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For the attention of: Jim McKie and Gayle Holland

4 July 2014

FORTH & TAY OFFSHORE WIND FARM PROPOSALS

FURTHER ADVICE FROM SNH AND JNCC FOLLOWING THE MEETING HELD AT MARINE SCOTLAND, ABERDEEN ON FRIDAY 27 JUNE.

Dear Jim

At our meeting in Aberdeen on Friday 27th June we agreed to reconsider some elements of the assessment and our advice. We have already sent you the updated results of collision risk modelling incorporating the latest parameters. This letter provides our response to the following action:

- **SNCBs to provide MS-LOT with updated advice on puffin having considered the new common currency table and the merits of the MacArthur Green model following today's meeting**

PUFFIN COMMON CURRENCY TABLE

We received the updated common currency table earlier this week, incorporating the revised proportion of immature/non-breeding birds agreed at the meeting on Friday 27 June (0.35). We have made further changes to it (Annex 1) taking account of revised displacement rates (see below) and our advice on apportioning effects to Forth Islands SPA (see below).

These changes have a net effect of slightly increasing predicted effects. Apportioning more of the effects to Forth Islands SPA counteracts the small downward effect of changing the displacement rate for ICOL.

Displacement rates

The starting point for displacement is a rate of 60% for auks and 40% for kittiwakes. These rates are precautionary and semi-quantitative. They are not based on any particular reference wind farm or empirical evidence of displacement but they do accord with disturbance scores derived from Furness et al. 2013. There is some evidence to support reduced displacement rates with a reduced turbine density and we agree that it is reasonable to expect reductions in turbine density to reduce displacement. For example, the Dutch wind farms OWEZ and PAWP (Leopold et al. 2013), noting the caveats that the conclusions are preliminary and the data are predominantly from usage outwith the breeding season, and for species other than puffin.

MSS use relative wind farm density (within the spreadsheet sent to SNCB's dated 30/06/2014) to adjust displacement rates. This approach takes the base rate (not derived for a specific reference wind farm) and derives wind farm specific rates from it through precise numerical adjustments based on comparison with an arbitrarily selected reference wind farm (BOWL or NnG). We believe that this results in false precision. Secondly, it is not clear whether the development footprints used to derive the wind farm densities are comparable. In each case they should be the minimum footprint occupied by the turbines plus a standard, specified buffer.

We therefore advise against the MSS approach. We prefer to maintain the semi-quantitative approach. Although aware of its limitations we have reviewed the densities of existing and consented wind farms (OWEZ, PAWP and the Moray Firth wind farms) alongside the densities proposed for the four Forth and Tay developments. **We advise that, given the lower turbine densities and greater spacing of the Seagreen and ICOL wind farms displacement rates of 40% for Seagreen and 50% for ICOL are justified. However, the current rate of 60% should still apply to Neart na Goithe.**

This advice is without prejudice to any advice on displacement rates we may give in future. This area of knowledge is moving rapidly and due to the current lack of empirical data to derive displacement rates, we will review and revise our advice on displacement, in light of any evidence that becomes available.

Apportioning to Forth Islands SPA

We understood that MSS would adopt the apportioning of effects to Forth Islands SPA puffins recommended by the SNCBs. The table sent to us on Monday 30 June still included the figures from Seagreen's addendum of October 2013. This may be an oversight and we continue to recommend the following:

Seagreen	- 0.976
ICOL	- 0.984
Neart na Goithe	- 0.998

THE MACARTHUR GREEN POPULATION MODEL

In our advice of March 2014, we advised using PBR and thresholds for 'proxy' species to assess the impacts of displacement on the Forth Islands puffin population. MSS have used a stochastic matrix population model ('the MacArthur Green model'), to assess the scale of puffin impacts.

The MacArthur Green model may overestimate population growth rate for the Forth Islands puffin population for two reasons:

- Immature survival is set the same as adult survival (annual survival rate of 0.922) but true immature survival is likely to be lower, as explained in our comments on the appropriate assessment.
- We believe there is an age class missing from the MacArthur Green model. From the information available in the report (MacArthur Green, 2014), it appears that there is no transition from age six to age seven, when birds become classed as adults.

The MacArthur Green model also underestimates uncertainty in population growth rate, as explained in our comments on the appropriate assessment.

In the meeting on 27 June we discussed how these issues with the MacArthur Green model can be overcome by using the counterfactual metric. This is the percentage decrease in the population size that would occur with the project than without it (RSPB 2014). The scenario closest to our predictions of impacts on puffin (3.3% decrease in adult survival and 4.9% decrease in productivity) in the MacArthur Green report is that in Table 14 (*Puffin summary*

population predictions. Adult survival reduced by 2%, productivity reduced by 5%). This produces a counterfactual of 30%. Given the counterfactual for a 3% decrease in adult survival with no effect on productivity is 35% (Table 7) the 'true' counterfactual for the predicted impacts is likely to be closer to 40%. We do not have an accepted method to interpret counterfactuals and their significance. However, as an illustration we note that 30% is much greater than the counterfactuals for kittiwake and gannet presented by RSPB for Hornsea Project 1 (ranging from 2% to 17%. RSPB 2014) and deemed by them to be incompatible with maintaining site integrity. We conclude that this method does not provide reliable scientific evidence that these effects will not result in an adverse effect on the Forth Islands SPA.

MSS have used the MacArthur Green model with the common currency outputs, in a risk-based approach, to assess impacts on the Forth Islands puffin population. They assessed the likelihood of the puffin population falling below the starting population at any time during the lifetime of the wind farm with the displacement impacts estimated by the common currency model. They concluded that the likelihood of decrease was very small. Whilst we support this risk-based approach to setting thresholds and assessing impacts in general, the MacArthur Green model is not suited to it. This is because the overestimated population growth rate and certainty noted above lead to underestimation of the likelihood of population decline below a desired population size (e.g. no more than a 5% decrease in population size during the 25-year projection). Given the current format of the MacArthur Green model, it is not possible to quantify the amount by which the likelihood of population decline would increase if it incorporated more realistic population growth and uncertainty. In simple terms, this approach cannot predict the trajectory of a population under increased mortality pressure. We conclude that the risk-based approach with the MacArthur Green model in its current form does not provide reliable scientific evidence that these effects will not result in an adverse effect on the Forth Islands SPA.

In our March 2014 advice, we recommended using guillemot and razorbill thresholds to infer whether displacement impacts were likely to have an adverse impact on the puffin population. These species exhibit different population characteristics to puffin, e.g. guillemot populations are generally stable and relatively consistent in size through time, whereas the puffin population has demonstrated a trend towards strongly increasing with some large fluctuations in population size around this trend. Consequently, the guillemot and razorbill thresholds are likely to be precautionary.

We also recommended using PBR to set a threshold for the puffin population, using an *f* value of 0.3. However, given uncertainty around the population growth rate, as illustrated by our comments on the MacArthur Green Model, the results of PBR should be used with caution in this case, meaning that PBR outputs are only useful as a rough guide to thresholds.

PBR and proxy species provide a range of possible thresholds as an indication of the levels of impacts the puffin population might be able to withstand. Given the proximity of predicted impacts to these indicative thresholds, we advise that it is not possible to conclude beyond reasonable scientific doubt that the Forth Islands puffin population will not be adversely affected by displacement impacts.

CONCLUSION

The meeting last Friday was a very useful opportunity to explore the differences between MSS and ourselves. The lack of good empirical evidence for most aspects of the assessment has made it very difficult to find consensus in all areas but we mustn't lose sight of the amount of very productive work done by people in MSS, SNH and JNCC. We hope we can build on this in future.

We trust that this advice is helpful. If you have any queries on any aspect of this advice, please do not hesitate to contact either John Uttley, john.uttley@snh.gov.uk 07876 447403 or Karen Hall, karen.hall@jncc.gov.uk 01224 266559.

Ron Macdonald

Director of Policy & Advice, SNH

John Goold

Director of Marine Advice, JNCC

REFERENCES

Furness, R.W., Wade, H.M., and Masden, E.A. 2013. Assessing vulnerability of marine bird populations to offshore wind farms. Journal of Environmental Management: 119. P 56-66.

Leopold, M.F., van Bemmelen, R.S.A., and Zuur, A.F. 2013. Responses of local birds to Offshore Wind Farms PAWP and OWEZ off the Dutch mainland coast. Report number C1S1/12: IMARES, Marine Ecology Dept, Texel, Netherlands

RSPB (2014) Written representations of the Royal Society for the Protection of Birds in relation to Hornsea Project One – Update of the RSPB position in light of the Applicant's new Information and Response to Second Round of Questions from the Examining Authority

Annex 1 – Puffin common currency table

Adult survival effects

Productivity effect

PUFFIN MSS original	**FORTH ISLANDS SPA**													
	NnG		**SG a**		**SG b**		**IC**		**TOTAL**	**SPA Pop**	**NnG**	**SG a**	**SG b**	**IC**	**TOTAL**
Mean Seasonal Max		3463		3419		4034		3152	**14068**	100564	-3.44	-3.40	-4.01	-3.13	-13.99
Proportion displaced	**0.6**	2077.8	**0.4**	1367.6	**0.4**	1613.6	**0.53**	1670.6	**6730**		-2.07	-1.36	-1.60	-1.66	-6.69
Prop SPA	**0.975**	2025.9	**0.864**	1181.6	**0.864**	1394.2	**0.929**	1552	**6154**		-2.01	-1.17	-1.39	-1.54	-6.12
Prop non breeding and/or immature	**0.35**	1316.8	**0.35**	768.04	**0.35**	906.2	**0.35**	1008.8	**4000**		-1.31	-0.76	-0.90	-1.00	-3.98
Prop Die	**0.5**	658	**0.5**	384	**0.5**	453	**0.5**	504	2000		-0.65	-0.38	-0.45	-0.50	-1.99
Prop fail to breed successfully	**1**	1317	**1**	768	**1**	906	**1**	1009	4000		-1.31	-0.76	-0.90	-1.00	-3.98
Productivity 1 Indiv = 1 Pair	**1**	1317	**1**	768	**1**	906	**1**	1009	**4000**		-1.31	-0.76	-0.90	-1.00	-3.98

PUFFIN New displ. & SNCB apportioning	FORTH ISLANDS SPA													
	NnG		SG a		SG b		IC		TOTAL	SPA Pop	NnG	SG a	SG b	IC	TOTAL
Mean Seasonal Max		3463		3419		4034		3152	**14068**	100564	-3.44	-3.40	-4.01	-3.13	-13.99
Proportion displaced	**0.6**	2077.8	**0.4**	1367.6	**0.4**	1613.6	**0.5**	1576	**6635**		-2.07	-1.36	-1.60	-1.57	-6.60
Prop SPA	**0.998**	2073.6	**0.976**	1334.8	**0.976**	1574.9	**0.984**	1550.8	**6534**		-2.06	-1.33	-1.57	-1.54	-6.50
Prop non breeding and/or immature	**0.35**	1347.9	**0.35**	867.61	**0.35**	1023.7	**0.35**	1008	**4247**		-1.34	-0.86	-1.02	-1.00	-4.22
Prop Die	**0.5**	674	**0.5**	434	**0.5**	512	**0.5**	504	2124		-0.67	-0.43	-0.51	-0.50	-2.11
Prop fail to breed successfully	**1**	1348	**1**	868	**1**	1024	**1**	1008	4247		-1.34	-0.86	-1.02	-1.00	-4.22
Productivity 1 Indiv = 1 Pair	**1**	1348	**1**	868	**1**	1024	**1**	1008	**4247**		-1.34	-0.86	-1.02	-1.00	-4.22

GREEN highlight – SNCB amendments

BLUE highlight – Consequent changes