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For the attention of: Gayle Holland

6 June 2014

FORTH & TAY OFFSHORE WIND FARM PROPOSALS

NEART NA GAOITHE – DRAFT APPROPRIATE ASSESSMENT SNH & JNCC ADVICE ON SPA SEABIRD INTERESTS

Thank you for consulting SNH & JNCC (statutory nature conservation bodies or ‘SNCBs’) on the draft appropriate assessment for Neart na Gaoithe. We provided some over-arching advice as well as comments on SAC marine mammals and fish interests in our response of 30 May 2014. We now address the qualifying interests of seabird SPAs.

There have been a number of updates since we provided our advice on 7 March 2014 on the cumulative impacts of the Forth & Tay proposals in combination (Neart na Gaoithe, Seagreen phase 1 and Inch Cape). This includes refinement of project envelopes as well as a number of changes to the technical assessments and modelling which underpin the Habitats Regulations Appraisal (HRA) in respect of SPA seabird interests – as discussed in more detail below. We provide supporting commentary on the draft appropriate assessment for Neart na Gaoithe as tracked changes and comments within the draft document, submitted alongside this letter. We will submit our comments on the draft conditions as soon as possible.

KEY ADVICE ON SPA SEABIRD SPECIES

Accounting for the updates to project envelopes and technical assessments, the most significant in combination effects of the Forth & Tay wind farm proposals on SPA seabird species remain:

- Collision and displacement with respect to **kittiwake** as a qualifying interest of Forth Islands SPA and Fowlsheugh SPA.
- Collision with respect to **gannet** as a qualifying interest of Forth Islands SPA.
- Displacement with respect to **puffin** as a qualifying interest of Forth Islands SPA.

In addition, re-assessment taking into account the updates referred to above shows that there is also **potential for significant in combination displacement effects on razorbill** as discussed in **Appendix 3**.

The key impact on SPA seabird species from **Neart na Gaoithe on its own** relates to:

- **Kittiwake** displacement at Forth Islands SPA

KEY UPDATES TO ASSESSMENT

Revisions to wind farm project envelopes

Since we provided our advice on 7 March 2014, there has been further discussion with each developer to establish the 'most likely' or 'most realistic' project envelopes (email from MS-LOT dated 17 April 2014). These have been confirmed as follows:

- **Neart Na Gaoithe, 450 MW, 75 turbines** (reduction from 90 turbines)
- **Seagreen, phase 1, 1050 MW, 150 turbines**
- **Inch Cape, 1050 MW, 110 turbines** (reduction from 213 turbines)

In our advice on 7 March 2014, we limited our advice on cumulative impacts to the three Forth & Tay wind farm developments in combination in respect of breeding seabird SPAs within foraging range of the proposals. We have reviewed the other development proposals that may need consideration in any HRA as suggested by Marine Scotland in the draft assessment for Neart na Gaoithe. Please see:

- **Appendix 1** SNCB advice on scope of cumulative HRA for SPA seabirds

Updates to seabird impact assessments

As noted in our letter of 7 March 2014, we indicated that "further iterations of the [Forth & Tay wind farm] proposals and their design envelopes will require further assessment. Assessment will be based on the most up-to-date methods and best available knowledge at that point in time (such as any correction to seabird flight height data used in collision risk modelling)."

Since providing our earlier advice, there have indeed been a number of updates to the technical assessments and modelling which underpin the HRA for SPA seabird species. We discuss these updates in the following appendices:

- **Appendix 2** Updates to collision risk modelling
- **Appendix 3** Updates to displacement modelling
- **Appendix 4** Advice on puffin displacement & significance of impacts

We recommend that the appropriate assessment for Neart na Gaoithe clearly states where changes have been made to the technical assessments subsequent to SNCB advice of 7 March 2014 and previous advice from Marine Scotland Science (draft received, 18 April 2014). It may be clearest to provide such iterative detail in a supporting appendix rather than to try and address this issue within the appropriate assessment itself. Please see our further comment on the text of the draft assessment, provided alongside this letter.

Advice on setting and using thresholds

As highlighted in our previous advice of 7 March 2014, we strongly advise that wind farm impacts on each SPA seabird population do not approach thresholds (or 'limits of acceptable change'), especially for species in decline such as kittiwakes.

For all seabird species, with the exception of gannet (email from John Uttley to Gayle Holland on 15 April 2014) and puffin (**Appendix 4**), our advice on thresholds remains the same as that which we presented in our response of 7 March 2014.

The appropriate assessment should define and justify the thresholds used. In the draft for Neart na Gaoithe, we recommend that a supporting appendix is provided to clearly set out the methods and calculations used to derive the threshold values.

We highlight our serious reservations about the scalar method proposed by Marine Science Scotland for use in setting thresholds. We advise that it is inappropriate to use this approach without more consideration and testing of the underlying assumptions. We provide our detailed comments in the following appendix:

- **Appendix 5** SNCB advice on the proposed scalar method

For information, we have updated the summary assessment presented in Tables 2a & 2b presented in our advice of 7 March 2014, highlighting changes and supplementing these with two tables summarising the changes (Tables 2c and 2d). The updated figures account for revisions to project envelopes, updates to the collision risk modelling utilising Band option 2 (see Appendix 2), updated displacement model outputs (see Appendix 3) and revised gannet threshold to 1300 birds. We do not provide any figures derived from Band option 3 because we do not wish to pre-empt the conclusions of the BTO report to MSS. We are happy to verify option 3 figures if MSS would like this. We can also provide the under-pinning spreadsheets and calculations if this would be helpful to Marine Scotland.

- **Appendix 6** Updated summary assessment

Finally, we reiterate that if the current wind farm proposals exceed or approach the thresholds this is likely to limit capacity for future development on the Scottish east coast including: further phasing in the Seagreen Round 3 zone (for which a zonal appraisal update was submitted on 30 April 2014); the two longer-term areas of search (OWNE1 and 2) proposed under the Sectoral Plan (on which we provided comment, 11 November 2013); and potentially the proposed demonstrator sites for floating wind technology (which although a much smaller-scale, may impact on the same SPAs as commercial development).

CONCLUSION

We trust that our advice is helpful and we are happy to be involved in further discussion of the Forth & Tay wind farm proposals. If you have any queries on any aspect of this advice, please do not hesitate to contact either Catriona Gall, catriona.gall@snh.gov.uk 01738 458665 or Karen Hall, karen.hall@jncc.gov.uk 01224 266559.



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APPENDIX 1

SNCB ADVICE ON SCOPE OF CUMULATIVE HRA FOR SPA SEABIRDS

In our advice on 7 March 2014, we limited our advice on cumulative impacts to the three Forth & Tay wind farm developments in combination in respect of breeding seabird SPAs within foraging range of the proposals. We have reviewed the other development proposals that may need consideration in any HRA as suggested by Marine Scotland in the draft assessment for Neart na Gaoithe.

For clarity, please note that the following advice relates only to the wind farm sites themselves and not to any linked applications i.e. the export cables that are required to transmit electricity to shore. Potential impacts to intertidal and / or terrestrial bird species from the export cables are addressed in the following responses on proposed transmission works for each site:

- Neart na Gaoithe, response to East Lothian Council dated 15 February 2013;
- Seagreen phase 1, response to Angus Council dated 12 July 2013; and
- Inch Cape, scoping advice to East Lothian Council dated 7 May 2014.

We also highlight that the scope of this cumulative HRA is limited to wind farm impacts that arise during the breeding season, assessed against the breeding SPA populations of seabird species within foraging range of the Forth & Tay wind farm proposals. It does not include impacts outside of the breeding season, which would potentially bring into scope additional developments (including those outside of Scottish waters).

This is the other development it is relevant to consider:

- **Aberdeen Bay offshore wind farm: consented, 100 MW, 11 turbines**

This proposal is relevant to consider in respect of **kittiwake** at Buchan Ness to Collieston Coast SPA and Fowlsheugh SPA – please see SNH advice on the application, 3 October 2012. Displacement effects are not predicted to be significant, but some collision risk is predicted: adult mortality during the breeding season of 19 birds at Buchan Ness to Collieston Coast and 6 birds at Fowlsheugh.

We have not been able to check the apportioning method used in the calculations for Aberdeen Bay, nor have we been able to check the collision risk modelling, although it predates Band (2012) therefore uses the earlier 'basic' model. This means that the CRM estimates for Aberdeen Bay are best compared against the CRM option 2 values for the Forth & Tay wind farms, at 98% (and see Appendix 2). While the levels of predicted mortality at Aberdeen Bay are very low, **we do highlight the potential for cumulative impacts on kittiwake at Fowlsheugh SPA** which we recommend should be addressed in the appropriate assessments required for the Forth & Tay wind farms.

- **Methil wind turbine: operational, 7 MW, single turbine**

Please refer to SNH's advice on this application dated 1 October 2012. We identified connectivity with the Firth of Forth SPA and the Forth Islands SPA: for the latter we identified 'likely significant effect' for SPA seabirds only in relation to collision risk. We confirmed that "predicted annual mortality is not expected to give rise to any detectible population-level effects upon any of the SPA qualifying species" and recommended that Marine Scotland undertake an appropriate assessment.

- **Blyth offshore wind demonstration site: consented, 100 MW, 15 turbines**

This proposal is relevant to consider in respect of **gannet** at Forth Islands SPA, as discussed in the appropriate assessment undertaken by the Marine Management Organisation (MMO), 4 October 2013. We have not been able to check the detail of the apportioning calculations or collision risk modelling underpinning the assessment, particularly whether Band (2012) has been used and, if so, which model option has been adopted (see Appendix 2).

However, as a degree of collision risk is predicted to gannet (16 birds annually) from the Blyth offshore wind farm demonstrator, we recommend that this is addressed in the appropriate assessments required for the Forth & Tay wind farms.

- **Blyth offshore wind farm: operational, 4 MW, two turbines**

This proposal is relevant to consider in respect of **gannet** at Forth Islands SPA, as discussed in the appropriate assessment from the MMO, 4 October 2013. As indicated above, we have not been able to check the detail of the underpinning calculations, and we recommend that the small degree of collision risk from this proposal (2 birds annually) is addressed in the appropriate assessments required for the Forth & Tay wind farms.

- **Teesside offshore wind farm: operational, 62 MW, 27 turbines**

This proposal is relevant to consider in respect of **gannet** at Forth Islands SPA, as discussed in the appropriate assessment from the MMO, 4 October 2013. As indicated above, we have not been able to check the detail of the underpinning calculations, and we recommend that the collision risk predicted from this proposal (12 birds annually) is addressed in the appropriate assessments required for the Forth & Tay wind farms.

APPENDIX 2

UPDATES TO COLLISION RISK MODELLING

The appropriate assessment (AA) takes account of new evidence available and changes to the wind farm scenarios since our advice dated 7th March 2014. These changes result in differences in predicted impacts between the appropriate assessment and our advice. The appropriate assessment would benefit from an annex detailing the scenarios and model parameters used. This would increase transparency. In the absence of this detail however, we outline our understanding of these differences below.

For information, we have updated the summary assessment presented in Tables 2a & 2b presented in our advice of 7 March 2014 (Appendix 6). The updated figures account for revisions to project envelopes and updates to the collision risk modelling utilising Band option 2 (see below) and displacement model outputs (see Appendix 3).

Flight height data

The AA uses flight height data from Johnston et al. (2014 corrigendum). This is published in a peer-reviewed scientific journal but was only available after we submitted our advice, based on Cook et al (2012). We concur with MSS that Johnston et al. (2014 corrigendum) is currently the best available evidence for generic flight height distributions of seabirds. However, we note there are still a number of outstanding uncertainties surrounding both estimation of flight heights and collision risk modelling, which still require consideration when interpreting outputs of collision risk models. This change results in different exposure to risk for key species in the AA. For gannet, where one particular survey resulted in the appearance of a secondary peak in the Cook et al. data, the Johnston et al. corrigendum data result in fewer flights at collision risk height. Conversely, kittiwake show more flights at collision risk height. While there are improvements in the modelling method, it is worth noting that some issues have been identified with the model fit for some gull species, as a consequence of flocking behaviour (Cook, pers comm).

Through discussion with MSS we understand that in updating the flight height data MSS have also made a change to the cell Npoints within the Flight Height sheet of the Collision Risk Model, from 155 to 299. This is a negligible change in terms of the output, and the AA now uses the correct interpolation within the calculation of the extended model.

Proportion of adults

MSS have updated the proportion of adult kittiwake used for the Inch Cape assessment. Previously we were unable to identify the proportion of adults observed in the at sea surveys, and had used the stable age distribution from the CEH PVA to derive this (74.4%). However, MSS have subsequently identified that this value is 87 % (from ICOL ES). While the stable age structure provides proportions of adults and immatures within the whole population, it does not take into account differences in behaviours and locations of age classes, i.e. immatures do not usually return to the colony in their first few years and may spend time elsewhere. We concur with MSS that this is the best metric to use to define the proportion of adult birds on the development site. This value is now also comparable with the values used in the Seagreen and Neart na Gaiithe assessments, as at sea proportions were used for these.

Collision risk model options & avoidance rates

Since the advice provided on the Moray Firth wind farms, SNH and JNCC have considered the various Band models and appropriate avoidance rates for each model and adopted a different approach for the Forth & Tay wind farm assessments. We have considered both Options 2 and 3

with a 98% avoidance rate. In this instance the final advice from SNH and JNCC was largely based on Option 2 because of uncertainties still outstanding with the Option 3 model. On the understanding that MSS would be presenting their advice on the Forth & Tay wind farms based on Option 3 at 98%, SNH and JNCC also presented an assessment against Option 3 at 98% for context, but we did not rely on this in our advice. We welcome Marine Scotland's consideration of Option 3 at a more precautionary avoidance rate of 95%, but, prior to the publication of the MSS Avoidance Rate report, we strongly recommend that outputs for Option 2 are also used within the assessment.

We note that collision risk modelling and associated avoidance rates are a fast moving area of research, with many unanswered questions and considerable uncertainty surrounding their use. Consequently, whilst SNH and JNCC will produce advice based on the best evidence available at the time our advice will differ between projects and stages of the process, although of course we endeavour to ensure consistency wherever possible and practical.

APPENDIX 3

UPDATES TO DISPLACEMENT ASSESSMENT

For information, we have updated the summary assessment presented in Tables 2a & 2b presented in our advice of 7 March 2014 (Appendix 6). The updated figures account for revisions to project envelopes and updates to the collision risk modelling utilising Band option 2 (see Appendix 2) and displacement model outputs (see below).

Updates to the CEH displacement modelling

Following submission of our Forth & Tay cumulative advice on 7 March 2014, CEH have provided an update to the final report for the displacement modelling project. This update includes some Monte Carlo simulations resulting in amendments to some of the cumulative results and also to the confidence CEH have in these.

We support the use of these updated values within the draft appropriate assessment for Neart na Gaoithe. Had this information been available at the time we provided our cumulative advice then we would have highlighted additional species where impacts approach the thresholds. Notably, in combination impacts on adult **razorbill** survival at Forth Islands SPA are now very close to the thresholds we advise (see supporting Tables 2a & 2b - updated) and thus we are **unable to advise that there will be no adverse effect on site integrity from Neart na Gaoithe, Seagreen and Inch Cape as currently proposed.**

Footnote: Impacts on **guillemot** breeding success at Forth Islands SPA are also approaching the threshold we have advised. This is solely due to the predicted impact of the Seagreen wind farm. However, we advise that it is still possible to conclude that there will be no adverse effect on site integrity because CEH have a low level of confidence in the relevant model outputs. This is true for guillemot effects specifically, but also for predicted productivity impacts more generally.

SNCB decisions regarding model options for prey distribution

We recommend that the appropriate assessment is clear regarding the decisions made for each species and SPA in respect of the CEH model options for prey distribution: either homogenous (flat) or heterogeneous (GPS) prey distribution. The figures we provide in the attached Tables 2a & 2b – updated, are informed by the following SNCB decisions in this regard, please see **Table 1** overleaf, informed by these decision rules:

- 1) Adult survival heterogenous (gps) model selected where more than 30 tagged birds followed over two years (with at least 10 tagged birds in each year) AND confidence in model from CEH was High or Moderate. Homogenous (flat) model selected otherwise.
- 2) Where applicable cumulative impacts from same model as individual sites.
- 3) For a given colony and species the same model is selected for all developments. Where rules 1 and 2 above would lead to a selection of mixture of flat and GPS then the model with majority of selections for that species and SPA preferred.
- 4) Productivity value is derived from the same model as selected for adult survival regardless of confidence in model for productivity. In only 1 case was the alternative estimate considered more reliable (Guillemot, Forth Island NnG) where alternative value was -0.03, compared to zero value accepted.
- 5) Positive values were corrected to zero (no impact) value.

Table 1 SNCB decisions over model options for prey distribution

Species	SPA	CEH model	GPS Tracks		CEH confidence in options for prey distribution		SNCB decision
			Tags for 2 years	Tags > 30 total	Flat	GPS	GPS or Flat
Guillemot	Forth Islands	NnG	Y	Y	H	H	GPS
	Fowlsheugh	SGb	Y	N	L	L	Flat
Kittiwake	Forth Islands	SGb	Y	Y	H	H	GPS
		SGa	Y	Y	H	H	GPS
		NnG	Y	Y	H	H	GPS
		IC	Y	Y	H	H	GPS
		Cumul	Y	Y			GPS
	Fowlsheugh	SGb	Y	Y	H	H	Flat
		SGa	Y	Y	H	M	Flat
		NnG	Y	Y	L	L	Flat
		IC	Y	Y	L	L	Flat
		Cumul	Y	Y			Flat
	St Abbs	SGb	Y	Y	M	L	Flat
		SGa	Y	Y	L	L	Flat
		NnG	Y	Y	H	M	Flat
		IC	Y	Y	L	L	Flat
		Cumul	Y	Y			Flat
Puffin	Forth Islands	SGb	N	N	M	H	Flat
		SGa	N	N	H	H	Flat
		NnG	N	N	H	H	Flat
		IC	N	N	H	L	Flat
		Cumul	N	N			Flat
Razorbill	Forth Islands	SGb	Y	Y	H	H	GPS
		SGa	Y	Y	H	M	GPS
		NnG	Y	Y	H	H	GPS
		IC	Y	Y	H	H	GPS
		Cumul	Y	Y			GPS

APPENDIX 4

ADVICE ON PUFFIN DISPLACEMENT & SIGNIFICANCE OF IMPACTS

Advice on displacement assessment for puffin

The draft appropriate assessment for Neart na Gaoithe proposes that the ‘common currency’ approach to displacement, adopted for the Moray Firth wind farm proposals by MSS, SNCBs, MORL and BOWL, could be used to assess displacement impacts on puffin from the Forth & Tay wind farms, where CEH have highlighted the limitations of their more sophisticated models in respect of puffin (see discussion on displacement in Appendix A5 of our advice of 7 March 2014).

We consider there is some merit in drawing on a ‘common currency’ approach for puffin, to be able to consider the outputs alongside the CEH displacement modelling to give an overall indication of impacts to this species. However, we recommend some changes to the values in ‘common currency’ for puffin displacement. We have not made use of the common currency approach to update our advice, summarised in Tables 2a and 2b because of these differences over the parameters. Our recommendations are provided in the following table:

Table of ‘common currency’ values for puffin displacement

Metric	MSS values	SNCB recommendations
Breeding season month	April – July	Agreed ¹
Abundance	Mean-peak	Agreed ²
Proportion displaced	0.6	0.6 (0.5 only in lower density) ³
Proportion immature	0.35	16.2% (Harris & Wanless 2011) ⁴
Proportion non-breeding	0.35	0.01 ⁵
Effect on productivity	100% failure	Agreed ⁶
Proportion SPA Seagreen	0.864	0.976 ⁷
Proportion SPA Inchcape	0.929	0.984 ⁷
Proportion SPA NNG	0.975	0.998 ⁷

1. Used in Moray Firth puffin displacement assessment and no change required.
2. Used in Moray Firth puffin displacement assessment and no change required.
3. Value used in Moray Firth, and adopted here. Lower proportion (0.5) may be acceptable under conditions of reduced turbine density, but requires further detailed examination of turbine pattern.
4. Table on page 74 of Harris and Wanless (2011) gives the proportion of birds with fewer than 2 full bill grooves at colony on Isle of May sampled in 22 years between 1976 and 2010. The mean of those percentages is 16.2%. The range of proportion of immatures over the 22 samples taken from Isle of May is 2% to 37%.

Helgason (2012) states that immatures spend more time in flight at colonies, which suggests that one method used to sample on isle of May (Mist-net) will capture a disproportionate number of immatures although the mean difference is small (Mist-net samples = 17%, telescope visual samples = 15% immatures).

Another metric for estimating the proportion of the population that is immature is stable age structure. The MacArthur Green matrix model PVA estimates the proportion of adults as 42%, with 13% < 1 year, and 45% immature, which is close to the 50% used by MORL in the Moray Firth assessment. However, this is likely to be an overestimate of the proportion of immature puffins on the development sites. Firstly, the matrix model used an unrealistically high estimate of juvenile survival (equal to adult survival) which will inflate the proportion of the population classed as immature. Secondly, there is evidence from other species that can be aged in the field (gannets) that the actual number of immatures using the development site is much lower than that predicted by the stable age structure. For puffins, although the estimate of immatures of 16% is from the colony rather than on development areas we prefer the direct observations of proportion immature and, given the relative distance to the development site from the colony is small, we assume that the percentage close-by at sea will not differ substantially. The stable age-structure approach has been used in the estimate of regional non-breeding season populations, as this is used to calculate proportions of birds over much larger areas for which other data was not available.

5. From Harris and Wanless (2011). Colour-ring studies indicated that non-breeding by adults is 'very rare' on Isle of May – 27 cases out of more than 2000 bird/years (Harris and Wanless 2011). We use 1%. Measures on Skomer indicate 17-20% of 'experienced' birds may not breed in any one year, but measures from Isle of May preferred here.
6. Used in Moray Firth puffin displacement assessment and no change required.
7. The SNCB apportioning follows the updated SNH guidance (which includes the reciprocal of distance from colony). The colony list, population counts, distance to development and sea area within forage range are the same for between MSS and SNCB calculations.

Advice on setting thresholds for puffin

In summary, and recognising the limitations of using PBR and thresholds from proxy species to set puffin thresholds, we favour the approach we advised on 7 March 2014 rather than relying on the matrix model PVA from MacArthur Green. Whilst the former approach is not ideal, it is the best use of available scientific information rather than using population model predictions that rely on unsupported assumptions and ignore inherent uncertainty.

CEH developed a sophisticated PVA for modelling future populations in the presence and absence of additional wind farm mortality. The PVA used a Bayesian framework to build a state-space model and, where data permitted, an integrated population modelling approach. Model predictions were sufficiently reliable to inform threshold setting for all species, with the exception of puffin. Considerable fluctuation in puffin population trends over the past 30 years caused large uncertainty in predicted future population sizes and as such CEH reported low confidence in the population predictions. Consequently, the CEH puffin population model was not used to set thresholds.

Subsequent to the SNCB advice, MSS then commissioned MacArthur Green to develop a simpler stochastic density-independent matrix population model for puffins. This approach uses only survival and fecundity rates and a starting population size to predict future population size. The CEH state-space model and the MacArthur Green matrix model provide broadly similar predictions of future puffin population size. MSS did not use the matrix model to set thresholds of acceptable reductions in puffin adult survival but instead used it to assess how likely the population would be to fall below starting population size in any year of the 25 year projection,

given the reductions in adult survival and productivity predicted by the CEH displacement modelling. They found a very small probability of the population declining below the starting population size when subject to the predicted effects of the wind farms.

Whilst the SNCBs agree with the approach of assessing the consequences of particular impacts on future puffin population size rather than identifying a specific threshold, we do not support the use of the matrix model to do this. The matrix model confers no advantage over the state-space model in terms of accurately predicting future population trends. In fact it fails to represent inherent uncertainty about future population size. Unlike the more sophisticated CEH modelling approach, the matrix modelling approach makes no attempt to incorporate information from previous population censuses when predicting future population size. As a consequence, the matrix model predictions have less uncertainty associated with them than the state-space model predictions. MSS see this as a benefit of the matrix model approach whereas, in fact, the state-space model approach is representing real uncertainty about future population size that is overlooked by the simpler matrix model approach.

Additionally, the immature survival rate used in the matrix model is too high. The annual adult survival rate (0.922) was also used for immature survival. However, species with a life history strategy of high adult survival always have lower juvenile/immature survival rates and puffin immature survival will be lower than the adult survival rate. The CEH PVA indicates a lower juvenile survival rate of approximately 0.89 (Fig 3.4.1, p. 85, Freeman et al (2014)). Consequently, the matrix model will produce a population growth rate that is too high, leading to predictions of thresholds of acceptable decreases to adult and chick survival that the population will not be able to withstand in reality.

Appendix 4 references

Harris M.P. and Wanless S. 2011 *The Puffin*. T&AD Poyser

Helgason H. H. 2012 *Survival of Atlantic Puffins (*Fratercula arctica*) in Vestmannaeyjar, Iceland during different life stages*. MSc Thesis.

APPENDIX 5

SNCB ADVICE ON THE PROPOSED SCALAR METHOD

We believe that the adult survival and chick survival thresholds contained in our 7 March 2014 advice are derived from a good PVA and constitute the best available information. We recommend the use of these rather than thresholds derived from the scalar method.

Adult survival only thresholds – the scalar method

The CEH displacement model represents effects of displacement as a decrease in adult survival and/or a decrease in chick survival. To accommodate these two effects, the CEH population model (PVA) ran scenarios with either adult or chick survival reduced and also both reduced, concurrently. As expected for species with a slow life history strategy and high adult survival, the PVA showed that reducing adult survival influenced future population size more than did reducing chick survival. When both adult and chick survival were reduced concurrently, future population size decreased still further. MSS and the SNCBs used the PVA in combination with ABC or ruABC to identify thresholds of additional adult and chick mortality that caused acceptably small decreases in future population size. MSS then used the scalar method to derive a single adult survival threshold for each colony.

We advised (7 March 2014) that if any project, either individually or in combination, was predicted to cause a decrease in either adult or chick survival that exceeded the thresholds, then an adverse impact on the respective SPA could be assumed. MSS consider impacts against only an adult survival threshold, using the scalar method.

The MSS scalar method takes the so-called 'spare capacity' in chick survival thresholds to increase adult survival thresholds. They first calculate the percentage point decrease in chick survival that brings about the same decrease in future population size as a 1% decrease in adult survival. This ratio is used to convert the difference between the chick survival threshold and the predicted reduction in chick survival to an adult survival rate. Finally, this additional adult survival is added to the original adult survival threshold to give a higher threshold. We advise that it is inappropriate to use this approach without more consideration and testing of the underlying assumptions.

Firstly, the scalar method assumes a linear relationship between decreases in adult or chick survival and population size and this may not be true. The scalar method does not take account of any non-linearity and the population consequences of the higher thresholds have not been tested within the current PVA models undertaken to date. Additionally, the scalar method does not consider any interaction effect between concurrent reductions in adult and chick survival. The assumption that the effects of reductions to chick and adult survival on future population size are interchangeable according to the linear scalar ratio remains to be empirically tested.

Secondly, in our advice of 7 March 2014, we explained the risks of allowing impacts that approach very close to any thresholds used in the assessment of these proposed projects. To summarise, there is uncertainty in both the level of the thresholds and the predicted impacts, so that an impact that appears to be close to, but below, a threshold could easily be above a level that actually causes large declines in population size. Additionally, we could not include non-breeding season wind farm mortality in the assessment, so total annual reductions in survival rates could be larger than predicted. The use of the scalar method will increase this risk as impacts right up to or beyond the original productivity threshold will be permitted. Consequently,

we reiterate our advice of 7 March 2014 that predicted impacts should not be so large that they are close to thresholds.

Thirdly, the relationship between chick mortality and adult mortality is a feature of the population dynamics of a population, related to age at first breeding and juvenile/immature survival, e.g. if for every seven chicks hatched, only one will reach maturity, the scalar ratio will be 7:1. Whilst Furness *et al.* (2013)¹ demonstrated that this relationship generally holds true within a species, there will be considerable intra-specific variation among colonies, and we know this having seen some of MSS's workings. Unfortunately, the appropriate assessment does not present the scalar ratio values so it is not possible to assess whether the intraspecific variability in scalar ratio is sufficient to undermine confidence in the thresholds set by MSS.

In conclusion, the appropriate assessment provides insufficient information on the detail of the scalar method to allow an independent assessment of the validity of the approach and the conclusions reached. In contrast other novel approaches like the ABC and ruABC methods have been through more thorough and collaborative review including the Renewables Scientific Advisory Group.

¹ Furness, B., MacArthur, D., Trinder, M. & MacArthur, K. (2013) *Evidence review to support the identification of measures that could be used to mitigate or compensate offshore windfarm impacts on selected species of seabirds*. MacArthur Green report to CEFAS.

APPENDIX 6.

UPDATED SUMMARY ASSESSMENT: Table 2a. Summary table of key SPA seabird impacts and thresholds – changes to adult survival
 (Updates from 7 March 2014 highlighted)

Please see Appendix 4 for advice on the method for setting thresholds.			CHANGES TO ADULT SURVIVAL <i>units are percentage point decrease in adult survival (except for gannet mortalities)</i>									
Species	SPA	Threshold	In Combination		Seagreen Alpha		Seagreen Bravo		Inch Cape		Neart na Gaoithe	
			CRM (2) + Displ.	CRM (3) + Displ.	CRM (2) + Displ.	CRM (3) + Displ.	CRM (2) + Displ.	CRM (3) + Displ.	CRM (2) + Displ.	CRM (3) + Displ.		
Kittiwake	Buchan Ness	-1.6%	-0.2		-0.1		-0.1		-0.0		0.0	
	Forth Islands	-1.5%	-2.6		-0.5		-0.4		-0.8		-1.3	
	Fowlsheugh	-1.3%	-2.4		-1.2		-1.0		-0.6		-0.1	
	St Abbs	-1.6%	-0.9		-0.2		-0.2		-0.2		-0.2	
Gannet	Forth Islands	1300 individuals	2204		761		468		633		342	
Puffin	Forth Islands	-1.4% (0.5-2.5% range)	-3.3		-1.2		-0.2		-1.4		-0.5	
Guillemot	Buchan Ness	-0.5%	0.0		0.0		0.0		0.0		0.0	
	Forth Islands	-0.6%	0.0		0.0		0.0		0.0		-0.3	
	Fowlsheugh	-0.6%	0.0		0.0		0.0		0.0		0.0	
	St Abbs	-0.8%	0.0		0.0		0.0		0.0		0.0	
Razorbill	Forth Islands	-0.9%	-0.8		-0.1		-0.1		-0.1		-0.1	
	Fowlsheugh	-1.0%	0.0		0.0		0.0		0.0		0.0	
	St Abbs	-1.3%	0.0		0.0		0.0		0.0		0.0	
Herring gull	Buchan Ness	-1.9%	0.0		0.0		0.0		0.0		0.0	
	Forth Islands	-2.0%	-0.2		0.0		0.0		0.0		-0.1	
	Fowlsheugh	-2.0%	-0.3		-0.1		-0.1		0.0		0.0	
	St Abbs	-1.9%	-0.1		0.0		0.0		0.0		0.0	
L. black-backed gull	Forth Islands	-1.8%	-0.3		-0.1		-0.1		0.0		-0.1	

UPDATED SUMMARY ASSESSMENT: Table 2b. Summary table of key SPA seabird impacts and thresholds – changes to productivity

(Updates from 7 March 2014 highlighted)

Please see Appendix 4 for advice on the method for setting thresholds.		CHANGES TO PRODUCTIVITY <i>units are percentage point decrease in chick survival</i>					
Species	SPA	Threshold	In combination	Seagreen Alpha	Seagreen Bravo	Inch Cape	Neart na Gaoithe
Kittiwake	Buchan Ness	-3.2%	0.0	0.0	0.0	0.0	0.0
	Forth Islands	-3.0%	-1.2	-1.6	-0.7	0.0	-0.9
	Fowlsheugh	-2.3%	-1.7	-1.0	-0.5	0.0	0.0
	St Abbs	-3.4%	0.0	-0.1	0.0	0.0	0.0
Gannet	Forth Islands	no thresholds but impacts are all negligible	<i>no in comb. effects available</i>	0.0	-0.1	0.0	-0.1
Puffin	Forth Islands	0.5-2.0% range	-4.9	-0.8	0.0	-1.7	-0.9
Guillemot	Buchan Ness	-0.5%	0.0	0.0	0.0	0.0	0.0
	Forth Islands	-0.6%	0.0	0.0	0.0	0.0	0.0
	Fowlsheugh	-0.6%	0.0	0.0	-0.5	0.0	0.0
	St Abbs	-0.8%	0.0	0.0	0.0	0.0	0.0
Razorbill	Forth Islands	-0.9%	0.0	0.0	0.0	-0.1	-0.1
	Fowlsheugh	-1.0%	0.0	0.0	0.0	0.0	0.0
	St Abbs	-2.0%	0.0	0.0	0.0	0.0	0.0
Herring gull	Buchan Ness Forth Islands Fowlsheugh St Abbs		<i>no displacement effects therefore no direct impacts on productivity, only on reduced adult survival</i>				
L. black-backed gull	Forth Islands		<i>no displacement effects therefore no direct impacts on productivity, only on reduced adult survival</i>				

UPDATED SUMMARY ASSESSMENT: Table 2c. Changes to predicted impacts on adult survival from the SNCB advice in March 2014 to the reassessment in June 2014 in relation to SNCB thresholds, which remain unchanged from the March 2014 advice

Species	Project	Opt 2 98% (SNCB)	Opt 3 95% (MSS)
Kittiwake	Cumulative	Impacts ↓ slightly - no change to advice	Impacts ↑ slightly - Fowlsheugh impact greater than SNCB threshold
	SG Alpha	Small ↓ change - Fowlsheugh impact very close to threshold now.	Impacts ↑ slightly – Fowlsheugh impacts very close to threshold
	SG Bravo	Negligible change	Negligible change
	Inchcape	Negligible change	Negligible change
	NnG	Negligible change	Negligible change
Gannet (threshold increased)	Cumulative	Impacts ↑ - remaining well over threshold	Impacts ↓ - still over SNCB threshold
	SG Alpha	Impacts ↓ - down to only one third of threshold	Impacts ↑ slightly - still well below threshold
	SG Bravo	Impacts ↑ - still well below threshold	Impacts ↑ slightly - still well below threshold
	Inchcape	Impacts ↓ - just below half of threshold	Impacts ↓ - previously over threshold, now about 20% of threshold
	NnG	Impacts ↑ slightly - still well below threshold	Impacts ↓ very slightly
Puffin	All	The puffin assessment in March was made using the CEH displacement model. The SNCBs are now considering use of the common currency approach, alongside the displacement model.	
Guillemot	All	No change	
Razorbill	Cumulative	Impacts ↑, now just below threshold.	
	SG Alpha	Impacts ↑ very slightly	
	SG Bravo	Impacts ↑ very slightly	
	Inchcape	Impacts ↑ very slightly	
	NnG	No change	
Herring gull	Cumulative	Negligible change	Negligible change
	SG Alpha	No change	Negligible change
	SG Bravo	No change	No change
	Inchcape	No change	No change
	NnG	No change	No change
Lesser black-backed gull	Cumulative	No change	Negligible change
	SG Alpha	No change	Negligible change
	SG Bravo	No change	No change
	Inchcape	No change	No change
	NnG	No change	Negligible change

UPDATED SUMMARY ASSESSMENT: Table 2d. Changes to predicted impacts on chick survival from the SNCB advice in March 2014 to the reassessment in June 2014 in relation to SNCB thresholds, which remain unchanged from the March 2014 advice

Species	Project	Changes to Productivity
Kittiwake	Cumulative	Impacts ↑ - now more than half of threshold at Forth Islands, other SPAs remain unchanged
	SG Alpha	No change
	SG Bravo	Impacts ↑ - still well below threshold
	Inchcape	No change
	NnG	Impacts ↓ slightly - remaining well below threshold
Gannet	Cumulative	No assessment made
	SG Alpha	Negligible change
	SG Bravo	Negligible change
	Inchcape	No change
	NnG	Negligible change
Puffin	Cumulative	The puffin assessment in March was made using the CEH displacement model. The SNCBs are now considering use of the common currency approach, alongside the displacement model.
Guillemot	Cumulative	No change
	SG Alpha	No change
	SG Bravo	Impacts ↑ at Fowlsheugh - just below threshold but adverse effect not concluded due to uncertainty around magnitude of impact; impacts at all other SPAs remain unchanged.
	Inchcape	No change
	NnG	No change
Razorbill	Cumulative	No change
	SG Alpha	No change
	SG Bravo	No change
	Inchcape	Negligible change
	NnG	Negligible change