From:	Dominika Phillips
To:	Hornsea Project Three; KJ Johansson; Kay Sully
Cc:	Andrew Guyton; Stuart Livesey
Subject:	Hornsea Project Three (UK) Ltd response to Deadline 4 (Part 15)
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Dear Kay, K-J

Please find attached the 15th instalment of documents.

Best regards,
Dr Dominika Chalder PIEMA
Environment and Consent Manager

[redacted]

Environmental Management UK | Wind Power
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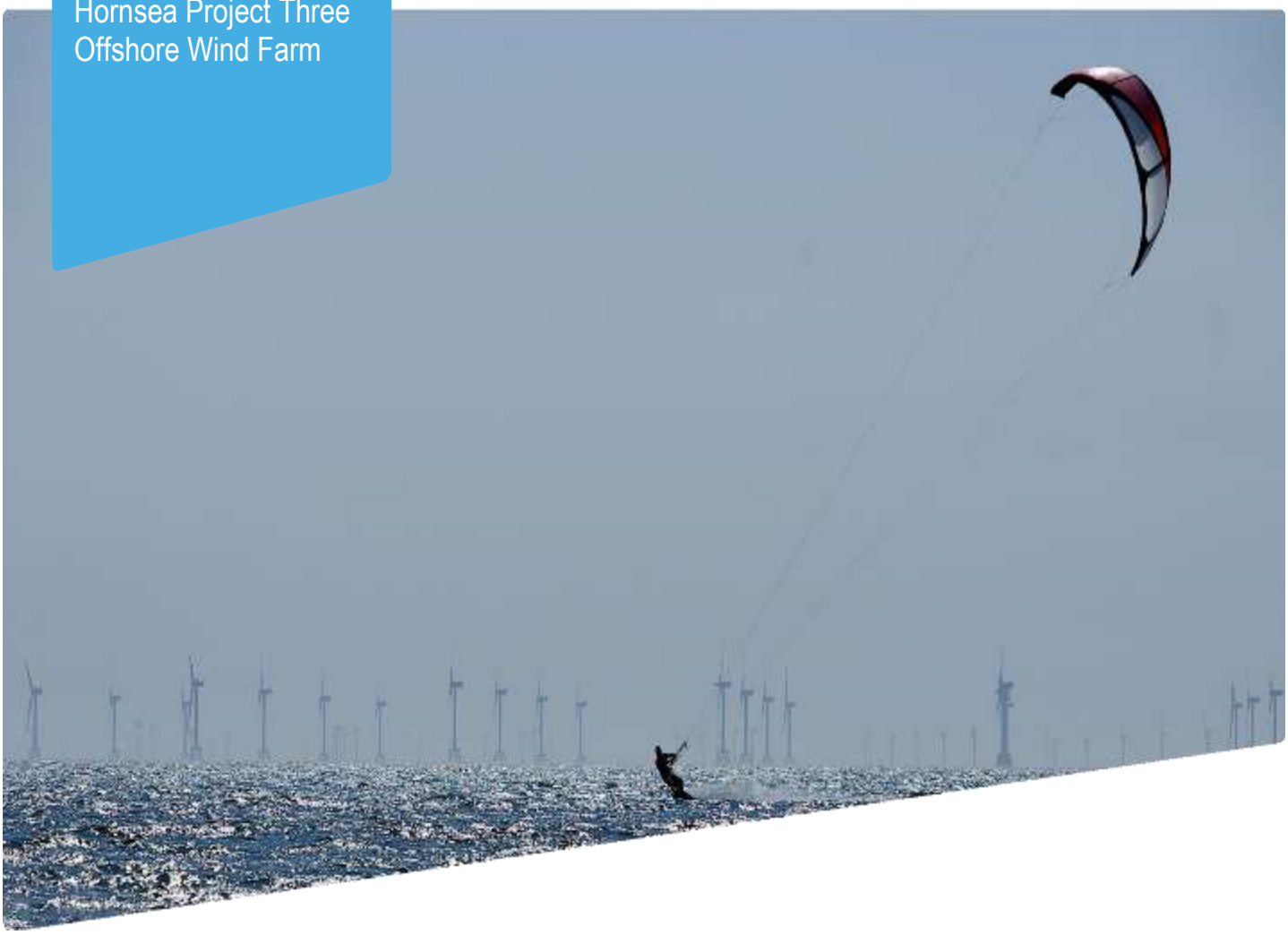
Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Appendix 70 to Deadline 4 Submission – Inch Cape Scoping Opinion (Ornithology)

Date: 15th January 2019

Hornsea 3
Offshore Wind Farm

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Front cover picture: Kite surfer near a UK offshore wind farm © Ørsted Hornsea Project Three (UK) Ltd., 2019.

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Marine Scotland - Licensing Operations Team Scoping Opinion

Addendum: Ornithology

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 – ORNITHOLOGY ASPECTS ONLY

Contents

1 Executive Summary

This is the Scottish Ministers' scoping opinion in respect of the ornithological aspects of the Scoping Report for the revised design parameters proposed for the Inch Cape Offshore Windfarm submitted by Inch Cape Offshore Limited ("ICOL").

This document sets out the Scottish Ministers' opinion on the basis of the information relating to ornithology 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 other receptors included in the Scoping Report, with the exception of marine mammals (included in a separate addendum issued on 03 August 2017) and should be read in conjunction with this document.

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 Environmental Impact Assessment Report ("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 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 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 stakeholder meeting was held on 26 May 2017, which included Scottish Natural Heritage ("SNH"), Royal Society for the Protection of Birds ("RSPB"), the Marine Scotland Licensing Operations Team ("MS-LOT") Marine Scotland Science ("MSS") and ICOL. A further ornithology meeting, attended by MS-LOT, SNH, RSPB and MSS, was held on 19 July 2017 to discuss the specific details of the methodology to be used in the

assessment.

The Scottish Ministers draw attention to the general points and those made specifically in respect of ornithology 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 ornithological aspects of 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 approach of assessing 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. ornithology.

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 EIA Report. 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 ornithology 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 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 was issued on 03 August 2017 for marine mammals.

4.1.2 An ornithology scoping meeting was held on 26 May 2017. A further meeting between MS-LOT, MSS, SNH and RSPB was held on 19 July 2017 to discuss common approaches to cumulative impact assessment, collision risk modelling, displacement assessment and non-breeding season effects etc. for all three Forth & Tay projects.

4.1.3 The Scottish Ministers are satisfied that the requirements for consultation have been met in accordance with the 2017 EIA Regulations.

4.1.4 Full consultation responses from SNH and RSPB are attached in Appendix I and each should be read in full. A summary of the advice from MSS is provided in Appendix II. Where conflicting advice has been provided by RSPB and SNH, the Scottish Ministers have, with input from MSS, provided their opinion on the approach that should be followed by ICOL.

5 Ornithological 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. The text follows two formats, where the questions can be answered directly this has been done, for some topics more detailed information and background e.g. summaries from the meeting on 19 July 2017, has been provided. Where necessary, consultee comments have been incorporated to provide further relevant information. 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 ES 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 state that they consider it likely that, for the ornithology receptors, the design envelope for the worst-case definition for the Revised Development will have similar or lower levels of predicted impacts to that of the Original Development and that most impacts and species will be scoped out of the Revised Development EIA Report. This will allow the EIA to remain focussed on the impacts and species that are of key

relevance. ICOL consider that the following impacts and species will be scoped in for the Revised Development and the cumulative impact assessment ("CIA"):

- The indirect impacts arising via noise impacts on prey species due to the need to undertake further noise modelling as a result of the higher piling energies estimated to be required for the Revised Development
- The impacts and species that were the focus of the Marine Scotland Appropriate Assessment for the Forth and Tay wind farms
- Species whose conservation status has changed as a consequence of being qualifying features of the Outer Firth of Forth and St Andrews Bay Complex proposed Special Protection Area ("pSPA") (details of which were not available at the time of the Original Development ES) and which were scoped out of the Original Development ES (in part at least) on the basis of unlikely connectivity to Special Protection Areas ("SPA")

5.2.2 This section of the scoping opinion provides information in two formats, firstly answers are given to the questions posed by ICOL in the Scoping Report and secondly, where further discussions have been had, and an opinion reached on the details of e.g. methodology, modelling etc. a summary of these decisions is given.

Scoping Question	Question
8.4.9. (Page 252)	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 proposed development.	

Scoping Question	Question
8.4.9. (Page 252)	Do you agree that the boat-based survey data for the Original Development EIA remain suitable for providing the baseline survey data for the Revised Development EIA?
SNH noted that no further baseline survey is required (see SNH advice note of 02 February 2017). SNH noted that this advice may change if the application is delayed. The RSPB noted that the dedicated two year ornithology site survey data is now 5-7 years old. They do not request an updated survey, however, RSPB wish to highlight the spatial and temporal variability of seabird distributions. As a consequence, the survey data may not represent an accurate account of seabird usage. This element	

of uncertainty will need to be taken into account within the assessment.

The Scottish Ministers agree that the boat-based survey data for the Original Development EIA remain suitable for providing the baseline survey data for the Revised Development EIA but advise ICOL that if their application is delayed this advice may change. The Scottish Ministers advise that 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 the survey data require updating.

Scoping Question	Question
8.4.9. (Page 252)	Do you agree that the near-shore and intertidal survey data remain suitable for describing the baseline characteristics in the areas around the landfall site, given the check on their validity that has been undertaken using recent WeBS data?
The Scottish Ministers agree that the near-shore and intertidal survey data remain suitable for describing the baseline characteristics in the areas around the landfall site.	

Scoping Question	Question
8.4.9. (Page 252)	Can confirmation be provided that the proposed list of developments to be considered for the cumulative EIA includes all those that would be expected? Are there any apparent omissions from the list?
At the meeting on 19 July 2017 SNH and RSPB both indicated that the cumulative impact assessment ("CIA") should include non-breeding season effects for razorbill, guillemot, kittiwake and gannet. SNH considered that for kittiwake and gannet this should be for all UK windfarms in the North Sea and RSPB additionally requested a qualitative assessment for non UK sites. For guillemot and razorbill SNH advice is that, as these species are not so wide ranging, the cumulative assessment should apportion non-breeding season effects in the same manner, and from the same wind farms, as in the breeding season. For herring gull SNH recommend presenting the updated collision risk modelling ("CRM") outputs for the breeding and non-breeding seasons. SNH do not anticipate that these will be significant, however, if the herring gull CRM figures indicate an issue SNH would advise that any non-breeding season impacts are assessed at a Forth and Tay regional level – rather than the biologically defined minimum population scale ("BDMPS") scale. MSS provided the following advice. For breeding season effects, the CIA should	

consider effects from projects within mean max foraging range of the colony SPA under consideration. If available, the Marine Scotland commissioned Apportioning Tool provides an output that ranks colonies by likelihood of a bird at a windfarm originating from that colony. For the CIA, effects should be considered quantitatively for the windfarm in isolation and in combination with the other three Forth and Tay wind farms (Neart na Gaoithe 2014 as consented and Seagreen Alpha and Bravo 2014 as consented). Effects from other windfarms should be considered within the CIA qualitatively.

MSS advise that the scope of the assessment for kittiwake and gannet during the non-breeding season relates to collision effects only, and note that they assume SNH and RSPB advised the same. MSS agreed with the approach advised by SNH in relation to the inclusion in the CIA of non-breeding season effects on guillemot and razorbill, and advised that non breeding season effects on puffin should be considered in a qualitative manner only. MSS agree with the advice relating to the assessment of herring gull during the non-breeding season provided by SNH.

MSS consider it will be challenging to identify gannet, kittiwake or herring gull collision estimates from the other offshore wind farms in the UK that have been estimated and/or reported in a consistent manner. Many will have been estimated using approaches that are no longer deemed to be the best available approach. The cumulative totals obtained should therefore be treated with extreme caution, as should the outputs from PVAs should these cumulative effect totals be modelled.

The Scottish Ministers have taken into account all the advice received and advise the following:

Breeding season effects:

For the breeding season, the CIA should consider effects from projects within mean max foraging range of the colony SPA under consideration.

Non-breeding season effects:

For guillemot and razorbill, the CIA should incorporate non-breeding season displacement effects from the Forth and Tay wind farms (Neart na Gaoithe and Seagreen), apportioning effect as to SPA and non-SPA colonies in the same manner as the breeding season.

For puffin, the CIA should consider in a qualitative manner non-breeding season displacement effects from the Forth and Tay wind farms (Neart na Gaoithe and Seagreen), as well as the other UK wind farms.

For gannet and kittiwake, the CIA should estimate non-breeding season collision effects from the Forth and Tay wind farms (Neart na Gaoithe and Seagreen) in isolation, and in combination with the other UK wind farms.

For herring gull, if the CRM figures indicate an issue then non-breeding season impacts are assessed at a Forth and Tay regional level.

For the CIA, the following assessment scenarios are required:

Scenario 1

Effects should be considered quantitatively for the windfarm in isolation and in combination with the worst case scenario (for each species) from:

- **Neart na Gaoithe (2014 as consented) or Neart na Gaoithe (2017 scoping report) and**
- **Seagreen Alpha and Bravo (2014 as consented) or Seagreen (2017 scoping report) and**
- **Breeding season effects from other windfarms should be considered within the CIA qualitatively.**

Scenario 2

Effects should be considered quantitatively for the windfarm in isolation and in combination with:

- **Neart na Gaoithe (2017 scoping report) and**
- **Seagreen (2017 scoping report) and**
- **Breeding season effects from other windfarms should be considered within the CIA qualitatively.**

The Scottish Ministers consider that by carrying out the assessment of these two scenarios the cumulative impact of the worst case scenarios of all the current consented and proposed projects are considered but also takes into account the scenario that the ongoing judicial review process may mean that the previously consented developments are no longer valid. If this was the case an assessment of the projects as described in the 2017 scoping reports alone will be required to allow the regulator to assess the cumulative impact of these.

Scoping Question	Question
8.4.9. (Page 252)	It is expected that the list of sites for the HRA in-combination assessment should be based upon the list for the cumulative EIA, at least in terms of providing the starting point for the in-

	combination assessment; can you confirm acceptability to this approach?
The Scottish Ministers agree that the approach outlined above is acceptable.	

Scoping Question	Question
8.4.9. (Page 252)	What advice is available on possible approaches to accounting for potential impacts outside the breeding season to SPA (and pSPA) breeding populations? Is there a recommended approach to predicting these impacts, and is it envisaged that such approaches can be based on quantitative methods or are they likely to rely upon a qualitative assessment? What is the advice regarding the incorporation of non-breeding components (e.g. juveniles and immatures) into the assessment of impacts on SPA breeding populations? Should such assessments consider only the breeding component of the population? If not, can specific recommendations be provided on exactly what is required in this regard?
See section 5.6	

Scoping Question	Question
8.4.9. (Page 252)	For the purposes of the HRA, ICOL would seek advice on the status that should be afforded to species that are listed as named components of SPA (and pSPA) assemblage features, and how these named components should be treated? Specifically, ICOL would wish to have clarification on whether these species should be regarded as having the same status as qualifying features and, if so, why that should be (given that these named components do not meet the criteria for inclusion as qualifying features and that it is the assemblage itself that is the qualifying feature).
RSPB note that the assemblage, as set out in the SPA citations, is specific to that designated site and comprises the relevant populations for each of the individual species that make that assemblage. Any change to individual species populations will alter the sites' assemblage of species. Therefore both the assemblage and the species populations within it need to be considered as part of the HRA. The two are not mutually exclusive. **The Scottish Ministers advise that species that are listed as named components of SPA and pSPA assemblage features should be assessed in the HRA. As part of an assemblage for the site the conservation objectives apply.**	

Scoping Question	Question
8.4.9. (Page 252)	The different options that are available for undertaking the prediction of displacement and barrier effects are outlined in 'Assessment methodologies' in section 8.4.6. What is the preferred approach to undertaking the prediction of these impacts, and is it advised to use the modelling approach of Searle et al (2014), or subsequent developments of that approach, on the species and populations for which it has been developed? In relation to predicting the impacts from displacement and barrier effects, what advice is available on the appropriate displacement rates to be applied to breeding populations of key species (i.e. kittiwake and the auks)? Specifically, for given species, these rates tended to be similar between the Original Development EIA and the MS Appropriate Assessment. However, the Revised Design involves a much reduced WTG density. Therefore, is it expected that the assumed displacement rates for these species should be reduced in line with this (but subject to the findings from recent reviews of displacement/macro-avoidance – e.g. Dierschke *et al.* 2016).
See section 5.5	

Scoping Question	Question
8.4.9. (Page 252)	MSS have recently put out a tender for the development of a stochastic collision risk model. Can confirmation be provided that ICOL would be expected to use only those collision risk models that have been developed and are currently available (as opposed to models that may become available part-way through the production of the EIA)?
The Scottish Ministers confirm that if the stochastic collision risk model is available in time (due December 2017) to use for the production of the EIA then it should be used as it would represent the best available method.	

Scoping Question	Question
8.4.9. (Page 252)	Assuming they are required, it is proposed that the population models (and resulting PVAs) to be applied to breeding populations of kittiwake, guillemot and razorbill within the EIA (and HRA) should be based upon those developed for the MS Appropriate Assessment (Freeman *et al.* 2014). However, it is

	not envisaged that the development of such complex population models is realistic for other species or populations (but recognising that similar models have also been produced for herring gulls for the Forth Islands and St Abbs Head to Fastcastle SPAs). Can confirmation be provided that this is considered to be an appropriate approach?
The Scottish Minister note this approach and confirm it is considered appropriate.	

Scoping Question	Question
8.4.9. (Page 252)	Can confirmation be provided that the existing matrix-based population models for Forth Islands gannet and puffin populations (as used in the MS Appropriate Assessment – MacArthur Green 2014a, b) would still be considered to be suitable for use in the EIA and HRA for the Revised Development?
The Scottish Ministers confirm that the existing matrix-based population models for Forth Islands gannet and puffin populations would still be considered suitable for use in the EIA and HRA for the Revised Development.	

Scoping Question	Question
8.4.9. (Page 252)	The approach proposed for selecting and using metrics to apply to PVA outputs to aid the interpretation of the population-level impact in the EIA and HRA is also described in 'Assessment methodologies' in section 8.4.6. Can confirmation be provided on the suitability of the proposed approach? If amendments to this approach are envisaged, can they be detailed?
See Section 5.8.	

Scoping Question	Question
8.4.9. (Page 252)	Can advice be provided on how the assessment of impacts should be undertaken for the seabird qualifying features of the Outer Firth of Forth and St Andrew's Bay Complex pSPA in cases where LSE is determined? In particular, can the reference populations against which such an assessment would be undertaken be specified, given that most (or all) breeding populations will relate closely to the breeding populations of nearby colony SPAs (for which assessment will also be undertaken), whilst the wider non-breeding populations may be difficult to define?

RSPB noted that Firth of Forth and St Andrew's Bay Complex proposed SPA (pSPA) requires inclusion in the assessment. The supporting habitats within this pSPA are especially relevant to the cabling corridor. Such development could lead to habitat disturbance or loss within the pSPA. The relative importance of the cable corridor in terms of the quality of habitat and how its structure and function could be affected.

SNH provided advice as to which pSPA interests should be scoped in (gannet, kittiwake, herring gull, puffin, razorbill and guillemot) and note that their advice in relation to SPA seabird colonies will also apply to the pSPA.

As noted below (5.4.1 and 5.4.4) the Scottish Ministers do not require a separate assessment for these species in relation to the Firth of Forth and St Andrew's Bay Complex pSPA and the impacts are to be considered in relation to the existing colony SPA breeding populations.

5.3 Summary of information from consultee responses and stakeholder meetings.

5.3.1 The meeting on 19 July 2017 between MSS, SNH and RSPB took the form of answering very specific questions that had been raised in the consultee responses and by ICOL in the Scoping Report.

5.3.2 This led to a very focussed discussion and the following text is based on the outcome of that meeting. The meeting followed a step by step process of working through each stage of the assessment. In the majority of cases agreement was reached on the discussion points. Where there were differences of opinion MSS have provided advice and the Scottish Ministers have used all this information to come to a decision on what they require.

5.3.3 The information below should answer the questions posed by ICOL in the Scoping Report. Where this is not the case further detail is provided to answer specific questions.

5.4 SPAs

5.4.1 It is the Scottish Ministers' opinion that the following SPAs/pSPA and qualifying features must be included in the assessment:

- Forth Islands SPA – gannet, kittiwake, herring gull, puffin, guillemot, razorbill
- Fowlsheugh SPA – kittiwake, herring gull, guillemot, razorbill
- Buchan Ness to Collieston Coast SPA and St Abb's Head to Fast Castle SPA should be scoped in due to connectivity. PVAs for these SPAs are

required unless the cumulative effects from the Forth and Tay projects are estimated to be less than a reduction in annual adult survival of 0.2%.

- Firth of Forth and St Andrews Bay Complex pSPA - gannet, kittiwake, herring gull, puffin, guillemot, razorbill. The assessment carried out for these species at the breeding colony SPAs listed above should also be used for the assessment of the pSPA species.

5.4.2 For the existing colony SPAs the conservation objective relating to the population of the species as a viable component of the site should be the focus of the assessment, although justification should be provided within the EIA/HRA Report as to why the other conservation objectives are less relevant or are addressed via this conservation objective.

5.4.3 The reference populations to be used for the SPAs are those detailed in appendix a(ii) of the SNH advice (see Appendix I of this scoping opinion).

5.4.4 Apportioning effects to colonies and SPAs should be via a two-step process:

- apportioning between SPA and non-SPA colonies should be done using Seabird 2000 data
- impacts apportioned between SPAs should use most recent colony counts (see appendix a(ii) of SNH advice)

5.4.5 As there is no overlap between the ICOL development and the pSPA there is no requirement for additional qualifying features from the pSPA other than those listed under 5.4.1 to be assessed. As discussed under 5.4.1 no additional assessment is required for the qualifying features which are also qualifying features of the breeding colony SPAs.

5.4.6 ***Commentary on the consideration of SPAs***: SNH and RSPB largely agreed on the species and sites to be included in the assessment, although RSPB also requested that great black backed gull and lesser black backed gull be included in the EIA. SNH noted that great black backed gull was included in EIA assessment previously carried out by all three Forth and Tay developers and they were content with these assessments. SNH noted that lesser black backed gull is on the HRA short list (SNH previous advice of 07 March 2014) and that they have no outstanding concerns and that their review of the CRM indicates no significant risk to this species. MSS advice was sought on this point, and it was their view that the assessed effects were negligible and that these two species could be scoped out of the EIA. The Scottish Ministers do not require great black backed gull and lesser black backed gull to be included in the assessment.

5.4.7 RSPB and SNH both agreed on the SPAs to be considered and on the apportioning method. The RSPB highlighted that the RSPB tracking data could be useful in providing information which might not be captured by other data. MSS advised that these data were incorporated into the MS commissioned Apportioning Tool.

5.4.8 SNH advised that for SPAs "the population of the species as a viable component of the site" should be used for all developments outwith the protected areas. RSPB advised that all conservation objectives should be taken into account in order to review whether they can be discounted.

5.4.9 SNH advised that population modelling would not be required for Buchan Ness to Collieston Coast SPA and St Abb's Head to Fast Castle SPA. RSPB advised that population modelling should be undertaken for these sites. MSS advised that this sites should be scoped in due to connectivity and that PVA would be required unless the estimated cumulative effects from the Forth and Tay projects are less than a reduction in annual adult survival of 0.2%.

5.5 Displacement

5.5.1 It is the Scottish Ministers' opinion that a displacement assessment should be completed in the following way:

5.5.2 The species to be included are: puffin, guillemot, razorbill, kittiwake.

5.5.3 The breeding season months are those described in the SNH advice. Density estimates should be mean seasonal peaks and include a 2km buffer and should include all birds, both those in flight and on the water.

5.5.4 Estimates of displacement should be presented following the SNCB guidance: (http://jncc.defra.gov.uk/pdf/Joint_SNCB_Interim_Displacement_AdviceNote_2017.pdf).

5.5.5 The updated CEH (SeaBORD) model should also be used if available. Outputs from the previous CEH modelling (2014) can be used for context.

5.5.6 For puffin a qualitative non-breeding season assessment is required. For guillemot and razorbill the approach described in the 2017 SNCB guidance should be used as it is not possible to use the CEH model for non-breeding season. Non-breeding season displacement effects on kittiwake should be considered in a qualitative way. For guillemot and razorbill all non breeding season effects should be assigned to relevant SPAs as per breeding season. For this assessment of non-breeding season effects ICOL should use the

total SPA population, all ages, and apportion impacts across age classes based on stable age structure unless suitable at-sea survey data from the non-breeding season are available for kittiwake.

5.5.7 A displacement rate of 60% should be used for the auk species and 30% for kittiwake. A mortality rate from displacement of 2% for puffin and kittiwake (quantitative assessment is for the breeding season only) and 1% for guillemot and razorbill (same rate across breeding and non-breeding seasons) should be applied. The same rates should be used for immatures as for adult birds.

5.5.8 Displacement effects are to be assessed using the SNCB advice on the matrix approach, the CEH displacement report (Searle *et al.* 2014 Population consequences of displacement from proposed offshore wind energy developments for seabirds at Scottish SPAs (CR/2012/03). Final report to Marine Scotland Science http://www.gov.scot/Resource/0046/00462950.pdf) and, if available, the SeaBORD model. Where displacement effects are considered using the SNCB guidance this should be in relation to changes in adult survival rates (Scottish Ministers recognise that the CEH models give outputs both in relation to adult survival and to productivity.)

5.5.9 ***Commentary on the displacement assessment****:* SNH and RSPB largely agreed on the most appropriate displacement methodology. SNH advised that there was no need to include kittiwake, the data available from post construction monitoring indicates no significant avoidance behaviour by this species (e.g. Welcker and Nehls 2016 Mar Ecol Prog Ser 554:173-82; Krijgsveld 2014 – report for Rijjkswarerstaat Sea and Delta; and Robin Rigg Year 5 monitoring report). RSPB advised that kittiwake should be included in the assessment, as the references do not provide adequate evidence during the breeding season. MSS advice was sought on this point. MSS advised that displacement should be included in the kittiwake assessment. Macro avoidance/ displacement has been observed at some wind farms, and whilst displacement and collision effects may be mutually exclusive for individuals, this may not be the case at the population level. Also, the CEH displacement report (Searle *et al.*, 2014) indicated that displacement/ barrier effects have the potential to affect individuals and impact populations.

5.5.10 Both SNH and RSPB agree that gannet does not need to be considered in the displacement assessment.

5.5.11 RSPB, although supporting the presentation of the SeaBORD model in principal, will need the opportunity to review the final model before coming to a formal view on its use.

5.5.12 RSPB suggested a 50% displacement rate for kittiwake, MSS advice was sought on this point. MSS advised that the displacement rate should be 30%. This value takes into account the advice from SNH (who do not consider that displacement of kittiwake is a potential effect that should be assessed), the advice from the RSPB, the approach taken in the original assessments for the Forth and Tay, and the lower number of WTGs (necessitating either a greater WTG spacing or reduced overall wind farm footprint) in the new applications.

5.5.13 With regards to the percentage mortality from displacement, SNH advised 2% for puffin and 1% for other species, RSPB advised 2% for all species. MSS advice for puffin, guillemot and razorbill agreed with that provided by SNH.

5.6 Apportioning

5.6.1 It is the Scottish Ministers' opinion that apportioning should be carried out in the following way:

Methods

5.6.2 The methods that should be used are the SNH apportioning approach and (if available) the Apportionment tool being produced for Marine Scotland by CEH (though note that this uses Seabird 2000 data only).

Reference populations

5.6.3 The Scottish Ministers advise the two step approach as advised by SNH is used, the reference populations to be used for the SPAs are those detailed in appendix a(ii) of the SNH advice.

- apportioning between SPA and non-SPA colonies should be done using Seabird 2000 data
- impacts apportioned between SPAs should use most recent colony counts (see appendix a(ii) of SNH advice)

Apportioning estimated effects from non-breeding season

5.6.4 For apportioning the estimated effects from the non-breeding season the Scottish Ministers recommend the biologically defined minimum population scales BDMPS should be used for gannet and kittiwake. The Scottish Ministers agree with the approach SNH recommend using reference populations as described in Furness (Furness, R.W. 2015. Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS) Natural England Commissioned Reports, Number 164), and adopted in recent English casework e.g. Hornsea 2. This will require two non-breeding

apportioning calculations to cover spring and autumn. SNH guidance should be used to define the seasons. The overall non-breeding season is as follows; gannet – Autumn, October to November; Spring, December to mid-March; kittiwake – Autumn, September to December; Spring, January to mid April.

5.6.5 For herring gull the Scottish Ministers recommend presenting the updated CRM outputs for the breeding and non-breeding seasons. If further quantitative assessment is needed, collisions during the non-breeding season should be apportioned across the regional population (a similar method was used previously for Moray Firth wind farms).

5.6.6 For auks the Scottish Ministers advise no quantitative assessment is required for puffin in the non-breeding season and for guillemot and razorbill all non-breeding season impacts should be assigned to SPAs as per breeding season. The Scottish Ministers recommend using the total SPA population, all ages, and apportioning impacts across age classes based on the PVA stable age structure.

Assigning estimated effects across age classes

5.6.7 The Scottish Ministers advise the following to assign effects between age classes:

- Breeding season gannet and kittiwake – effects apportioned to age classes using proportions derived from site survey data
- Non-breeding season gannet and kittiwake – effects apportioned to age classes using proportions derived from at sea survey data or, if not available, PVA stable age structure
- Breeding and non-breeding auks – effects apportioned to age classes using proportions from PVA stable age structure

5.6.8 ***Commentary on apportioning:*** SNH and RSPB were in agreement on most points. For apportioning estimated effects to non-adult age classes to SPAs, RSPB agree with the approach outlined by SNH and would prefer, if available, on site survey age structures for non-breeding gannet and kittiwake. MSS advise that for non-breeding gannet and kittiwake the age structure of the non-breeding season effects should be based on the age structure derived from the at sea survey data at this time of year. If this is not available then the PVA stable age structure will provide the best available evidence and should be used.

5.7 Collision Assessment

5.7.1 The Scottish Ministers advise that CRM is required for gannet, herring gull and kittiwake. The nocturnal activity scores of 2 (25%) should be used for herring gull and kittiwake and 1 (0%) for gannet.

5.7.2 The Scottish Ministers advise that for birds in flight, the mean monthly value should be used in the collision risk modelling, and density of birds in flight values should also have 95% confidence limits presented.

5.7.3 The Scottish Ministers confirm boat based bias should not be accounted for in density estimates.

5.7.4 The Scottish Ministers recommend that comparison is made of the proportion of birds at collision height using site specific flight height data and the generic flight height data (Johnson *et al.* 2014 with corrigendum https://www.bto.org/science/wetland-and-marine/soss/projects). Any differences between the two should be discussed.

5.7.5 For kittiwake and gannet, the assessment should assume Option 2 using Johnson *et al*. (2014) with corrigendum. If sufficient site specific flight height data are available, outputs using Option 1 should also be presented. Option 2 (at a 98.9% avoidance rate) should be assumed for the PVA.

5.7.6 For herring gull, the assessment should present Options 2 and 3 using Johnson *et al*. (2014) with corrigendum flight height distributions. However, if sufficient site specific flight height data are available, outputs using Option 1 or 4 should also be presented. Option 2 (at a 99.5% avoidance rate) should be assumed for the PVA.

5.7.7 For avoidance rates the Scottish Ministers recommend using:

- Gannet – 98.9% (± 0.002)
- Kittiwake – 98.9% (± 0.002)
- Herring gull – 99.5% (± 0.001) for option 2, 99.0% (± 0.002) for option 3

5.7.8 The mean avoidance rate values should be used for PVA and the ± 2SD values can be used to inform conclusions. Uncertainty in collision estimates should be presented as ± 2SD and should take account of SNH advice provided in appendix A(iv) of their scoping response.

5.7.9 The Scottish Ministers note that the breeding season months as recommended by SNH are gannet (mid-March – September), kittiwake (mid

April – August) and herring gull (April – August) and that non-breeding season effects should be included. The collisions attributed to the SPA should be as agreed in section 5.6.

5.7.10 The Scottish Ministers note that SNH have provided some advice with regard to how to update the flight height data in the Band collision risk model spreadsheets to Johnston *et al*.. 2014. This is included in Appendix III.

5.7.11 The Scottish Ministers request (as noted by SNH) that CRM outputs are presented as described in the table below. This is to provide information on the largest number of smallest turbines (lower end in the table) and smallest number of largest turbines (upper end in the table). The missing information is indicated by question marks. This information will allow comparisons with the 2014 'most likely' scenarios ("MLS") i.e. the parameters used in the Appropriate Assessment for the Original Development. The Scottish Ministers suggest that the lower end of the 2017 design scenario could act as a 'worst case' for the Revised Development. ICOL should clarify whether they would want to use this 'worst case' or whether they will define a 'most likely' 2017 scenario.

		2014 MLS	2017 lower end	2017 upper end
Inch Cape	no. of turbines	110	72	?
	rotor diameter	172m	?	250m
	height to blade tip	197m	?	301m

5.7.12 ***Commentary on collision assessment:*** There was agreement on most of the points raised at the meeting. There were some differences of opinion.

5.7.13 The main area of disagreement was that both SNH and RSPB advised using the monthly maximum at-sea survey data whereas MSS advised using the mean monthly value. At the meeting on 19 July 2017 SNH and RSPB indicated that they preferred the use of this value as it would capture uncertainty. MSS advised that the approach taken by SNH and RSPB actually ignores uncertainty, is overly precautionary and runs the very high risk of producing an estimated effect that is highly likely to be unreasonable and unrealistically high. MSS advised that for birds in flight, the mean monthly value should be used in the collision risk modelling, and density of birds in flight values should also have 95% confidence limits presented. The Scottish Ministers have considered all the advice presented (see Appendices I and II) and agree with MSS that the mean monthly estimates are presented alongside confidence limits, and that the mean values are those assumed in

the effects scenarios incorporated into the PVAs because this is the most robust approach, is consistent with previous assessments, and will provide information on the uncertainty around estimated values.

5.7.14 For the nocturnal activity scores RSPB agreed with SNH apart from gannet where they would prefer a score of 2 (25%) as they have concerns regarding at-sea survey periods omitting dawn and dusk, when gannet activity may be greatest. MSS advised using the scores as suggested by SNH as the justification from RSPB to use different scores for gannet appears to conflate nocturnal activity with colony attendance, foraging activity and timing of at-sea surveys and lacks an adequate empirical basis.

5.7.15 The flight height distribution and the Band CRM options to be used were discussed together. RSPB noted that comparison should be made of site specific and generic data and associated confidence intervals using Proportion at Collision Height ("PCH") as defined by survey height bands of both data sets. This should also include discussion of any significant differences. RSPB note such comparison does not necessarily need to involve running the CRM. There was agreement on this point.

5.7.16 RSPB agreed with the avoidance rates and Options advised by SNH with the exception of gannet where they advised that an avoidance rate of 98.0% should be applied during the breeding season. MSS advised that there was no evidence to support going against the advice provided by SNH and summarised in the joint SNCB document on avoidance rates.

5.8 Population Viability Analysis (PVA)

5.8.1 The Scottish Ministers advise that PVA outputs are required for SPA breeding colonies where the assessed effects exceed a change to the adult annual survival rate of 0.2% and consider they are likely to be needed for the following:

- Forth Islands SPA – gannet, kittiwake, puffin, guillemot, razorbill
- Fowlsheugh SPA – kittiwake, guillemot, razorbill

5.8.2 PVAs should be produced for the estimated effects from:

- For guillemot, razorbill, puffin, gannet and kittiwake, the windfarm in isolation (effects throughout the year and on all age classes),
- For guillemot, razorbill, puffin, gannet and kittiwake, the wind farm in combination with the other three Forth and Tay windfarms (effects throughout the year and on all age classes)

- For gannet and kittiwake the breeding season effects from the Forth and Tay wind farms combined with the non-breeding season effects from the offshore wind farms in UK waters

5.8.3 For kittiwake, PVAs for the following should also be provided:

- Collision effects (throughout the year and on all age classes) in isolation *and*
- Collision effects (throughout the year and on all age classes) in combination with displacement effects (during the breeding season and on all age classes)

5.8.4 The Scottish Ministers advise that stochastic, density independent PVA models should be used and they will need to include:

- All age classes
- Sabbaticals for which the following rates should be used:
  - Large gulls 35%
  - Kittiwake 10%
  - Guillemot (and Razorbill/Puffin) 7%
  - Shag 35%
  - Gannet 10%
- Effects during the non-breeding season for all species listed above apart from puffin
- A baseline demographic rate based on site specific information where available or alternatively Horswill and Robinson 2015 Review of seabird demographic rates and density dependence. JNCC Report No. 552. Joint Nature Conservation Committee, Peterborough.
- The impacts should be assessed over both 25 years and 50 years with no recovery period. If ICOL intend to have an extended construction timeframe then the potential effects of this should be taken into consideration in the PVA.
- PVA should be produced for the 'worst case scenario' estimated effects and for estimated effects that are 10% higher and 10% lower than those estimated for the worst case scenario.
- Presentation of the PVA metrics as

i. median of the ratio of impacted to unimpacted annual growth rate
ii. median of the ratio of impacted to unimpacted population size
iii. centile for unimpacted population that matches the 50th centile for impacted population

5.8.5 MSS have provided guidance on the presentation of the assessed change using the results of PVA (see Appendix IV). They advise that the outputs of

the PVA should be presented using these metrics. SNH advised that i) and ii) should be presented, and the RSPB that ii) should be presented.

5.8.6 ***Commentary on PVA:*** There were differences of opinion as to how to carry out the PVA. There was general agreement between SNH and RSPB on sites and species to be included although the SNH did not consider that Buchan Ness to Collieston Coast SPA and St Abbs to Fast Castle SPA should be included. Advice was sought from MSS on this point who suggested a PVA is undertaken if the estimated cumulative effects from the Forth and Tay projects are a reduction in annual adult survival of more than 0.2%.

5.8.7 SNH noted that they could not provide final advice on whether population models were required until the outputs for the updated collision risk and displacement modelling were available. If further models were required SNH recommended that, as a minimum, deterministic, density independent Leslie Matrix Models were required. RSPB broadly agreed with SNH's view but considered stochastic models would also be helpful. MSS advice was sought on this point and they recommended stochastic models as they have been found to be precautionary (Lande, R., Engen, S. & Sæther, B.-E. (2003) Stochastic populated dynamics in ecology and conservation. Oxford University Press, Oxford), are able to provide a greater range of potentially informative outputs, and are recognised as the best available information. There was agreement that the PVAs should be density independent.

5.8.8 SNH do not require kittiwake to be included in the assessment of displacement effects (see 5.5.8). To take account of this the Scottish Ministers have advised that the PVAs for kittiwake are presented as collision effects in isolation and collision effects in combination with displacement effects. This will provide outputs that will allow SNH to provide advice on the effects of concern to them (collision) and will also provide information on collision effects in combination with displacement to take account of the concerns of RSPB and MSS.

Signed

Gayle Holland
10/08/2017
Authorised by the Scottish Ministers to sign in that behalf

Appendix 1: Consultee Responses

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

Scottish Natural Heritage

Note: only the ornithology advice is presented here, see scoping opinion of 28 July 2017 for full response.

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 A(i) – ORNITHOLOGY

ADVICE FOR INCH CAPE OFFSHORE WIND FARM

Ornithological interests are addressed in section 8.4 and Appendix B (HRA screening) of Inch Cape's scoping report. Changes to turbine numbers and parameters are the key consideration for reassessment of potential ornithological impacts, as summarised in Table 4-1. In this regard, we provide the following advice; please see **Appendix A(iii)** for our advice in relation to the transmission works.

On the basis of Inch Cape's intended application timeframe we confirm that no further baseline survey is required (SNH advice note of 2 February 2017): the available datasets are summarised in Table 8-31 of the scoping report. This advice may change if their application is delayed.

BIRD RECEPTORS FOR REASSESSMENT

For the original assessments, the Forth & Tay developers – Inch Cape, Seagreen (alpha, bravo) and Neart na Gaoithe – collaborated on an extensive scoping exercise to consider the range of bird species potentially impacted by the developments. We have reviewed the final HRA short-list of SPA populations requiring assessment.

- **SPA seabird colonies**

For seabird species of concern, we confirm that SNH does not require any assessment against regional populations – our focus remains on the individual breeding colonies, particularly SPAs. In this regard, the final HRA short-list comprised a range of breeding seabird interests from a range of SPA colonies within foraging range of the proposed

Forth & Tay wind farms. SNH has reviewed this list in order to confirm key species and SPAs for reassessment.

Table 1. SPA seabird interests for reassessment

Species	Impact	Key SPAs for reassessment
Gannet	Collision	Forth Islands SPA (Bass Rock)
Kittiwake*	Collision	Forth Islands SPA, Fowlsheugh SPA
Herring gull*	Collision	Forth Islands SPA, Fowlsheugh SPA
Puffin	Displacement	Forth Islands SPA
Guillemot*	Displacement	Forth Islands SPA, Fowlsheugh SPA
Razorbill*	Displacement	Forth Islands SPA, Fowlsheugh SPA
* We will review the updated apportioning calculations for these three species in order to confirm whether or not any further reassessment is needed for either Buchan Ness – Collieston Coast SPA or St Abb's – Fast Castle SPA. (On the basis of previous advice we consider this unlikely.)		

On the basis of previous advice, we don't consider that Inch Cape (on its own or in combination with the other Forth & Tay proposals) will give rise to significant population level impacts in relation to lesser black-backed gull, fulmar, common tern and Arctic tern at any of the identified SPAs.

- **Outer Firth of Forth & St Andrews Bay pSPA**

Scottish Government is currently considering the designation of a new suite of marine SPAs. This process is significantly further ahead than it was at the time of the original assessments and the formal proposals were submitted to Government for consideration on 30 June 2015.As a result the qualifying features of the Outer Firth of Forth & St Andrews Bay pSPA must be subject to HRA. The proposed site boundary and features of interest are now available[1]. We provide our scoping advice in respect of pSPA features of interest below.

Table 2 gives an overview of proposed pSPA seabird interests and whether or not these are also qualifying interests of SPA breeding colonies in the area. We then consider potential impacts on these pSPA features in order to confirm our scoping advice in **Table 3**. We confirm that these species are the only ones needing consideration in respect of the wind farm: we provide advice in relation to the transmission works in **Appendix A(iii)**.

[1] http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/proposed-marine-spas/firth-of-forth-and-st-andrews-bay/

Table 2. Firth of Forth and St Andrews Bay Complex pSPA – breeding colony and marine seabird interests

Species	SPA breeding colonies HRA shortlist	Marine pSPA	
		breeding	non-breeding
Gannet	✓	✓	✗
Kittiwake	✓	✓	✓
Herring gull	✓	✓	✓
Puffin	✓	✓	✗
Guillemot	✓	✓	✓
Razorbill	✓	✗	✓
Common tern	✓	✓	✗
Arctic tern	✓	✓	✗
Shag	✗	✓	✓
Manx shearwater	✗	✓	✗
Little gull	✗	✗	✓
Black-headed gull	✗	✗	✓
Common gull	✗	✗	✓

Inch Cape lies roughly 10km from the pSPA and is therefore very unlikey to disturb or displace seabirds while they're foraging within the pSPA. Outwith the pSPA we advise that impacts on individuals can only meaningfully be considered in relation to these birds as members of a breeding population. Six key pSPA interests – gannet, kittiwake, herring gull, puffin, razorbill, guillemot – are scoped in for reassessment – see **Table 3** below. For these species, we have set out our advice above ('SPA seabird colonies') and this also covers pSPA requirements (see further discussion under 'approach to assessment').

Table 3. Firth of Forth and St Andrews Bay Complex pSPA – SNH scoping advice

pSPA seabirds	SNH scoping advice: include for assessment (yes / no) and rationale	
Gannet, Kittiwake, Herring gull, Puffin, Razorbill, Guillemot	✓	These key species and pSPA interests should be **scoped in** to the Inch Cape reassessment and are addressed in this response.
Common tern, Arctic tern	✗	Inch Cape did not record either tern species on-site in any significant numbers. We do not consider that the wind farm presents any significant risk to these species and they can

		be **scoped out** of assessment.
Shag	×	Shag were included on the original Forth & Tay 'long-list' but the developers, including Inch Cape, did not record this species on-site in any significant numbers. We do not consider the wind farm presents any significant risk to shag and it can be **scoped out** of assessment.
Manx shearwater	×	Manx shearwater were included on the original Forth & Tay 'long-list'. Although this species is difficult to survey, we do not consider it will be present on-site at any of the wind farms in any great numbers. We do not consider that any of the wind farms present a significant risk to this species and confirm that it can be **scoped out** of assessment.
Little gull, Common gull, Black-headed gull	×	We have reviewed available information on these wintering gull species. The boundary of the pSPA is drawn to protect the key concentrations of these birds in the non-breeding season. We confirm that Inch Cape has not recorded any of these species on-site in any significant numbers so that they can be **scoped out** of assessment.

- **Other birds**

All other bird interests were fully considered and addressed in pre-application dialogue and in final assessments for the previous application. The key possible impact from the Forth & Tay wind farms on these interests relates to the collision risk that turbines may present to birds on migration. In this regard, Marine Scotland commissioned a strategic 'worst case' collision risk assessment[2] for all wind farms proposed in Scottish waters at the time. We used the outputs from this strategic CRM to inform our previous advice.

Since this work was published, a number of the wind farms included for assessment have been withdrawn, and the remaining schemes are in the process of refining their design envelopes. In this regard, the proposed design changes at Inch Cape lie well within the 'worst case' previously assessed, so that we can continue to rely on the outputs from Marine Scotland's strategic CRM. We confirm that current offshore wind proposals in Scottish waters do not present significant risk to any other bird interests and we do not require any individual developer to submit further information in this regard.

These aspects are discussed in paragraphs 373 and 374 of the Inch Cape scoping report (p199) and also referenced in Appendix B (on HRA screening). In respect of paragraph 46 (p35 of Appendix B), SNH confirms that we do not have any outstanding concerns in respect of osprey, corncrake, purple sandpiper or whimbrel. These have been addressed in the strategic CRM report and we do not consider that any of the Scottish wind farms, either individually or in combination, will present a significant risk

[2] *Strategic Assessment of Collision Risk of Scottish Offshore Windfarms to Migrating Birds.* Available from: http://www.gov.scot/Resource/0046/00461026.pdf

of collision to these species. There is no further assessment or any reassessment that we require Inch Cape to undertake in this regard.

We note that the estimates of collision provided in Table 3-11 (p 33 of Appendix B) could be misleading when taken out of context. As noted above, these are estimates of collision risk to migratory populations flying through Scottish waters from breeding locations across a range of different countries (i.e. not solely UK breeding birds). Thus for whimbrel (discussed in paragraph 44) the estimated collision risk (671 birds) should be considered against a migratory population of 500,000 individuals (the whole Icelandic population – see paragraph 3.103 of the MS report). This is the relevant context, not the UK breeding population, and in this regard we confirm that the estimate of whimbrel mortality is not significant.

APPROACH TO ASSESSMENT

Inch Cape only presents a risk to seabirds when they're outwith SPA or pSPA boundaries. Therefore, as previously advised, any potential wind farm impacts should be considered in relation to the conservation objective for 'population of the bird species as a viable component of the SPA'. This means that the significance of any collision mortality, disturbance or displacement of individual birds at sea is considered in relation to the consequent effects on SPA breeding populations. We do not require any assessment against regional populations nor do we require a separate assessment for the pSPA.

We note that for impacts occurring in the non-breeding season it is a complex task to determine the proportion which should be assigned back to the relevant (SPA) breeding populations. We provide our recommendations on methodology in the relevant sections below.

ASSESSMENT METHODOLOGIES

- **COLLISION RISK**

The key species at risk of collision from Forth & Tay wind farms are **gannet, kittiwake** and **herring gull**. Please refer to SNH guidance[3] for advice on definitions of breeding and non-breeding seasons:

Species	Breeding	Non-breeding
Gannet	mid-March - September	October - mid-March
Kittiwake	mid-April - August	September - mid-April
Herring gull	April - August	September - March

[3] Explanatory notes for table of 'Seasonal Periods for Birds in the Scottish Marine Environment'. http://www.snh.gov.uk/docs/A2200567.pdf

Work on ways to incorporate uncertainty into collision risk modelling is ongoing but there is not yet any agreement on a final approach (please see **Appendix A(iii)** for further discussion). We therefore advise that the Band offshore model is used to update the calculations for reassessment[4].

We provide copies of our final collision risk workings for Inch Cape, as consented (110 turbines, blade length of 86m and hub height of ~111m). We request that the developer updates and resubmits these same spreadsheets with their supporting calculations for the new design scenario – the changes in turbine numbers and the new turbine parameters.
We recommend that collision risk modelling (CRM) is undertaken for the two scenarios at either 'end' of the updated design envelope. For these scenarios our advice on updating the CRM for each species is as follows:

- **Gannet**, **kittiwake**
  CRM outputs should be presented for model options 1 and 2 using Johnston *et al.* flight heights[5] and a 98.9% (+/- 2 standard deviations, SD) avoidance rate. Until better data becomes available, we do not require, nor do we recommend, that option 3 outputs are presented for kittiwake or gannet. This recommendation is based on advice agreed between SNH and the other statutory nature conservation bodies.[6]

- **Herring gull**
  CRM outputs should be presented for model options 1, 2 and 3 using Johnston *et al.* flight heights and a 99.5% (+/- 2 SD) avoidance rate.

In order to consider any population consequences arising from these estimated collisions, the overall impacts will need to be apportioned by season, between SPAs and across age classes. We advise on this as follows:

Apportioning collision mortality between seasons

Annual CRM totals will need to be apportioned between breeding and non-breeding seasons following SNH guidance as defined above. For half months the collisions calculated for that month are split equally between breeding and non-breeding period.

Apportioning collision mortality between age classes

Collision mortality will need to be apportioned between age classes. In this regard, we note that the CEH population models do not address sabbaticals (see further discussion in the 'population consequences' section below): we therefore recommend that all adults recorded during survey work are considered as breeding adults. We note

[4] Band collision risk model, guidance and model spreadsheets available from: https://www.bto.org/science/wetland-and-marine/soss/projects

[5] Flight height data available from https://www.bto.org/science/wetland-and-marine/soss/projects

[6] SNCB advice on use of the Band model and avoidance rates: http://www.snh.gov.uk/docs/A1464185.pdf

that this is a precautionary assumption and it may be possible to refine it – further discussion may be helpful.

Apportioning collision mortality in the breeding season to breeding colonies

Impacts which occur during the breeding season will need to be apportioned between the breeding colonies (SPA and other) within foraging range of the proposed wind farm. The current method for doing so is set out in SNH guidance[7].

We advise that this is a two-step process:

- The first step is to apportion impacts between SPA and non-SPA breeding colonies within foraging range of the wind farm. We recommend that this is done on the basis of Seabird 2000 data as this provides a common reference point and many of the non-SPA breeding colonies have not been counted since this time. Seabird 2000 data is available from JNCC who manage the seabird monitoring database[8].

- Impacts assigned to the SPA component then need to be further apportioned between the individual SPAs within foraging range. For this step, the most recent colony counts should be used and those for the key SPAs are presented in **Appendix A(ii)**.

Addressing collision mortality in the non-breeding season

We advise that assessment of collision mortality in the non-breeding season for **herring gull**, **kittiwake** and **gannet** can use the approach agreed for herring gull during the Moray Firth determinations. While many **herring gulls** remain locally in the Forth & Tay over-winter, there is also an influx of wintering birds from elsewhere. Any collisions which might occur at the wind farm will therefore need to be apportioned between the local SPA breeders and these other wintering birds. We consider that a similar method can be worked up for **kittiwake** and **gannet**: defining the overall wintering population in the Forth & Tay and determining what proportion of this comprises birds from the relevant SPA breeding colonies.

- **DISPLACEMENT**

We advise that reassessment of displacement impacts should be undertaken for **puffin**, **guillemot** and **razorbill**. Please refer to SNH guidance definitions of breeding and non-breeding seasons:

Species	Breeding	Non-breeding
Puffin	April - mid-August	mid-August - March
Guillemot	April - mid-August	mid-August - March

[7] SNH guidance on apportioning breeding season impacts: http://www.snh.gov.uk/docs/A1355703.pdf

[8] Seabird monitoring programme: http://jncc.defra.gov.uk/smp/

Razorbill	April - mid-August	mid-August - March

Our preferred approach to assessment would be to use the updated displacement model commissioned by MSS and produced by CEH[9]. The seabird distribution maps used to inform this displacement modelling are based on 2010/2011 tracking data and we recommend that they are updated to take account of more recent information.

SNH does not advise non-breeding season assessment for puffin as this species disperses from the Forth & Tay region over-winter and is not present in significant numbers. Guillemot and razorbill do, however, remain in the area and are proposed features of the marine pSPA. The new CEH model is only applicable to displacement in the breeding season and we therefore request that displacement in the non-breeding season is considered for these two species using the approach described in joint SNCB guidance.[10]

In this regard, we advise using a **60% rate of displacement** and a **1% rate of mortality**. We consider that a 1% rate of mortality is sufficiently precautionary for guillemot and razorbill in the non-breeding season based on outputs from previous CEH modelling[11].

The estimates of displacement thus calculated will need to be apportioned and assigned back to the relevant SPA breeding colonies using the same approach recommended above under collision risk. The non-breeding season mortality can then be apportioned and considered alongside the breeding season impacts for each species.

- **IMPACTS ON PREY**

SNH confirms that we do not require any reassessment of potential impacts on seabird prey species from piling (underwater noise) impacts during construction (see Table 8-37 in the scoping report, p229). Any such impacts are relatively short-term and we believe would be offset by greatly reduced long-term impacts (habitat / prey loss) from using fewer turbines.

We also note that the Inch Cape lies at least 10km from the Firth of Forth and St Andrews Bay Complex pSPA so that we do not identify any likely significant effects from the proposed wind farm piling on any prey species or supporting habitats within this pSPA.

- **POPULATION CONSEQUENCES**

[9] CEH simplified displacement model: http://marine.gov.scot/data/simplified-displacement-model-foraging-birds

[10] SNCB joint guidance note on displacement assessment http://jncc.defra.gov.uk/pdf/Joint_SNCB_Interim_Displacement_AdviceNote_2017.pdf

[11] CEH original displacement model for the Forth & Tay, further information available from: http://www.gov.scot/Topics/marine/marineenergy/Research/SB7

The impacts of collision and displacement will need to be considered in the context of relevant SPA breeding colonies. Where apportioned impacts are large and / or the SPA populations are small it is likely that population models will be required to establish whether or not there could be long-term impacts on population viability. We cannot provide our final advice in this regard until the outputs are available for the updated collision risk and displacement modelling. We will compare these outputs against the previous estimates (taken from the SNH collision risk spreadsheets and the CEH displacement models) in order to provide advice on the requirements for population modelling.

If population modelling is required for the revised Inch Cape proposal, we recommend:

a) reviewing the utility of the models commissioned by Marine Scotland and produced by CEH[12] for kittiwake, herring gull, guillemot and razorbill;

b) reviewing the Macarthur Green population modelling for gannet and puffin;

c) only producing further models for particular species if it's not possible to utilise either (a) or (b); in this case we would be requesting the production of deterministic, density independent Leslie Matrix Models.

As well as modelling their individual impacts Inch Cape should also model cumulative impacts with the other Forth & Tay proposals (see below). We request that the counterfactual of population size and population growth rate are presented as part of the model outputs[13], both for the impacts of Inch Cape on its own and cumulatively.

Finally, we request that the modelling of impacts is undertaken over two time periods; 25 years (as used for the original consent) and 50 years (as proposed now). No recovery period should be applied to either model run. **We highlight** that it is more difficult to make predictions over a longer time-frame as uncertainty in the model outputs increases with the length of model run. For SPA seabird species this may make it harder to conclude no long-term impacts on population viability and no adverse impact on site integrity.

CUMULATIVE IMPACTS

We have reviewed the projects listed in the Inch Cape scoping report for cumulative impact assessment. In this regard, we advise that assessment focuses on Inch Cape in combination with the other Forth & Tay wind farms: Neart na Gaoithe and Seagreen (alpha and bravo). This assessment will require population models to consider the

[12] The 2014 CEH population modelling report is available here: http://www.gov.scot/Topics/marine/marineenergy/Research/SeabirdsForthTay

Further information may also be available from the recent MS contract on 'Testing and Validating Metrics of change produced by Population Viability Analysis (PVA)'

[13] 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.

impacts of each wind farm individually and also together.

We do not advise that Inch Cape present an ornithological impact assessment in combination with any of the other proposals listed in section 5.7.2 (offshore wind farms), 5.7.3 (onshore wind farms), 5.7.4 (coastal projects) or 5.7.5 (other onshore projects).

In this regard, if there are any aspects which need further consideration we shall do so in providing our advice at application stage.

APPENDIX A(ii) – SEABIRD POPULATION COUNTS

Table 4. Most recent population counts for the key seabirds and SPAs of relevance to the Inch Cape reassessment.

Species	SPAs	SPA citation population	P/I	SNH/JNCC 2014 advice: SPA counts	P/I	SNH/JNCC 2014 advice: dates of counts	Most recent counts	P/I	Dates of most recent counts
Gannet	Forth Islands	21,600	P	55,482§	P	*2009*	75,259	P	*2014*
Kittiwake	Buchan Ness / Collieston Coast	30,452	P	12,542§	P	*2007*	*Counts undertaken 2016-2017˜*		
	Forth Islands	8,400	P	3,776§	P	*2012*	4,333	P	*2015*
	Fowlsheugh	36,650	P	9,337§	P	*2012*	9,655	P	*2015*
	St. Abb's Head to Fast Castle	21,170	P	6,317§	P	*Trend applied*	2,779	P	*2016*
Herring Gull	Buchan Ness / Collieston Coast	4,292	P	3,079§	P	*2007*	*Counts undertaken 2016-2017˜*		
	Forth Islands*****	6,600	P	5,027§	P	*2002*	6,500	P	*2014-2016*
	Fowlsheugh	3,190	P	259§	P	*2012*	125	P	*2015*
	St. Abb's Head to Fast Castle	1,160	P	356§	P	*Trend applied*	325	P	*2016*
Puffin	Forth Islands	14,000	P	50,282	P	*2009*	51,956	P	*2013*
Guillemot**	Buchan Ness / Collieston Coast	17280λ	I	25,857	I	*2007*	*Counts undertaken 2016-2017˜*		
	Forth Islands	8000λ	I	29,169	I	*2011*	30,910	I	*2015-16*
	Fowlsheugh	56,450	I	60,193	I	*2012*	55,507	I	*2015*

	St. Abb's Head to Fast Castle	31,750	I	58,617	I	*1998/2000****	33,627	I	*2016*
Razorbill**	Forth Islands	2800ȝ	I	4,950	I	*2011*	4,993	I	*2015*
	Fowlsheugh	5,800	I	7,048	I	*2012*	7,426	I	*2015*
	St. Abb's Head to Fast Castle	2,180	I	4,588	I	*Trend applied*	2,067	I	*2016*

***** Please be aware that herring gull at Forth Islands SPA and fulmar at Forth Islands SPA and Fowlsheugh SPA may not qualify as designated interests.

****** For guillemot and razorbill the counts were converted to 'individuals on land equivalent' then corrected using (x 1.34) to give total breeding adults in population.

******* Best available estimate at the time of our 2014 advice.

˜ Buchan Ness / Collieston Coast counted 2016-17, counts should be available shortly from the seabird monitoring database. If not, we will provide further advice.

§ Our 2014 advice used number of individuals – converted to pairs (0.5*individuals) for consistency.

ȝ The SPA citation uses number of pairs – so converted to number of individuals (2*pairs) for consistency.

APPENDIX A(iii) – ORNITHOLOGY

TRANSMISSION WORKS

Inch Cape are proposing minor changes to the export cable, see Table 4-7 (p. 46) and discussion under section 4.5.3. They have confirmed their choice of landfall point in vicinity of Cockenzie, illustrated on Figure 4-1 (p. 32) and discussed in section 4.5.4 (p. 47). The landfall option at Seton Sands has now been removed from the design envelope (paragraph 83, p. 31).

In this regard, we have considered the proposed transmission works in relation to the relevant qualifying interests of the Firth of Forth and St Andrews Bay Complex pSPA, in order to confirm that in our view there are no outstanding matters requiring further assessment.

Potential impacts from the transmission works on seabird species were fully considered for the relevant marine licence. We do not consider there will be any significant disturbance to these seabirds (including pSPA qualifiers) arising from the proposed cable-laying activity in the export corridor. The relevant conditions on the issued licence will be transferred to any new licence and these address our recommendations to ensure good working practice is adopted for cable installation.

We also confirm that non-breeding waterfowl interests were fully considered as qualifying features of the Firth of Forth SPA. In this regard, planning consent has been issued for the onshore works – including the cable landfall and intertidal works – and remains current[14].

[14] Planning consent for the Inch Cape onshore transmission works issued in 2014:
https://pa.eastlothian.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=N6LDH7GN7T000

And renewed in 2016:
https://pa.eastlothian.gov.uk/online-applications/applicationDetails.do?activeTab=documents&keyVal=OGZYRVGN07V00

APPENDIX A(iv) – ORNITHOLOGY

UNCERTAINTY IN COLLISION RISK MODELLING

The following request is additional to our statutory scoping advice, and the information does not need to be included in any application submission (provided this is not significantly delayed).

While there is current discussion around ways to incorporate uncertainty into collision risk modelling there is no agreement on a final approach. However, if possible, we would find it helpful if Inch Cape could provide the following information. This would help us in thinking about these issues for the future. We'd welcome any comments.

Table 5. Incorporating uncertainty in collision risk modelling

Data	Parameter	Unit	Figures to be presented and notes
Survey data	*Proportion of birds at collision risk height		Used for Basic Band model Option 1 only. Mean + standard deviation (SD) of proportion of birds in site survey data estimated to be flying in the rotor swept area.
	*Bird density estimates	birds/km^2	Mean + SD for survey data with multiple counts per month and/or per season and/or per year.
Development data	Total power output of proposed development	MW	Single value required.
	Turbine rating / capacity	MW	Single value required.
	Width of development	km	Single value required.
	Latitude of development	decimal degrees	Single value required: central point of wind farm footprint.
	Number of blades		Single value required.
	Rotor radius	m	Single value required.
	Maximum blade chord width	m	Single value required.
	Hub height	m	Single value required: measured from

			Highest Astronomical Tide.
	Tidal offset	m	Single value required.
	Blade pitch	degrees	Going forward we would welcome further discussion on whether this parameter can be calculated as a function of wind speed.
	Turbine rotation speed	rpm	Going forward we would welcome further discussion on whether this parameter can be calculated as a function of wind speed.
	Turbine operation time	%	Going forward we would welcome further discussion on methods to calculate and refine this parameter.

Further advice sent by SNH to RSPB and copied to MS-LOT regarding the onshore transmission works – by email 09 August 2017

Thank you for raising your query about SNH advice on the cable installation works for the Forth & Tay wind farms in relation to the Outer Forth and St Andrew's Bay Complex pSPA.

In providing our scoping advice to MS-LOT, we considered all possible impacts from the cables on the pSPA. We considered whether designation of the new pSPA would make a material difference to previous assessment or raise any new or different ornithological issues which had not been previously assessed.

We did consider potential loss or damage to supporting habitat and prey species within the pSPA, arising from cable installation, as well as any disturbance to pSPA bird interests. We advise that any habitats or prey disturbed during the cable laying should not take long to recover and we'd note that developers are seeking to minimise the amount of cable protection, if it's used at all. We do not consider that cable installation will give rise to any significant amount of permanent habitat loss.

We're satisfied that the previous assessments adequately address cable impacts for each of the Forth & Tay wind farms. The Section 36, marine licence and onshore planning consents, as issued, require submission of a cable installation plan (or cable lay strategy). This will set out good practice working measures and any required mitigation to minimise habitat / prey disturbance and to avoid any significant disturbance of seabirds and waterfowl, including pSPA features of interest.

We therefore do not require further assessment or information from developers in this regard. We do, however, recognise that MS-LOT will need to address cable installation in any new appropriate assessment(s) for the pSPA – hence we've copied them in.

We note that East Lothian Council have undertaken an appropriate assessment for the Inch Cape transmission works (as attached). This addresses the impacts of cable installation on wintering waterfowl as features of the Firth of Forth SPA, and seabirds as features of Forth Islands SPA. In respect of the Outer Forth and St Andrew's Bay Complex pSPA, any new appropriate assessments for Forth & Tay wind farms can be informed by this previous work and the conclusions reached.

Royal Society for the Protection of Birds

RSPB Scotland welcomes this opportunity to comment on the scoping report for the above noted proposed offshore windfarm.

The new Inch Cape proposal represents a significant change to the original consented development. It is likely that a comparison between the two will show a significant reduction in predicted impacts on internationally protected seabird populations within and beyond the Forth and Tay region. However, there is no doubt that this project is located within an environmentally sensitive region, particularly for seabirds. We therefore continue to have significant concerns with the risks this project poses to these seabird populations. In addition we have concerns with the potential in- combination impacts presented by other offshore proposals, including the Neart na Gaoithe, Seagreen Alpha and Bravo projects and effects on the Firth of Forth and St Andrew's Bay Complex proposed SPA.

To assess these risks adequately through the Environmental Impact Assessment and Habitats Regulations Appraisal and to ensure the population scale effects of the proposal are clearly understood by the decision-maker, use must be made of the latest and best available science. We are referring to relevant science and environmental information which has emerged since the original Inch Cape project consent was granted in October 2014.

We have developed a set of focused recommendations on the assessment parameters that are included in the detailed annex. These have been prepared following discussions with Marine Scotland, Scottish Natural Heritage and Red Rock Ltd and consideration of the Inch Cape's scoping report. We hope the annex is of assistance with the relevant aspects to the ornithological assessment, including answers to the questions raised in the scoping report. We do acknowledge that further discussion will be required to address some outstanding issues. We are very keen to offer our support where clarification or further discussion is required.

ANNEX: RSPB Scotland scoping response – 13th June 2017

1.0 Operational Lifetime

In principle we support seeking to extend the operational lifetimes of offshore wind projects. This could increase renewable energy generation and increase the overall lifecycle efficiencies of large scale renewable infrastructure. However, a proposed operating lifetime of up to 50 years presents challenges to the environmental assessment, which need to be overcome to enable a determination.

Our primary concern is the degree of uncertainty in predicting population scale effects on protected seabird colonies. Confidence in projected population model outputs decreases as time increases. This increasing lack of confidence extending to 25 years and beyond has a direct effect on the decision-makers' ability to reach an ecologically robust conclusion on the potential adverse effects to the Natura network and its protected species. We would welcome further discussion on this topic as mechanisms for addressing the issue may exist.

2.0 Environmental Baseline

2.1 Survey data

The dedicated two-year ornithology site survey data is now 5 - 7 years old. We do not request an updated survey, however we highlight the spatial and temporal variability of seabird distributions. As a consequence the survey data may not represent an accurate account of seabird usage within and around the site. This element of uncertainty could increase with time. As the project progresses, if consented, there could be a 7-10+ year gap between baseline and pre-construction surveys. This element of uncertainty must be a consideration within the assessment.

2.2 Impacts and Species Scoped In

Potential Impact	Species to be included in assessment
Displacement	Puffin Razorbill Guillemot Kittiwake
Barrier	Puffin Razorbill Guillemot Kittiwake Gannet
Collision	Kittiwake Gannet Herring Gull Great Black Backed Gull Lesser Black Backed Gull

2.3 Cumulative/ In-combination Assessment

To undertake this part of the assessment a worst case scenario must be established. All three Forth and Tay developers have indicated their intention to submit new alternative designs with fewer, larger turbines. However, all four project consents issued in 2014 could be progressed.

Working on the above basis and with the assumption that the 2014 projects have the greatest potential impact to birds. We would suggest the worst-case scenario is the Inch Cape revised development plus the Neart na Gaoithe and Seagreen Alpha and Bravo consented projects issued in 2014.

Verification will be required to demonstrate the working assumption above; that the 2014 consents are in fact the worst case in terms of impact. Another aspect, which will require further discussion, is that since 2014 there have been changes to the methods of assessing ornithological impacts and these need to be accommodated.

3.0 Assessment Methodologies

3.1 Reference Populations

The RSPB holds the results of an extensive seabird tracking programme. The information could provide additional evidence of seabird foraging distances. Information that can be used to identify reference populations for assessment purposes.

In discussion with Inch Cape, we raised the potential of providing analysed information on foraging ranges to support the assessment. We will seek to provide this in due course.

3.2 Displacement

We defer to the guidance provided by SNH on the various attributes for undertaking a displacement assessment.

3.3 Barrier

We defer to the guidance provided by SNH on the various attributes for undertaking a assessment of barrier impacts.

3.4 Collision risk modelling:

At present Band (2012) is the preferred model for undertaking the collision risk assessment.

Model Options: We recommend use of the following model options and species specific avoidance rates. These recommendations align with SNH guidance except

for our request to also present collisions for gannet applying a 98% avoidance rate during the breeding season. This is to account for the fact that the evidence presented in
Cook et al.. (2014)15 for a change in avoidance rate for gannet was based almost entirely on non-breeding birds and as such is considered to ensure suitable precaution is applied in the assessment. This is in contrast to other species such as Kittiwake and the gulls where the BTO review's evidence base included breeding birds.

Species	Basic model	Extended model
Gannet	98.9% non-breeding/ 98.0% breeding	n/a
Kittiwake	98.9%	n/a
Lesser black backed	99.5%	98.9%
Herring gull	99.5%	99.0%
Great black-backed	99.5%	98.9%

Nocturnal activity:

We recommend that values are used as per the previous 2013/14 guidance provided by SNH. We do not accept the suggested change for breeding gannet (rate of 1 which equates to 0%), unless a detailed breakdown of the timing of surveys is presented. This is because including a proportion of birds flying at night compensates for the likely under-recording of birds associated with peaks in foraging activity outwith the survey timings.

For example, Warwick-Evans *et al..,*(2015)[16] reported the highest levels of gannet activity between the hours of 0400 and 0600 in the morning, with a slightly lower peak between 0300 and 0400. And Cleasby *et al* (2015) reported that activity associated with foraging by plunge diving, when collision risk is greatest[17], was

[15] Cook, A.S.C.P., Humphreys, E.M., Masden, E.A. and Burton, N.H.K. 2014. The avoidance rates of collision between birds and offshore turbines. BTO Research Report No. 656.

[16] Warwick-Evans, V., Atkinson, P.W., Gauvain, R.D., Robinson, L.A., Arnould, J.P.Y. & Green, J.A. (2015). Time- in-area represents foraging activity in a wide-ranging pelagic forager. Marine Ecology Progress Series, 527, 233-246.

[17] Cleasby, I. R., Wakefield, E. D., Bearhop, S., Bodey, T. W., Votier, S. C., & Hamer, K. C. (2015). Three- dimensional tracking of a wide-ranging marine predator: flight heights and vulnerability to offshore wind farms. Journal of Applied Ecology, 52(6), 1474-1482

highest between 0500 and 0600 and between 1900 and 2000. The purpose of differentiating between night-time and daytime flight activity, as detailed in the Band Model Guidance, is simply to separate between times when surveys take place ("daytime") and where they do not ("night-time") and the flight activity factor applied is a correction for this. In the absence of presentation timings for when the original surveys were carried out, it is unlikely they carried out surveys so far from shore between 0300 and 0600, and to a lesser extent between 1900 and 2000. As such the results for gannet could omit a large part of flight activity and therefore produce a potentially serious underestimation of collision risk. Reducing the nocturnal activity rating to 0% is therefore not considered sufficiently precautionary.

Summer

Breeding season:	as per SNH guidance.
Boat based bias:	we support SNH's current position of not accounting for boat based biased as there is a lack of data to support any assumptions.
Proportion from SPA:	As per SNH approach.
Age classes:	Recommend including all age classes as per SNH advice and justification provided below which is equally relevant in this instance.

Winter

It is vital for consideration to also be made to potential impacts during the non- breeding season.

Non-breeding season:	Non breeding season mortality should be detailed.
Boat based bias:	As per above.
Proportion from SPA:	Non-breeding season collision mortality impacts must be considered in the context of the relevant SPA populations. To account for potential in-combination impacts to seabird populations we would also welcome further discussion on how to consider these mortalities in the context of regional BDMPs (east coast region) as listed in Furness, 2015.[18]
	We state this requirement for non-breeding

[18] Furness, R.W. 2015. Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Reports, Number 164.

season impact assessment as the JNCC guidance "The UK SPA network: its scope and content" recognises in the following paragraphs, protection requirements must apply across the year in order for the special conservation measures to achieve their conservation objectives:

"A5.5 Qualifying species... In all these and similar instances, the provisions of the Habitats Regulations apply throughout the year, with no implied seasonality.

...

A5.5.2 Seasonal occurrence... The inclusion of a site within a species suite ensures consideration of the conservation needs and ecological requirements of the relevant species at all times of year."

Proportion immature birds:	Not to be excluded as per above justification.
Proportion adults:	As above.
Remove winter influx adults:	As per SNH advice
Remove winter influx Immature:	As per SNH advice

3.5 PVAs

Species to be addressed:	As per SNH advice.
Model population:	As per SNH advice.
Type:	Either deterministic or stochastic.
Run:	As per SNH advice.
Demographic rates:	As per Horswill & Robinson, 2015.[19]
Output metrics:	Present either as formula or table to allow for testing a range of mortality input scenarios. To present counterfactuals as per Cook & Robinson, 2016.[20]

3.6 Assemblages

At page 253, the scoping report asks for clarity on the status that '*should be afforded to species that are listed as named components of SPA assemblage features, and how these named components should be treated?*'

The assemblage, as set out in the SPA citations, is specific to that designated site and comprises the relevant populations for each of the individual species that

[19] Horswill, C. & Robinson R. A. 2015. Review of seabird demographic rates and density dependence. JNCC Report No. 552. Joint Nature Conservation Committee, Peterborough.

[20] 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.

make that assemblage. Any change to individual species populations will alter the sites' assemblage of species. Therefore both the assemblage and the species populations within it need to be considered as part of the HRA. The two are not mutually exclusive.

3.7 pSPAs

Firth of Forth and St Andrew's Bay Complex proposed SPA (pSPA) requires inclusion in the assessment. The supporting habitats within this pSPA are especially relevant to the cabling corridor. Such development could lead to habitat disturbance or loss within the pSPA. The relative importance of the cable corridor in terms of the quality of habitat and how its structure and function could be affected.

Appendix II – Summary of MSS advice

Table of questions provided in advance of the meeting on 19 July 2017 to focus discussion on key points. The table was prepared by MS-LOT and MSS and provided to SNH and RSPB.

Advice Required		Response- with justification/s
SPAs		
1.	Which SPAs/ pSPA need to be included in the assessment?	
2.	Which qualifying features of the SPAs/ pSPAs should be included in the assessment?	
3.	What reference populations should be used for each SPA/ pSPA qualifying feature?	
4.	Which conservation objectives are most relevant for the SPAs/pSPAs/ species to be considered in the assessment?	
Displacement		
5.	Which species should be included in the assessment of displacement effects?	
6.	What are the breeding season months?	
7.	Which density estimate should be used for assessments (e.g. mean seasonal max)?	
8.	Should the density estimates be based on all birds or birds on the water?	
9.	Should sabbatical birds within the population be accounted for, and if so what rate should be used for each species, and how should it be accounted for in the assessment?	
10.	How should displacement effects be estimated for the assessment?	
11.	What displacement rate should be assumed for each species?	

12.	How are displacement rates effected by WTG density/ spacing?	
13.	Should barrier effects be estimated and if so, for whish species/ SPAs and how?	
14.	Should displacement effects be expressed as reductions to adult survival and/or productivity?	
15.	Should displacement effects in the non-breeding season be considered qualitatively, qualitatively or not at all?	
16.	If quantitatively, how?	
17.	If qualitatively, how?	
18.	If yes, do new runs of the model need to be carried out?	
19.	If available, should the MSS commissioned displacement modelling tool being produced by CEH be used?	
20.	If the SNCB 'matrix' method should be used, what mortality rate and/or reduced productivity rate should be assumed for the PVA wind farm effect scenarios?	
Apportioning		
21.	Which method should be used to apportion effects to SPA/ non SPA colonies?	
22.	Which colony population counts should be used for apportioning?	
23.	Should estimated effects from the non-breeding season be apportioned to SPAs, and if so how?	
24.	Should estimated effects to non-adult age classes be apportioned to SPAs, and if so how?	
25.	If available, should the CEH apportioning tool be used?	
Cumulative Impacts		
26.	Which other projects should be	

	included in the cumulative assessment?	
27.	Should non-breeding season effects be included in the cumulative assessment, if so how?	
28.	If non-breeding season effects are included in the assessment, how does this influence the other projects to be included in the cumulative assessment?	
29.	How should effects from the different projects be combined?	
Collision Assessment		
30.	Which species should have Collision Risk Models produced?	
31.	What nocturnal activity score should be used for each species?	
32.	What bird parameters should be used for each species?	
33.	Which density estimate to be used?	
34.	Which flight height distribution should be used, or what should be considered when deciding which to use?	
35.	Which Band CRM option/s should be used?	
36.	Which avoidance rates should be used for each species/ Band version?	
37.	Should a range of avoidance rates be presented, and if so which ones?	
38.	Which Band CRM option and avoidance rate should be assumed for the PVA wind farm effect scenarios?	
39.	Should uncertainty in collision estimates be considered or presented, and if so how	
40.	Should boat based bias i.e. from large scale attraction to survey vessels, be accounted for in density estimates and if so how	
41.	What are the breeding season	

	months	
42.	Should non breeding season effects be included	
43.	If yes, how would collisions be attributed to the SPA (as opposed to 'regional' population	
44.	If yes, what non-breeding season reference population/s should be used for each species	
45.	Should sabbatical birds within the population be accounted for, and if so how.	
46.	How should the proportion of adult birds be estimated?	
47.	Should collision of non-adult aged birds be included in the assessment?	
48.	If yes, how would the proportion of non-adults be determined	
49.	If yes, how would collisions be attributed to the SPA (as opposed to birds from the 'regional' breeding season population)?	
50.	If yes, how would collisions be attributed to the SPA (as opposed to birds from the 'regional' non-breeding season population)?	
51.	Which (if any) species and SPAs are PVAs required for?	
52.	What type of PVA is required (stochastic, deterministic, or doesn't matter)?	
53.	Do the PVAs need to include effects on non-adult age classes, and if so which species and SPAs?	
54.	Do the PVAs need to include effects from during the non-breeding season, and if so which species and SPAs?	
55.	At what point in time should estimated wind farm effects be incorporated into PVA (year of application, year of proposed	

	completion, etc)?	
56.	Over what time period should the PVAs be run?	
57.	Which 'baseline' demographic rates should the PVAs use?	
58.	How should estimated displacement, barrier, and collision effects be combined for the PVAs?	
59.	What combination of productivity and adult survival effects on adults (and immature?) in the breeding (and non-breeding?) season should be assumed in the wind farm effect scenarios?	
60.	Which PVA metrics should be presented?	
61.	Can the original PVAs produced by CEH be relied upon (will depend upon answers above)?	
62.	What other information is required to help inform advice on adverse impact on site integrity?	

Follow on questions from MS-LOT after the meeting on the 19 July 2017 and MSS response.

MS-LOT have now had the scoping advice from SNH and RSPB for all Forth and Tay developers. We have also had the ornithology wash up meeting which you attended. During that meeting the SNH and RSPB positions in relation to the ornithology table of questions was recorded. This has been sent to SNH and RSPB for refinement and to ensure that it accurately reflects discussions at the meeting. I have attached the draft table at present but will send on the final version once SNH and RSPB have reviewed it. MS-LOT request advice where there are differing views between SNH and RSPB on certain points. The question numbers relate to the numbers in the table.

My questions are:

2. RSPB suggested GBBG and LBBG should be included in an EIA assessment, however the ES submitted by Inch Cape assessed effects to be negligible therefore I would propose to scope these species out, do you agree?

MSS agree that the assessed effects are negligible and that this provides a good reason to scope out GBBG and LBBG.

2. For the pSPA species SNH advised that displacement should be assessed, RSPB advised that displacement and collision should be assessed. Please provide MSS advice on this point with justification.

Where proposed WTG locations are within the pSPA boundary, it would seem sensible for collision effects to also be included within the assessment. This is because the potential windfarm effects are occurring within the pSPA, which evidence indicates is a particularly important foraging area for the species potentially affected.

4. Which Conservation objectives do you consider to be most relevant?

For all four wind farms, the Conservation Objective "Population of the species as a viable component of the site" captures all of the other COs for the existing colony SPAs, and this should be the focus of the assessment. For NNG only, the conservation objectives of the pSPA relating to deterioration of habitats should also be considered due to its overlap with the pSPA .

5. Should displacement be assessed for kittiwake?

Yes, it should be included in the assessment. Macro avoidance/ displacement has been observed at some wind farms, and whilst displacement and collision effects may be mutually exclusive for individuals, this may not be the case at the population level. Also, the CEH displacement report (Searle *et al*., 2014) indicated that displacement/ barrier effects have the potential to effect individuals and impact populations.

10. Do MSS advise a qualitative or quantitative assessment for pSPA species for NnG, SNH advised qualitative, RSPB advised matrix. Please provide justification.

Where a species' reference population is an existing breeding colony SPA, quantitative. Where this is not the case, effects should be quantified but due to the lack of an appropriate reference population for these species the matrix approach is not possible and the assessment of the population consequences will need to be qualitative.

11. If your answer to Q5 is that a displacement assessment should be completed for kittiwake, what displacement rate would you advise (RSPB advise 50%)?

The displacement rate should be 30%. This value takes into account the advice from SNH, the advice from the RSPB, the approach taken in the original assessments for

the Forth and Tay, and the lower number of WTG (necessitating either a greater WTG spacing or reduced overall wind farm footprint) in the new applications. If the matrix approach is used, the mortality rates should match those advised by SNH for the other (auk) species.

24. For non-breeding gannet and kittiwake would you advise site survey age structure or stable age structure to determine age structure?

The age structure of the non-breeding season effects should be based on the age structure derived from the at-sea survey data at this time of year. If this is not available then the stable age structure will provide the best available evidence and should be used.

26. For the breeding season which other projects do you consider should be included in CIA. Of these which should be included in the PVAs for the CIA?

For the breeding season, the CIA should consider effects from projects within mean max foraging range of the colony SPA under consideration. If available, the MS commissioned Apportioning Tool provides an output that ranks colonies by likelihood of a bird at a windfarm origination from that colony. For the CIA, effects should be considered quantitatively for the windfarm in isolation and in combination with the other three F&T wind farms. Effects from other windfarms should be considered within the CIA qualitatively.

PVA should be produced for the estimated effects from:

- the windfarm in isolation (effects throughout the year and on all age classes),
- the wind farm in combination with the other three F&T windfarms (effects throughout the year and on all age classes)
- for gannet and kittiwake the breeding season effects from the F&T wind farms combined with the non-breeding season effects from the offshore wind farms in UK waters (but see MSS advice in points 1-4 below)

27. For non-breeding season SNH advised for kittiwake and gannet all North Sea UK windfarms should be included in CIA. RSPB advise also include a qualitative assessment of North Sea European sites. Please provide MSS advice on this point.

At the meeting we discussed contacting PINS which I have done. P141 of East Anglia 3 ES includes A UK NS CIA, please consider and provide views.

See 26 above and final row of MSS advice below. Note that it is assumed that the SNH and RSPB advice relates to collision effects only.

31. Please provide MSS advice on most appropriate nocturnal activity scores with

justification.

MSS advice is to use the scores advised by SNH. RSPB advise using a score of 2 for gannet but the justification for this appears to conflate nocturnal activity with colony attendance, foraging activity and timing of at-sea surveys without an adequate empirical basis.

51. Do you consider that PVAs should be provided for Buchan Ness to Collieston Coast and St. Abbs to Fast Castle SPAs?

Yes, unless the estimated cumulative effects from the F&T projects are less than a reduction in annual adult survival of 0.2%.

52. Please provide MSS view on whether deterministic or stochastic models should be used.

Stochastic models should be used as these have been found to be precautionary (Lande, R., Engen, S. & Sæther, B.-E. (2003) Stochastic populated dynamics in ecology and conservation. Oxford University Press, Oxford), are able to provide a greater range of potentially informative outputs, and constitute are the best available information. The PVAs should be density independent.

Please provide detail of any concerns you have with the advice provided by SNH or RSPB.

1. SNH advise that the displacement rates for guillemot, razorbill and puffin should be assumed to be 60%. This is higher than the rates that they advised for the previous assessments of ICOL, SGA and SGB, which SNH advised would have lower displacement rates due to the lower turbine density/ higher turbine spacing on these windfarms. If the number of WTG is even lower for the new applications for ICOL, SGA and SGB (and indeed NNG) then either the WTG density within the windfarm will also be lower, or the dimensions of the windfarm will be smaller. The displacement rate should reflect this, and MSS advise a displacement rate of 50% be used. This is the higher end of the range of 40-50% advised by SNH in the original F&T windfarms with reduced WTG density.

2. Both SNH and the RSPB advise the monthly maximum at-sea survey estimates should be used to inform the collision risk assessment rather than the mean values. This is a change to advice provided for other windfarms, and the rationale is unclear from the SNH advice. The suggestion appears to be that it is in order to account for uncertainty, but the approach advised ignores uncertainty/ variability and instead appears to be aimed at being as precautionary as possible. Defaulting to the most precautionary approach available is not in itself a justification, and runs the very high risk of producing an estimated effect that is highly likely to be

unreasonable and unrealistically high. It also lacks robustness because with each year of survey undertaken, the likelihood of a higher value being identified would increase, and the representativeness of the high value would become increasingly questionable. The RSPB suggest that a reason for them advising this approach is due to the Regulator wishing to see a single effects estimate modelled in the PVA, but it was the RSPB that indicated at the meeting on 19.07.17 and in their subsequent email on 21.07.17 that they wished to see a single effects estimate (though this was not what they advised previously). Neither SNH nor the RSPB mention presentation of uncertainty around the monthly maximum values, which further undermines their "to account for uncertainty" justification. MSS would advise that the mean monthly estimates are presented alongside confidence limits, and that the mean values are those assumed in the effects scenarios incorporated into the PVAs because this is the most robust approach, is consistent with previous assessments, and will provide information on the uncertainty around the mean value in order to account for uncertainty.

3. SNH appear to be advising that alongside the baseline, PVAs should be run for the estimated WCS effects only. The RSPB indicated on 19.07.17 that they were in two minds over whether single effect scenarios should or should not be presented by the developer. MSS advise that PVAs are also run for estimated effects that are 10% higher and 10% lower than those estimated for the WCS. This should be for the windfarm combinations identified under 26 above. This is advised as MSS believe that it is important for the assessment to be able to consider the sensitivity of population consequences (as estimated by the PVAs) of windfarm effects that may be higher or lower than those estimated for the WCS, as this may have some bearing on the conclusions reached in the assessment.

4. It will be challenging to identify collision estimates from the other offshore wind farms in the UK that have been estimated and/or reported in a consistent manner (see 26 and 27 above). Many will have been estimated using approaches that are no longer deemed to be the best available approach. The cumulative totals obtained should therefore be treated with extreme caution, as should the outputs from PVAs should these cumulative effect totals be modelled.

Further advice requested by MS-LOT and provided by MSS on the most appropriate mortality rate from displacement.

We have had further advice from SNH on the most appropriate mortality rate from displacement (related to Q20 of the table) SNH now advise 2% for puffin and 1% for other auk species (both during the breeding and non-breeding season). RSPB suggest 2% during both seasons. Please could you provide the MSS view on this point with reasons, also please advise value for kittiwake.

In response to your questions below:

- Assuming a reduction in adult mortality rate of 2% for displaced puffin during the breeding season seems appropriate considering the results of the CEH displacement model (Searle et al 2014) suggested that this species may be more susceptible to displacement effects than the other two auk species (guillemot and razorbill considered. It should be noted both that the tracking data available to that study were limited, and also that the update to the 2014 model (the “Fate of Displaced Birds” model) being produced by CEH aims to include puffin (as well as guillemot, razorbill and kittiwake).
- Assuming a reduction in adult mortality rate of 1% for displaced guillemot and razorbill during the breeding season is appropriate considering the results of the CEH displacement model (Searle et al 2014) that suggested these species were not particularly susceptible to displacement effects from the F&T wind farms.
- Assuming a reduction in adult mortality rate of 1% for displaced guillemot and razorbill during the non-breeding season is appropriate considering that they are no longer central-place foragers tied to the breeding colony at this time of year, but also taking into consideration that they do not disperse as widely as e.g. puffin during the non-breeding season.
- For kittiwake, the assessment of displacement during the breeding season using the SNCB guidance (the ‘matrix’ approach) should assume a reduction in adult mortality rate for displaced individuals of 2%. This takes into consideration the results from the CEH displacement model (Searle et al 2014) that indicated that displacement from the Forth and Tay windfarms had the potential to impact the SPA populations considered.

Appendix III – Note on updating flight height data in the Band collision risk model

Collision risk modelling – flight height data and spreadsheet advice

- Band CRM spreadsheets are available from the SOSS website: https://www.bto.org/science/wetland-and-marine/soss/projects

  However, please be aware that the 'Flightheight' tab is **NOT** up to date with advised flight height data: https://www.bto.org/sites/default/files/u28/downloads/Projects/Final_Report_SOSS02_Band2Tool.xlsm

- To access the most up to date flight height data the Flight Heights Spreadsheet must be downloaded: https://www.bto.org/sites/default/files/u28/downloads/Projects/Final_Report_SOSS02_FlightHeights2014.xls

  This uses the amended Johnston *et al.*. 2014 flight height data.

- Flight height data should be copied from the species-specific tabs in the Flight Heights Spreadsheet – copy the 'Maximum Likelihood' column into column B of the 'Flightheight' tab of the CRM excel spreadsheet. **Or** copy the species-specific column from the '1m_height_bands' in the Flight Heights Spreadsheet – copy the 'speciesname.est' column into column B of the 'Flightheight' tab of the CRM excel spreadsheet.

- Species-specific flight height data can be stored in the 'Flightheight' tab of the CRM excel spreadsheet to the right of column B, and then be copied and pasted into column B as required. However, column B is the only *active* column – only data placed in this column will be used to calculate collision risk.

- It should be checked that cell B7 (called 'Npoints') in the 'Flightheight' tab of the CRM excel spreadsheet has a value of 300. This ensures that all cells containing flight height data are taken into consideration when estimating collisions.

- It is worth naming the flight height columns in the 'Flightheight' tab of the CRM excel spreadsheet with the species the data relates to (as shown in the example spreadsheet) and an indication of the flight height data used (e.g. Gannet - Johnston corrected).

Appendix IV – MSS advice on presentation of outputs from PVA modelling

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 correspondin g derived metric)	median of the ratio of impacted to unimpacted population size (and correspondi ng 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)