative in the generation of a dose response curve.***
9.0	**Other discussion points**
	A discussion was had on the use of Acoustic Deterrent Devices (ADD) for mitigation purposes***.*** FR noted that WDC do not support the use of ADD as mitigation due to the introduction of additional noise into the marine environment. It was noted a new version of the interim PCoD model was due in the coming month(s) and should be used. ***Agreement was reached that the cumulative impact assessment should draw on the ICOL Original ES in the consideration of cumulative impact of other developments***.

Figure 1


Inch Cape Offshore Limited
KEY
Inch Cape OWF
Firth of Forth OWF
Neart na Gaoithe OWF
Density (number of animals per 5x5km grid cell)
0
1.26
Horizontal Scale1:2,000,000
A4 Chart
Geodetic Parameters: WGS84 UTM Zone 30N
Produced: LG
Reviewed: RDS
Approved: DR
Date: 28/07/2017
Revision: 1
REF: 401_008_M_247
Bottlenose Dolphin Density
Inch Cape Offshore Wind Farm

Appendix V – Advice note from MSS on presentation of outputs from PVA modeling

MSS advice on presentation of outputs from PVA modelling

MSS commissioned a research project undertaken by CEH to review the use of Population Viability Analysis (PVA) metrics in the context of assessing effects of offshore renewable developments on seabirds and to test PVA metric sensitivity to mis-specification of input parameters. The most useful metrics in this context are those that are least sensitive to such mis-specification, enabling more robust assessment of offshore renewable effects.

The report by Jitlal *et al* (2017) which tested and validated metrics of change produced by PVA models is not yet published but a draft final version is available. The results support previous work undertaken by Cook *et al* (2016). Jitlal *et al* identify 3 metrics that MSS advise should be presented:

- median of the ratio of impacted to unimpacted annual growth rate
- median of the ratio of impacted to unimpacted population size
- centile for unimpacted population that matches the 50th centile for impacted population (n.b. Cook *et al* did not consider this metric in their report)

Jitlal *et* al found the ratio metric 'median of the ratio of impacted to unimpacted annual growth rate' was least sensitive, followed by the ratio metric 'median of the ratio of impacted to unimpacted population size' and then the probabilistic metric 'centile for unimpacted population which matches the 50th centile for the impacted population'. They recommend that interpretation of outputs should take account of their relative sensitivities.

Jitlal *et al* also conclude that the probabilistic PVA metric 'probability of a population decline' was much more sensitive and is not recommended for use in the context of assessing impacts of marine renewable development.

Each of the 3 metrics provides information on the change to populations associated with different attributes of the change. The median of the ratio of impacted and unimpacted annual growth rates provides information on how closely related the trends of the impacted and unimpacted scenarios are (n.b. it does not provide information on whether the trend changes from positive to negative). The population size metric provides information on how closely related the median population sizes of the impacted and unimpacted populations are at the end point of the assessment period (rather than the difference in size between the end of the assessment period and the start). The centile metric provides probabilistic information on how closely related the median impacted population is to the median of the unimpacted population, taking into account the distribution of population sizes associated with

the unimpacted population at the end point of the assessment period. By providing information on each of these attributes of the change resulting from the proposed activity the decision maker will be more fully informed than they would be otherwise.

Median of the ratio of impacted to unimpacted annual growth rate

The value of the assessed impact should be presented both for the project alone and for the cumulative/in-combination assessment. The value should be presented as a ratio e.g. 0.98, and the derived value from the ratio of the median difference in impacted and unimpacted annual growth rates would be 0.02.

Median of the ratio of impacted to unimpacted population size

The value of the assessed impact should be presented both for the project alone and for the cumulative/in-combination assessment. The value should be presented as a ratio i.e. 0.85, and the derived value from the median difference between impacted and unimpacted population size would be 0.15.

Centile for unimpacted population that matches the 50th centile for impacted population

The population size for each of the centiles between 0.01 and 0.99 for the unimpacted population should be provided at 0.01 intervals. For certain types of population modelling this may be computationally demanding to the extent that it could delay the process of assessment. In which case a more limited set of centiles can be agreed.

The centile value of the predicted unimpacted population size that corresponds to the median value of the assessed effects on the impacted population size should also be presented. This should be provided for the project alone and for the cumulative/in-combination assessment.

Tabulation of outputs

scenario	median of the ratio of impacted to unimpacted annual growth rate (and corresponding derived metric)	median of the ratio of impacted to unimpacted population size (and corresponding derived metric)	centile for impacted population that matches the 50th centile for unimpacted population	Adult survival rate (and corresponding derived metric)	Productivity rate (and corresponding derived metric)	End population size (breeding pairs)

unimpacted	1	1	.50	.91	0.40	100,000
cumulative effect	0.98 (0.02)	0.85 (0.15)	0.41	0.88 (0.03)	0.33 (0.07)	85,000
Project alone	0.99	0.96	0.48			96,000

References:

Cook, A.S.C.P. & Robinson, R.A. 2016. Testing sensitivity of metrics of seabird population response to offshore wind farm effects. *JNCC Report No. 553*. JNCC, Peterborough.

Jitlal, M., Burthe, S., Freeman, S. and Daunt F. 2017 Testing and validating metrics of change produced by Population Viability Analysis (PVA) – Marine Scotland Science commissioned report (currently unpublished)