**From:** Philip Pearson
**To:** Norfolk Boreas
**Cc:** Carrie Marchbank
**Subject:** RE: RSPB submissions for Deadline 3
**Date:** 20 January 2020 22:34:55
**Attachments:** RSPB comments on Boreas offshore ornithology assessment update.docx

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Dear Sir or Madam,

As promised in our Deadline 3 submission, please find attached the RSPB's further comments on the Offshore Ornithology Assessment Update for Norfolk Boreas. Having reviewed the report, the RSPB's position remains unchanged and we still consider that it is not possible to conclude no adverse effects will arise from the Norfolk Boreas offshore wind farm based on the available evidence.

Unfortunately, the RSPB will not be able to attend the Issue Specific Hearing on 22nd January. However, we have seen the agenda and specifically note the item regarding suggestions from the Applicant that the RSPB has misinterpreted the results of their PVA. This is not the case. Sections 4 and 5 of our attached submission on the Offshore Ornithology Assessment Update provides our detailed position on the PVA outputs and their interpretation. We hope this will address any concerns regarding this issue, but will review future questions and submissions and provide further information as required.

We are aware of the examination schedule and will endeavour to attend future Issue Specific Hearings where this would be helpful.

I would be grateful for acknowledgement of your receipt of this email.

Kind regards,
Phil Pearson

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# Further comments on the Offshore Ornithology Assessment Update

## on behalf of the

## Royal Society for the Protection of Birds

**Submitted prior to 22 January Issue Specific Hearing**

**20 January 2020**

**Planning Act 2008 (as amended)**

**In the matter of:**

**Application by Norfolk Boreas Limited for an**

**Order Granting Development Consent for the**

**Norfolk Boreas Offshore Wind Farm**

**Planning Inspectorate Ref: EN010087**

**Registration Identification Ref: 20022916**

## The RSPB's further comments on the Applicant's Deadline 2 submission 'Offshore Ornithology Assessment Update'

## 1. Introduction

1.1 This note is a further response to the Offshore Ornithology Assessment Update submitted by the Applicant at Deadline 2 (Document Reference: REP2-035).

1.2 In the introduction and frequently throughout the Offshore Ornithology Assessment Update the Applicant has argued why they consider that the Natural England and RSPB recommended approach to assessment of offshore wind farm developments is overly precautionary. Many of the arguments presented to support that position are unjustified and in this note the RSPB will demonstrate why the approach taken is not overly precautionary. The RSPB considers its approach and that of Natural England is a measured and reasonable response to the considerable uncertainty inherent in the assessment procedure. While the RSPB welcomes the Offshore Ornithology Assessment Update, there is nothing presented within it that would cause a change in our position with regard to adverse effects, as laid out in previous written submissions.

1.2 Whilst the RSPB is unable to attend Issue Specific Hearing 4 on the 22nd January 2020, we note that the Applicant has indicated that the RSPB has misinterpreted the results of their PVA and that this is scheduled as an agenda item. The RSPB sets out our reasoning why we have not misinterpreted the PVA results in sections 4 and 5 below. We hope this will help inform the item to be considered on this issue at the Hearing.

The precautionary principle

1.3 The precautionary principle exists for situations where scientific data does not exist or is incomplete and therefore it is not possible to complete a full evaluation of the possible risks a plan, project or activity may cause to the environment, including possible danger to humans, animal or plant health, or to the environment in general. The European Commission's Precautionary Principle guidance[1] states that it should apply when a phenomenon, product or process may have a dangerous effect, identified by a scientific and objective evaluation, if this evaluation does not allow the risk to be determined with sufficient certainty. As such the degree of precaution applied to an evaluation, or assessment, can be seen to be directly proportional to the extent of scientific uncertainty inherent in that assessment. As the guidance goes on to recommend, "*The implementation of an approach based on the precautionary principle should start with a scientific evaluation, as complete as possible, and where possible, identifying at each stage the degree of scientific uncertainty*."

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52000DC0001&from=EN

Uncertainty

1.3 As there can be "*almost as many definitions of uncertainty as there are treatments of the subject*"[2], following Masden *et al.* (2015)[3], the RSPB defines it as a lack of knowledge, or incomplete information about a particular subject. Masden *et al.,* identified a hierarchy of uncertainty in offshore wind farm assessment. This included not only the uncertainty arising from scientific knowledge, as argued by the Applicant, but uncertainty arising more strategically from the process of assessment itself, such as uncertainty within language and decision-making. Included within this process, uncertainty can be considered as anything that increases the difficulty in reaching firm and robust conclusions, such as revisions in modelling approaches, late submissions, overly complicated language and unsupported arguments put forward as evidence. As such, the approach taken by the Applicant to date, and as evidenced below, is one of increasing uncertainty rather than reducing it. As the degree of precaution is proportional to the degree of uncertainty, such an approach increases the need for precaution in the assessment.

1.4 Our comments below follow the order in the Offshore Ornithology Assessment Update.

## 2. Collision Risk Assessment

Consented and built out capacity

2.1 The Applicant refers to projects in the in-combination assessment that have been built out to a lower capacity than that consented as a source of precaution within the assessments. As discussed in our earlier written submissions, this is an acceptable point for windfarms where the Development Consent Order (DCO) has been amended and therefore there is legal certainty regarding the reduction. However, where windfarms still have their original DCOs and therefore the ability to construct more wind turbines, it is not appropriate to do anything less than consider the full extent of those DCOs when considering in-combination/cumulative effects.

2.2 The Applicant cites an unpublished report commissioned by the Crown Estate (Appendix 2 of The Applicant's comments on Written Representations and Additional Submissions; doc REP3-007). This report, which was not designed for use in assessment, was flawed for several reasons and took an approach counter to the principles of sustainable development. Rather than seeking to achieve maximum capacity for least environmental effect, the report implied that the calculated 'headroom' for each species is simply expendable. Furthermore, no new knowledge and understanding was accommodated within the report, for example, there was no clarity on the accuracy of the underlying baseline data sets, uncertainties within the modelling and expression of confidence intervals for the outputs of those models. In the absence of this context, the report cannot be relied upon to be used to inform assessment.

[2] Argote, L. (1982). Input Uncertainty and Organizational Coordination in Hospital Emergency Units. *Administrative Science Quarterly, 27*(3), 420-434. doi:10.2307/2392320

[3] Masden, E. A., McCluskie, A., Owen, E., & Langston, R. H. (2015). Renewable energy developments in an uncertain world: the case of offshore wind and birds in the UK. *Marine Policy*, *51*, 169-172.

Nocturnal activity

2.3 We do not agree with the changes in nocturnal activity rates proposed. While for gannet, we welcome the latest published evidence review (Furness *et al*. 2018[4]), for the other species there is no such peer reviewed evidence. There are several issues with this.

2.4 Mortalities are potentially underestimated because in doing so there is no account for the potential interaction between survey timing and diurnal behavioural patterns. Peaks in foraging activity at first and last light (see for example, Fig. 3 in Furness *et al.* 2018) will not be accounted for in the assessment if these did not coincide with surveys (the timings of which are currently unknown, but likely to be in the middle of the day), and the survey may have been carried out at a time of much lower activity. Thereby the application of the revised nocturnal activity rates either recommended by Furness *et al*. (2018) or the rates suggested by the Applicant could result in underestimates of collision risk. We request that details of the timings of survey are presented.

2.5 It is not clear how the revised rates, other than those for gannet, account for the distinction between the definition of daylight as used in the Band model and with the official concept of 'twilight' and 'night'. This is an issue, as the Band (2012) model considers the nocturnal period as between sunset to sunrise and so treats flight activity that occurs at twilight as being within the nocturnal flight period. This period is of importance as evidence from tagging shows that a number of seabirds actively forage at twilight.

2.6 The Applicant's proposed reductions in collisions from nocturnal activity do not take into account spatial or temporal variability in nocturnal activity. This variation in seabird behaviour has been shown by a number of studies (e.g. Dias *et al*., 2012[5], Parades *et al.,* 2014[6], Kokubun *et al*., 2015[7], Dias *et al*., 2016[8]). This variation can be related to underlying habitat and prey choice and stages of the lunar cycle, potentially due to different light levels that affect the ability to effectively forage. As such, cloud cover could also cause variability in nocturnal activity. Furthermore, there is likely to be significant individual and colony scale variability not included in the Applicant's limited reviews. Such variability highlights the importance of presenting a range of nocturnal activity factors, in order to capture the uncertainty inherent in the estimate and ensure a proportionately precautionary assessment. The Applicant's preferred approach of presenting a single value, derived from a limited sample of studies and non-peer reviewed in all cases except gannet, does not sufficiently account for variability and therefore is not suitably precautionary. This may lead to a serious underestimation of uncertainty.

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[4] Furness, R. W., Garthe, S., Trinder, M., Matthiopoulos, J., Wanless, S., & Jeglinski, J. (2018). Nocturnal flight activity of northern gannets Morus bassanus and implications for modelling collision risk at offshore wind farms. *Environmental Impact Assessment Review*, *73*, 1-6.

[5] Dias, M. P., Granadeiro, J. P., & Catry, P. (2012). Working the day or the night shift? Foraging schedules of Cory's shearwaters vary according to marine habitat. *Marine Ecology Progress Series*, *467*, 245-252.

[6] Paredes, R., Orben, R. A., Suryan, R. M., Irons, D. B., Roby, D. D., Harding, A. M., ... & Heppell, S. (2014). Foraging responses of black-legged kittiwakes to prolonged food-shortages around colonies on the Bering Sea shelf. *PloS one*, *9*(3), e92520.

[7] Kokubun, N., Yamamoto, T., Kikuchi, D. M., Kitaysky, A., & Takahashi, A. (2015). Nocturnal foraging by red-legged kittiwakes, a surface feeding seabird that relies on deep water prey during reproduction. *PloS one*, *10*, e0138850.

[8] Dias, M. P., Romero, J., Granadeiro, J. P., Catry, T., Pollet, I. L., & Catry, P. (2016). Distribution and at-sea activity of a nocturnal seabird, the Bulwer's petrel Bulweria bulwerii, during the incubation period. *Deep Sea Research Part I: Oceanographic Research Papers*, *113*, 49-56.

Over emphasis on 95% confidence intervals

2.7 Following Masden *et al.* (2015) Natural England requested that an indication of uncertainty is given around estimates of abundance – a request that the RSPB strongly supports. This means that although there may be insufficient scientific knowledge for an estimate to be made with full confidence, as uncertainty is inherent in all scientific research, presenting an indication of the extent of this uncertainty provides a measure of confidence that greatly assists any decision making. This point is made by Millner-Gullard & Shea (2017[9]) as follows: "*In order to manage uncertainty it must first be acknowledged and identified*".

2.8 However, the Applicant argues that the 95% confidence intervals requested by Natural England to give the indication of uncertainty, are an "*over emphasis*". This misinterprets the advice given by Natural England, which is that the means are used in the overall assessment, but confidence intervals also need to be presented to allow *consideration* of the variability (and therefore the uncertainty) in the underlying annual population estimates. This ensures confidence in any conclusions can be expressed, but does not affect the actual conclusions, which should of course be based on the means (or other measure of central tendency). This is an entirely appropriate method and not in any way over precautionary. Not to express this uncertainty, as the Applicant seems to advocate, would not be consistent with European Commission Guidance on the Precautionary Principle. By not identifying and highlighting uncertainty, the need for precaution could therefore increase.

Kittiwake flight speeds

2.9 The Applicant highlights the difference in flight speed of kittiwake that is typically used in assessment and which was recorded during the study carried out by Skov *et al*. (2018)[10]. The RSPB welcomes the use of parameters with an evidence base in collision risk assessment, however, there are several reasons why the flights speeds presented in Skov *et al.* should not be used in isolation, which we outline below.

2.10 The speed given is from a single study, the ORJIP Bird Collision Avoidance study, that was carried out at a single wind farm offshore from Kent and distant from kittiwake breeding colonies. As such, the behaviours recorded will largely have not been from breeding birds. Indeed, Bowgen and Cook (2018) [11] in their analysis of Skov *et al.* caution that the flight speeds "*come from a single site during the non-breeding season. Given the influence of site-specific data on the estimated collision rates, such data may not be directly transferable to other sites or, to the breeding season.*"

2.11 There is considerable variability in the flight speeds of seabirds, and this can be related to, for example, behavioural state, prey type and abundance, and the presence of fishing vessels

[9] Milner-Gulland, E. J., & Shea, K. (2017). Embracing uncertainty in applied ecology. *The Journal of applied ecology*, *54*(6), 2063.

[10] Skov, H., Heinänen, S., Norman, T., Ward, R.M., Méndez-Roldán, S. & Ellis, I. 2018. ORJIP Bird Collision and Avoidance Study. Final report – April 2018. The Carbon Trust. 247 pp

[11] Bowgen, K. & Cook, A. 2018. Bird Collision Avoidance: Empirical evidence and impact assessments. JNCC Report No. 614, JNCC, Peterborough, ISSN 0963-8091.

(Votier *et al*., 2010[12]), (the latter is of interest in this context, as aspects of the Skov *et al*. study were compromised by the presence of fishing vessels (Bowgen & Cook, 2018)), and can vary between years and between colonies (Petex *et al*., 2012[13]). There are also different measures of flight speed presented in Skov *et al*., true flight speed and straight-line speed, and there remains no consensus as to which is the most appropriate to use with the Band model.

2.12 Given the extent of this potential variability, it is not precautionary to base assessment on a speed parameter derived from a single site where not all behavioural states will have been recorded. This may be compromised by the presence of vessels and may not have the environmental conditions relative to the site being assessed. In this case it is best to have site specific parameters, or, in the absence of these, a range of values.

Avoidance rates

2.13 The Applicant cites Bowgen and Cook (2018) as evidence of higher Avoidance Rates than those currently used. The work this report is drawn from has acknowledged limitations that prevent conclusions being drawn from it. These include the fact that fishing vessels were present on the periphery of the wind farm during the study, thereby biasing the results, and that due to the wind farm being of some distance from breeding colonies, that gannets and kittiwakes seen were non-breeders, or were recorded out with the breeding season. It is also of note that the Bowgen and Cook (2018) report's calculated avoidance rate for kittiwake is actually lower than that previously recommended by the BTO (the report's authors) indicating that avoidance rates can go up as well as down and so are not always the most precautionary.

2.14 The Avoidance Rate is cited by the Applicant from Bowgen and Cook as an "Empirical" Avoidance Rate, that is one derived from behavioural observation. **This is not correct.** An Empirical Avoidance Rate differs from those Avoidance Rates conventionally used in the Band model which are correction factors used to account not only for avoidance behaviour, but also model and parameter uncertainty, error and variability. As such, Empirical Avoidance Rates are not directly comparable with conventional Avoidance Rates and Bowgen & Cook (2018) were careful to make the distinction between the two.

2.15 In their comments on Written Representations and Additional Submissions (doc REP3-007), the Applicant highlights the difference in preferred or recommended breeding season avoidance rate for gannet between the RSPB and Natural England and the other Statutory Nature Conservation Bodies. Whilst the RSPB accepts the Statutory Nature Conservation Bodies' recommended amendment[14] to the gannet avoidance rate (AR) from 98% to 98.9% for non-breeding birds, we do not agree that this figure should be applied to the breeding season due to the lack of available evidence relating to breeding birds. During the breeding

[12] Votier, S. C., Bearhop, S., Witt, M. J., Inger, R., Thompson, D., & Newton, J. (2010). Individual responses of seabirds to commercial fisheries revealed using GPS tracking, stable isotopes and vessel monitoring systems. *Journal of Applied Ecology*, *47*(2), 487-497.

[13] Pettex, E., Lorentsen, S. H., Grémillet, D., Gimenez, O., Barrett, R. T., Pons, J. B., ... & Bonadonna, F. (2012). Multi-scale foraging variability in Northern gannet (Morus bassanus) fuels potential foraging plasticity. *Marine biology*, *159*(12), 2743-2756.

[14] Joint Nature Conservation Committee (JNCC), Natural England (NE), Natural Resource Wales (NRW), Northern Ireland Environment Agency (NIEA), Scottish Natural Heritage (SNH) (2014). Joint Response from the Statutory Nature Conservation Bodies to the Marine Scotland Science Avoidance Rate Review

season there are significant time and energy constraints imposed on foraging birds by the requirement to return to the nest to incubate eggs or brood and provide food for chicks. As such, the response of foraging and commuting birds to the presence of a windfarm is likely to be different during the breeding season. Consequently, the avoidance rate, which incorporates such reactive behaviour, is also likely to be different.

2.16 As acknowledged in the BTO Review the Statutory Nature Conservation Body advice is drawn from[15,16], the majority of the evidence used to assess avoidance behaviour of gannet is from non-breeding birds (the BTO review makes this clear, saying: "*it should be noted that this figure is based on data that are most representative of the non-breeding season*"). Breeding birds, under the constraints outlined above, will behave differently and potentially be subject to greater impacts from developments[17]. As such, we recommend a more precautionary AR of 98% for the breeding season to account for this uncertainty regarding breeding bird behaviour around windfarms.

2.17 This difference between the RSPB and Natural England is the only difference in our positions on Collision Risk Assessment. There is agreement that due to the uncertainty and variability in model parameters, such as gannet breeding season Avoidance Rate, that a range of values be used. Natural England have confirmed this position in their response to Q8.10.3 of the Examining Authority's Written Questions (doc REP2-080).

## 3. Displacement Assessment

3.1 There have been few robust studies of seabird displacement, the results differ, and we do not know the consequences for mortality or population trajectories. Because of the consequent uncertainty, it is appropriate to consider a range of putative displacement and mortality rates.

<u>Extent of Displacement</u>

3.2 Citing their own review (MacArthur Green 2019[18]), the Applicant claims that their preferred displacement rates are precautionary, for guillemot and razorbill claiming few studies show greater than 50% displacement. Unfortunately, the review did not include Vanerman *et al*. (2019[19]) which reports on 6 years of post-construction study at Thornton Bank wind farm. This study reports displacement rates of 60 and 63% for guillemot and 75-80% for razorbill. In this context, the higher values in the range recommended by Natural England should be viewed as realistic, rather than over-precautionary.

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[15] Cook, A.S.C.P., Humphreys, E.M., Masden, E.A. & Burton, N.H.K. (2014) The Avoidance Rates of Collision between Birds and Offshore Turbines. *Scottish Marine and Freshwater Science Volume 5 Number 16*, Report Published by Marine Scotland Science

[16] Cook, A. S., Humphreys, E. M., Bennet, F., Masden, E. A., & Burton, N. H. (2018). Quantifying avian avoidance of offshore wind turbines: current evidence and key knowledge gaps. *Marine environmental research*, *140*, 278-288.

[17] Masden, E. A., Haydon, D. T., Fox, A. D., & Furness, R. W. (2010). Barriers to movement: modelling energetic costs of avoiding marine wind farms amongst breeding seabirds. *Marine Pollution Bulletin*, *60*(7), 1085-1091.

[18] MacArthur Green (2019c) Norfolk Vanguard Offshore Wind Farm. The Applicant Responses to First Written Questions Appendix 3.3 - Operational Auk and Gannet Displacement: update and clarification.

[19] Vanermen, N., Courtens, W., Van De Walle, M., Verstraete, H., & Stienen, E. (2019) Seabird monitoring at the Thornton Bank Offshore wind farm. In Environmental Impacts of Offshore Windfarms in the Belgian Part of the North Sea. Degraer, Brabant, Rumes and Vigin (eds) Roya Belgian Institute of Natural Sciences.

3.3 The Applicant argues that displacement rates are based on evidence from studies carried out at older wind farms and that these had smaller, more closely spaced turbines. However, the argument is then made, without evidence, that displacement will be reduced with modern turbine design, where the turbines are spaced further apart and are considerably larger. Notwithstanding the lack of evidence for this assertion, it intuitively seems very unlikely that larger turbines will cause less displacement. It would be far more likely that greater displacement would arise. Again, the use of these speculative and counter-intuitive arguments has the effect of increasing the uncertainty within the assessment process.

Mortality arising from Displacement

3.4 Despite acknowledging that mortality rates arising from displacement are less well known, in support of their preferred lower mortality percentage, the Applicant cites a review carried out previously by their consultants (MacArthur Green, 2019). In this review it is claimed that as some seabirds attain higher weights during the non-breeding season, that they have little difficulty finding food at this time. However, the review does not include other conflicting evidence that some seabirds may have an "energetic bottleneck" in the winter (Fort *et al*., 2009[20]). The higher weight in some non-breeding seabird reported by the Applicant is also likely to be because birds are not subject to the stresses and constraints of breeding. As such the non-breeding period can be seen as a recovery and preparatory period and it is wrong to suggest that higher weights during this period mean that the birds can be subjected to greater disturbance without consequence. Such consequences could apply by reducing condition prior to breeding and thereby decreasing breeding success.

3.5 The Applicant also suggests that as current estimates of red-throated diver mortality include that occurring as a consequence of shipping activity, that additional mortality arising from displacement from wind farms is likely to be small. This ignores the recent evidence from Mendel *et al*. (2019)[21] that the extent of displacement caused by the presence of wind farms is far greater than that arising from shipping traffic. The Applicant's argument appears to be that because the birds are already disturbed by shipping traffic that further disturbance will not matter. However, it is not known whether red-throated divers in the southern North Sea are close to a tipping point in terms of disturbance and whether any more could significantly exacerbate the mortality and lead to catastrophic impacts. The use of mortality figures that are lower than the current recommendations therefore risks under-estimating the significance of the impact on this and other species.

## 4. Population Viability Analysis

4.1 The RSPB welcomes the Applicant's presentation of Population Viability Assessment (PVA) using the Natural England PVA tool in their Offshore Ornithology Assessment Update. This

[20] Fort, J., Porter, W. P., & Grémillet, D. (2009). Thermodynamic modelling predicts energetic bottleneck for seabirds wintering in the northwest Atlantic. *Journal of Experimental Biology*, *212*(15), 2483-2490.

[21] Mendel, B., Schwemmer, P., Peschko, V., Müller, S., Schwemmer, H., Mercker, M., & Garthe, S. (2019). Operational offshore wind farms and associated ship traffic cause profound changes in distribution patterns of Loons (Gavia spp.). *Journal of Environmental Management*, *231*, 429-438.

represents the most transparent, reliable and repeatable method for doing so. However, there are several arguments that the Applicant presents alongside the results and in their comments that the RSPB disagrees with. These are dealt with below.

4.2 The RSPB also hopes the following will be helpful in highlighting why the RSPB has not misinterpreted the PVA results, which we understand will be considered at Issue Specific Hearing 4 on the 22nd January 2020.

Density Dependence

4.3 We do not accept the arguments for the use of PVA outputs incorporating compensatory density dependence, although acknowledge that both density dependent and independent formulations are presented. The reasons for this are outlined in Green *et al*. (2016)[22] and the reviews by Cook and Robinson (2015)[23] and Horswill and Robinson (2015)[24]. It is not that density dependence does not exist, but rather that we do not have the means to accurately quantify the strength and form of it in a biologically meaningful way in order to incorporate it into PVA.

4.4 Whilst we accept that density dependence is likely to exist in seabird populations, precise species and colony specific knowledge of its size and shape are needed to correctly parameterise the population models. This is important to acknowledge because density dependence is not always compensatory, but can also be depensatory, slowing the rate of population growth at lower population densities. In other words, a population decline arising from an offshore wind farm could have larger consequences on the population than are predicted by the compensatory density dependent or even density independent models.

4.5 Horswill and Robinson (2015) identified depensation occurring in three gull species (black-legged kittiwake, black-headed gull and herring gull). As such, it would be very wrong to simply assume that density independent outputs are highly precautionary, rather that density independent outputs are the most sensible to use for assessment. The Applicant claims depensatory density dependence will only occur on small populations. Given the length of time the wind farm will be operational, and the potential decline in populations, particularly kittiwake, there is no way of knowing if in the future these populations could be subject to depensatory density dependence.

4.6 The Applicant's preference for density dependent modelling is counter to all advice, including the Applicant's own consultants who made clear in a report to Defra, "*the most robust approach is to avoid the temptation to include density dependence, since it is often based on the premise that 'it must be operating therefore it must be included', even if the mechanism is*

[22] Green, R. E., Langston, R. H. W., McCluskie, A., Sutherland, R. and Wilson, J. D. (2016), Lack of sound science in assessing wind farm impacts on seabirds. J Appl Ecol. doi:10.1111/1365-2664.12731

[23] Cook, A.S.C.P. and Robinson, R.A. (2015) The scientific validity of criticisms made by the RSPB of metrics used to assess population level impacts of offshore windfarms on seabirds. BTO Research Report No. 665. https://www.bto.org/sites/default/files/publications/rr665.pdf

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

*unknown*" (Furness *et al*., 2013[25]). The argument against the use of density dependent population models is not that density dependence does not exist in seabird populations, rather that it should only be incorporated when its strength and form are known for a specific species and colony (Cook and Robinson, 2015). The Applicant's approach of modelling density dependence almost entirely based on a single meta-analysis (Cury *et al*., 2011[26]), is against this advice. Indeed, Cook and Robinson (2015) also point out that "*focussing on a single study, even one as comprehensive as Cury et al. (2011), therefore risks potentially over-looking important responses*."

Counterfactual of Population Size

4.7 There are a range of output metrics possible from PVA, and for some time there was no consensus on which was the most appropriate for use in the assessment of offshore wind farms. In the absence of such guidance, inappropriate methods for the assessment of population-scale effects were often used. As an outcome of the casework undergone in response to Hornsea Project One and the Forth and Tay developments, the RSPB more clearly defined the most suitable methods for undertaking PVA (Green, 2014[27] and Green *et al*., 2016[28]) advising that counterfactual metrics, in particular the Counterfactual of Population Size (CPS), was the most appropriate method to use. This was due to it being relatively insensitive to the assumptions made about the magnitude, variability and trends of demographic rates in the model from which it is calculated. This is because the same uncertainties apply to both the impacted and unimpacted scenarios. In response to this advice from the RSPB, both the Joint Nature Conservation Committee (JNCC) and Marine Scotland Science (MSS) commissioned independent reviews of this advice.

4.8 The JNCC review was carried out by the BTO and resulted in two reports and one paper (Cook and Robinson, 2015[29], Cook and Robinson, 2016[30], Cook and Robinson, 2017[31]). All three were in entire agreement with the RSPB advocated counterfactual approach. Cook and Robinson (2015) also introduced a further metric, the Counterfactual of Population Growth Rate, recommending that both this and CPR be presented together, as they are the most useful metrics.

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[25] Furness, R.W., MacArthur, D., Trinder, M. and MacArthur, K. 2013. Evidence review to support the identification of potential conservation measures for selected species of seabirds. Report to Defra.

[26] Cury, P. M., Boyd, I. L., Bonhommeau, S., Anker-Nilssen, T., Crawford, R. J. M., Furness, R. W., Mills, J. A., Murphy, E. J., Österblom, H., Paleczny, M., Piatt, J. F., Roux, J.-P., Shannon, L. & Sydeman, W. J. (2011) Global seabird response to forage fish depletion – one-third for the birds. Science 334, 1703- 1706.

[27] Green, R.E. (2014) Misleading use of science in the assessment of probable effects of offshore wind projects on populations of seabirds in Scotland. Unpublished RSPB paper.

[28] Green, R. E., Langston, R. H., McCluskie, A., Sutherland, R., & Wilson, J. D. (2016). Lack of sound science in assessing wind farm impacts on seabirds. *Journal of Applied Ecology*, *53*(6), 1635-1641.

[29] Cook, ASCP and Robinson RA, 2015. *The Scientific Validity of Criticisms made by the RSPB of Metrics used to Assess Population Level Impacts of Offshore Wind Farms on Seabirds.* BTO research report no. 665.

[30] 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.

[31] Cook, A. S., & Robinson, R. A. (2017). Towards a framework for quantifying the population-level consequences of anthropogenic pressures on the environment: The case of seabirds and windfarms. *Journal of environmental management*, *190*, 113.

4.9 The review commissioned by MSS was undertaken by the Centre for Ecology and Hydrology (Jitlal *et al*., 2017[32]) and agreed that the counterfactual metrics (described as ratio metrics) performed best among all the metrics considered with respect to sensitivity to mis-specification in input parameters, and both showed low sensitivity to demographic input mis-specification.

4.10 Following this, both Scottish Natural Heritage and Natural England have recommended that the counterfactual metrics are presented as the preferred outputs in PVA used in offshore wind farm environmental assessment. The RSPB agrees and welcomes the consensus that has developed following our original recommendation to use counterfactual metrics.

4.11 It is therefore surprising that the Applicant in their comments on Written Representations and Additional Submissions; doc REP3-007) suggest the RSPB has misinterpreted the results of a metric which was included in statutory guidance as a direct result of RSPB advice. The Applicant's reasons for this accusation are purely semantic and are an unconstructive distraction in the discussion around the assessment of impact.

4.12 To be clear, the CPS, as first defined by the RSPB in Green (2014) and subsequently Green *et al.* (2016), is the ratio of the expected population size with the wind farm to that without it, as derived from Population Viability Models. To calculate it, a PVA is run predicting the size of the population in question in the absence of a wind farm and this is compared with the size of the population predicted if the additional mortality arising from the wind farm is included. The population sizes are compared after the life of the wind farm, typically 25 or 30 years. As there is additional mortality included in the model run including the wind farm, there is typically a decrease in the predicted population size *compared with the predicted population size in the absence of the wind farm.* The metric does not make any prediction as to whether the population with the wind farm is greater or less than the starting population, it is only a comparison between the with and without scenarios. This is one of the key strengths of the approach; it does not attempt to make predictions of future population trajectory, as this is usually impossible as there is no robust predictive method that can account for potential changes in population demographics due to unforeseen or unpredictable events, for example changes in discard policy or severe weather incidents.

4.13 In the RSPB's written submissions to the Boreas DCO examination, we describe the CPS output metrics as a percentage decrease in the population size. The Applicant has taken this to mean in comparison with the starting population. As described above, this is not the case, it is in comparison with the *predicted population size in the absence of the wind farm,* as is implicit in the title of the metric and clear in all the refences cited above.

Utility of Counterfactual Metrics

4.14 In their Offshore Ornithology Assessment Update, the Applicant claims that the counterfactuals of population growth rate are more informative and credible for assessment purposes than counterfactuals of population size. This is in direct contradiction to the results of the reviews of PVA metrics described above.

[32] Jitlal, M, Burthe, S., Freeman, S. and Daunt, F. (2017) *Testing and Validating Metrics of Change Produced by Population Viability Analysis (PVA)*. Report to Marine Scotland Science

4.15 Cook and Robinson (2015) recommend referencing both metrics: the counterfactual of growth rates to quantify the consequence of impacts at a population level and the counterfactual of population sizes to present these impacts in an easily understandable context. Jitlal *et al.* (2017) suggest that both metrics showed low sensitivity to demographic input mis-specification. Neither review identified the issue suggested by the Applicant that the counterfactual of population growth rate was insensitive to the absolute value for the baseline rate of growth or direction whereas the counterfactual of population size is. The Applicant presents no evidence to support this assertion.

4.16 Conversely, the analysis carried out by Jitlal *et al*. (2017) found both metrics showed no discernible difference in sensitivity between decreasing and increasing populations. We therefore do not agree with the Applicant's preference for the counterfactual of population growth rate. The RSPB welcomes the presentation of both metrics, following guidance and the literature cited above.

4.17 In order to reach their conclusions, the Applicant sets the Counterfactual of Growth Rate output metric against the recent SPA colony growth rate. **This is a misapplication of this metric**.

4.18 A key justification of the use of counterfactual metrics (both population size and growth rate) is that they are not influenced by the uncertainty around future populations (Green *et al.*, 2016). We have no robust predictive method that can account for potential changes in population demographic due to unforeseen or unpredictable events, for example, changes in discard policy or severe weather incidents. As the counterfactual approach is relatively insensitive to the assumptions made about the magnitude, variability and trends of demographic rates in the model from which it is calculated because the same uncertainties apply to both the impacted and unimpacted scenarios, this is not a problem for the counterfactual approach. However, to compare the predicted change in population growth rate in 30 years' time against the current population growth rate does not account for the high probability that the future population growth rate will likely be considerably different from this and that, if it were possible, it would be this growth rate that should be compared to the predicted change in population growth rate.

4.19 As it is impossible to determine what that growth rate will be, we do not accept this as an adequate method for reaching conclusions of the significance of an effect.

## 5. Conclusions regarding adverse effects

5.1 The RSPB welcomes the Applicant's Offshore Ornithological Assessment Update. However, none of the details presented in the update alter our position with regards to adverse effects. Our concerns focus on the following aspects:

- The impact of collision mortality on the kittiwake population of the Flamborough and Filey Coast Special Protection Area (SPA) in-combination with other plans and projects;
- The impact of collision mortality on the gannet population of the Flamborough and Filey Coast SPA in-combination with other plans and projects;

- The impact of collision mortality on the lesser black-backed gull population of the Alde-Ore Estuary SPA alone and in-combination with other projects;
- The impact of operational displacement on the razorbill population of the FFC SPA in-combination with other plans and projects;
- The impact of operational displacement on the guillemot population of the FFC SPA in-combination with other plans and projects;
- Cumulative collision mortality to North Sea populations of kittiwake and great black-backed gull; and
- Cumulative operational displacement to North Sea populations of red-throated diver, guillemot and razorbill.

5.2 We also consider that it is not currently possible to rule out AEOI of the following SPAs and their species:

- The impact of collision mortality on the gannet population of the FFC SPA from this project alone; and
- The impact of collision mortality on the lesser black-backed gull population of the Alde-Ore Estuary SPA from this project alone.

5.3 In Tables 1-3 below we present summaries of the calculations carried out by the Applicant that have led us to these conclusions. These show both counterfactual metrics presented as a range. As detailed above, we have a number of disagreements with the manner in which the Applicant has presented these. This relates specifically to misleading claims regarding the amount of precaution inherent in the assessment. As such, we maintain that figures at the higher end of the range are entirely feasible, and potentially could be even greater.

**Table 1. The output metrics of Population Viability Analysis on the gannet, kittiwake, guillemot and razorbill populations of the Flamborough and Filey Coast SPA with regard to the in-combination impacts. The metrics are the Counterfactual of Population Growth Rate (CPGR) and the Counterfactual of Population Size (CPR). Both are presented as percentage decrease between impacted and unimpacted population (see above text on counterfactual metrics)**

| Species | Metric | |
|---|---|---|
| | CPGR | CPR |
| Gannet | 0.015 - 0.018% | 34.9 - 41.1% |
| Kittiwake | 0.003 - 0.008% | 9.4 - 21.7% |
| Guillemot | 0.0014 – 0.0408% | 4.08 – 72.56% |
| Razorbill | 0.002 – 0.024% | 6.6 – 50.1% |

5.4 Table 1 shows that the Applicant predicts up to a **41.1%** reduction in the gannet population of the Flamborough and Filey Coast SPA as a result of in-combination collision impacts, in comparison with the unimpacted population, during the lifetime of the wind farm. We therefore find it impossible to conclude no adverse effect on integrity as a result of collision mortality through the project in-combination.

5.5 Table 1 shows that the Applicant predicts up to a **21.7%** reduction in the kittiwake population of the Flamborough and Filey Coast SPA as a result of in-combination collision impacts, in comparison with the unimpacted population, during the lifetime of the wind farm. We therefore find it impossible to conclude no adverse effect on integrity as a result of collision mortality through the project in-combination.

5.6 Table 1 shows that the Applicant predicts up to a **72.56%** reduction in the guillemot population of the Flamborough and Filey Coast SPA as a result of in-combination displacement impacts, in comparison with the unimpacted population, during the lifetime of the wind farm. We therefore find it impossible to conclude no adverse effect on integrity as a result of displacement mortality through the project in combination.

5.7 Table 1 shows that the Applicant predicts up to a **50.1%** reduction in the guillemot population of the Flamborough and Filey Coast SPA as a result of in-combination displacement impacts, in comparison with the unimpacted population, during the lifetime of the wind farm. We therefore find it impossible to conclude no adverse effect on integrity as a result of displacement mortality through the project in combination.

**Table 2. The output metrics of Population Viability Analysis on the lesser black-backed gull of the Alde Ore Estuary SPA with regard to the in-combination impacts. The metrics are the Counterfactual of Population Growth Rate (CPGR) and the Counterfactual of Population Size (CPR). Both are presented as percentage decrease between impacted and unimpacted population (see above text on counterfactual metrics)**

| Species | Metric | |
|---|---|---|
| | CPGR | CPR |
| Lesser black-backed gull | 0.009 – 0.014% | 22.5 – 33.1% |

5.8 Table 2 shows that the Applicant predicts up to a **33.1%** reduction in the lesser black-backed gull population of the Alde Ore Estuary SPA as a result of in-combination collision impacts, in comparison with the unimpacted population, during the lifetime of the wind farm. We therefore find it impossible to conclude no adverse effect on integrity as a result of collision mortality through the project in combination.

**Table 3. The output metrics of Population Viability Analysis on the kittiwake and great black-backed gull populations of the North Sea with regard to the in-combination impacts. The metrics are the Counterfactual of Population Growth Rate (CPGR) and the Counterfactual of Population Size (CPR). Both are presented as percentage decrease between impacted and unimpacted population (see above text on counterfactual metrics). The results are presented for both the BDMPS and biogeographical populations.**

| Species | Population | | | |
|---|---|---|---|---|
| | BDMPS | | Biogeographical | |
| | Metric | | | |
| | CPGR | CPS | CPGR | CPS |
| Kittiwake | 0.0056 – 0.0063% | 15.9 – 17.71% | 0.0009 – 0.0011% | 2.77 – 3.12% |
| Great black-backed gull | 0.0118 – 0.0141% | 30.7 – 35.63% | 0.0049 – 0.0055% | 13.26 – 15.68% |

5.9 Table 3 shows that the Applicant predicts up to a **17.7%** reduction in the kittiwake population of the North Sea as a result of in-combination collision impacts, in comparison with the unimpacted population, during the lifetime of the wind farm. We therefore cannot agree that this magnitude of effect is low nor that this would equate to impacts of minor adverse significance.

5.10 Table 3 shows that the Applicant predicts up to a **35.6%** reduction in the great black-backed gull population of the North Sea as a result of in-combination collision impacts, in comparison with the unimpacted population, during the lifetime of the wind farm. We therefore cannot agree that this magnitude of effect is low nor that this would equate to impacts of minor adverse significance.

5.11 The Applicant has not presented a PVA for the North Sea populations of guillemot, razorbill or red throated divers. However, at Norfolk Vanguard, Natural England were unable to rule out a significant adverse effect for cumulative operational displacement on these species. The proposed development at Norfolk Boreas adds additional mortality to this and therefore the impact cannot be concluded to be of negligible magnitude.

5.12 Based on the above results, the RSPB remains of the view that there is insufficient robust evidence available to support conclusions of no adverse effect on the integrity of the Flamborough and Filey Coast SPA or the Alde-Ore Estuary SPA, or to rule out significant effects on the above listed North Sea seabird populations.