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NORFOLK BOREAS OFFSHORE WIND FARM

Pre 22nd January 2020 Issue Specific Hearing Advice

Planning Inspectorate Reference: EN010087

Updated Ornithology Advice

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9 January 2019

Please accept this document as Natural England's headline comments in response to the Applicant's Offshore Ornithology Assessment Update as Submitted at Deadline 2. Document Reference: ExA; AS-1.D2.V1 Examination Library Ref REP2-035. We will provide our final conclusions/advice on detailed figures once we have completed our review of the updated assessments in REP2-035, which will be provided at Deadline 4.

Natural England, again recommends that the Boreas Applicant considers raising turbine draught height, as has been done by other projects in order to minimise their contribution to the cumulative/in-combination collision totals by as much as is possible. We would also advise that Norfolk Boreas considers a range of possible options of draught heights be presented, to demonstrate due consideration of alternative mitigation options

1. Precaution in assessments

The Applicant asserts that the methods requested by Natural England, and used for the updated assessments in REP2-035, are over-precautionary and result in greatly over-estimated impacts with highly improbable outcomes. Natural England notes the following regarding the points made by the Applicant:

1.1 ***Use of collision estimates calculated for consented wind farm designs in the cumulative and in-combination totals:*** The Applicant refers to projects in the cumulative and in-combination assessments that have been built out to a lower capacity than that consented as a source of precaution within the assessments. As Natural England has stated previously during the Norfolk Vanguard examination (see our Deadline 2[1] and 8[2] responses for this examination), we acknowledge that this is an important issue with regard to cumulative/in-combination collision risk modelling (CRM) predictions and assessments. However, without a legally secured reduction in the consented Rochdale envelope, and a re-run CRM with the final design parameters (noting that the predicted impacts still need to be calculated for

[1] Natural England (2019) Norfolk Vanguard Offshore Wind Farm: Comments on Offshore Ornithological Aspects of Applicant's Response to Section 51 Advice from the Planning Inspectorate. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-002461-Natural%20England%20-%20NE%20detailed%20comments%20on%20Offshore%20Ornithology%20S51%20Advice.pdf

[2] Natural England (2019) Norfolk Vanguard Offshore Wind Farm: Natural England's Comments on Norfolk Vanguard Ltd. Deadline 7 and Deadline 7.5 submissions in relation to Offshore Ornithology Related matter. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-003121-DL8%20-%20Natural%20England%20-%20Deadline%20Submission.pdf

the worst case scenario within the consent unless there is documented evidence that what has been built cannot be added to/changed etc. over the lifetime of the project consent), cumulative assessments should be based on consented parameters. We note that East Anglia 1 is currently the only project to date to meet these tests.

1.2 **Nocturnal activity:** The Applicant refers to nocturnal activity factors used in the assessments as being overestimates. As we have noted previously during the Norfolk Vanguard examination (see our Relevant and Written Representations, our Deadline 2[1] and Deadline 8[2] submissions for the Vanguard examination), we recognise that from recent evidence presented e.g. by MacArthur Green (2015) and Furness et al. (2018), nocturnal activity levels relative to daytime levels for some species may be lower than the levels that equate to the nocturnal activity factors currently used in CRM. However, this does not necessarily translate into an over assessment of nocturnal collision risk, because of the way that densities of birds derived from baseline digital aerial surveys may not reflect diurnal activity patterns as measured by tagging studies. Our position regarding nocturnal activity rates/factors position remains unchanged from that set out during the Norfolk Vanguard examination, which includes that offshore survey periods will have missed the periods of peak activity around dawn and dusk, which means it is not appropriate to apply 'empirically derived' nocturnal activity rates from tracking studies to offshore survey recorded results. Additionally, as we have previously noted during the Norfolk Vanguard examination (see our Deadline 2[1] and 8[2] responses for this examination), Natural England considers that it is not appropriate to simply adjust the CRM figures for the other OWFs included in the cumulative assessments to account for a change in nocturnal activity rate without re-running the CRM, as the modelling calculates the reduction in activity at night through the interaction of nocturnal activity and the latitude of the specific wind farm. Therefore this is a calculation specific to the windfarm in question and hence a re-run of the model is required.

1.3 **Over-emphasis on predictions using upper 95% confidence intervals:** As noted in our Deadline 9 response during the Norfolk Vanguard examination, the distribution of birds in the marine environment appears to be highly variable between days, seasons and years. It is likely that e.g. 24 days of surveys over 2 years - approximately 3.3% of the total number of 720 days - do not fully capture the full extent of variation density/abundance of seabirds that can be present within

the survey areas during the 2 year period, including low as well as high counts, let alone over the 30-year period of the lifespan of the project. In that context, if uncertainty in an offshore ornithology survey dataset is to be properly addressed, it is entirely appropriate for the Applicant to present values from both lower and upper 95% confidence limits for consideration, bearing in mind that Natural England takes, and has consistently advocated, a range based approach.

1.4 **Slower flight speeds for kittiwake:** The Applicant notes that recent studies have reported slower flight speeds for kittiwake (e.g. from Skov et al. 2018) compared with the value which has previously been assumed for use in CRM, and that reducing the value for flight speed entered in the collision model reduces the predicted number of collisions. Natural England recognises the need to review the evidence base for flight speeds. However the Offshore Renewable Joint Industry Project (ORJIP) avoidance study (reported in Skov et al. 2018) is just one data source for this parameter, whereas a robust review would need a range of locations/seasons per species. (Such an analysis should be possible via flight speed tracking data – please note that Marine Scotland have a project underway reviewing flight speed: CR/2018/13 'Improving our understanding of seabird behaviour at Sea'). In addition, the ORJIP data (Skov et al. 2018) also presents very different flight height distributions from the generic (pooled and modelled) data used. There is likely to be a relationship between flight speed and height, which in turn undermines confidence in the applicability of the flight speeds collected at Thanet by ORJIP for use at other projects.

1.5 **Under estimated avoidance rates:** The Applicant notes that there is evidence (e.g. Bowgen & Cook 2018; Skov et al. 2018) that for some species the currently advised avoidance rates are too low. Natural England note that the SNCBs are currently reviewing the evidence on avoidance rates presented in the recently published Bowgen & Cook (2018), and its applicability to SNCB advice on CRM. This work is ongoing. Therefore Natural England's position remains that the appropriate avoidance rates to use with Band (2012) model are those set out in the SNCB guidance note JNCC et al. (2014), i.e. 98.9% for gannet and kittiwake with the 'Basic' Band model (i.e. Options 1 and 2).

1.6 **Extent of displacement:** The Applicant notes that the review of studies conducted at operational wind farms during the Vanguard Examination (MacArthur Green 2019a) concluded that an evidence-based, but still precautionary, assessment of

displacement of auks by offshore wind farms might assume that their densities would be reduced inside offshore wind farms by 50% relative to densities in the surrounding area, and by 30%, on average, across a 1 km buffer zone surrounding the wind farm. The Applicant asserts that there are very few examples where displacement is greater than this, and many cases where it is much less. The Applicant considers that this contrasts with Natural England's advice to assess displacement rates of 30% to 70% across the wind farm and a 2km buffer.

As was noted in our Deadline 3[3] response during the Vanguard examination, Natural England considers that the evidence for auk displacement is variable, with some studies finding a strong displacement effect of guillemots and razorbills from offshore wind farms, whereas other studies have found none. For example displacement of guillemots and razorbills have been reported in the non-breeding season in the southern North Sea of distances from 2 to 4km (Petersen et al. 2004) and Petersen & Fox (2007) demonstrated the exclusion of guillemots out to at least 2km at Horns Rev development site. Mendel et al. (2014), studying the Alpha Ventus windfarm in Germany found that guillemot were in significantly lower numbers in all distance bands from the windfarm (out to 6-10km), with the highest displacement within 2km of the windfarm (razorbill were not in sufficient numbers to assess). Welcker & Nehls (2016), also studying Alpha Ventus, found that auks (predominantly guillemot) were 75% lower inside compared to outside the windfarm and that the lower numbers were evident out to 2.5km of the windfarm. Welcker & Nehls (2016) also conducted a literature review of studies looking at displacement and concluded that there was strong evidence across studies that auks are displaced by offshore windfarms. However, this has not been the case for other studies, e.g. guillemots at Robin Rigg wind farm in Scotland (Vallejo et al. 2017) and a study by Webb et al. (2017) found no displacement or attraction occurred at the Lincs and LID wind farms for all auks. Dierschke et al. (2016) conducted a review (for full details see table 3 in the paper) and they concluded that common guillemot and razorbill 'weakly avoided' windfarms. We note that displacement of auks may be state-specific (breeding or non-breeding) or it may be due to habitat quality and/or availability (e.g. birds will be more easily displaced from poorer quality habitat or where habitat is not limiting). Hence we again conclude that

[3] Natural England (2019) Norfolk Vanguard Offshore Wind Farm: Natural England's comments on Appendix 3.3 – Operational Auk and Gannet Displacement: update and clarification. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-002568-DL3%20-%20Natural%20England%20-%20Deadline%203%20Submission.pdf

consideration of a range of displacement rates from 30%-70% across a 2km buffer remains our advice.

The Applicant also asserts that larger turbines that are spaced further apart will result in reduced displacement effects. Natural England considers that this idea that spacing is all and other factors such as turbine size has no bearing on displacement effects has very little supporting evidence, and unless other evidence can be brought forward, we disagree with the assertion that displacement is 'very likely' to be over-estimated with regard to this specific point. It is plausible that turbine spacing is one of several variables that could affect displacement effects on birds, but such an effect, and the strength of such an effect (including relative to other variables), is yet to be demonstrated. It also seems likely that there will be site specific and species/individual specific variability in the effect (if any), which is one of the reasons why Natural England advises that a range of displacement levels should be considered, in order to reflect such potential variability.

1.7 **Mortality resulting from displacement:** The Applicant states that: *'The consequences of displacement are less well understood than rates of displacement, and Natural England therefore adopts precautionary values for assessment of up to 10% (i.e. 10% of displaced individuals suffer mortality as a direct result).'*

As noted in our Deadline 9[4] response at Vanguard, it is not the case that Natural England focusses its assessments on a 10% mortality rate alone – we consider a range of potential rates. Critically though, empirical evidence regarding the energetic consequences of displacement for seabirds and wintering waterbirds using the marine environment are very limited, and the role of overwinter survival on seabird population dynamics is poorly understood. Therefore as there is very little information available about the consequences of displacement for individuals, there is actually no evidence to suggest that 10% is precautionary. Furthermore, we again note that the mortality rates are a crude method of capturing a range of potentially deleterious effects that could arise from displacement, including reduced fitness for migration and reduced productivity during the breeding season. These are

[4] Natural England (2019) Norfolk Vanguard Offshore Wind Farm: Natural England's comments on Deadline 8 Submission – Offshore Ornithology Precaution in ornithological assessment for offshore wind farms. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-003190-DL9%20-%20Natural%20England%20-%20Deadline%20Submission.pdf

particularly relevant when considering displacement effects within sites designated for the species affected.

2. Key notes/points on Applicant's updated offshore ornithology assessments in REP2-035

We note the following regarding the updated assessments in REP2-035:

2.1 We welcome that the Applicant has given consideration of the uncertainty/variability in input parameters of the assessments through consideration of the collision and displacement predictions for Norfolk Boreas alone based on the 95% confidence intervals of the bird density or abundance data.

2.2 We agree that the collision predictions from Norfolk Boreas alone are based on outputs from the Band (2012) collision risk model, and that the uncertainty/variability is considered through consideration of the 95% confidence intervals of the bird density data. As given the current issues identified with the stochastic collision risk model, this represents the best available approach and the greatest variability in predictions for Norfolk Boreas comes from variation of the bird density data.

2.3 We welcome that the cumulative and in-combination collision and displacement assessments have been updated to include the missing offshore wind farms noted in our Relevant Representations [RR-099] and to correct the figures for other projects (e.g. Vanguard, Thanet Extension, Hornsea 3) as identified in RR-099.

2.4 With regard to the numbers included in the cumulative/in-combination assessments for Hornsea 3, we note that Natural England highlighted throughout our written and oral submissions for Hornsea 3 that the lack of sufficient baseline information for the Hornsea 3 Zone (i.e. the array area) means that there is a considerable degree of uncertainty (and thereby level of risk) associated with these figures and these should in no way be seen as Natural England's agreed position on the levels of impact from Hornsea 3. We acknowledge that the Hornsea 3 decision has been delayed and that BEIS has sought further information from the Hornsea 3 developer. We therefore note that there is the potential that the figures for Hornsea 3 could change during the Norfolk Boreas examination process and there may hence be a requirement to update the figures included in the cumulative/in-combination assessments for this project.

2.5 Due to Natural England's significant concerns regarding the incomplete baseline surveys for the Hornsea 3 project, and the associated level of uncertainty as regards the potential impacts of that project, Natural England is not in a position to advise that a significant adverse impact for cumulative impacts at EIA scale or adverse effect on integrity (AEoI) for in-combination impacts at HRA can be ruled out for any relevant species or feature of an SPA when the Hornsea 3 is included in the totals.

2.6 We note that there may be the potential for figures for the East Anglia One North and East Anglia Two projects to change during the examinations for these projects. However, we acknowledge that values currently included by the Norfolk Boreas Applicant for these projects represent the most appropriate at present.

2.7 We also note that the figures for Hornsea 4 come from the PEIR for that project. These figures and the methodologies to produce them are hence subject to ongoing discussions through the evidence plan process and therefore have an element of uncertainty associated with them and a likelihood of being subject to change. For example, the CRM figures presented in the Hornsea 4 PEIR were undertaken using the stochastic CRM, and therefore are potentially affected by the issues currently being investigated with this model.

2.8 The inevitable uncertainty around the Hornsea 4 figures along with that position set out above regarding inclusion of Hornsea 3 in the cumulative and in-combination assessments means that Natural England is not in a position to advise that a significant adverse impact for cumulative impacts at EIA scale or adverse effect on integrity (AEoI) for in-combination impacts at HRA can be ruled out for any relevant species or feature of an SPA when the Hornsea 3 and Hornsea 4 projects are included in the totals.

2.9 We understand that the figures included in the gannet and kittiwake cumulative and in-combination collision assessments (in Tables 7.1 and 7.2 of REP2-035) for the Dogger Bank Creyke Beck projects have been updated with numbers from collision risk modelling (CRM) undertaken as part of a non-material change application (Dogger Bank Wind Farms 2018). Natural England notes that our initial response to this non-material change application suggested that any future projects entering the consenting process should take into account the revised Dogger Bank Creyke Beck

project envelope in their in-combination assessment, should this non-material change to the DCO be accepted. However, subsequent to this advice it became apparent from the developer that the non-material change application increased the Rochdale envelope to include larger turbines, but the rest of the envelope remained unchanged, i.e. smaller turbines aren't removed. Therefore, the worst case scenario for the Dogger Bank Creyke Beck projects still stands and we advise that these figures should be used in the cumulative/in-combination assessments.

2.10 The Applicant has run EIA scale Population Viability Analysis (PVA) models for gannet, kittiwake, lesser black-backed gull (LBBG) and great black-backed gull (GBBG) for the Biologically Defined Minimum Population Scale (BDMPS) and biogeographic population scales using the Natural England commissioned Seabird PVA Tool (https://github.com/naturalengland/Seabird_PVA_Tool). This updates the previous PVA models for EIA scale kittiwake and GBBG undertaken at East Anglia 3 assessment (EATL 2015 & 2016) and the SOSS national gannet PVA (WWT 2012), so that the models are run over 30 years, the stochastic simulations are run as matched pairs and present outputs for the Natural England recommended metrics of the counterfactual of population growth rate and the counterfactual of population size to quantify the relative changes in a population in response to anthropogenic impacts. Further specific comments regarding the PVAs run using the Natural England tool are set out in Section 2.1 below.

2.11 We welcome that the Applicant has considered the PVAs undertaken during the Norfolk Vanguard examination for LBBG at the Alde-Ore Estuary SPA (MacArthur Green 2019b); and the updated PVAs undertaken during the Hornsea examination for gannet, kittiwake, razorbill and guillemot at the FFC SPA (Hornsea Project Three Offshore Wind Farm 2019). As noted in our Relevant Representations for Norfolk Boreas [RR-099], we had outstanding concerns with the Hornsea 3 PVAs which were not resolved by the close of the Examination, relating to the number of simulations and the demographic data not being updated (see our Deadline 6 response to the Hornsea 3 Examination – written summary of representations of ISH5[5]). Given these outstanding concerns, we would recommend that these models

[5] Natural England (2019) Hornsea Project Three Offshore Wind Farm: Natural England Written Submission for Deadline 6 – Written Submission of Natural England's Representations at Issue Specific Hearing 5, Offshore Ecology. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-001688-Natural%20England%20-%20Written%20Submission%20of%20Natural%20England's%20Representations%20at%20Issue%20Specific%20Hearing%205%20-%20Offshore%20Ecology.pdf

are updated/re-run using the Natural England commissioned Seabird PVA Tool once the updates to the tool have been completed. However, these existing PVA models nevertheless represent the best available evidence on which to base an assessment, though this should not be taken as an endorsement or 'acceptance' of the models.

2.12 As noted in the 2017 SNCB interim advice on displacement (SNCBs 2017), the number of birds at risk of reduced individual fitness (i.e. mortality and productivity losses) as a result of displacement is based on the numbers of birds present within a development area and buffer both on the water and in flight. Assessment of the number of birds at risk of mortality as a result of collisions (e.g. with wind turbines) is based on the number of birds present within a development area that are in flight only. The mortality impacts estimated from CRM are assumed to be in addition to any mortality caused by displacement impacts. Productivity impacts due to displacement would be a further addition (but this is not currently quantitatively accounted for under existing methods/advice). Therefore, at present, the SNCBs regard the **two impacts (collision and displacement) as additive and advise that they should be summed**. In summing the predicted mortalities that arise via these two mechanisms, there is a risk of some degree of double counting as a bird that collides with a turbine cannot be displaced and vice versa. Thus, it is acknowledged that this simplistic approach will therefore incorporate a degree of precaution. The level of precaution is difficult to gauge, but will be highest when the number of birds recorded flying at turbine height (and therefore the predicted number of collisions) is greatest (SNCBs 2017). We therefore welcome that the Applicant has in REP2-035 undertaken this assessment for gannet for EIA for Norfolk Boreas alone and cumulatively with other plans and projects and also for gannets from the FFC SPA both alone and in-combination.

2.13 We welcome that the Applicant has in the assessment of kittiwake collisions to the FFC SPA from Norfolk Boreas alone considered a range of breeding season apportionment rates up to 100% in Table 3.7 of REP2-035, as advised by Natural England. This includes the Applicant's preferred breeding season apportionment rate of 26.1%. We also welcome that the Applicant has provided the requested information on kittiwake age classes recorded in the baseline digital aerial site-specific surveys undertaken of the Norfolk Boreas site in Appendix 1 of REP2-035.

We note the issues highlighted by the Applicant with ageing of kittiwakes from digital aerial survey data and hence acknowledge the issues around confidence in this data.

2.14 We welcome that the Applicant has included in REP2-035 an assessment of impacts on the assemblage qualifying feature of the FFC SPA.

2.15 We welcome that the Applicant has undertaken a cumulative red-throated diver operational displacement assessment using the 'like for like' approach using the SeaMast data (Bradbury et al. 2014), as was undertaken at Thanet Extension and also used at Norfolk Vanguard during the examination.

2.16 We consider that the LSE screening should be a coarse filter and as the offshore cable route passes through the Greater Wash SPA, this would indicate a potential impact pathway for species sensitive to disturbance/displacement from the presence of vessels and hence an LSE concluded for the common scoter qualifying feature. We therefore welcome that the Applicant has included an assessment of impacts to the common scoter feature of this SPA in REP2-035.

2.17 Whilst Natural England is still in the process of undertaking a full review of the updated assessments provided by the Applicant in REP2-035 and will provide our full advice on this at Deadline 4, we note that the cumulative and in-combination collision and displacement totals presented in REP2-035 for all relevant species and designated sites have increased from those presented in our Deadline 8[6] and 9[7] responses during the Norfolk Vanguard examination. This is the case for both the totals for all projects excluding Hornsea 3 and Hornsea 4, and those including Hornsea 3 and Hornsea 4. Therefore, whilst we haven't yet completed our review, it is considered highly likely that the same conclusions as those made by Natural England during the Norfolk Vanguard examination will still hold for Norfolk Boreas, namely:

[6] Natural England (2019) Norfolk Vanguard Offshore Wind Farm: Natural England's Comments on Norfolk Vanguard Ltd. Deadline 7 and Deadline 7.5 submissions in relation to Offshore Ornithology Related matters. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-003121-DL8%20-%20Natural%20England%20-%20Deadline%20Submission.pdf

[7] Natural England (2019) Norfolk Vanguard Offshore Wind Farm: Natural England's Comments on Deadline 8 Submission – Offshore Ornithology Auk Displacement Assessment Update for Deadline 8. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-003190-DL9%20-%20Natural%20England%20-%20Deadline%20Submission.pdf

i. A significant adverse impact (moderate or above) cannot be ruled out for cumulative operational collisions for gannet, kittiwake and great black-backed gull, or cumulative operational displacement for guillemot, razorbill and red-throated diver at the EIA scale.

ii. An adverse effect on integrity (AEoI) cannot be ruled out for in-combination operational collisions for kittiwake at the Flamborough and Filey Coast SPA, irrespective of whether the Hornsea 3 and Hornsea 4 projects are excluded from the total, or for lesser black-backed gulls at the Alde-Ore Estuary SPA.

iii. We also note our comments above on the uncertainty regarding the figures for the Hornsea 3 and Hornsea 4 projects and therefore in addition we will be unable to rule out an AEoI for in-combination operational collisions for gannet at the Flamborough and Filey Coast SPA or for in-combination operational displacement for guillemot and razorbill at the Flamborough and Filey Coast SPA when the Hornsea 3 and Hornsea 4 projects are included in the in-combination totals.

iv. However, we will provide a final conclusions/advice on all of these once we have completed our review of the updated assessments in REP2-035, which will be provided at Deadline 4.

2.18 Natural England, therefore again recommends that the Boreas Applicant (and all relevant future projects located in the North Sea) considers raising turbine draught height, as has been done by other projects (e.g. Hornsea 2, East Anglia 3 and Norfolk Vanguard), in order to minimise their contribution to the cumulative/in-combination collision totals by as much as is possible. We would also advise that Norfolk Boreas considers a range of possible options of draught heights be presented, to demonstrate due consideration of alternative mitigation options.

3. Specific comments on PVAs run using Natural England commissioned Seabird PVA Tool

3.1 As noted by the Applicant in Appendix 3 of REP2-035, Natural England did note to the Applicant that the Natural England Seabird PVA tool was available for use and advised consideration of it in any updates/re-running of PVA models undertaken as part of the Norfolk Boreas assessment. We also advised that, as was being done with the stochastic CRM, that any issues should be flagged on the GIT hub for the tool. We subsequently informed the Applicant that further changes were being made to the model and we advised waiting on running the models to make sure that

the change is finalised before outputs for Boreas are generated. However, these models have been run before the updates to the tool have been completed. This is expected in mid-January 2020.

3.2 Whist the Applicant has confirmed that the simulated impact was applied to all ages in proportion to their presence in the population, the counterfactual metrics presented in Tables 3.2, 3.6, 3.11 and 3.18 in REP2-035 relate to breeding pairs only (i.e. adults in the population). We note that the tool can be set so that it outputs all age classes separately, but the metrics are then also reported against each age class separately. This is just an output reporting issue with the tables in the tool, which is one of the aspects being addressed in the updates currently being undertaken. Therefore, whilst we welcome that the Applicant has run these PVA models using the PVA tool, we have advised the Applicant in discussions since submission of our Relevant Representations [RR-099] that this additional work on the tool is due to be completed in mid-January 2020 and hence we recommend that the models are re-run when the updated version of the tool is available, and that the assessments present the metrics calculated across the whole population. The new version of the tool will have this as a new option that can be selected as an output type.

3.3 We note that whilst the input parameters for these PVAs have been provided in Appendix 3 of REP2-035, there does not appear to be anything included on the outputs from the models in terms of the growth rates predicted by the models for the un-impacted scenarios. These are needed in order to assess whether the models are suggesting a reasonably sensible trajectory for the populations with no offshore wind farm impacts. Therefore, we advise that the Applicant includes this information if the models are re-run, as advised by Natural England, following completion of the updates currently being undertaken on the PVA tool.

3.4 We also note from Appendix 3 of REP2-035 that:

i. The kittiwake BDMPS and biogeographic density independent models and the guillemot FFC SPA density independent and density dependent models have been run for only 500 simulations; and,

ii. The lesser black-backed gull BDMPS model and the great black-backed gull BDMPS and biogeographic independent and density dependent models have been run for 1,000 simulations.

3.5 We note that the Seabird PVA Tool report (Searle et al. 2019) states that 'it is not recommended to use small values of sim.n (number of simulations) because PVAs based on small numbers of simulations are likely to be unreliable (using a value of less than 1,000 will generate a warning message in the tool, but in practice the minimum number of simulations may need to be substantially higher than this in order to achieve reliable results). Natural England considers that a larger number of simulations than 500 would be needed to generate reliable results for the kittiwake and guillemot models. With regard to models run for 1,000 simulations we recommend that the Applicant presents evidence to demonstrate that using 1,000 simulations in the models produces reliable results.

3.6 However, these models nevertheless currently represent the best available evidence on which to base an assessment, though this should not be taken as a Natural England endorsement or 'acceptance' of the model. Natural England will therefore consider the outputs from these models as they currently stand in our full response to REP2-035, which will be submitted at Deadline 4.

4. Approach to interpretation of predicted impacts

4.1 Where predicted impacts equate to 1% or below of baseline mortality for a population (e.g. colony population) then this level of impact could be considered non-significant. However, while 1% baseline mortality can be considered to be insignificant in the context of the population, we are not saying that this level of additional mortality should not be added to an assessment of in-combination impacts. Where predicted impacts equate to greater than 1% of baseline mortality of the relevant population (e.g. colony population), then we advise this is given further consideration, e.g. through population modelling, to determine the significance of the mortality for the population in question.

4.2 We advise that population modelling is undertaken using stochastic Leslie matrix models. Where possible, demographic rates from the focal population should be used but where these are not available, we recommend using the best available estimates from other populations. Unless there is clear evidence of the form and strength of density dependence operating on the focal population, we recommend presenting outputs from density independent models. When using stochastic models it is necessary to use a 'matched-runs' approach (Green et al. 2016), where a metric is derived for each matched pair of baseline and impacted simulations.

Matching simulations under impact scenarios with simulations under the baseline scenarios, allows the uncertainty associated with the impact of each scenario to be accurately represented, rather than uncertainties such as the variability in the demographic parameters that have been sampled. Cook & Robinson (2016) recommend using both the counterfactual of population growth rate and the counterfactual of population size metrics. Natural England therefore recommends that assessments should focus on the counterfactual of population growth rate and the counterfactual of population size metrics to quantify the relative changes in a population in response to anthropogenic impacts, as these are the two metrics that have been shown to be the least sensitive metrics to mis-specification of the population trend and demographic rates used in the PVA model.

4.3 As quantitative thresholds applied to metrics are arbitrary Natural England advises that a range of site, and project, specific factors need to be considered when making integrity judgements. Population metrics need to be considered with reference to the site trend, population status and SPA conservation objective for HRA, or to the relevant reference population trend and conservation status of the species for EIA. As it is not known what the growth rate of a specific feature of a colony will be over the next 30 years, this uncertainty should be considered when judging the significance of predicted impacts against the conservation objectives for the feature.

4.4 In interpreting the metrics from a PVA, the counterfactual of growth rate and counterfactual of population size metrics at the end of the impact (e.g. after 30 years) should be considered against a realistic assessment of the current and potential future population trend. Where a specific feature of a designated site has a conservation objective to restore the population size to a given level (as is the case for kittiwakes at the Flamborough and Filey Coast SPA and lesser black-backed gulls at the Alde-Ore Estuary SPA), reductions in population growth rates and population size as a result of additional anthropogenic impacts may be counter to such conservation objectives. Whereas if a specific feature has a conservation objective to maintain the population size at or above a given level, as is the case for gannets, guillemots and razorbills at the Flamborough and Filey Coast SPA, then consideration will need to be given to a range of plausible growth rates for the colony and whether the PVA metrics suggest that the population will be maintained at or be able to grow above the current or designated population size over the lifetime of the predicted additional impact.

4.5 This approach will be taken by Natural England in our comments/advice on the Applicant's updated offshore ornithological assessment in REP2-035 in our full response which will be submitted at Deadline 4.

REFERENCES

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