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Marine Scotland - Licensing Operations Team Scoping Opinion

Addendum: Ornithology

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

THE MARINE WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS 2007 (AS AMENDED)

SCOPING OPINION FOR THE PROPOSED SECTION 36 CONSENT AND ASSOCIATED MARINE LICENCE APPLICATION FOR THE MORAY EAST OFFSHORE WINDFARM ALTERNATIVE DESIGN PARAMETERS – ORNITHOLOGY ASPECTS ONLY

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1 Executive Summary

This is Marine Scotland Licensing Operations Team's ("MS-LOT") Scoping Opinion in respect of the ornithological aspects of the Scoping Report for the alternative design parameters proposed for Moray East Offshore Windfarm.

This document sets out MS-LOT's opinion on the basis of the information relating to ornithology provided in the Scoping Report of 06 March 2017. The first version of the Scoping Opinion (issued 9 May 2017) includes MS-LOT's opinion and advice on all other receptors included in the Scoping Report and should be read in conjunction with this document. This approach was agreed by stakeholders at the scoping meeting held on Wednesday, 29 March 2017 at the Marine Laboratory, Aberdeen.

The scoping request relates to the Moray East Alternative Design to be situated in the same area of the Moray Firth as the previously consented Telford, Stevenson and MacColl offshore windfarms. The total capacity would not exceed the already consented 1,116MW. The approach taken in the Scoping Report is to use the Environmental Statement ("ES") submitted in relation to the Telford, Stevenson and MacColl offshore windfarms in 2012 as an evidence base. The 2012 ES is used to scope factors out of the forthcoming ES 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 the Developer. The matters addressed by the Developer in the Scoping Report have been carefully considered and use has been made of professional judgment and experience in order to adopt this opinion. It should be noted that when it comes to consider the ES, MS-LOT will take account of relevant legislation and guidelines (as appropriate). MS-LOT will not be precluded from requiring additional information if it is considered necessary in connection with the ES submitted with the application for section 36 consent and associated marine licence.

MS-LOT have consulted on the Scoping Report and the responses received have been taken into account in adopting this opinion. Two ornithology meetings have been held with Scottish Natural Heritage ("SNH"), Royal Society for the Protection of Birds ("RSPB"), Marine Scotland Science ("MSS") and the Developer to discuss the Scoping Report further.

The main potential ornithological issues identified are:

- The risk of collision to great black backed gull, herring gull, kittiwake and gannet.
- The risk of displacement of puffin, guillemot and razorbill.
- The consideration of impacts on East Caithness Cliffs SPA and North Caithness Cliffs SPA.

Table 1 Summary of MS-LOT's decision(s) as to whether potential ornithological effects can be scoped out.

Potential Effect proposed to be scoped in by the Developer	MS-LOT advice
Great black backed gull	Based on SNH/RSPB advice - to be scoped in for collision risk
Herring gull	Based on SNH/RSPB advice - to be scoped in for collision risk
kittiwake	Based on SNH/RSPB advice - to be scoped in for collision risk
gannet	Based on SNH/RSPB advice - to be scoped in for collision risk
puffin	Based on SNH/RSPB advice - to be scoped in for displacement
guillemot	Based on SNH/RSPB advice - to be scoped in for displacement
razorbill	Based on SNH/RSPB advice - to be scoped in for displacement
fulmar	Based on SNH advice – scoped out of further assessment
Pink footed goose	Based on SNH advice – scoped out of further assessment
Greylag goose	Based on SNH advice – scoped out of further assessment
Shag (cumulative impact only)	Based on SNH advice – scoped out of further assessment
Arctic skua (cumulative impact only)	Based on SNH advice – scoped out of further assessment
Great skua (cumulative impact only)	Based on SNH advice – scoped out of further assessment
Arctic tern (cumulative impact only)	Based on SNH advice – scoped out of further assessment

2 Aim of this Scoping Opinion

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

3 EIA Regulations

The request for a scoping opinion was made by the Developer on 6 March 2017 under The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) (herein referred to as "The Marine Works 2007") and The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (as amended) ("herein referred to as The Electricity Works 2000").

On the 16th May 2017 The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (herein referred to as "The Electricity Works 2017") and in relation to Scottish offshore waters (12-200 nm) The Marine Works (Environmental Impact Assessment) (Amendment) Regulations 2017 (herein referred to as "The Marine Works Amendment 2017") came into force, transposing the requirements of the 2014 amendment (2014/52/EU) to the EIA Directive. The Electricity Works 2017 provide transitional arrangements and revocations. They revoke The Electricity Works 2000 regulations. The Electricity Works 2017 regulations apply instead but under transitional arrangements and provide that in certain circumstances they apply in cases pre-existing as of the 16th May 2017, but in a modified form. This is where an applicant for a section 36 consent for an EIA project has, before the 16th May 2017, either – (1) submitted an environmental statement in connection with an application to the Scottish Ministers; (2) made a request to the Scottish Ministers for a scoping opinion in connection with the project; or (3) made a request to the Scottish Ministers for a screening opinion. These regulations therefore now apply under the transitional arrangements. The Moray East project is out with 12 nautical miles, therefore The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) apply in relation to the marine licence aspect. The transitional arrangements provided in The Marine Works Amendment 2017 mean that The Marine Works 2007 regulations apply, but not as amended by The Marine Works Amendment 2017.

The Electricity Works 2017 regulations now refer to an EIA report, rather than an

Environmental Statement (ES) (using the terminology within the 2014 amendment to the EIA Directive. The Marine Works 2007 regulations still use the term ES. In this opinion any reference to ES, should also be interpreted as also meaning EIA report for the purposes of the Electricity Works 2017 regulations.

4 Consultation

On receipt of the scoping opinion request documentation, MS-LOT, in accordance with The Electricity Works 2000 and The Marine Works 2007 regulations, initiated a 28 day consultation process, which commenced on 13 March 2017. Advice was also sought from Marine Scotland Science ("MSS") on certain points. Full details of this consultation process are included in the Scoping Opinion for other receptors, (issued 9 May 2017).

An ornithology scoping meeting was held on 29 March 2017 where it was agreed that the Developer should complete collision risk modelling ("CRM") for gannet, great black backed gull, herring gull and kittiwake in order to assist SNH and RSPB in informing their scoping advice. Advice on how this CRM was to be completed was provided to the developer on 19 April 2017 and is included at appendix 2.

Following this advice the developer provided MS-LOT with CRM results for the 4 species as requested. This information is included at appendix 5. This CRM modelling showed a reduction in the collision risk estimates when considering the alternative design with the previously consented Telford, Stevenson and MacColl wind farms. This information was shared with RSPB and SNH. Having considered this information, SNH provided MS-LOT with a summary table of the predicted effects compared with effects from the previously consented wind farms, this is included at appendix 3.

The CRM results were discussed at a further ornithology meeting on 9 May 2017, attended by the Developer, SNH, RSPB, MSS and MS-LOT. At this meeting SNH and RSPB advised that further work would be required to inform the ornithology assessment, and that advice on how this should be done would be provided through the formal scoping consultation. This advice was received from SNH and the RSPB on 1 June 2017 and is attached at appendix 1. Prior to this advice a table prepared by SNH and RSPB setting out the assessment criteria was provided to MS-LOT on 23 May (attached at appendix 4). When requested by MS-LOT, SNH provided clarity on certain assessment methodology points in a letter on 9 June, and clarity on species to be scoped in and out of the assessment in an email dated 9 June 2017.

MS-LOT are satisfied that the requirements for consultation have been met in accordance with the EIA Regulations.

Full consultation responses from SNH and RSPB are attached in appendix 1 and each should be read in full. Where conflicting advice has been provided by RSPB and SNH, MS-LOT (with input from MSS) have provided advice on which advice should be followed by the Developer (see section 5.1 of this opinion).

The advice from SNH dated 1 June 2017 states that "*At the meeting on 9 May 2017, we agreed that it would be helpful to use this reapplication as an opportunity to address the concerns raised by the RSPB in respect of the original proposal and supporting assessments*". MS-LOT have clarified with SNH that Marine Scotland did not agree this at the meeting. MS-LOT consider that re-assessment of the impact on key bird species is required based on advice from SNH, RSPB and MSS in order to ensure that the best available evidence and most up to date science is used to inform the decision on the application.

5 Ornithological Interests to be Considered Within the ES

The Scoping Report contained a series of questions posed by the Developer and these are used to inform the structure of this opinion. Each question is addressed in turn below and MS-LOT's answers or advice 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.

This section contains a summary of main points raised by consultees and MS-LOT's opinion on whether EIA topics should be scoped in or out. The consultation responses are contained in appendix 1 and the Developer is advised to carefully consider these responses and use the advice and guidance contained within them to inform the ES.

The Developer has used an ES undertaken for the Telford, Stevenson and MacColl developments, which obtained consent in March 2014, for much of the baseline information in their Scoping Report and this is referred to as the 'Moray East ES 2012' in this opinion. The ES to be submitted for the current project should be a standalone document without the need for users to refer back to the Moray East ES 2012 to understand the information contained within the 2017 report. MS-LOT consider that it would be appropriate for previous assessment work being relied on from the Moray East ES 2012 to be contained in appendices so that the main text of the ES for the current project is concise.

To ensure that all potential significant impacts are considered as part of the consent determination they will be reported within the ES for the new Moray East application. Relevant conditions attached to the Telford, Stevenson and MacColl consents will also be reported in the ES. A schedule of mitigation should also be included in the ES.

5.1 Scoping Questions

Scoping Question	Question
8.1 (Page 126)	Is Marine Scotland in agreement with the following with regards to the proposed windfarm EIA for ornithology? • Have all the appropriate sources of data been identified to inform the site characterisation/baseline description?

In their consultation response RSPB highlight that the ornithology site survey data is now 5-7 years old, however RSPB do not request any updated surveys. RSPB did highlight the spatial and temporal variability of seabird distributions and therefore that survey data may not represent an accurate account of seabird usage within and around the site (this uncertainty could increase with time).

MS-LOT received advice from SNH on 2 February 2017 in relation to east coast wind farm site characterisation surveys. SNH advised that no new site based surveys are required for the Moray East site to inform a new application.

MS-LOT recognise that the site survey data is now 5-7 years old, however based on the advice from SNH and RSPB advise that no new surveys are required. However this position may need to be revisited if there is a long delay in an application being made. The Developer should contact MS-LOT on this point if the application is not made within 12 months of this Scoping Opinion.

MS-LOT conclude that the appropriate sources of data as described in section 8.4 of the Scoping Report have been identified.

- Is the method of project specific impact assessment proposed appropriate?

The scoping report suggests that fulmar, pink-footed goose and greylag goose should be scoped in to the EIA. The report also suggests that shag, Arctic skua, great skua and Arctic tern should be scoped in for cumulative impacts only. SNH advised in an email dated 9 June 2017 that these species can all be scoped out of the EIA. MS-LOT confirm that these species can be scoped out.

There have been 2 ornithology meetings (29 March and 9 May 2017) held with the Developer, SNH, RSPB and MSS and much of the discussion has been around the assessment methodology. The consultation responses provided by SNH and RSPB

describe in detail the methods which should be followed. There is consensus between RSPB and SNH on much of the assessment methodology. Where this is the case the advice within the consultation responses should be followed. Below are some of the main points, including clarity where conflicting advice has been received from SNH and RSPB.

Collision Risk Modelling

The CRM already completed for great black backed gull, herring gull, kittiwake and gannet (appendix 5) should be included in the ES with the additional presentation of a 98% avoidance rate for gannet during the breeding season as requested by RSPB and advised by MS-LOT (email of 19th April 2017). SNH advice should be followed in relation to breeding seasons for use in apportioning to SPA colonies.

The RSPB do not agree with SNH on the nocturnal activity rating of 1 for gannet which was used in the CRM presented at the meeting on 9 May 2017. MSS have advised that the RSPB advice appears to be conflating foraging behaviour with proportion of time at sea, and suggesting that the nocturnal activity adjustment can be used to account for any bias in density of birds at sea that may result from at-sea surveys not being undertaken during the very early hours of daylight. The case for doing this is not well justified and MSS advice would be to follow the advice provided by SNH. MS-LOT advise that the SNH advice should be followed in relation to nocturnal activity.

SNH and RSPB have advised that a correction factor should not be applied for potential boat-based attraction of gull species during survey work, MS-LOT accept this advice.

Displacement

As advised by SNH and RSPB, MS-LOT confirm that only the auk species (puffin, razorbill and guillemot) require displacement impacts to be calculated. As advised by SNH and RSPB, a range of displacement rates and mortality rates should be presented (as per Table 3 of the SNCB Interim Displacement Advice Note). However the assessment should be based on 60% displacement and 2% mortality as per the SNH advice of 9 June 2017. RSPB did not provide advice on which displacement rate or mortality rate was most appropriate for use in the assessment, only that a range should be presented.

SNH advice should be followed in relation to breeding seasons and survey counts used in the assessment. Displacement calculations should be based on the data for ‘all birds’ (not solely those ‘on the water’). There is no requirement for separate consideration of barrier effects. RSPB and SNH agreed on these points. MSS advised that the number of puffin, guillemot and razorbill potentially displaced during the non-breeding season should be presented and a qualitative assessment of its

significance in combination with any breeding season effects made.

Apportioning

Breeding season impacts (collision risk / displacement) will need to be apportioned between the SPAs within foraging range of the wind farm. MS-LOT advise that the 2 step process detailed in the SNH advice of 9 June 2017 should be followed. For non-breeding season collision effects on herring gull and great black-backed gull, apportioning should use the same method as the original assessment, but using the Biologically Defined Minimum Population Scale ("BDMPS") as the reference population. Non-breeding season effects on kittiwake, gannet, guillemot, razorbill and Atlantic puffin should be presented by age class only (assuming the species' Population Viability Analysis ("PVA") stable age class) and used to inform the assessment in a qualitative manner.

Consideration of sabbaticals

The RSPB advice is that sabbaticals should be included in the assessment. MSS advised that to include sabbaticals would seem likely to overestimate the effects to these species/ populations. MS-LOT therefore advise that the advice provided by SNH on 1 June and 9 June 2017 should be followed i.e. the impacts assigned to sabbaticals should be removed from any subsequent population modelling using the values presented in the 1 June advice under "% sabbaticals".

Non-breeding season

In relation to displacement SNH advise that for auk species in the non-breeding season there is a wide dispersal of these species and only low densities of birds from the breeding colonies remain in the Moray Firth over winter. MSS suggest that this effect could be considered in a qualitative manner. MS-LOT advise that this is appropriate.

For collision effects SNH advised on 9 June that for great black backed gull and herring gull the method used to apportion estimates of collision mortality in the non-breeding season in relation to the Telford, Stevenson and MacColl consents be used. For gannet and kittiwake SNH advised that Moray East should simply present estimates of non-breeding season mortality which they would use to inform their advice. MSS advised that for these species a qualitative assessment of the significance of non-breeding season collision effects in combination with any breeding season effects should be provided.

RSPB advised that non-breeding season collision mortality estimates should be considered in the context of the relevant SPA populations. RSPB also advised that they would welcome discussions on how to consider these mortalities in the context of BDMPS for consideration of in-combination effects. MSS advice is that this would be best undertaken as a strategic Cumulative Impact Assessment and that it would

not be reasonable to ask a developer to undertake this work.

MSS advised that the non-breeding season reference populations should be taken from the BDMPS report. These values were not used to inform the original consents as they were not produced until after the Moray Offshore Renewable Limited ("MORL") and Beatrice Offshore Wind Limited ("BOWL") assessments were completed, and so this would be an update to the approach taken previously. This will allow the effect scenarios to be captured in the PVAs and reflect the effects estimated for the wind farm scenarios under consideration.

MSS advised that collision estimates produced for the non-breeding season are apportioned to the SPAs of interest using the proportion of SPA population to the BDMPS. For non-adult age classes, the stable age structure assumed in the BDMPS report should be used to calculate the population of non-adult birds of each SPA under consideration. Attention should also be paid to existing information on dispersal during the non-breeding e.g. Frederiksen et al 2012 when considering the likely consequences of non-breeding season effects upon the populations of potential concern.

MS-LOT advise that the MSS advice should be followed on non-breeding season effects as it is considered that this represents the best available science.

Effects on immature age classes

SNH advised that where possible collision effects on immature age classes should be included in the assessment, and this was consistent with the advice provided by the RSPB. It was not clear from the advice provided by SNH and RSPB how these effects would be apportioned to the SPA/ non SPA populations. MSS advice was that apportioning to SPAs should use the same methods as for adults, with the reference population that is presented in the BDMPS report.

MSS advice was that for northern gannet, herring gull, great black-backed gull, and kittiwake the age structure of the collision mortalities should be based on at-sea survey data gathered for the wind farm site. Where this information is not available, the stable age structure assumed in the PVA for the relevant species could potentially be assumed.

Population modelling

The RSPB advised that stochastic or deterministic models should be used and that counterfactuals should be presented.

SNH advised that it may be possible for the Developer to reuse their original population models. If this is not possible SNH advise that deterministic, density independent Leslie Matrix Models using standard demographic parameters are used and that counterfactuals and population growth rate are presented.

MS-LOT sought MSS advice on population modelling. MSS advised that in the past all PVAs have used stochastic models. MSS advise that the argument for using stochastic PVAs has been, and remains, that they provide the best available science, that they are precautionary in their outputs (Cook & Robinson, 2016), and that they are able to provide a wider range of outputs and therefore information of relevance to advisors and decision makers. MSS would therefore advise that stochastic PVAs are used and that alongside the counterfactual of population size and the counterfactual of growth rate advised by SNH, that the growth rates, and start population and end populations, with and without windfarm effects are provided. The end population estimate without wind farm effects at 1 centile intervals across the range 0.1 to 0.99 should also be presented, alongside an indication of which centile the impacted end population is situated on. MS-LOT advise that if new PVAs are required then MSS advice on this should be followed with a stochastic model used and the outputs as advised by MSS presented.

SNH advised that the PVAs should accommodate reductions in annual survival rates of both adult and immature age classes.

Protected Areas in the marine environment.
East Caithness Cliffs Marine Protected Area (MPA) – MS-LOT confirm as per SNH advice no re-assessment of black guillemot is required.

Proposed Special Protection Areas (pSPAs) – these should be acknowledged in the ES, however SNH have advised that there is no connectivity between the Moray East site, the Moray Firth pSPA, the Scapa Flow pSPA or the Pentland Firth pSPA therefore no detailed assessment is required.

- Is the method of whole project and cumulative impact assessment proposed appropriate?

MS-LOT confirm that the final scheme design for the Beatrice Offshore wind farm must be included in the cumulative assessment. As per the letter sent to Moray East on 30 April 2017 MS-LOT confirm that Moray West does not need to be included in the cumulative assessment. SNH advise that no other projects are required to be included in the cumulative assessment, however MS-LOT agree with the approach outlined in the scoping report of including those projects that were considered in the

Moray East ES 2012 and other new relevant projects that have been consented or proposed since the submission of the 2012 ES. These projects should be considered for both breeding and non-breeding season effects. The Dounreay Tri Demonstration Project is the most relevant for breeding season effects. MS-LOT are content that as per SNH advice we do not require information on onshore wind farms to be included in the cumulative assessment.

Signed

Gayle Holland
16/06/2017
Authorised by the Scottish Ministers to sign in that behalf

Appendix 1: Consultee Responses

Consultee Comments relating to the ornithological aspects of the Moray East Offshore Windfarm

Scottish Natural Heritage (1 June 2017)

Thank you for this scoping consultation for the design change at Moray East (previously called the 'eastern development area'). Overall capacity for the site will remain the same as before (1116 MW), however, it is proposed to utilise turbines of a higher rated capacity (8.1 – 15 MW) and this will reduce the number required; a maximum of 137 machines, compared to a previous maximum of 186. Details of the new design envelope and turbine parameters are given in Table 3-1 of the scoping report. The scoping relates solely to the wind farm infrastructure with no proposals to alter either the export cable or landfall works.

Approach to ornithological impact assessment

SNH has already provided scoping advice on all receptors, excepting ornithology, in our letter of 7 April 2017. Further to the meetings held 29 March and 9 May 2017 we now provide this update on bird interests.

We confirm that it is only the changes to turbine numbers and parameters which need consideration in respect of bird interests; we do not identify any major pathways to impact in respect of suction buckets, a new foundation type included in the updated design. We confirm that suction buckets are covered by the 'worst case' assessment previously undertaken for gravity base foundations in relation to possible habitat (prey) loss and / or construction disturbance to birds. In this regard, there is no additional mitigation we require, and the previous consent conditions will be transferred across to any new consent.

We're anticipating the new Section 36 and marine licence applications for Moray East this coming autumn, 2017. As we're recommending methods of assessment based on published guidance, we highlight that our scoping advice is limited to this same time-frame. If there is any significant slippage in the application timescale then we'll need to be informed of this as soon as possible because it may have a bearing on our advice.

Marine Scotland have confirmed that this reapplication for Moray East is to be determined before any subsequent application for Moray West. We've taken cognisance of this in presenting the following advice (and please see the section on cumulative impacts). Finally, we note that Moray East are not intending to specify the duration of consent for which they're applying (section 1.6 of the scoping report). Previous consent was issued for a period of 25 years, with all supporting

assessments undertaken on this basis. If there is to be any change to the consent period then this has implications for assessment, particularly in relation to bird interests. This will need further consideration and review of assessment methodologies, if any such changes are to be made.

Bird receptors for reassessment

At the meeting on 9 May 2017, we agreed that it would be helpful to use this reapplication as an opportunity to address the concerns raised by RSPB in respect of the original proposal and supporting assessments. The table below identifies the key bird interests which we've agreed need further consideration in respect of the design change at Moray East. We also identify the key Special Protection Areas (SPAs) against which impacts are likely to need consideration (based on review of previous advice). For gannet we advise that impacts are considered against the population at Troup Head Site of Special Scientific Interest (SSSI).

Species	**Impact**	**Key sites within foraging range**
Great black backed gull	Collision	East Caithness Cliffs SPA
Herring gull	Collision	East Caithness Cliffs SPA
Gannet	Collision	Troup Head SSSI
Kittiwake	Collision	East Caithness Cliffs SPA, North Caithness Cliffs SPA
Puffin	Displacement	East Caithness Cliffs SPA*****, North Caithness Cliffs SPA
Razorbill	Displacement	East Caithness Cliffs SPA, North Caithness Cliffs SPA
Guillemot	Displacement	East Caithness Cliffs SPA, North Caithness Cliffs SPA
***** SNH are recommending to government that puffin be removed from the East Caithness Cliffs SPA citation as a named assemblage species. For the time-being it should continue to be included for assessment, but we'll provide further advice as the process continues.		

We confirm that there are no other potential impacts requiring reassessment other than collision and displacement, as indicated in the table above. Assessment of displacement encompasses potential barrier effects. Potential impacts on prey species and possible disturbance during wind farm construction both fall within the "worst case" previously assessed: the agreed mitigation and consent conditions will be transferred across to any new consent.

Protected areas in the marine environment

Since the time of previous consent (19 March 2014), a new suite of marine protected areas (MPAs) has been designated in Scotland and a new suite of marine SPAs is proposed. In this regard we have the following advice:

- **East Caithness Cliffs MPA** – this site has been designated for breeding aggregations of black guillemot. This species is relatively sedentary and remains in coastal waters. We advise that there is no strong connectivity between Moray East and this MPA, and no risk of any significant impacts to black guillemot. We therefore do not consider this to be a significant issue and it does not require any re-assessment; black guillemot was addressed in MORL's original environmental statement and we are satisfied with this work (section 4.24, p218, Appendix 4.5A).

- **Moray Firth proposed SPA** – this pSPA is located in the inner Moray Firth and is proposed for wintering diver and seaduck interests, as well as for European shag. Further information is available from:

  http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/proposed-marine- spas/moray-firth/

SNH advises that there is **no connectivity** between Moray East and this proposed SPA. The species of interest have a coastal distribution and are recorded in greatest numbers within the proposed SPA – this will lie roughly 41km from the wind farm at its closest point. Two years of boat-based survey work for Moray East recorded minimal numbers of these species on-site (Table 21, p62-67, Appendix 4.5A of MORL's environmental statement). Therefore there is no risk of Moray East having any significant effects on this pSPA.

We confirm that we have also considered the Scapa Flow pSPA and Pentland Firth pSPA and advise that there is also **no connectivity** between Moray East and these proposed sites.

Assessment methodologies

- **Collision risk**

We provided our advice on collision risk modelling in our preliminary advice (23 February 2017) and in the RSPB and SNH table (12 April 2017). Moray East

submitted the requested CRM report for discussion at the meeting on 9 May 2017 and SNH have no further comment to make on this work. We are satisfied with the modelling undertaken and are happy for this to be referred to, or presented, in the Environmental Impact Assessment report.

This report provides annual totals of estimated collision mortality for the updated Moray East turbine parameters in combination with those for the Beatrice (the confirmed choice and number of turbines, as currently being built). The annual totals will now need to be apportioned between breeding and non-breeding seasons if there's to be a more detailed consideration of impacts. In this regard, please refer to SNH's published guidance on seabird seasonality:

http://www.snh.gov.uk/docs/A2200567.pdf

On this basis we advise that the following definitions are used:

Species	Breeding	Non-breeding
Great black backed	April - August	September - March
Herring gull	April - August	September - March
Kittiwake*	mid April - August	September - mid April
Gannet*	mid March - September	October - mid March
***For half months the collisions calculated for that month are split equally between breeding and non-breeding period.		

- **Displacement**

We confirm that we only require auk displacement impacts to be calculated for the breeding season, considered against the relevant breeding colony SPAs. We note that there is wide dispersal of these species during the non-breeding season, and only low densities of birds from the breeding colonies remain in the Moray Firth over-winter.

Calculation of potential displacement impacts should be undertaken in accordance with the interim advice published earlier this year by the joint statutory nature conservation bodies:

http://jncc.defra.gov.uk/pdf/Joint_SNCB_Interim_Displacement_AdviceNote_2017.pdf

While we advise the following breeding seasons for auk species (link as before); we note that **assessment should be based on the mean seasonal peak derived from survey counts undertaken April - July**. This is because there can be variability in the date of survey work undertaken in August (it may not occur at the start of the month) and in the timings of breeding seabird dispersal and any wintering influx.

Species	Breeding
Puffin	April - mid August
Razorbill	April - mid August
Guillemot	April - mid August

In respect of applying the joint SNCB guidance, we advise the following:

Rate of displacement: we recommend that this is discussed at a meeting between Marine Scotland, Moray East, RSPB and ourselves. In the meantime we advise presenting a range of displacement rates, including 60% as this was used for the original assessments.

Rate of mortality: please note that we are now considering displacement in relation to adult mortality rather than as an impact on breeding success. There will need to be further discussion around the possible rate(s) to use, informed by any available outcomes from the relevant projects commissioned by MSS.

- **Apportioning impacts**

In carrying out assessment, impacts will need to be apportioned by season, apportioned between SPAs and apportioned across age classes. This is so that we can consider such impacts against the relevant SPA and SSSI bird populations as identified above.

(i) Apportioning between seasons

It's only for collision risk where we've identified non-breeding season impacts will require consideration. For each species of concern – great black-backed gull, herring gull, kittiwake and gannet – we provide the seasonal definitions in the table above. We discuss the approach to non-breeding assessment in the relevant section below.

(ii) Apportioning between SPAs

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 that set out in SNH guidance:

http://www.snh.gov.uk/docs/A1355703.pdf

We recommend that the detail of these apportioning assessments, and the population counts to use in apportioning, are agreed at a meeting between Marine Scotland, Moray East, RSPB and ourselves. We provide previous and current SPA population counts in Appendix A.

(iii) Apportioning between age classes

For all the bird species under consideration, we advise that the apportioning of impacts (collision risk / displacement) between adults and juveniles is undertaken on the basis of the survey work available for Moray East.

We also advise that any impacts occurring on sabbatical birds (adults which are not breeding in any one year) are removed from further consideration. If this is not done then impacts are over-estimated against the breeding populations (there is not yet an easy way to incorporate sabbatical birds in population modelling).

We recommend that the detail of the approach is agreed at a meeting between Marine
Scotland, Moray East, RSPB and ourselves. In the meantime, from our initial review of the literature, we would suggest the following rates:

Species	%
Great black backed	35%
Herring gull	35%
Kittiwake	10%
Gannet	10%
Puffin	7%
Razorbill	7%
Guillemot	7%

- **Collision risk in the non-breeding season**

We recommend that the approaches to assessing collision risk in the non-breeding season are agreed at a meeting between Marine Scotland, Moray East, RSPB and ourselves. In the meantime, we advise the following based on review of Marine Scotland's appropriate assessment for the consented development:
http://www.gov.scot/Resource/0044/00446526.pdf

Great black backed gull

We're content to adopt the same approach to non-breeding season assessment as used previously.

Herring gull

We're content to adopt the same approach to non-breeding season assessment as used previously.

Gannet

Previously all adult breeding and non-breeding season mortality was considered against the Troup Head SSSI population. We consider there's merit in refining this

approach.

Kittiwake

Previously all adult breeding and non-breeding season mortality was considered against the East Caithness Cliffs and North Caithness Cliffs SPA populations. We consider there's merit in refining this.

- **Cumulative impacts**

We advise that Moray East should focus on assessing their project impacts in addition to Beatrice 'as built'. It should be possible to demonstrate that the predicted impacts for the revised design envelope in combination with the final scheme design for Beatrice (now under construction) are less than those previously assessed for the cumulative 'worst case'.

Marine Scotland have given direction in their scoping opinion that Moray East will be submitted and determined before any application for Moray West (so the former does not need to account for the latter):

http://www.gov.scot/Resource/0051/00517693.pdf

We confirm that no other offshore wind farm on the Scottish east coast – Hywind, Aberdeen Bay, Kincardine, Forthwind or the Forth & Tay developments – presents any significant risk to seabird populations at East Caithnesss Cliffs SPA, North Caithness Cliffs SPA or any of the Orkney SPAs. There is therefore no requirement for Moray East to undertake cumulative assessment in this regard.

Nor do we identify any requirement for further cumulative assessment of Moray East in relation to any wave and tidal proposals or harbour redevelopments (as listed in Table 6-1, p98-99). These have all been assessed previously in respect of possible bird impacts and no further updates are required.

Of the new projects listed in Table 6-2 (p102), we advise that only Dounreay, the NorthConnect interconnector and the Caithness Moray interconnector may need further consideration in respect of bird interests. We do not identify the possibility for any significant cumulative impacts from Moray East in combination with Aberdeen Harbour expansion or the Eastern HVDC Link.

SNH continues to take an overview of the predicted amount of collision risk from onshore wind farms in Caithness (and elsewhere). As we did at the time of the original MORL and BOWL applications, we've reviewed the estimates of collision mortality from onshore and offshore wind on great black backed gull and herring gull. We confirm that there's still no risk of population- level impacts at East Caithness SPA for either species. We will continue to keep an eye on this matter and we do not require Moray East to present any further information in this regard.

- **Population consequences**

Identified impacts on bird interests (collision risk / displacement) need to be considered against the relevant breeding populations. Once all apportioning has been undertaken (as above), the level of impact assigned to each SPA (or SSSI) should broadly be considered against the current population estimates. This may be enough to determine that impacts are unlikely to be significant for the population in question.

In some cases, however, population modelling may be needed to further investigate this. Based on previous assessment but taking account of more recent population counts, we consider that population models are likely to be required for the following species and breeding colonies noted in the table below. However, we'll need to review the apportioning calculations in order to confirm final advice in this regard.

Species	Population modelling
Great black backed gull	East Caithness Cliffs SPA
Herring gull	East Caithness Cliffs SPA
Gannet	Troup Head SSSI
Kittiwake	East Caithness Cliffs SPA
Puffin	North Caithness Cliffs
Razorbill	East Caithness Cliffs SPA
Guillemot	East Caithness Cliffs SPA

We recommend that Moray East review the utility of their previous population models. It may be that this modelling can be re-used, or adapted, for the purposes of reassessment. Once this review has been completed, we recommend that modelling requirements are discussed at a meeting between Marine Scotland, Moray East, RSPB and ourselves.

We recommend that models consider impacts across adult and juvenile age-classes where data allows. As discussed above, there is no easy way to incorporate sabbatical birds into the modelling, so we recommend that the impacts assigned to these birds are removed from further consideration.

If any new population models are required, we advise that deterministic, density independent Leslie Matrix Models provide the necessary outputs to inform our consideration of population consequences. Model outputs should be considered in relation to SPA counts of breeding adults and we require the counterfactual of population size and population growth rate to be presented.[1]

[1] 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

Information on demographic rates has now been collated, and Horswill & Robinson (2015) acts as the standard reference.[2] To establish the distribution of age classes, models can either have a 'burn-in' period or this information can be taken from Furness (2015).[3]

Finally, we advise that the modelling of impacts should undertaken for a 25 year period (anticipated wind farm operation) with no recovery period. As noted at the start of this letter, if there is to be any change to the period of consent (and therefore the number of years the wind farm will be operational) then this matter will need further consideration.

Further Information and Advice

SNH will be actively involved in the recommended pre-application dialogue. In the meantime, we would be grateful if you could copy us into the formal scoping opinion once issued. Please don't hesitate to contact me if you need any further information or advice from SNH in respect of this scoping consultation.

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

[3] 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.

APPENDIX A
MORAY FIRTH – SPA POPULATION COUNTS

Seabird Species	Special Protection	SPA citation populatio	P/I	Year		SNH / JNCC 2013 advice	P/I	Year		Recent counts	P/I	Year
Great black-backed	East Caithness Cliffs	800	P	*1996*		175	P	*1999*		266	P	*2015*
Herring gull	East Caithness Cliffs	9,400	P	*1985-88*		3,393	P	*1999*		3,267	P	*2015*
Kittiwake	East Caithness Cliffs	32,500	P	*1985-88*		40,140	P	*1999*		24,460	P	*2015*
	North Caithness	13,100	P	*1996*		10,147	P	*1999-2001*		5,573	P	*2016*
Guillemot	East Caithness Cliffs	106,700	I	*1985-88*		158,985	I	*1999*		149,228	I	*2015*
	North Caithness	38,300	I	*1985-88*		70,154	I	*1999-2001*		38,863	I	*2016*
Razorbill	East Caithness Cliffs	15,800	I	*1985-88*		17,830	I	*1999*		30,042	I	*2015*
	North Caithness	4,000	I	*1985-88*		2,466	I	*1999-2001*		3,507	I	*2015*
Puffin	East Caithness	1,750	P	*1985-88*		274	I	*1999*		189	I	*2015*
	North Caithness	1,750	P	*1996*		7,071	I	*1999-2000*		3,507	I	*2016*

***** SNH are recommending to government that puffin be removed from the East Caithness Cliffs SPA citation as a named assemblage species. For the time-being it should continue to be included for assessment, but we'll provide further advice as the process continues

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Following a request from MS-LOT for clarity on some points SNH provided the following response.

Clarification of SNH's advice for Ornithological Impact Assessment (9 June 2017)

Should Marine Scotland determine that reassessment is needed to support the new application for the alternative design for Moray East; our additional advice below will help inform the work required.

- **Displacement**

Previous assessment was carried out on a 'worst case' basis covering both breeding and non-breeding season impacts. If reassessment is required then displacement impacts should be recalculated for puffin, guillemot and razorbill in the breeding season only. We advise that this calculation uses a **60% rate of displacement** and a **2% rate of mortality**.

We consider the 2% rate of mortality to be sufficiently precautionary based on outputs from the displacement modelling commissioned by MSS and undertaken by CEH for the wind farm proposals in the Forth & Tay:
http://www.gov.scot/Topics/marine/marineenergy/Research/SB7

Finally, as advised in the table of assessment criteria, 23 May 2017, displacement calculations should be based on the data for 'all birds' (not solely those 'on the water').

- **Collision risk**

As advised in the table of assessment criteria, 23 May 2017, we don't think it yet possible to apply a correction factor for potential boat-based attraction of gull species during survey work. The available data is inconclusive, leaving it impossible to determine what might be appropriate.

- **Apportioning between SPAs**

As advised in our letter of 1 June 2017, breeding season impacts (collision risk / displacement) will need to be apportioned between the SPAs within foraging range of the wind farm.

We clarify that this is a two stage process:

(i) 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 European seabirds at sea (ESAS) database: http://jncc.defra.gov.uk/page-4469

(ii) The impacts assigned to the SPA component will need to be further apportioned between the individual SPAs within foraging range. In this regard, the most recent counts should be used – counts for the key SPAs (against which most

impacts will be assigned) are presented in Appendix A of our 1 June 2017 advice. Most recent counts for other SPAs within foraging range can be obtained from the ESAS database.

- **Consideration of sabbaticals**

Our advice of 1 June 2017 makes it clear that the impacts assigned to sabbaticals should be removed from any subsequent population modelling. (This is an update to the advice we previously provided in the table of assessment criteria, sent 23 May 2017). While there is uncertainty around appropriate rates to use, we are content for Moray East to adopt the '% sabbaticals' we present in our 1 June 2017 advice. These are likely to be underestimates and therefore remain precautionary.

- **Collision risk in the non-breeding season**

As advised on 1 June 2017, for great black-backed gull and herring gull the previously agreed method should be used to apportion estimates of collision mortality in the non-breeding season. Further information on this approach is available in our response to the original wind farm (8 July 2013) and from Marine Scotland's appropriate assessment:
http://www.gov.scot/Resource/0044/00446526.pdf

For gannet and kittiwake we simply request that Moray East present the estimates of non-breeding season mortality which we will use to inform our advice on the application.

- **Population modelling**

We are not sure what elements of our 1 June 2017 advice are unclear in this regard. We advise that the outputs from population models should be presented as counterfactuals. If Moray East cannot reuse their original population models to do this then we advise they construct deterministic, density independent Leslie Matrix Models using standard demographic parameters. We have advised the key SPAs for which updated models would be needed. Please let us know if you require any further clarification on this matter.

Royal Society for the Protection of Birds (1 June 2017)

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

We have significant concerns with the risks this project could have on internationally important seabird populations in the Moray region. In addition we are concerned about the potential in-combination effects with other offshore wind projects. Preliminary assessment on collision risk impacts has been presented by the Applicant, which
does not alter our concerns (circulated by EDPR on 30th April). We emphasise the importance and need to assess these risks adequately and robustly and that the population scale effects of the proposal are established and understood using best available science. New environmental data, research and guidance relevant to ornithological impact assessments, which has emerged since the original 2014 consents, must be used to achieve an adequate Environmental Impact Assessment and Habitats Regulations Appraisal and help ensure a robust determination.

Following discussions with Marine Scotland and Scottish Natural Heritage we have focused our recommendations on the set of assessment parameters that are included in the enclosed annex. These parameters are considered to cover all aspects relevant to the ornithological assessment that require comment, including species and impacts to be considered. However, we offer our support where clarification or further discussion may be required.

RSPB Scotland has already provided initial scoping comments to MS LOT as per SNH email dated 12th April and provided additional clarification by email dated 18th April, which answered specific queries raised by the Applicant related to collision risk modelling. We confirm these remain valid for the purposes of undertaking the environmental assessment.

1.0 Environmental Baseline

1.1 Site Survey

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.

1.2 SPAs, Citations and pSPAs

We note SNH are considering changing the species for which certain SPAs are designated. Some of these SPAs are relevant to the Moray East assessment. At present we are unaware of the details of these proposed changes.

The data supporting these changes is available now (although not publically) so to comply with the assessment and conservation requirements, any potential impacts need to be included in the assessment. This will require assessment of existing SPA species and the potential future SPA species.

Without consideration at this stage, once the SPAs are re-designated any consent granted will need to be reviewed and a further assessment carried out.

For the existing suite of pSPAs there is a requirement to include these in the environmental assessment.

2.0 Impacts and Species Scoped In

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

2.1 Cumulative/ In-combination Assessment

The Beatrice offshore wind farm must be included in the cumulative impact and in-combination assessments. Whilst the project has been consented it is not yet built therefore it cannot be considered as part of the baseline. This issue is equally relevant to other consented but not yet built projects.

The scoping report suggests that parts of the Moray East 2012 consented development could be developed together with part of this proposed alternative design, but not exceeding the 1,116MW capacity. Given this potential scenario it is

not clear for the purposes of the assessment what the worst case scenario (WCS) would be? For example, could 50 or even 90% of Telford, Stevenson and MacColl be built and the remainder built out under this proposed design?

There is an assumption the new design will result in lower potential impacts than the consented projects. On this assumption the WCS is reliant upon defining what proportion of the consented projects will ultimately be built. We ask that the WCS is fully justified and clearly detailed in the assessment and would welcome further discussion on this point if necessary.

3.0 Assessment Methods

3.1 Displacement

Breeding seasons:	April – mid-August should be used in accordance with SNH advice. Numbers from the April-July surveys can then be applied to the fortnight in August for Puffin.
Mean Seasonal Peaks:	Use mean seasonal peak as per SNCB advice.
All birds vs birds on water:	Use all birds as per SNCB advice
Proportion displaced:	Matrix to be presented as per SNCB advice.
Proportion of birds that fail to breed successfully:	Matrix to be presented as per SNCB advice.
Barrier:	Agree with SNH that it is to be dealt with via displacement assessment.

3.2 Collision Risk

Collision risk modelling:	Approach should be undertaken as per recommendations made to MS LOT and Moray East on 12th April and presented by Moray East on 28th April' 2017. However we ask for additional presentation of gannet breeding season collisions at 98% avoidance rate.
Nocturnal activity:	We recommend that values are used as per the previous 2013/14 guidance. However 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)[4] 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. Activity associated with foraging by plunge diving, when collision risk is greatest[5], was 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.

3.2.1 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.
Proportion immature birds:	Recommend including immature birds within the assessment, as per SNH advice.
Proportion of adults:	As per above, we recommend including all age classes.
Exclude sabbatical birds:	As per above, we recommend including all age classes.

[4] 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.

[5] 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.

3.2.2 Winter

Non-breeding season: Non breeding season mortality should be detailed and assessed.

Boat based bias: As per above.

Proportion from SPA: Non-breeding season collision mortality impacts to 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.[6]

We state this requirement for non-breeding 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.

Exclude sabbatical adults: Not to be excluded as per above.

Remove winter influx adults: As per SNH advice.

Remove winter influx

Immature: As per SNH advice

[6] 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.

3.3 Population Viability Analysis

Species to be addressed:	As per above listed species.
Model population:	As per SNH advice.
Model type:	Either deterministic or stochastic.
Age classes:	Preferably from at sea survey data, but if unavailable or unsuitable use stable age structure from population model.
Input scenarios:	Present.
Run	As per SNH advice.
Demographic rates:	As per Horswill & Robinson, 2015.[7]
Outputs:	Present either as formula or table to allow for testing a range of mortality input scenarios. Present counterfactuals as per Cook & Robinson, 2016[8] and SNH advice.

[7] Horswill, C. & Robinson R. A. 2015. Review of seabird demographic rates and density dependence. JNCC Report No. 552. Joint Nature Conservation Committee, Peterborough.
[8] 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.

Appendix 2: Advice from SNH and RSPB on Collision Risk Modelling

Q	SNH Advice	RSPB Comment
1	Moray East propose to update the CRM using Band (2012) to provide a clear and transparent comparison to the figures produced for the 2012 consent. Are outputs also required using more recent updates to the model? If so, why? For Moray East, SNH confirms that we only require Band (2012) to be used for CRM and not the Masden updates. Our recommendations on Band model options and avoidance rates is given in our pre-scoping advice note, 23 February 2017. In respect of the design scenarios to be modelled, we request that CRM is undertaken for the "worst case" – we consider this to be the "lower end" of the new design envelope - 137 turbines @8.1MW. For comparison it may be beneficial to also model the "top end" of this design envelope - 74 turbines @15MW. We request that CRM outputs are presented on the Band spreadsheets, and we attach the relevant sheets for the "whole site" scenario (as modelled by SNH) for the original application. We also attach the spreadsheets for BOWL's "most likely" scenario which, as agreed, will need to be updated for the final "build out" design. We recommend these spreadsheets are reused as much as possible, although updates in flight height data may limit their utility. If these spreadsheets can't be reused, we recommend that any new work adopts a similar format and uses the SNH input parameters for bird data and bird survey data (including monthly bird	As per SNH's advice.

	densities) unless otherwise discussed and agreed. We advise using that the following definitions of breeding season and nocturnal activity are used, to keep the CRM aligned with previous advice (on Moray wind farms and subsequently): • Great black-backed gull, April – August, nocturnal activity @ 25% • Herring gull, April – August, nocturnal activity @ 25% • Kittiwake, April – August, nocturnal activity @ 50% • Gannet, April – September, nocturnal activity @ 0% Following receipt of CRM outputs if any of these assumptions need to be revisited then this can be discussed at the meeting on 9 May.	
2	SNH have advised that for great black-backed gull and herring gull Band Options 1-3 are presented using the relevant avoidance rates detailed in the joint SNCB response to Cook *et al.* (2014). Are RSPB in agreement that the extended model (option 3 in this case) is applicable to large gulls? As indicated, SNH provided advice on CRM model options in our preliminary note, aligned to joint SNCB guidance. From discussion with RSPB our one area of difference is in respect of gannet, where we'd recommend that outputs are presented to cover both SNH & RSPB requests (see Q4 below).	As per SNH's advice.

3	The avoidance recommendations in Cook *et al.* (2014) differ with respect to kittiwake to the joint SNCB response. Do RSPB concur with the SNCB view? Moray East considers that the 99.2% presented by Cook et al. is a valid consideration. As indicated, SNH provided advice on CRM model options in our preliminary note, aligned to joint SNCB guidance.	RSPB support use of the 98.8% avoidance rate for Kittiwake as set out in the joint SNCB guidance.
4	Moray East intend to apply avoidance rates and PCH values that are consistent over an annual cycle. Do either SNH or RSPB consider that there is any requirement for any of the key species considered (gannet, kittiwake, great back-backed gull and herring gull) to deviate from this approach? We don't consider there's enough data currently available to determine whether or not there are season-specific differences in avoidance rate or flight heights. Therefore we're content with this being based on an annual cycle.	With respect to gannet, RSPB recommend use of 98% avoidance rate during the breeding season and a 98.8% during the non-breeding season. The latest avoidance rate recommendations are based upon data that includes little information on breeding gannets. As a result we consider the above rates are justified, specifically for breeding gannets from colonies located close to proposed offshore wind farms.

5	SNH advise that flight height values from Johnston *et al.* (2014) are applied to Band model options 1-3 for great black-backed gull and herring gull and options 1-2 for kittiwake and gannet. Option 1 typically however applies a PCH value derived from site specific surveys – can this be clarified? SNH clarifies that we're looking for Johnston *et al.* (2014) to be used only in respect of the relevant CRM options (2 & 3). MORL correctly indicate that option 1 will use their own site-specific survey data.	As per SNH's advice.
6	Considering Q5, is there a preference from either SNH or RSPB for site specific or generic flight height data in the case of Moray East? MORL should provide the CRM options as requested in our preliminary advice. We recommend that this includes discussion of the available flight height data (both site-specific and generic) and how well this informs CRM for the updated design envelope – the increase in turbine height and rotor swept area, and associated changes to the collision risk window.	As per SNH's advice. We would welcome presentation of any variation in PCH across seasons, even if it is not taken forward in analysis.

Appendix 3: Comparison table provided by SNH on collision risk modeling

CRM bird parameters

These are the same between the original and updated CRMs, with the exception of gannet nocturnal flight activity (now 1).

GBBG	
bird length	0.71
wing span	1.58
flight speed	13.7
nocturnal activity	2
flap/glide	flapping
CRM option	3
breeding season	May-Aug
avoidance rate	98%

Herring gull	
bird length	0.61
wing span	1.44
flight speed	12.8
nocturnal activity	2
flap/glide	flapping
CRM option	3
breeding season	May-Aug
avoidance rate	98%

Kittiwake	
bird length	0.39
wing span	1.08
flight speed	13.1
nocturnal activity	3
flap/glide	flapping
CRM option	3
breeding season	Apr-Aug
avoidance rate	98%

Gannet	
bird length	0.94
wing span	1.73
flight speed	14.9
nocturnal activity	1
flap/glide	gliding
CRM option	3
breeding season	Apr-Sep
avoidance rate	98%

Summary CRM comparison

Original CRM figures for GBBG and herring gull taken from 'common currency' spreadsheet, p44 in the appropriate assessment (A2279518).

This was for these assessment scenarios: MORL Stevenson 3.6MW, Telford 5MW, MacColl 5MW and BOWL 'most likely' at 6MW.

Original CRM figures for kittiwake and gannet taken from the SNH and JNCC response letter (A984147): those for kittiwake are used in the appropriate assessment (p22-23).

Updated CRM figures taken from MORL report (A2278084), options and avoidance rates as indicated, using MORL 8.1MW and BOWL 'as built'

	original CRM all option 3 at 98%			**updated CRM GBBG, option 3 at 98.9% Herring gull, option 3 at 99% Kittiwake and gannet, option 1 at 98.9%**		
GBBG	**MORL**	**BOWL**	**cumulative**	**MORL**	**BOWL**	**cumulative**
CRM annual	105.2	109.3	**214.5**	28	22	**50**
CRM breeding	22.6	25.43	-	-	-	-
CRM non-breeding	82.6	83.87	-	-	-	-
Herring gull	**MORL**	**BOWL**	**cumulative**	**MORL**	**BOWL**	**cumulative**
CRM annual	136.1	182.09	**318**	35	30	**65**

CRM breeding	20.4	12.72	-	-	-	-
CRM non-breeding	115.7	169.37	-	-	-	-
Kittiwake	**MORL**	**BOWL**	**cumulative**	**MORL**	**BOWL**	**cumulative**
CRM annual	96	44	**140**	77	52	**129**
CRM breeding	70	21	-	-	-	-
CRM non-breeding	26	23	-	-	-	-
Gannet*	**MORL**	**BOWL**	**cumulative**	**MORL**	**BOWL**	**cumulative**
CRM annual	53	42	**95**	86	42	**128**
CRM breeding	29	17	-	-	-	-
CRM non-breeding	24	25	-	-	-	-

*****Note that SNH & JNCC advised a threshold of 83-138 breeding adults for annual gannet mortality at Troup Head SSSI.

Appendix 4: Assessment Criteria Table completed by SNH and RSPB (23 May 2017)

	Parameters	RSPB – Position	RSPB - Discussion/ Explanation	SNH
Displacement	**Birds to be assessed**	Puffin, razorbill and guillemot require displacement assessment.	-	If thresholds are to be revisited for these three species then MORL may wish to consider updating the displacement calculations both for their own project and also for Beatrice.
	Breeding season	As per SNH approach. That April – mid-August should be used in accordance with their guidance, but calculate numbers from April-July surveys then apply to the fortnight in August for Puffin.	Puffin, breeding season used in the assessment is April to July. Furness (2015) cites April to early August. However developers do have evidence of influx of non-breeders in August.	SNH confirms that we only require these auk displacement impacts to be calculated for the breeding season and considered against the relevant breeding colony SPAs. We note that there is wide dispersal of these species during the non-breeding season, and only low densities of birds from the breeding colonies remain in the Moray Firth over-winter. We advise that the breeding season for auk species is defined in accordance with our guidance on seabird seasonality: www.snh.gov.uk/docs/A2200567.pdf On this basis we advise the following breeding seasons are used: • Puffin: April - mid August. Calculate numbers of birds from April - July surveys, then apply to the fortnight in August. • Razorbill: April - mid August. If possible, use early August survey information to assess numbers, otherwise use Apr-July value. • Guillemot: April - mid August. If possible, use early August survey information to assess numbers, otherwise use Apr-July value.
	Mean Seasonal Peak	Use mean seasonal peak as per SNCB advice.	-	As given in the appropriate assessment in line with SNH & JNCC advice.
	All birds vs birds on water	Use all birds as per SNCB advice.	-	As given in the appropriate assessment in line with SNH & JNCC advice.

	Proportion displaced	Matrix to be presented as per SNCB advice	It is acknowledged that this is an estimate, but we consider it to be a realistic value and there has been no evidence since the original application to support changing it.	We think the rate of auk displacement will need further discussion as we've already accepted slight reductions where increased turbine spacings are used. For example, SNH and JNCC accepted 40% auk displacement for Seagreen and 50% for Inch Cape.
	Proportion from SPA	As per SNH approach.	We realise that the MSS commissioned apportioning project may improve this method but acknowledge that the project has still to report.	We advise following the draft SNH guidance on apportioning, available from: www.snh.gov.uk/docs/A1355703.pdf
	Proportion of birds that fail to breed successfully	Matrix to be presented as per SNCB advice.	-	We advise following the joint SNCB advice on displacement, available from: jncc.defra.gov.uk/pdf/Joint_SNCB_Interim_Displacement_AdviceNot e_2017.pdf Note that we're now considering displacement in relation to adult mortality rather than as an impact on breeding success.
	Barrier	Agree that it is to be dealt with via displacement assessment.	-	We agree that consideration of barrier effects forms part of the displacement assessment as noted in the appropriate assessment.
Collision Risk Model	**Bird, Bird Parameters, Band Options & Avoidance Rates**	As per recommendations made to MS LOT and Moray East on 12th April '17 and presented by Moray East on 28th April '17. However we ask for additional presentation of gannet breeding season collisions at 98% AR Species to be assessed include: Great Black Backed Gull, Herring Gull, Kittiwake, Gannet.	-	As advised at the meeting on 9 May 2016, SNH is content with the collision risk modelling report presented by MORL and we have no further requirements in respect of these calculations.

	Nocturnal Activity	Caveated recommendation that values are used as per the previous guidance. We do not accept the change made for breeding gannet, unless a detailed breakdown of the timing of surveys is presented. (see explanatory text)	Whilst recognising that on first glance these can appear precautionary, we would caution against any changes for the following reasons. For example, for breeding gannets, a standard reference is Warwick-Evans *et al.,*(2015)[9]. This indicates low levels of nocturnal activity by gannets, but it also 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. Activity associated with foraging by plunge diving, when collision risk is greatest[10], was 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 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 precautionary.	As advised at the meeting on 9 May 2016, SNH is content with the collision risk modelling report presented by MORL and we have no further requirements in respect of these calculations. At the meeting we noted that gannet had been modelled using a nocturnal activity rating of 1 (which currently equates to 0%) and we raised no issues with this.

[9] 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.
[10] Cleasby et al. 2015

	Summer			
	Breeding season	As per SNH advice.	For GB and HG MSS recommend May to August, but Furness (2015) details the following, Gannet: March to September, Herring gull: March to August, Great black-backed gull: (late) March to August, kittiwake: March to August. However the start of breeding is likely to be later at these more northern colonies.	MORL's report provided annual totals of collision risk both for their own project and also for Beatrice. These will now need to be apportioned between breeding and non-breeding seasons if there's to be a more detailed consideration of impacts. In this regard, please refer to SNH guidance on seabird seasonality: http://www.snh.gov.uk/docs/A2200567.pdf On this basis we advise the following breeding seasons are used: Great black backed gull: April - August. Herring gull: April - August. Kittiwake: mid April - August. Gannet: mid March - September. For half months the collisions calculated for that month are split equally between breeding and non-breeding period.
	Boat Based Bias	As per SNH advice.	Corrections have in the past been applied to the mortality for large gulls as it is known that gulls in particular are attracted to fishing and other vessels and that this is likely to artificially inflate count numbers and therefore predicted mortalities. The developers have presented evidence for this using comparison between boat based and aerial survey. However one consideration not taken into account is the occurrence of vertical attraction to the boat; in other words potential for a lower recorded flight height, either as recorded by the site specific survey or in the generic flight height data, since the majority of these data were collected from boats. Birds that are attracted to boats will fly lower in the presence of boats (e.g. Thaxter *et al.,*2016) and it therefore may be that birds are being removed from the mortality estimation twice, giving an artificially low estimate. At this stage, given the lack of evidence to quantify boat based bias we agree with SNH's position.	We don't think the available data allows quantification of this issue; we continue to advise that it's not yet possible to apply a correction factor for the potential boat-based attraction of gull species during survey work.

	Proportion from SPA	As per SNH approach.		We advise following the draft SNH guidance on apportioning, available from: www.snh.gov.uk/docs/A1355703.pdf
	Proportion immature birds	Recommend including immature birds within the assessment, as per SNH advice.	Potential mortalities to immatures and non-breeders within the breeding season are to be included in the PVAs.	Where data allows, we recommend that impacts should be considered across all age classes and population models should be constructed to allow for this (please see our advice below). Model outputs should allow for interpretation in relation to breeding adults.
	Proportion of adults	As above.	-	
	Exclude sabbatical birds	As above.	-	
	Winter			
	Non-breeding season	Non breeding season mortality should be detailed.	-	MORL's report provided annual totals of collision risk which will need to now be apportioned between breeding and non-breeding seasons to allow more detailed consideration of impacts.
	Boat based bias	As above.	-	We don't think the available data allows quantification of this issue; we continue to advise that it's not yet possible to apply a correction factor for the potential boat-based attraction of gull species during survey work.

	Proportion from SPA	Request that non-breeding season collision mortalities be considered in the context of the relevant SPA populations. To account for potential in-combination impacts to seabirds 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[11].	E.g. SNH advised that GBBG population from ECC SPA has a limited dispersal and so it is possible to tie collisions back to the breeding SPA pop.	For great black backed gull and herring gull we're content to adopt the approach to non-breeding season assessment as previously agreed via 'common currency' discussions. For gannet, we note that all adult breeding and non-breeding season mortality was considered against the Troup Head SSSI population. There may be merit in discussing ways to refine this assessment. For kittiwake, we note that all adult breeding and non-breeding season mortality was considered against the East Caithness Cliffs and North Caithness Cliffs SPA populations. There may be merit in discussing ways to refine this assessment.

[11] 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

				In respect of the scope for assessment, we are content for the developer to consider the updated Moray East impacts in combination with Beatrice 'as built'. These should be considered (both breeding and non-breeding impacts) against the relevant SPA breeding colonies of concern. We do not require the developer to undertake any wider cumulative assessment in the non-breeding season as we are uncertain of the merits of this or the available data quality.
	Proportion immature birds	Not to be excluded as per above justification.		Where data allows, we recommend that impacts should be considered across all age classes and population models should be constructed to allow for this (please see our advice below). Model outputs should allow for interpretation in relation to SPA counts of breeding adults.
	Proportion adults	As above.		
	Exclude sabbatical adults	As above.		
	Remove winter influx adults	As per SNH advice		Relevant only to non-breeding season assessment for great-black backed gull and herring gull.
	Remove winter influx immatures	As per SNH advice		Relevant only to non-breeding season assessment for great-black backed gull and herring gull.
PVAs	**Species / SPAs to be addressed**	As per SNH advice.		For all species impacts will be apportioned across the relevant breeding populations. Based on previous assessment, but taking account of more recent population counts, we think population models are likely to be required for the following breeding colonies. We will need to review the updated apportioning calculations in order to confirm our final advice in this regard: Puffin: North Caithness Cliffs SPA. Razorbill: East Caithness Cliffs SPA. Guillemot: East Caithness Cliffs. Great black backed gull: East Caithness Cliffs SPA. Herring gull: East Caithness Cliffs SPA. Gannet: Troup Head SSSI. Kittiwake: East Caithness Cliffs SPA.

	Model population	As per SNH advice		As a first step, we recommend reviewing the utility of the population models previously provided by MORL. We recommend that models are based on the 'whole population' – the distribution of age classes could be taken from Furness (2015). Model outputs to be considered in relation to SPA counts of breeding adults.
	Type	Either.	-	This will depend on a review of MORL's previous population models. However, going forward we consider that deterministic, density independent Leslie Matrix Models provide the necessary outputs to inform our consideration of population consequences.
	Run	As per SNH advice.	-	If new modelling is required, we recommend that it has a 'burn-in' period, or else the distribution of age classes could be taken from Furness (2015)[3]. We agree that the run for applied impacts should be over a 25 year period (project consent / anticipated operation) with no recovery period.
	Demographic rates	As per Horswill & Robinson, 2015[12].	-	Horswill & Robinson (2015) now acts as a standard reference for information on demographic rates.
	Output metrics	To present counterfactuals as per Cook & Robinson, 2016[13]	-	Model outputs to be considered in relation to SPA counts of breeding adults. We recommend presenting the counterfactual of population size and population growth rate.

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

MORAY EAST
OFFSHORE WINDFARM

Moray East Offshore Windfarm
Alternative Design Parameters

Collision Risk Modelling Results and Assumptions

April 2017

Moray Offshore Windfarm (East) Limited

Produced by Niras on behalf of Moray Offshore WindFarm (East) Limited	
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Review / Approval

Xodus	**Moray East**	
Sarah Edwards (Moray East EIA Manager)	Catarina Rei (Offshore Consents Manager)	Sarah Pirie (Head of Development)

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1 Introduction

The following presents a summary of the results from the Collision Risk Modelling (CRM) undertaken for the proposed Moray East Offshore Wind Farm Alternative Design Parameters consent application (proposed wind farm consent application). Detailed results are presented in the attached worksheets.

The objective of this CRM work is to inform the provision of scoping responses to Marine Scotland from Scottish Natural Heritage (SNH) and Royal Society for the Protection of Birds (RSPB) to inform the Scoping Opinion on the scope of the work required with respect to the ornithology impact assessment.

The approach to carry out the CRM to inform the scoping response was agreed during the scoping meeting held at Marine Scotland's offices, Aberdeen on 29 March 2017.

As agreed at the meeting, the results presented in this report and the attached worksheets will provide the basis for further discussions on 9 May 2017.

2 Species for Consideration for the CRM

The CRM was conducted for the following four species as agreed with SNH and RSPB:

- Gannet;
- Kittiwake;
- Herring gull; and
- Great black-backed gull.

These four species were selected based on results from the Moray East ES 2012 which concluded these to be the key species of concern with respect to collision risk impacts.

3 Key Assumptions

The key assumptions used to inform the CRM are listed in Table 3-1 below.

Table 3-1: Parameters used for collision risk modelling

Parameter	Source	Notes
Bird parameter		
Bird length (m)	Snow and Perrins (2008)	Consistent with parameters in SNH collision risk models received 19th April 2017.
Wingspan (m)	Snow and Perrins (1998)	Consistent with parameters in SNH collision risk models received 19th April 2017.
Flight speed (m/s)	Pennycuick (1987) or Alerstam (2007)	Consistent with parameters in SNH collision risk models received 19th April 2017.
Nocturnal activity factor	King *et al*. (2009)	Consistent with values as recommended in SNH advice received 19th April 2017.
Flight type	N/A	Consistent with parameters in SNH collision risk models received 19th April 2017.
Proportion at rotor height (%)	Site-specific surveys Johnston *et al.* (2014)	Consistent with parameters in SNH collision risk models received 19th April 2017. Flight height distributions updated using Johnston *et al.* (2014)
Proportion of flights upwind	N/A	Consistent with parameters in SNH collision risk models received 19th April 2017.
Avoidance rate – Basic model (%)	Cook *et al.* (2014) JNCC *et al*. (2014)	Updated following recently published information/ guidance. Modelling also incorporates a 98% avoidance rate as used in modelling for the original consent. See Table 3-2 below
Avoidance rate – Extended model (%)	Cook *et al.* (2014) JNCC *et al*. (2014)	Updated following recently published information/ guidance. Modelling also incorporates a 98% avoidance rate as used in modelling for the original consent. See Table 3-2 below.
Densities	Site-specific surveys	Consistent with parameters in SNH collision risk models received 19th April 2017.
Wind farm and turbine parameters		
Moray East (original consent)	Moray East	See Table 4-1 and Table 4-2 below.
BOWL (original consent)	Wilson (2015)	See Table 4-3 below.

Table 3-2: Avoidance rates applied for each species in the Basic and Extended models of the Band (2012) CRM. Those rates shown in bold are applied in the results tables in Sections 5 and 6

Species	Basic Band (2012) model	Extended Band (2012) model
Gannet	**98%** **98.9%** (± 0.2)	**98%**, 98.5%, 99%, 99.5%
Kittiwake	**98%** **98.9%** (± 0.2) **99.2%** (± 0.3)	**98%**, 98.5%, 99%, 99.5%
Great black-backed gull	**98%** **99.5%** (± 0.1)	**98%** **98.9%** (± 0.2)
Herring gull	**98%** **99.5%** (± 0.1)	**98%** **99%** (± 0.2)

4 Design Parameters

The design parameters used to inform the CRM associated with the alternative design envelope for the proposed wind farm consent application are summarised in Table 4-1 and Table 4-2 below. The Worst Case Scenario (WCS) parameters for the consented Telford, Stevenson and MacColl wind farms was assessed to be 159 x 7 MW turbines, with the physical parameters of the consented 7 MW turbine kept the same as for the 8.1 MW turbine for the proposed wind farm consent application design envelope.

Design parameters for the Beatrice Offshore Wind Farm (BOWL) project are presented in Table 4.3. These are based on the 'as built' parameters included in the BOWL Design Specification and Layout Plan (DSLP).

Table 4-1: Parameters used for collision risk modelling for the updated turbine scenarios at Moray East

Parameter	8.1 MW	10 MW	12 MW	15 MW
Number of turbines	137	111	93	74
Rotor radius (m)	86	95	115	125
Hub height (m) (HAT)	103.41	117	137	147
Max blade width (m)	5.8	6	6.5	7
Pitch (°)	30	30	30	30
Monthly proportion of time operational (%)	80	85	85	85

Table 4-2: Rotor speed quartiles for each turbine scenario and the proportion of time for which each quartile will operate at Moray East

Rotor Speed	Proportion of time (%)	8.1 MW	10 MW	12 MW	15 MW
Minimum	-	6.5	6.0	5.5	4.0
1st quartile	8	7.3	6.9	6.4	5.1
2nd quartile	6	8.9	8.6	8.2	7.3
3rd quartile	9	10.4	10.3	10.1	9.5
4th quartile	77	12.0	12.0	11.9	11.7
Maximum	-	12.8	12.8	12.8	12.8

Table 4-3: Parameters used for collision risk modelling for the updated turbine scenarios at BOWL

Parameter	Updated
Number of turbines	84
Rotor radius (m)	77
Rotor speed (rpm)	11.8
Hub height (m)	105.5 (HAT)
Max blade width (m)	4.98
Pitch (°)	7
Monthly proportion of time operational (%)	85
Tidal offset	2.5

5 Results – Moray East Offshore Wind Farm

Results from the CRM for the Moray East Offshore Wind Farm based on the proposed alternative design parameters are presented in Table 5-1 to Table 5-4 below for each of the four key species. These results are presented with the CRM results for the consented Telford, Stevenson and MacColl wind farms. The CRM results presented for the consented wind farms are based on WCS assessed at the time which was 159 x 7 MW turbines.

5.1 Gannet

Table 5-1: Moray East Gannet CRM Results

Avoidance Rate (%)	Turbine Scenario				
	Original Consent (159 x 7 MW turbines)	8.1 MW	10 MW	12 MW	15 MW
Option 1					
98.0	174	156	148	155	136
98.9		86	82	85	75
Option 2					
98.0		104	100	105	92
98.9		57	55	58	51
Option 3					
98.0	36	32	29	26	21

5.2 Kittiwake

Table 5-2: Moray East Kittiwake CRM Results

Avoidance Rate (%)	Turbine Scenario				
	Original Consent (159 x 7 MW turbines)	8.1 MW	10 MW	12 MW	15 MW
Option 1					
98.0	157	140	134	141	125
98.9		77	74	77	69
99.2		56	54	56	50
Option 2					
98.0		297	284	301	268
98.9		163	156	166	147
99.2		119	114	120	107
Option 3					
98.0	96	87	77	69	56

5.3 Great Black-Backed Gull

Table 5-3: Moray East Great Black-Backed Gull CRM Results

Avoidance Rate (%)	Turbine Scenario				
	Original Consent (159 x 7 MW turbines)	8.1 MW	10 MW	12 MW	15 MW
Option 1					
98.0	140	125	119	124	109
99.5		31	30	31	27
Option 2					
98.0		105	100	105	92
99.5		26	25	26	23
Option 3					
98.0	56	50	45	41	34
98.9		28	25	22	18

5.4 Herring Gull

Table 5-4: Moray East Herring Gull CRM Results

Avoidance Rate (%)	Turbine Scenario				
	Original Consent (159 x 7 MW turbines)	8.1 MW	10 MW	12 MW	15 MW
Option 1					
98.0	230	206	197	206	182
99.5		52	49	51	45
Option 2					
98.0		151	144	151	133
99.5		38	36	38	33
Option 3					
98.0	77	69	62	56	46
99.0		35	31	28	23

6 Cumulative CRM

Results from the CRM for Moray East in combination with BOWL are presented below. To inform the results for the cumulative CRM for the proposed wind farm consent application results from the CRM for BOWL for the four key species, based on the as built design parameters, have also been provided. These are summarised below.

6.1 CRM – BOWL alone

6.1.1 Gannet

Table 6-1: BOWL Gannet CRM Results

Avoidance Rate (%)	Original Consent (125 turbines)	As Built (84 turbines)
Option 1		
98.0	116	76
98.9		42
Option 2		
98.0		16
98.9		9
Option 3		
98.0	8	5

6.1.2 Kittiwake

Table 6-2: BOWL Kittiwake CRM Results

Avoidance Rate (%)	Original Consent (125 turbines)	As Built (84 turbines)
Option 1		
98.0	156	94
98.9		52
99.2		38
Option 2		
98.0		37
98.9		20
99.2		15
Option 3		
98.0	19	10

6.1.3 Great Black-Backed Gull

Table 6-3: BOWL Great Back-Backed Gull CRM Results

Avoidance Rate (%)	Original Consent (125 turbines)	As Built (84 turbines)
Option 1		
98.0	284	179
99.5		45
Option 2		
98.0		86
99.5		22
Option 3		
98.0	69	41
98.9		22

6.1.4 Herring Gull

Table 6-4: BOWL Herring Gull CRM Results

Avoidance Rate (%)	Original Consent (125 turbines)	As Built (84 turbines)
Option 1		
98.0	450	275
99.5		69
Option 2		
98.0		134
99.5		33
Option 3		
98.0	106	60
99.0		30

6.2 Cumulative – BOWL and Moray East combined

Results for BOWL and Moray East combined (cumulative CRM) are presented for the four key species in Table 6-5 to Table 6-8 below. The results under 'Original Consent' represent the WCS cumulative CRM results for the consented Telford, Stevenson and MacColl wind farms together with the consented BOWL wind farm. The results under each of the different turbines (8.1 MW, 10 MW, 12 MW and 15 MW) represent the cumulative CRM results for each turbine scenarios of the proposed wind farm consent application together with the BOWL as built turbine parameters.

6.2.1 Gannet

Table 6-5: Cumulative Gannet CRM Results

Avoidance Rate (%)	Turbine Scenario				
	Original Consent	8.1 MW	10 MW	12 MW	15 MW
Option 1					
98.0	289	231	224	230	211
99.5		127	123	127	116
Option 2					
98.0		120	116	121	108
99.5		66	64	66	60
Option 3					
98.0	44	37	34	31	26

6.2.2 Kittiwake

Table 6-6: Cumulative Kittiwake CRM Results

Avoidance Rate (%)	Turbine Scenario				
	Original Consent	8.1 MW	10 MW	12 MW	15 MW
Option 1					
98.0	313	234	228	235	219
98.9		129	125	129	120
99.2		94	91	94	87
Option 2					
98.0		333	321	338	305
98.9		183	176	186	168
99.2		133	128	135	122
Option 3					
98.0	114	96	86	78	66

6.2.3 Great Back-Backed Gull

Table 6-7: Cumulative Great Black-Backed Gull CRM Results

Avoidance Rate (%)	Turbine Scenario				
	Original Consent	8.1 MW	10 MW	12 MW	15 MW
Option 1					
98.0	425	304	298	303	288
99.5		76	75	76	72
Option 2					
98.0		192	186	191	179
99.5		48	47	48	45
Option 3					
98.0	125	91	86	82	74
98.9		50	47	45	41

6.2.4 Herring Gull

Table 6-8: Cumulative Herring Gull CRM Results

Avoidance Rate (%)	Turbine Scenario				
	Original Consent	8.1 MW	10 MW	12 MW	15 MW
Option 1					
98.0	680	481	471	481	456
99.5		120	118	120	114
Option 2					
98.0		284	277	285	267
99.5		71	69	71	67
Option 3					
98.0	183	129	121	116	106
99.0		65	61	58	53

7 References

Alerstam, T., Rosén, M., Bäckman, J., Ericson, P.G.P. and Hellgren, O., 2007. Flight speeds among Bird Species: Allometric and Phylogenetic Effects. PLoS Biology, 5 (8), pp. 1656-1662.

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. Thetford: BTO

JNCC, Natural England, Natural Resources Wales, Northern Ireland Environment Agency and Scottish Natural Heritage, 2014. Joint Response from the Statutory Nature Conservation Bodies to the Marine Scotland Science Avoidance Rate Review.

Johnston, A., Cook, A.S.C.P., Wright, L.J., Humphreys, E.M. and Burton, N.H.K., 2014. Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines. Journal of Applied Ecology, 51, pp. 31-41.

King, S., Maclean, I., Norman, T. and Prior, A., 2009. Developing Guidance on Ornithological Cumulative Impact Assessment for Offshore Wind Farm Developments. COWRIE Ltd.

Pennycuick, C.J., 1987. Flight of auks (Alcidae) and other northern seabirds compared with southern procellariformes: ornithodolite observations. Journal of Experimental Biology, 128, pp. 335-347.

Snow, D.W. & Perrins, C.M. 1998. The birds of the western Palearctic, Concise edition. Oxford University Press.

Wilson, J., 2015. Letter to Nicola Bain, 26th November 2015. [Online]. Available at: http://www.gov.scot/Topics/marine/Licensing/marine/scoping/Beatrice/CRM/CRM-letter (Accessed April 2017).

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