

APPROPRIATE ASSESSMENT

APPLICATIONS FOR CONSENT UNDER SECTION 36 OF THE ELECTRICITY ACT 1989 AND APPLICATIONS FOR MARINE LICENCES UNDER THE MARINE AND COASTAL ACCESS ACT 2009 AND THE MARINE (SCOTLAND) ACT 2010 FOR THE CONSTRUCTION AND OPERATION OF THE BEATRICE OFFSHORE WINDFARM IN THE OUTER MORAY FIRTH

MARINE SCOTLAND'S CONSIDERATION OF A PROPOSAL AFFECTING DESIGNATED SPECIAL AREAS OF CONSERVATION ("SACs") OR SPECIAL PROTECTION AREAS ("SPAs")

SITE DETAILS: Beatrice Offshore Windfarm Limited ("BOWL") development in the Outer Moray Firth.

FILE REF: 003/OW/BOWL – 8

APPROPRIATE ASSESSMENT CONCLUSION: Marine Scotland Licensing Operations Team ("MS-LOT") concludes that, based upon the content of the following assessment, the proposed BOWL development will not adversely affect site integrity of the East Caithness Cliffs SPA ("ECC SPA"), North Caithness Cliffs SPA ("NCC SPA"), Hoy SPA, Dornoch Firth & Morrich More SAC, Moray Firth SAC, Berriedale & Langwell Waters SAC, River Evelix SAC, River Moriston SAC, River Oykel SAC, River Spey SAC, River Thurso SAC, River Borgie SAC, River Dee SAC and River Naver SAC either alone or in-combination with Moray Offshore Renewable Limited ("MORL") Eastern Development Area ("EDA") comprising; the Telford Offshore Wind Farm, the Stevenson Offshore Wind Farm and the MacColl Offshore Wind Farm and other projects which have already been consented provided that the conditions detailed in section 3d are complied with.

Introduction

This is a record of the Appropriate Assessment ("AA") of the Beatrice Offshore Wind Farm. The assessment has been undertaken by MS-LOT and Marine Scotland Science ("MSS") on behalf of the Scottish Ministers. This assessment is required to be undertaken under Council Directive 92/43/EEC on the conservation of natural habitats of wild fauna and flora ("the Habitats Directive") and Council Directive 79/409/EEC on the conservation of wild birds (as amended, and codified by Directive 2009/147/EC of the European Parliament and of the Council) ("the Wild Birds Directive") as implemented, in particular, by Regulation 25 of the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 for projects beyond 12 nautical miles ("nm") and by Regulation 48 of the Conservation (Natural Habitats, &c.) Regulations 1994 for projects within 12 nm before the Scottish Ministers may decide to give consent to the development. As the BOWL development is located within 12 nm and the cable route is, in part, out with 12 nm and because the assessment is a cumulative assessment with MORL, which is out with 12 nm, both sets of regulations ("the Habitats Regulations") apply to this assessment.

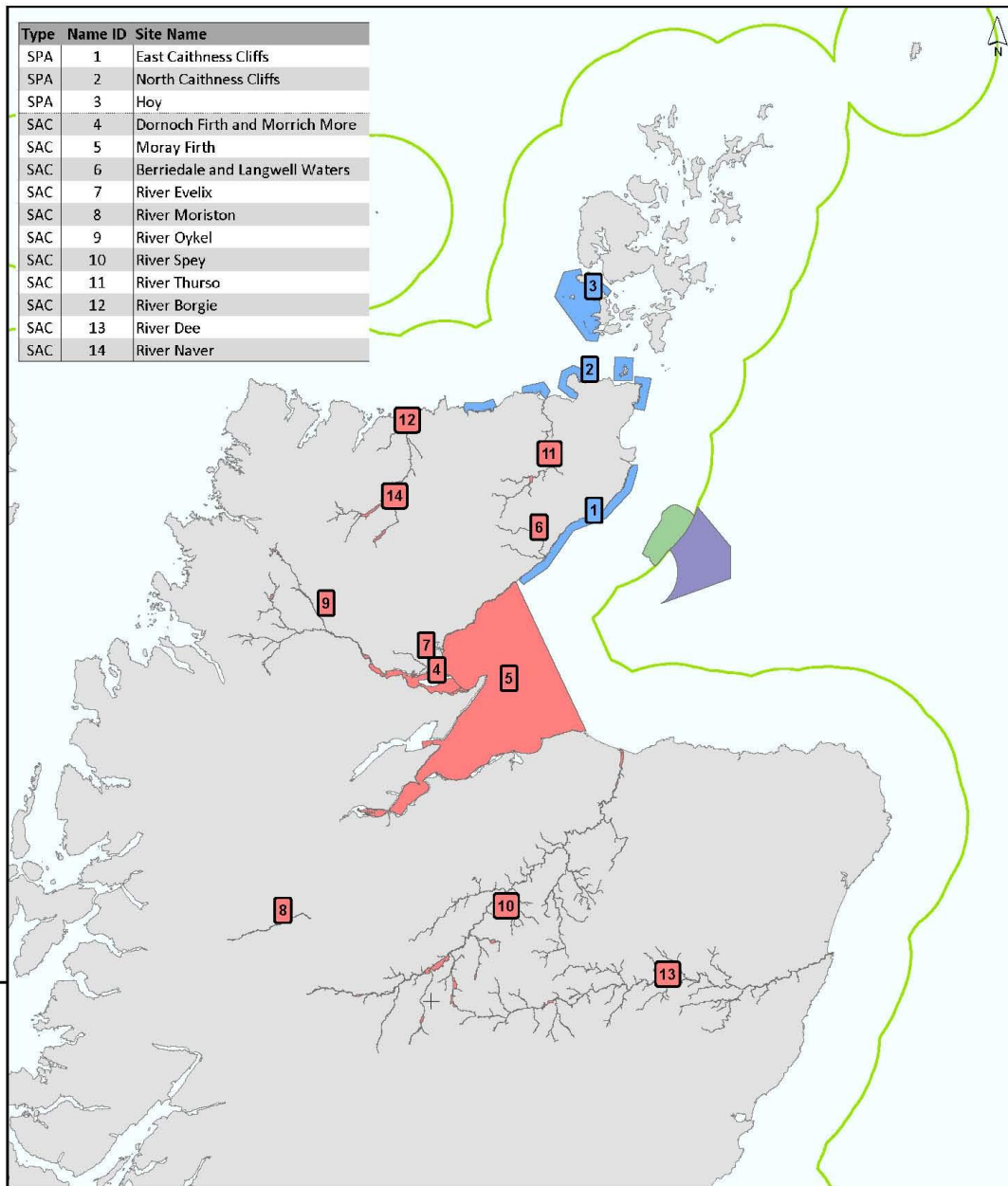
MS-LOT, on behalf of the Scottish Ministers as the 'competent authority' under the Habitats Regulations, has to be satisfied that the project will not adversely affect the integrity of any European protected sites (SACs and SPAs) before it may recommend the grant of consent for the project. The precautionary principle requires to be applied when complying with obligations under the Habitats Directive and in preparing an AA. In accordance with the ECJ case of *Waddenzee*¹ the Scottish Ministers may only authorise the development if they are certain that it will not adversely affect the integrity of European protected sites; and "that is the case where no reasonable scientific doubt remains as to the absence of such effects".

A detailed AA has been undertaken and Scottish Natural Heritage ("SNH") and the Joint Nature Conservation Committee ("JNCC") have been consulted, as is required, under the Habitats Regulations. Those Regulations allow for the competent authority to consult the general public on the AA if they consider it appropriate. This has not been done as the general public have already had the opportunity to respond to the applications through the Environmental Impact Assessment ("EIA") process where information regarding the potential impacts on European protected sites was available in the Environmental Statements ("ESs") provided by both MORL and BOWL. The Additional Ornithology Information submitted by MORL and the Supplementary Environmental Information Statement ("SEIS") submitted by BOWL were also made publically available and consulted on. Public representations were received regarding the potential impacts on SPAs and SACs from the MORL proposal in combination with BOWL, however as this assessment has concluded, the BOWL development in combination with the MORL proposal will not adversely affect site integrity for all sites of concern. It is therefore not deemed appropriate to consult the general public further.

A map showing the locations of the MORL and BOWL developments along with the European protected sites which are considered in this assessment is presented below.

¹ ECJ Case no - C-127/02 – judgment issued on 07.09.2004.

SACs & SPAs relevant to Moray Firth Offshore Wind Developments



- Special Areas of Conservation included in AAs
- Special Protection Areas included in AAs
- United Kingdom
- 12 Nautical Miles Limit
- Wind Developments**
- Beatrice Offshore Windfarm Limited
- Moray Offshore Renewables Limited



0 15 30 60 Km

1:1,600,000 Size: A4 Author: Andronikos Kafas

British National Grid

Version 4.0 20/01/2014

Positions shown relative to British National Grid.
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Table 1a. provides links to the Scottish Natural Heritage Interactive (“SNHi”) website where the background information on the sites being considered in this assessment is available. Table 1c. details the qualifying features of the SACs and SPAs in this assessment. The conservation objectives being considered are detailed in section 1d. For the qualifying interests where likely significant effect (“LSE”) has been identified (section 3b), the appropriate assessment assesses whether or not the relevant conservation objectives will be achieved. This enables a conclusion to be made in relation to whether or not the BOWL development, in combination with the MORL proposal, will adversely affect the integrity of the sites which have been assessed.

1a. Name of Natura site affected & current status available from:

1. East Caithness Cliffs SPA http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8492
2. North Caithness Cliffs SPA http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8554
3. Hoy SPA http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8513
4. Dornoch Firth & Morrich More SAC http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8242
5. Moray Firth SAC http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8327
6. Berriedale & Langwell Waters SAC http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8206
7. River Evelix SAC http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8358
8. River Moriston SAC http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8361
9. River Oykel SAC http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8363
10. River Spey SAC http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8365
11. River Thurso SAC http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8368
12. River Borgie SAC http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8356
13. River Dee SAC http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8357
14. River Naver SAC http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8362

1b. Name of component SSSI if relevant

Not considered relevant for this assessment

1c. European qualifying interests & whether priority/non-priority:

1. East Caithness Cliffs SPA <ul style="list-style-type: none"> ▪ Cormorant (breeding) ▪ Fulmar (breeding) ▪ Great black-backed gull (breeding) ▪ Guillemot (breeding) ▪ Herring gull (breeding) ▪ Kittiwake (breeding) ▪ Peregrine (breeding) ▪ Puffin (breeding) ▪ Razorbill (breeding) ▪ Shag (breeding) ▪ Seabird assemblage (breeding) 	2. North Caithness Cliffs SPA <ul style="list-style-type: none"> ▪ Fulmar (breeding) ▪ Guillemot (breeding) ▪ Kittiwake (breeding) ▪ Peregrine (breeding) ▪ Puffin (breeding) ▪ Razorbill (breeding) ▪ Seabird assemblage (breeding)
3. Hoy SPA <ul style="list-style-type: none"> ▪ Arctic skua (breeding) ▪ Fulmar (breeding) ▪ Great black-backed gull (breeding) ▪ Great skua (breeding) ▪ Guillemot (breeding) ▪ Kittiwake (breeding) ▪ Peregrine (breeding) ▪ Puffin (breeding) ▪ Red-throated diver (breeding) ▪ Seabird assemblage (breeding) 	4. Dornoch Firth & Morrich More SAC <ul style="list-style-type: none"> ▪ Common (harbour) seal ▪ Otter ▪ Atlantic salt meadows <ul style="list-style-type: none"> ▪ Coastal dune heathland* ▪ Dune grassland* ▪ Dunes with juniper thickets* ▪ Estuaries <ul style="list-style-type: none"> ▪ Glasswort and other annuals colonising mud and sand ▪ Humid dune slacks <ul style="list-style-type: none"> ▪ Intertidal mudflats and sandflats ▪ Lime-deficient dune heathland with crowberry* ▪ Reefs ▪ Shifting dunes <ul style="list-style-type: none"> ▪ Shifting dunes with marram ▪ Subtidal sandbanks <p>(* indicates priority habitat)</p>
5. Moray Firth SAC <ul style="list-style-type: none"> ▪ Bottlenose dolphin ▪ Subtidal sandbanks 	6. Berriedale & Langwell Waters SAC <ul style="list-style-type: none"> ▪ Atlantic salmon
7. River Evelix SAC <ul style="list-style-type: none"> ▪ Freshwater pearl mussel 	8. River Moriston SAC <ul style="list-style-type: none"> ▪ Atlantic salmon ▪ Freshwater pearl mussel
9. River Oykel SAC <ul style="list-style-type: none"> ▪ Atlantic salmon ▪ Freshwater pearl mussel 	10. River Spey SAC <ul style="list-style-type: none"> ▪ Atlantic salmon ▪ Sea lamprey ▪ Freshwater pearl mussel ▪ Otter

11. River Thurso SAC <ul style="list-style-type: none"> ▪ Atlantic salmon 	12. River Borgie SAC <ul style="list-style-type: none"> ▪ Atlantic salmon ▪ Freshwater pearl mussel ▪ Otter
13. River Dee SAC <ul style="list-style-type: none"> ▪ Atlantic salmon ▪ Freshwater pearl mussel ▪ Otter 	14. River Naver SAC <ul style="list-style-type: none"> ▪ Atlantic salmon ▪ Freshwater pearl mussel

1d. Conservation objectives for qualifying interests:

In their scoping advice the Statutory Nature Conservation Bodies (“the SNCBs” – SNH and the JNCC) advised that it is important to recognise that the conservation objectives primarily offer site-based protection and that some of the objectives will not directly apply to species when they are not present within the boundaries of the SPA or SAC in question.

The SNCBs advice for the SPAs is that the relevant conservation objective for this appropriate assessment is to ensure the maintenance of the population as a viable component of the site. The SNCBs also advised that this was the most relevant conservation objective for the marine mammals being considered. MSS advised that other conservation objectives which ensure the establishment and maintenance of “the distribution of the species within the site” and of “no significant disturbance of the species” may also be relevant in the case of bottlenose dolphins from the Moray Firth SAC. The primary impact upon this species comes from noise associated with pile driving which could potentially cause the dolphins to alter their distribution within the SAC, depending upon where the piling activity was taking place. The noise may also disturb the dolphins out with the SAC. For those other SACs for which the qualifying feature is a species rather than a habitat the assessment follows the SNCBs advice which is to consider the objective which ensures the establishment and maintenance of the population as a viable component of the site.

East Caithness Cliffs, North Caithness Cliffs and Hoy SPAs

To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and

To ensure for the qualifying species that the following are maintained in the long term:

(i) Population of the species as a viable component of the site*

- (ii) Distribution of the species within site
- (iii) Distribution and extent of habitats supporting the species
- (iv) Structure, function and supporting processes of habitats supporting the species
- (v) No significant disturbance of the species

*As the potential effects of the proposed development, as identified, occur outside the SPA itself, any disturbance to the qualifying interests is only considered to be significant in terms of the relevant conservation objective if it could undermine the conservation objectives relating to population viability.

Moray Firth SAC - Habitats

To avoid deterioration of the qualifying habitat thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and

To ensure for the qualifying habitat that the following are maintained in the long term:

- (i) extent of the habitat on site
- (ii) distribution of the habitat within site
- (iii) structure and function of the habitat
- (iv) processes supporting the habitat
- (v) distribution of typical species of the habitat
- (vi) viability of typical species as components of the habitat
- (vii) no significant disturbance of typical species of the habitat

Moray Firth SAC - Bottlenose dolphin

To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and

To ensure for the qualifying species that the following are established then maintained in the long term:

- (i) Population of the species as a viable component of the site***
- (ii) Distribution of the species within site**
- (iii) Distribution and extent of habitats supporting the species
- (iv) Structure, function and supporting processes of habitats supporting the species
- (v) No significant disturbance of the species**

Dornoch Firth and Morrich More SAC – Common seal

To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and

To ensure for the qualifying species that the following are maintained in the long term:

- (i) Population of the species as a viable component of the site***
- (ii) Distribution of the species within site
- (iii) Distribution and extent of habitats supporting the species

- (iv) Structure, function and supporting processes of habitats supporting the species
- (v) No significant disturbance of the species

*As the potential effects of the proposed development, as identified, occur outside the SAC itself, any disturbance to the qualifying interests is only considered to be significant in terms of the relevant conservation objective if it could undermine the conservation objectives relating to population viability.

SACs – Migratory fish and Freshwater Pearl Mussel

To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and

To ensure for each species that the following are maintained in the long term:

(i) Population of the species, including range of genetic types for salmon, as a viable component of the SACs*

- (ii) Distribution of the species within site
- (iii) Distribution and extent of habitats supporting each species
- (iv) Structure, function and supporting processes of habitats supporting each species
- (v) No significant disturbance of the species

And for freshwater pearl mussel in particular, to ensure that the following are maintained in the long term:

- (vi) Distribution and viability of freshwater pearl mussel host species
- (vii) Structure, function and supporting processes of habitats supporting freshwater pearl mussel host species

*As the potential effects of the proposed development, as identified, occur outside the SAC itself, any disturbance to the qualifying interests is only considered to be significant in terms of the relevant conservation objective if it could undermine the conservation objectives relating to population viability.

PROPOSAL DETAILS

2a. Proposal title & name of consultee (i.e. applicant or competent authority)

Beatrice Offshore Wind Farm, outer Moray Firth

2b. Date of Consultation:

MS-LOT received advice regarding the applications from the SNCBs, on 19th July 2012, 8th July 2013, 28th August 2013, 29th October 2013 and 17th January 2014. The SNCBs advised MS-LOT to carry out an AA. MSS provided advice to MS-LOT on 25th June 2012, 16th July 2013, 25th July 2013, 4th September 2013, 31st October 2013, 22nd November 2013, 28th November 2013 and 3rd December 2013. This advice is available to view at the [Marine Scotland Interactive Website](#).

2c. Type of Case:

AA of the proposed BOWL development, in the Outer Moray Firth.

2d. Details of proposed operation (inc. location, timing, methods):

Installation and operation of the Beatrice Offshore Wind Farm which is located in the outer Moray Firth 13.5 km from the Caithness coast. The total area of the development is 131.5 km². The eastern edge of the development site is adjacent to the proposed MORL EDA comprising the proposed Telford Offshore Wind Farm, Stevenson Offshore Wind Farm and MacColl Offshore Wind Farm. The operational lifespan of the wind farm is expected to be 25 years.

The original application was for a design envelope of up to 277 wind turbine generators ("WTGs"), and a maximum generating capacity of up to 1,000 MW. This is the envelope that was considered in all advice from the SNCB's and MSS up until 8th July 2013. Since this advice was received continued discussions have led to a reduction in the design envelope. A reduced envelope of up to 140 WTGs was specified by the Company and this envelope informed the SNCBs advice on collision risk to SPA bird species on the 29th October 2013. The maximum generating capacity of any consent granted for the BOWL development will be 750 MW.

For WTG, there will be a substructure (either a mono-tower or a tubular jacket structure) and foundations (either pin piles, suction piles or gravity bases). For each WTG, there will be a transition piece (including access ladders / fences and landing platforms), turbine tower and nacelle

Also included in the infrastructure is:

- Up to a maximum of two AC and one DC Offshore Substation Platforms ("OSPs");
- Up to a maximum of three meteorological masts;
- Up to 350 km of inter-array cabling linking turbines, OSPs and meteorological masts

The construction programme is expected to cover a period of three to five years. No date is yet available for commencement of construction, but it is likely to commence in 2015/2016.

A full BOWL project description can be found in [chapter 7 of the ES](#) and [chapter 4 of the SEIS](#).

As this assessment focuses on the in-combination impacts with the MORL proposal, a brief description of the whole MORL project is provided below:

The original MORL design envelope was for up to 339 WTGs with a maximum generating capacity of up to 1,500 MW. This is the envelope that was considered in all advice from the SNCB's and MSS up until 31st October 2013. Since this advice was received continued discussions have led to a reduction in the design envelope. The reduced design envelope is for a maximum generating capacity of up to 1,116 MW and for a maximum of 186 WTGs. The proposed MORL proposals are located on the Smith Bank in the outer Moray Firth (approximately 22 km from the Caithness coastline, in water depths of 38-57m). The operational lifespan of the wind farms is expected to be 25 years.

The three proposed wind farm sites: the Telford, Stevenson and MacColl wind farms lie within the EDA, part of Zone 1 of Round 3 leasing agreements in the UK Renewable Energy Zone. Each farm (based on the reduced design envelope) will have a maximum generating capacity of 372 MW. Substructure and foundation design for the WTGs will consist of either a mixture of, or one design option of -

- concrete gravity base foundation with ballast and a gravel/grout bed, or
- steel lattice jackets with pin piles.

The infrastructure also contains 3-6 AC OSPs, 2 AC to DC convertor OSPs, inter-array cabling, DC export cable to shore and an offshore meteorological mast. Substructure and foundation design for the OSPs will be chosen from five possible concepts:

- concrete gravity base foundation with ballast and a gravel/grout bed,
- steel lattice jackets with pin piles,
- steel lattice jackets with suction caissons,
- steel lattice jack-up with pin piles, or
- steel lattice jack-up with suction caissons.

Construction of the wind farms is proposed to occur from Q1 2016 to Q3 2020.

A full project description can be found in [volume 2 of the ES](#).

ASSESSMENT IN RELATION TO REGULATION 25 OF THE OFFSHORE MARINE CONSERVATION (NATURAL HABITATS, &C.) REGULATIONS 2007 AND REGULATION 48 OF THE CONSERVATION (NATURAL HABITATS, &C.) REGULATIONS 1994

3a. Is the operation directly connected with or necessary to conservation management of the site? YES/NO If YES give details:

The operation is not connected with or necessary to conservation management of the site

If yes and it can be demonstrated that the tests in 3b have been applied to all the interest features in a fully assessed and agreed management plan then consent can be issued but rationale must be provided, including reference to management objectives. If no, or if site has several European qualifying interests and operation is not directly connected with or necessary to the management of all of these then proceed to 3b

3b. Is the operation likely to have a significant effect on the qualifying interest? Repeat for each interest on the site.

During the scoping phase of the EIA process the SNCBs advised in the [scoping opinion](#) that there may be a LSE on several SPAs and SACs. This initial list of SPAs and SACs was revised to those sites that are detailed in 1c following pre-application dialogue between the applicant and MS-LOT and consideration of the survey work presented in the applicant's ES. Final details on the list of SPAs and SACs to be included in the AA was provided by the SNCBs in their advice dated 8th July 2013.

SPAs

During the consultation phase of the section 36 and marine licence application process, the SNCBs advised on the 8th July 2013 that 2013 that the proposed BOWL development in combination with the MORL proposal, is likely to have a significant effect on the following qualifying features and SPAs, by virtue of either collision risk and/or displacement:

- Collision risk to great black-backed gull of the ECC SPA.
- Collision risk to herring gull of the ECC SPA.
- Displacement to Atlantic puffin of the ECC SPA, NCC SPA & Hoy SPA.
- Displacement to common guillemot of the ECC SPA & NCC SPA.
- Displacement to razorbill of the ECC SPA & NCC SPA.
- Collision risk and/or displacement to black-legged kittiwake of the ECC SPA & NCC SPA.
- Collision risk and/or displacement to Northern fulmar of the ECC SPA & NCC SPA.
- Collision risk to Arctic skua of Hoy SPA.

- Collision risk to Great skua of Hoy SPA.

The remaining species listed in the SPA citations in 1c are scoped out of further consideration in this AA as no LSE was identified.

SACs

During the consultation phase of the section 36 and marine licence application process, the SNCBs advised on 8th July 2013 that the proposed BOWL development, in combination with the MORL proposal, is likely to have a significant effect on several of the qualifying features of the SACs listed in 1c. These are listed below along with the effects to be considered for the different species. Due to uncertainty surrounding the origin of potentially impacted Atlantic salmon, additional river SACs, which were advised as having LSE at the scoping stage (for BOWL) are also considered.

- Common seals as the qualifying feature of the Dornoch Firth and Morrich More SAC due to underwater noise impacts arising from the wind farm construction.
- Bottlenose dolphins as the qualifying feature of the Moray Firth SAC due to underwater noise impacts arising from the wind farm construction.
- Subtidal sandbanks as a qualifying feature of the Moray Firth SAC due to uncertainties surrounding the dredging and disposal of sediment related to the use of gravity bases.
- Atlantic salmon as a qualifying feature of the Berriedale & Langwell Waters SAC and the River Moriston, Spey, Oykel, Thurso, Borgie, Dee and Naver SACs due to disturbance from construction noise and possible effects of electro-magnetic fields ("EMF") arising from installed cables.
- Freshwater pearl mussel ("FWPM") as the qualifying feature of the River Evelix, Moriston, Oykel, Spey, Borgie, Dee and Naver SACs due to potential indirect impacts to this species as its life cycle is dependent on Atlantic salmon.
- Sea lamprey as the qualifying feature of the River Spey SAC due to disturbance from construction noise and possible effects of EMF arising from installed cables.

The remaining species and habitats listed in the SAC citations in 1c are scoped out of further consideration in this AA as no LSE was identified.

Otters, as qualifying features of the Dornoch Firth and Morrich More SAC, River Spey, River Borgie and River Dee SACs are not considered further in this assessment as they are a riverine or coastal species. The location of the wind farm being 13.5 km (minimum) out to sea from the coast, significantly out with the habitat of otters.

The potential impacts to consider for common seals and bottlenose dolphins are:

- a) disturbance due to the construction noise, boat movements and cable-laying, and;

b) any affects to their prey species.

The potential impacts to consider for FWPM are linked to Atlantic salmon, as salmonids are integral to the life cycle of FWPM. Any impacts to Atlantic salmon that prevent them from returning to their natal rivers may have a resulting effect on FWPM populations.

If no for all features, a consent or non-objection response can be given and recorded under 4 (although if there are other features of national interest only, the effect on these should be considered separately). If potential significant effects can easily be avoided, record modifications required under 3d.

If yes, or in cases of doubt, proceed to 3c.

3c. APPROPRIATE ASSESSMENT of the implications for the site in view of the site's conservation objectives.

Due the close proximity of the BOWL and MORL wind farm sites this assessment focuses on the cumulative impacts from these developments.

SPAs

As detailed in section 1d, as the potential effects identified occur outside the SPA itself, the relevant conservation objective is to “ensure the population of the species as a viable component of the site” is maintained in the long term. In order to assess the potential effect of the proposed developments on the achievement of the conservation objective the assessments for relevant species involved 1.) estimation of the level of predicted effect; and 2.) setting a precautionary level of acceptable change to a population given the statutory requirements. Where it can be shown that the populations of all qualifying interests of concern can be maintained within the thresholds of change it can be concluded that that the proposed developments will not adversely affect site integrity.

1). Estimation of the level of predicted effect

The main effects to bird species come from a). collision risk with the turbines (of relevance to species which may regularly fly at the same height as the rotating blades e.g. gulls) and b). displacement of birds from potential foraging areas (of relevance to species with more limited foraging ranges or greater flight energetic costs e.g. guillemot, razorbill and puffin).

a.) Collision Risk - Both MORL and BOWL presented Collision Risk Models (“CRMs”) in their ESSs, and in the case of MORL in their Additional Ornithology Information, and in the case of BOWL in their SEIS. Options 1 and 2 of the ‘basic’ Band (2012) model were presented along with Option 3, the extended version of the Band model. The basic model assumes a uniform distribution of flight heights between lowest and highest levels of the rotors. The extended model assumes that both the density of flying birds and collision risk vary across the rotor swept height.

Option 3 uses flight height distributions modelled from a pooled dataset collected from a large number of sites by a range of surveyors (Cook et al. 2012). The SNCBs noted some concerns over this dataset as it is solely derived from boat-based survey data and there could be associated observer error. This potential issue exists with all data collected during boat based surveys including the data collected at the proposed development sites. The Royal Society for the Protection of Birds Scotland (“RSPB Scotland”) also raised concerns about the use of the extended Band model (Option 3) due to assumptions implicit in the model.

The Renewables Scientific Advice Group (“RSAG” – represented by SNH and the JNCC, with attendance from MSS when required) met on 28th June 2013, and considered the use of the outputs from Option 3 in the Moray assessments appropriate. Comparison of outputs from Options 1 and 2 was undertaken to identify whether substantial differences in values and therefore flight heights between the site data and the pooled data in Cook et al 2012 existed. There were no reasons to suspect that site specific drivers would cause flight heights to differ from the sites included in Cook et al 2012, and it was accepted that pooling robustness was likely to result in the data modelled by Cook et al being more robust to errors (but not systematic bias) in flight height estimation. Any systematic bias in flight height estimates either from the site specific data or that used by Cook et al would be carried through the CRM calculations, regardless of the Option used.

At the RSAG meeting on the 28th June 2013 it was agreed that the most appropriate avoidance rate for use with the extended Band model was 98%. Both MORL and BOWL had previously provided arguments for increasing the avoidance rate for use with the standard Band model (i.e. Options 1 and 2). Conversely, RSPB Scotland has suggested that the avoidance rate should be decreased for the extended Band model. This is due to the need to undertake separate calculations for the ‘basic’ and ‘extended’ Band models in order to provide appropriate avoidance rates. The SNCBs and MSS considered that existing offshore avoidance rates are default, and not based upon observed or derived collision rates. The Cook et al data set constituted best available evidence and consequently should be used for assessment purposes. It was concluded that continued use of 98% as a default rate was justified.

b.) Displacement – It is recognised that increased activity in a sea area, or the establishment of structures such as wind farms, have the potential to displace birds. However there is limited understanding of any resulting effects on the birds displaced, for example how to quantify the increased energetic demands on the adult, through additional flight around a wind farm or to alternative foraging locations, or decreased nest attendance and provisioning of chicks and how these may affect either adult survival or productivity. As such the assumptions used for assessment are currently highly precautionary: the mean maximum abundance estimate of all birds are used to estimate numbers displaced, it is assumed that each displaced bird represents a separate pair and it is assumed that 100% of displaced birds will fail to breed successfully.

2.) Setting a precautionary level of acceptable change

Acceptable and precautionary effect thresholds were calculated using Potential Biological Removal ("PBR") and Acceptable Biological Change ("ABC").

PBR and ABC are considered to be precautionary and in compliance with the statutory requirements in that they allow assessments on the maintenance of the populations as viable components of protected sites (the primary conservation objective under consideration) to be carried out, enabling conclusions on site integrity to be reached.

A common feature of PBR and ABC is that they establish baselines for the assessment that are future points in time. Consequently, assessments in relation to the statutory requirements are based on modelled scenarios. A number of the populations assessed have declined over recent time. Seabird population sizes and trends are thought to be principally regulated by food supply. There is considerable uncertainty over the range of factors that contribute to variations in food availability over time; however several of the factors are thought to operate over large spatial scales (e.g. climate change). Future research may inform our understanding of seabird population management over larger spatial scales. The underlying drivers of population change are not considered to be a consequence of activities that require cumulative assessment under the terms of the Habitats Regulations. The inherent uncertainties associated with the populations and their trends are taken into account by the assessment methods used.

a.) PBR - The SNCBs principally provided advice based upon the PBR model. The PBR equation is based on a simple form of population modelling, which was first formulated for marine mammals (Wade 1998) to estimate allowable bycatch. PBR requires the setting of a recovery factor (f), the value of which is a conservation management decision. PBR calculates the number of additional mortalities that can be sustained annually by a population, accepting the assumptions and goals of the method.

b.) ABC - MSS principally used the outputs of the density independent population models provided by MORL and BOWL, by applying the ABC tool. This tool follows the equation $ABC = P + (1-fP/3)$, where P is the probability of the conservation objective in the absence of any proposed wind farm based on the population model forecasts. An outline of the ABC tool is attached in Appendix 3 of this assessment.

The main differences between PBR and the ABC tool are summarised below:

- The timescales are different. PBR's goals are based upon a greater recovery period after the effect than is used with the MORL and BOWL population models. PBR goals assume that the population will recover to at least maximum net productivity level over a period of up to 100 years at a logistic growth rate of 0.5. MORL and BOWL population model outputs are for the 25 year period of effect and assume no recovery period.
- The PBR model structure assumes regulation by density dependence whereas the MORL and BOWL Population Viability Analysis ("PVA") models

assumed density independence. The MORL and BOWL population models used the best available evidence on population size and demographic rates. The SNCBs advised that recent population declines of some populations may not have been reflected in the PVA outputs that indicated an increasing population. For example, the great black-backed gull population is thought to have declined from 800 pairs cited in the Standard Data Form at time of SPA designation to 175 pairs in 1999. *Ad hoc* monitoring data collected since 2002 in the Caithness coast (Robin Sellers *personal comm.*) suggests that the population is largely stable but the models assume growth. MSS recommended use of the ABC tool took account of this. A 'forced' probability (fP) of 0.78 was used, i.e. applying ABC in a more precautionary manner using the International Panel on Climate Change ("IPCC") likelihood bands.

- The intended purpose of the PBR model is to inform annual adaptive management which is not practical in this case. The MORL and BOWL models have been developed to address the specific effects associated with this assessment.
- PBR is not intended for establishing acceptable limits to changes in productivity. In order to use the PBR calculation, where the effect of displaced birds is assumed to be upon productivity, the SNCBs have adopted an additional step which converts changes in productivity to an assumed equivalent change in adult mortality. This conversion rate has been taken from a different population model to the PBR model, with different underlying assumptions about population dynamics, and then applied to the estimates of adults displaced by the wind farms. Using the PBR's model to calculate the conversion rate would be likely to give different values to those used in this assessment. Wade suggests further simulations with the PBR's population model may inform calculation of a PBR where effects are highly selective. MSS are not aware that the statistical issues associated with attempting to apply a conversion rate from adult survival to productivity using PBR have been explored.

MSS recommend that reliance upon PBR is limited to those scenarios where it constitutes the best available evidence, and this is unlikely to include scenarios where bespoke population models are available.

For some species: black-legged kittiwake, northern fulmar, great skua and Arctic skua the SNCBs were able to advise no adverse effect on site integrity without calculating impact thresholds as a qualitative assessment was appropriate due to the minimal predicted effects. For species where predicted impacts were greater (great black-backed gull, herring gull, puffin, razorbill and guillemot) levels of acceptable change (impact thresholds) were calculated.

For a limited number of species and sites outstanding concerns remained following initial advice from SNCBs (8th July 2013). To address these outstanding concerns, the magnitude of effects assumed by this assessment is based upon a common currency in relation to relevant factors where a range of potential values could influence the outcome of the assessment. The common currency approach was developed iteratively, as part of a process to inform the assessment of those

species at sites where initial consideration of Worst Case Scenarios (“WCS”) indicated a concern. This approach involved MORL and BOWL, the SNCBs and MSS agreeing the parameters which were most appropriate when predicting the levels of impact that MORL and BOWL were likely to have on the bird populations. The common currency allowed numbers to be generated for collision and displacement effects for each species of concern giving a cumulative impact from the two developments. The results of the common currency approach and the supporting explanation of how each factor was appraised is provided in Appendix 1 & 2 of this assessment.

The species for which a common currency has been calculated are:

- Great black-backed gull from ECC SPA;
- Herring gull from ECC SPA;
- Puffin from ECC and NCC SPA;
- Guillemot from ECC SPA; and
- Razorbill from ECC SPA.

Background information on the bird species considered in this assessment can be found at <http://seabird.wikispaces.com/>

East Caithness Cliffs SPA – great black-backed gull

The common currency estimated that the MORL WCS of 339 WTGs in combination with the BOWL Most Likely Scenario (“MLS”) of 140 WTGs would result in an additional mortality due to collision of 14.82 (8.62 from BOWL and 6.20 from MORL) great black-backed gulls of all ages (appendix 1 – collision risk cell c45) or 3.95 (2.01 from BOWL and 1.94 from MORL) breeding birds (appendix 1 – collision risk cell e46). The SNCBs advice on appropriate thresholds was based primarily on use of PBR. They recommended that integrity would be maintained if the impact was to be no more than 6 breeding adults each year. This is based upon a recovery factor (f) of 0.3. PBR outputs are sensitive to the recovery factor, and the setting of f is a conservation management decision. The SNCBs also advised that use of ABC should be based upon a P value for the management objective that was “highly unlikely”, i.e. a P of 0.925.

MSS advice (received on 31st October 2013) using ABC, was that site integrity would be maintained if the impact was approximately 10 birds (of all age classes). This was a precautionary threshold based on the BOWL PVA threshold of 15 (equating to 15 birds of all ages) and the MORL PVA threshold of 13 (which owing to the design of the MORL PVA equates to 20 birds of all ages). This ABC calculation was based upon a baseline probability of any population decline over the 25 year period of 0.78 i.e. a precautionary application of the IPCC likelihood bands.

The choice of a P value of 0.78 limited the potential increase in probability of decline in response to potential concerns that the demographic data used in the model may not reflect current conditions. MSS advice in relation to use of the PBR model is that the impact should be no more than 10 breeding adults. This is based

upon a recovery factor of 0.5 and consideration that the population is thought to be at, or possibly slightly above, its carrying capacity.

MS-LOT concludes, after taking into account all the advice provided above, for great black-backed gull at ECC SPA, that the MORL WCS and BOWL MLS will not adversely affect site integrity if cumulative mortality is no more than 11 birds of all age classes. This is considered to be precautionary in that the number is below the thresholds estimated using the precautionary application of the ABC tool applied to both the BOWL and MORL population models (15 and 20 respectively). This figure is also well below that advised by the SNCBs in that it relates to all birds, whereas the SNCBs figure of 6 relates to breeding adults only which would equate to significantly more than 11 birds of all age classes (MSS have estimated that 6 breeding birds equates to between 19 and 25 birds of all age classes depending on whether the MORL or BOWL population model is used).

The identified threshold of 11 has been split between BOWL and MORL, the MORL threshold has been set at 4 great black-backed gull and the BOWL threshold has been set at 7. The common currency estimate for MORL of 6.20 collisions was based on the WCS of 339 WTGs, the reduction in the number of WTGs being recommended for consent for MORL from 339 to 186 will ensure that their threshold of 4 is not exceeded. The common currency estimate was already based on the BOWL MLS of 140 WTGs, and the estimated collisions from BOWL was 8.62 (which is greater than the BOWL threshold of 7). BOWL, due to its closer proximity to the ECC SPA, will have the greatest impact on great black-backed gull and therefore a condition will be required on the BOWL consent to ensure that impacts are within acceptable limits and to ensure that the proposed development will not adversely affect site integrity. This condition restricts the numbers of WTGs to 125. If BOWL wish to exceed this number up to a maximum of 140 WTGs then the exact parameters must be agreed with the Scottish Ministers to ensure that the predicted collisions of great black-backed gulls are within the acceptable threshold. This will be accomplished by running the proposed parameters through an agreed collision risk model prior to authorisation.

East Caithness Cliffs SPA – Herring gull

The cumulative collision estimate from the common currency is approximately 32 individuals of all age classes (appendix 1 – collision risk cell c47). This is safely within thresholds of acceptable change identified using ABC tool and/or PBR method. The PBR threshold advised by the SNCBs is 43 breeding birds using a f value of 0.3. The ABC threshold using a P value of 0.78, is 600 birds of all age classes (c. 70 adults) using the BOWL model and 170 of all age classes (c. 100 adults) using the MORL model. MSS agree with the conclusions provided by the SNCBs, and MS-LOT also concludes that the BOWL and MORL proposal will **not adversely affect site integrity**.

East Caithness Cliffs and North Caithness Cliffs SPAs – Puffin

Establishing thresholds for puffin

The SNCBs have provided advice on appropriate thresholds based primarily on use of PBR. Original advice from 8th July and 29th October 2013 was based on a PBR calculation for each SPA. The October advice provided a threshold of up to 7 breeding adult mortalities for ECC SPA using a *f* value of 0.3, and 341 breeding adult mortalities for NCC SPA using a *f* value of 0.5. The SNCBs advice on the *f* value was based on trend information at the colonies. Subsequent to this advice uncertainties arose about the population sizes of the ECC and NCC SPAs at time of designation and the subsequent trends. The citations state that both sites supported populations of 1750 at time of designation. This is considered unlikely to be accurate and a combined population of 3500 at time of designation is considered more reliable. To address this issue the SNCBs provided advice on 17th January 2014 based on use of PBR applied to a combined population of both sites. This provided a combined threshold of 212-354 breeding adult mortalities based on using an *f* value range of 0.3-0.5, and a joint SPA population estimate of 7345 pairs (from the seabird 2000 count). The SNCBs advised that this joint assessment addresses the requirements under the Habitats Regulations.

In relation to use of thresholds of change to the combined ECC and NCC SPAs population, MSS advise that:

- The population estimates and trends for puffin at all sites considered in this assessment have considerable uncertainty associated with them. The estimates used by the SNCBs in their recommendation to undertake a combined assessment of both SPAs are the most appropriate.
- Application of the ABC tool to the BOWL and MORL population model outputs should be based upon a *P* value of 0.5 as the model forecasts are considered to be representative of trends.
- Application of the ABC tool to the BOWL PVA outputs for ECC and NCC results in thresholds of c.50 and c.850 displaced pairs respectively.
- Application of the ABC tool to the MORL PVA outputs for ECC and NCC results in thresholds of 140 and >2000 displaced adults respectively.
- Application of the ABC tool to the PVA outputs for ECC and NCC combined results in cumulative thresholds of c.900 displaced pairs and >2140 displaced adults respectively.
- The BOWL population model's assumption (based on the SNCBs advice) that each displaced individual equates to a pair that fails to breed successfully is overly precautionary (this is reflected in the lower ABC threshold values). The MORL model assumes displaced individuals belong to the same pair as other displaced individuals, which represents the upper limit of what is ecologically realistic. Overall thresholds based on the BOWL outputs can be considered at the lower limit of the range and those of MORL as the upper limit.

Estimating the effect upon puffin

The effects were estimated using the common currency approach. The estimate

provided a metric of individuals displaced, which for the purposes of assessing against a PBR threshold resulted in an additional step of conversion to adult mortality. In their advice of 17th January 2014, the SNCBs assumed that 99% of the effect from the MORL proposal was apportioned to ECC and NCC combined. The SNCBs estimated the combined effect as being 199 breeding adult mortalities. Following the SNCBs draft guidance on apportioning, as has been done with BOWL's effects, results in approximately 25% of the effect being apportioned to non-SPA colonies in the Pentland Firth area. MSS applied the SNCBs draft guidance on apportioning (see Appendix 1) and estimate that 483 displaced individuals should be apportioned to NCC from the MORL and BOWL developments combined. Using the SNCBs conversion factor this equates to 137 breeding adult mortalities at NCC.

Summary table comparing estimated puffin effects with identified thresholds:

	Effects	PBR	PVA & ABC
ECC	79 individuals displaced converted to 23 breeding adult mortalities	7-13 breeding adult mortalities	Between ~ 50 pairs and 140 individuals failing to breed
NCC	483 individuals displaced converted to 137 breeding adult mortalities	205 - 341 breeding adult mortalities	Between ~ 850 pairs and > 2000 individuals failing to breed
ECC/NCC combined	562 individuals displaced converted to 159 breeding adult mortalities	212 - 354 breeding adult mortalities	Between ~ 900 pairs and > 2140 individuals failing to breed

MSS advice is that the manner in which displacement effects have been quantified is highly precautionary for the following reasons:

- It has been assumed that 100% of displaced birds fail to breed successfully (outputs from the Centre for Ecology and Hydrology ("CEH") seabird displacement model indicate that this is a significant over estimate).
- The assumption that each displaced bird represents a discrete pair i.e. 1 displaced bird = 1 failed pair. This is unlikely and so represents an extreme view.
- The near doubling in WTG spacing resulting from BOWL's move from WCS of 277 WTGs to MLS of 140 WTGs has not been accounted for in the proportion of birds being displaced or the percentage of pairs failing to breed successfully. Nor has recent confirmation from MORL that the maximum number of WTGs has been reduced from 339 to 186 been considered. This would result in an increase in spacing and/or reduction in area occupied by WTGs. Evidence from Holland (Leopold et al 2012) suggests that displacement effects are greater in wind farms with higher turbine density i.e. smaller inter-turbine spacing, and the mitigating effects of increased turbine spacing is acknowledged in the SNCBs recommendations of 19th December 2013.
- Habituation of birds to the presence of WTGs during the 25 year life of the wind farms has not been considered.

- Evidence as summarised by MacArthur Green's Review of Evidence of Seabird Displacement from Offshore Windfarms (Oct, 2013) suggests that the displacement rate of 60% applied to the auk species is likely to be an overestimate.
- Birds on the water and in flight have both been assumed to be displaced and therefore fail to breed successfully.
- The mean seasonal peak abundance, rather than the mean abundance estimates have been used.

MSS advise that adopting a number of additional assumptions and further, more precise, quantification would reduce the estimated effects substantially. This has not been done, as MSS do not consider the additional quantification would substantively change the advice in relation to the overall conclusions.

Conclusion of puffin assessment

The population estimates underpinning the assessment methods used should be regarded as indicative. Although best available evidence has been used throughout, the inherent uncertainties are sufficiently great that the precise estimates of the effects and the acceptable thresholds should not be considered as absolute values. It is, however, reasonable to consider the lower calculated thresholds of acceptable change as being underestimates, and the estimated effects as being overestimates.

Following the SNCBs advice, overall conclusions in relation to site integrity should be based upon the population estimate for ECC and NCC combined. The SNCBs conclude that the BOWL and MORL WCSs will **not adversely affect site integrity** based upon their application of PBR to set a threshold and conversion of the PBR value to an "equivalent" productivity value. MSS have used the PVA models to assess effects on productivity and taken account of the precautionary nature of the estimation of the magnitude of effects. MSS advise that the estimated effects are typically within the range of values used to estimate the acceptable thresholds. A reasonable interpretation of best available evidence leads MSS to conclude no adverse effect on site integrity based upon the number of birds displaced and the thresholds described above.

MS-LOT are satisfied that the best available evidence has been used by the advisors in formulating their advice and consider, having assessed all the evidence provided and taking into account the reduction in design envelopes, that whilst it is clear that puffin as a SPA qualifying interest, appears the most sensitive to the displacement effect. MS-LOT concludes, taking into account the justification detailed above, that the MORL and BOWL MLSs will **not adversely affect site integrity based upon the current number of birds estimated to be displaced.**

East Caithness Cliffs SPA – Guillemot

In their advice dated 8th July 2013 the SNCBs advised that the PBR outputs indicate that based on an *f* value of 0.1-0.3 the population could sustain an additional annual mortality of 563-1689 breeding adults per year. The common

currency indicated that 3448 guillemots from this population may be displaced by both projects in combination. The SNCBs concluded in their advice dated 29th October 2013 that this figure lies within the acceptable thresholds predicted by PBR method and the ABC tool. MSS advised that they were in agreement with the conclusion. MS-LOT concludes that the MORL and BOWL developments will **not adversely affect site integrity**.

East Caithness Cliffs SPA – Razorbill

In their advice dated 8th July 2013 the SNCBs advised that the PBR outputs indicate that the population could sustain an additional annual mortality of 111-334 breeding adults per year. The common currency indicated that 822 razorbills from this population may be displaced by both projects in combination. The SNCBs advised on 29th October 2013 that the 822 birds displaced equated to approximately 339 adult mortalities. This figure is slightly higher than the PBR threshold advised by the SNCBs (based on an f value of 0.1-0.3), however the SNCBs also noted the precaution within the assumption regarding each displaced individual equating to a failed breeding pair and that the threshold is only marginally exceeded. The SNCBs concluded no adverse effect on site integrity. The figure also lies within the acceptable thresholds calculated by the ABC tool. MSS advised that they were in agreement with the conclusion. MS-LOT concludes that the MORL and BOWL developments will **not adversely affect site integrity**.

East Caithness Cliffs SPA and North Caithness Cliffs SPA – Northern Fulmar

In their advice dated 8th July 2013 the SNCBs advised that the PBR outputs using an f value of 0.3-0.5 indicate that the ECC SPA population could sustain an additional annual mortality of 190-317 breeding adults per year and the NCC SPA population could sustain an additional annual mortality of 187-312 breeding adults per year. No fulmar were observed flying at collision risk height (20-200m) in the MORL EDA (refer to section 4.1.6 of technical Appendix 4.5A of the MORL ES). For the BOWL WCS, the SNCBs estimated there would be ~5 collisions of breeding adults during the breeding season and ~23 collisions in the non-breeding season. The SNCBs used their (draft) apportioning method to consider how many of the estimated collisions should be assigned against each SPA population. This indicates that ~83% of the impact will be to the fulmar population of ECC SPA and ~11% to the population of NCC SPA. The SNCBs concluded that neither wind farm alone, or in combination, would affect the long-term maintenance of fulmar as a viable component of either SPA. MSS advised that the magnitude of the effects are sufficiently minor to safely conclude no adverse effect to integrity on a qualitative basis. MS-LOT concludes that the MORL and BOWL developments will **not adversely affect site integrity**.

East Caithness Cliffs SPA and North Caithness Cliffs SPA – Black-legged kittiwake

In their advice dated 8th July 2013 the SNCBs advised that the PBR outputs using

an f value of 0.1- 0.3 indicate that the ECC SPA population could sustain an additional annual mortality of 467-1400 breeding adults per year and the NCC SPA population could sustain an additional annual mortality of 117-352 breeding adults per year. The estimate for the MORL EDA is in the order of ~70 collisions of breeding adults during the breeding season and a further 26 collisions of SPA birds during the non-breeding season. Using their (draft) approach to apportioning, the SNCBs considered how many of the estimated collisions should be assigned against each SPA population. This indicates that ~95% of the impact will be on kittiwakes from the ECC SPA and ~3% on those from the NCC SPA. At these levels, it is clear that neither wind farm alone, or in combination, will affect the long-term maintenance of kittiwake as a viable component of either SPA. MSS advised that the magnitude of the effects are sufficiently minor to safely conclude no adverse effect to integrity on a qualitative basis. MS-LOT concludes that the MORL and BOWL developments will **not adversely affect site integrity**.

North Caithness Cliffs SPA – Guillemot

In their advice dated 8th July 2013 the SNCBs advised that the PBR outputs assuming a recovery factor of 0.1- 0.3 indicate that the NCC SPA population could sustain an additional annual mortality of 248-745 breeding adults per year. The combined developments are predicted to displace 332 birds from this population which is within the range of the PBR. The SNCBs concluded no adverse effect on site integrity. MSS advised that they were in agreement with the conclusion based on application of the ABC tool. MS-LOT concludes that the MORL and BOWL developments will **not adversely affect site integrity**.

North Caithness Cliffs SPA – Razorbill

In their advice dated 8th July 2013 the SNCBs advised that the PBR outputs assuming a recovery factor of 0.1-0.3 indicate that the NCC SPA population could sustain an additional annual mortality of 15-46 breeding adults per year. The 2 developments are predicted to displace 22 birds from this population which is within the range of the PBR. The SNCBs concluded no adverse effect on site integrity. MSS advised that they were in agreement with the conclusion based on application of the ABC tool. MS-LOT concludes that the MORL and BOWL developments will **not adversely affect site integrity**.

Hoy SPA – Puffin

In their advice dated 8th July 2013 the SNCBs advised that the PBR outputs assuming a recovery factor of 0.1-0.3 indicate that the Hoy SPA population could sustain an additional annual mortality of 4-12 breeding adults per year. The combined MORL and BOWL developments are predicted to displace 13 birds. The SNCBs advised that although these figures are just above the threshold there will be no adverse effect on site integrity as the PBR method has been used in a precautionary manner for considering the effects of displacement. MSS advised that they were in agreement with the conclusion based on application of the ABC

tool. MS-LOT concludes that the MORL and BOWL developments will **not adversely affect site integrity**.

Hoy SPA – Arctic Skua

In their advice dated 8th July 2013 the SNCBs advised that they agreed with the conclusions reached in both the BOWL SEIS and the MORL ES, that there would be no adverse effect on site integrity (see [appendix 4.5A, volume 10 of the MORL ES](#) and [annex 3B, volume 4 of the BOWL SEIS](#)). MS-LOT concludes (based on the SNCBs advice) that the MORL and BOWL developments will **not adversely affect site integrity**.

Hoy SPA – Great Skua

In their advice dated 8th July 2013 the SNCBs advised that they agreed with the conclusions reached in both the BOWL SEIS and the MORL ES that there would be no adverse effect on site integrity (see [appendix 4.5A, volume 10 of the MORL ES](#) and [annex 3B, volume 4 of the BOWL SEIS](#)). MS-LOT concludes (based on the SNCBs advice) that the MORL and BOWL developments will **not adversely affect site integrity**.

Other In-Combination Impacts

When considering other projects to include in the in-combination assessment, MS-LOT have included projects which have already been given consent, where LSE has been identified on the same qualifying interests and protected sites as the BOWL and MORL proposal. Sufficient information on projects at earlier stages of the consenting process is not available to usefully inform quantitative assessment. The AAs completed for these early stage projects will consider the in-combination effects with BOWL and MORL before any consent is granted.

Therefore, MS-LOT considered the in-combination impacts with the MeyGen Phase 1 development. This is a tidal array located within the Inner Sound, Pentland Firth (approximately 40 km from the Moray Firth developments). Although consent is for a 61 turbine, 86 MW array, the first phase is limited to a maximum of 6 turbines through conditions attached to the consent. MeyGen was identified as having LSE on all the qualifying features from the sites above excluding herring gull and great black-backed gull. The AA concluded that the MeyGen development would **not adversely affect site integrity of any site** because of the minimal impacts from displacement and disturbance during construction. For some species collision risk with the tidal turbines was identified as a theoretical issue; however the limit of the first phase to 6 turbines will mitigate this. A further AA for additional phases of the MeyGen development will be required prior to consent being determined and this will evaluate the in-combination impacts from these additional phases with BOWL and MORL. **MS-LOT concludes that the BOWL development and MORL proposal in-combination with MeyGen will not adversely affect site integrity of the protected sites above.**

SACs

Dornoch Firth & Morrich More SAC – Common seal

A common seal [impact assessment framework](#) has been developed for the Moray Firth Offshore Wind Developers Group (“MFOWDG”). This framework considers whether any noise (and other) impacts to individuals would result in population level effects. These effects are all based on the assumption that disturbance will affect breeding success. No direct mortality is predicted as a result of construction.

As presented by BOWL and MORL in their ESs (see [appendix 7.3A, volume 10 of the MORL ES](#) and [annex 12B, volume 4b of the BOWL ES](#)), the framework makes a base assumption that noise and other impacts from wind farm construction will reduce the breeding success of the common seal population to zero for the duration of construction. While this results in population-level effects during wind farm construction (a construction phase of up to 6 years for BOWL and MORL together), the population is predicted to recover in the long-term once this construction is complete. The modelling is for a ‘worst case’ that considers the construction impacts of both developments together on common seals.

The framework assessment demonstrates that disturbance from underwater noise from wind farm construction will not result in any long-term effects on the common seal population. The relevant conservation objective to consider is the maintenance of the common seal population as a viable component of a SAC. This encompasses any significant disturbance to individuals while they are out with the SAC, such as underwater noise impacts arising from wind farm construction.

Advice from the SNCBs and MSS is that this framework constitutes an appropriate approach to impact assessment for common seals. It sets out a process for considering the outcomes of noise disturbance and behavioural displacement as a reduction in the individual fitness of animals and then models the consequences of this for the population, using reproductive success as the key parameter that is affected. Key areas of scientific uncertainty are highlighted, including their significance to the assessment framework. The SNCBs advised that disturbance from underwater noise will not result in any long-term effects on the common seal population and that the MORL and BOWL developments would **not adversely affect site integrity provided that the conditions listed in 3d are complied with.**

In-Combination Impacts

The potential for in-combination effects with port developments in the inner Moray Firth was suggested in the MORL ES but not taken any further because at the time of their submission there were too few details about what work would be undertaken. Three proposals are now at different stages in the planning system; at Nigg (Global Energy Nigg), Ardersier (Port of Ardersier Limited) and Invergordon (the Cromarty Firth Port Authority). The development at Ardersier is the only one within 50 km of the Dornoch Firth and Morrich More SAC, and has applied to the Scottish Ministers only to use vibro-piling, which is not predicted to impact upon common seals.

Further discussions have been underway regarding the potential for corkscrew injuries to harbour seals from construction and operation of the port at Ardersier. MSS currently do not have enough information to be able to make a quantitative assessment of the likely numbers of animals affected because the mechanism by which these injuries occur is not known. Discussions surrounding Ardersier have centred on increased monitoring to detect whether seals using that area are in fact impacted through these corkscrew injuries. Much of the concern has centred around vessels using the port once it is operational, which is not a regulated activity. There have been a small number of reports of corkscrew seals in the inner Moray Firth, but the area is not considered to be a hotspot for this currently (Thompson et al. 2013).

Having considered advice from the SNCBs and MSS, MS-LOT concludes that the MORL proposal and BOWL development alone, and in-combination with other regulated activities, will not adversely affect the integrity of the Dornoch Firth & Morrich More SAC.

Moray Firth SAC – Bottlenose dolphin

Summary conclusion

The principal conservation objective to consider is the maintenance of the bottlenose dolphin population as a viable component of the Moray Firth SAC. This encompasses any significant disturbance to individuals while they are outside the SAC, such as underwater noise impacts arising from wind farm construction. More qualitative consideration is given to other conservation objectives.

MORL and BOWL have modelled potential underwater noise impacts to bottlenose dolphins during construction. Predicted zones of disturbance from the noisiest construction activities (associated with pile-driving the turbine foundations) could slightly extend into areas used by bottlenose dolphins transiting along the coast in the Moray Firth: this is for a 'worst case' of piling activity at MORL and BOWL wind farm sites together (see [appendix 7.3F, volume 10 of the MORL ES](#) and [annex 7A, volume 4a of the BOWL ES](#)).

Further modelling of whether any resulting disturbance to individuals could lead to population level effects was undertaken (see [appendix 7.3A, volume 10 of the MORL ES](#) and [annex 6A, volume 4 of the BOWL SEIS](#)). This concludes that there are no long-term effects from underwater noise disturbance on the bottlenose dolphin population of the Moray Firth SAC. As such the MORL and BOWL developments will **not adversely affect site integrity of the Moray Firth SAC**. Conditions to further mitigate the effects of noise are identified in Section 3(d).

In-combination effects

The potential for in-combination disturbance to bottlenose dolphin from construction activities associated with the Forth and Tay offshore wind developments has not been included in this assessment, but will be included in the AA of those projects. The modelling work for the Forth and Tay developments is

still being considered and MS-LOT are awaiting advice from the SNCBs on the predicted impacts, therefore MS-LOT do not consider it appropriate to assess the in-combination impacts in this AA.

The potential for disturbance from, for example, the installation of export cable routes, may if necessary be managed through construction programming for BOWL and for MORL.

Other developments have been identified as having LSE on bottlenose dolphins from the Moray Firth SAC:

1. Aberdeen Bay Offshore Wind Farm - Installation and operation of a European Offshore Wind Deployment Centre consisting of 11 turbines, inter-array and export cables. To be located 2-4.5 km off the coast at Blackdog, Aberdeenshire, and likely to be constructed in 2016-2017. The licensee predicts that the installation of the 11 turbines will take place over a period of approximately 2 weeks and at most 4 turbines might be installed using piling techniques. A section 36 consent has been issued. The AA completed for the proposal concluded that it would **not adversely affect site integrity of the Moray Firth SAC**.

2. Global Energy Nigg Ltd ("GEN") : South quayside proposal, Nigg – The south quayside extension will comprise of a solid berthing structure, with structural steel combi sheet piles forming the external perimeter and in-filled with material dredged from the seabed local to the proposed works. Most of the piling will be undertaken with vibro-piling and the remainder undertaken through impact piling. The construction will extend the south quayside some 135m to 155m into the adjacent Cromarty Firth, and provide an additional 750m to 800m of berthing facilities for vessels. In addition, a new frontage replacing the existing quayside will be constructed from interlocking structural steel piles, with this repair extending some 5m into the adjacent Cromarty Firth. The enclosed berthing area will be dredged to an approximate depth of -10m Chart Datum, with the approach to the new quayside also typically dredged to -10m Chart Datum. Locally, and approximately mid-length along the outer perimeter of the new quayside, an area will be dredged to -16m Chart Datum. The dredge burden associated with the south quayside extension amounts to approximately 240,000m³ - 250,000m³. Dredge material is targeted for offshore disposal at the long established disposal ground at the "Sutors". The marine licence for this development has recently been issued and work is expected to commence imminently. The AA for the proposal concluded that it would **not adversely affect site integrity of the Moray Firth SAC**.

3. CFPA: Berth development, Invergordon

The proposal involves the construction of an additional deep water berth and lay-down area by widening of the existing finger of the Queen's Dock and construction of a 150m berth structure for the south end of the finger. The project involves dredging of approximately 20,000 – 25,000m³ with disposal at "Sutors"; vibro and impact piling; 3.48 hectares of land reclamation and block paving. Construction works are provisionally scheduled to begin in March 2014. The marine licence for this development has recently been issued. The AA for the proposal concluded that it would **not adversely affect site integrity of the Moray Firth SAC**.

4. POAL: Port development, Ardersier

The proposal involves the construction of new deep water quay facilities and an associated dredged access channel. The new quay wall will comprise of a combi-wall construction, a combination of tubular and sheet piling, driven to the required design depth. All piling works are to take place using vibro-piling techniques. Dredge depth of the new access channel will be in the region of -8.5 m Chart Datum. The amount of material from the capital dredge will be in the region of 2,000,000m³. Proposals for the use of this material are currently under consideration and are likely to involve all, or the vast majority of the dredge material, being brought ashore. The details of the method of construction are not known at this time. Dredging was provisionally scheduled to commence in September 2013, but at the current time a revision to the marine licence application is pending.

Details of assessment

The conservation objectives for the Moray Firth SAC in relation to the bottlenose dolphin feature are stated as follows:

“To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and

To ensure for the qualifying species that the following are established then maintained in the long term:

- (i) Population of the species as a viable component of the site*
- (ii) Distribution of the species within site*
- (iii) Distribution and extent of habitats supporting the species*
- (iv) Structure, function and supporting processes of habitats supporting the species*
- (v) No significant disturbance of the species”*

The proposals under discussion may potentially affect objectives (i), (ii) and (v) and these points are addressed below.

MSS advice on assessment

a) Reference population

The SNCBs advice is that the relevant population unit for bottlenose dolphins is the “Coastal East Scotland” unit, which extends to 12 nm, from the north coast of the Scottish mainland (including Orkney) to the border with England (UK SNCRB 2013). This is because there is strong evidence of a large degree of connectivity between animals in the SAC and animals regularly using other areas, extending to the Forth.

This is consistent with the approach taken in relation to other proposals (e.g. offshore wind farms, seismic surveys, harbour maintenance works) where assessments are routinely made at the whole east coast population scale.

b) Level of effect

Consideration has been made of the combined effects of all the projects in the Moray Firth that are considered by Lusseau (2013), and previously considered for the Moray offshore wind farms alone under the Habitats Regulations Appraisal (“HRA”) and EIA process. The most up to date assessment is the one by Lusseau, and more than 50% (i.e. the median) of model runs in that assessment returns to baseline after 5 or 6 years when the whole east coast population was considered. Based on the results of noise modelling presented in MORL’s ES and BOWL’s SEIS, it is not considered likely that construction operations will cause direct disturbance to dolphins within the SAC. MSS therefore conclude that there will be no effect on the distribution of bottlenose dolphins within the site. It is likely that dolphins using the south coast of the Moray Firth, closer to the development than the SAC, will receive noise levels sufficient to cause some disturbance. However, noise propagation modelling presented by the developers shows that in coastal areas, the predicted noise level does not breach 75 dB_{ht} (*Tursiops truncatus*). At this level, most individuals in a population are expected to exhibit a mild avoidance response. Such a response would not be considered to be significant and MSS therefore conclude that there will be no significant disturbance of bottlenose dolphins. Based on these assessments, MSS have advised that the combined effects from these projects will not have an adverse effect on site integrity, subject to the adoption of appropriate mitigation measures.

The SNCBs have advised that impacts arising from the offshore wind farms in the Moray Firth will **not adversely affect site integrity**.

c) Mitigation and monitoring

It is likely that bottlenose dolphins will experience disturbance as a result of each project independently, and cumulatively. Developers should therefore take steps to mitigate this where possible. Cetacean (and in particular bottlenose dolphin) absence from the area prior to piling should be monitored both visually and acoustically.

Monitoring of both noise levels and bottlenose dolphin responses to the noise should be undertaken to confirm the assessment of the extent to which dolphins may be disturbed and to improve the knowledge base to inform future licensing decisions. This should preferentially be undertaken with acoustic methods for detecting dolphins, since they will provide greater power to detect change than visual methods (e.g. Thompson et al. 2013).

MS-LOT concludes that BOWL and MORL in-combination with the projects already consented, namely – Aberdeen Bay Offshore Wind Farm, GEN South Quayside, Nigg and CFPA berth development, Invergordon – will not adversely affect the site integrity of the Moray Firth SAC with respect to bottlenose dolphins. The assessment framework for the Moray Firth wind farms shows no long-term impacts, as does the Lusseau assessment of Nigg combined with the Moray Firth wind farms. In addition the consents issued for Nigg, Invergordon and Aberdeen Bay contain several conditions to mitigate the impacts.

Moray Firth SAC – subtidal sandbanks

Concerns had been raised by the SNCBs over the dredging and disposal of sediments which would be required if gravity bases were to be used as foundations. MS-LOT has agreed with both BOWL and MORL that if these foundations are to be used this will be subject to a further marine licence application to cover the dredging and disposal, and any impacts will be assessed in the AA for these applications. The SNCBs have welcomed this approach and concluded that in relation to the current project there would be no adverse effect on site integrity for habitat interests. **MS-LOT concludes (based on the SNCBs advice) that the MORL proposal and BOWL development will not adversely affect the site integrity of the Moray Firth SAC with respect to subtidal sandbanks.**

Atlantic Salmon SACs

Berriedale & Langwell Waters, River Moriston, Spey, Oykel, Thurso, Borgie, Dee and Naver

The relevant conservation objective to consider is whether or not the wind farm proposals in the Moray Firth would alone, or in combination, result in any impacts on the viability of Atlantic salmon populations supported by the above SACs.

Due to the closer proximity to shore of the BOWL development the SNCBs advised that impacts from BOWL were likely to be greater than impacts from MORL. Also the BOWL cable comes ashore close to mouth of the River Spey SAC.

It is considered that **underwater noise** from piling foundations for WTGs and OSPs would be the most significant effect. However, due to lack of knowledge concerning migratory movements of Atlantic salmon in Scottish waters, and the effects of underwater noise on Atlantic salmon behaviour, it is not considered feasible to ascertain whether any noise disturbance to individual salmon could result in population level change at SACs. It should be noted that these knowledge gaps could not reasonably be remedied by scientific research for the purpose of these applications. It is considered feasible to avoid adversely affecting site integrity of any sites by agreement of working practice and mitigation that relate to the effects via conditions on any consents, as follows:

1. Soft start for piling work could be expected to help mobile fish move out of the area and thereby assist in mitigating against noise disturbance to individuals during construction.
2. Piling schedules and construction programmes should be further discussed, post-consent, between MS-LOT, MSS, the Association of Salmon Fishery Boards (“ASFB”), the SNCBs and developers, once WTG layouts, numbers and foundation choices have been confirmed. It is noted that the zone of predicted noise impacts for Atlantic salmon is based on a ‘worst case’ scenario which may not occur.
3. Strategic monitoring and research will help to improve the knowledge base on salmon population ecology and migratory movements in Scottish waters and may help inform mitigation proposals.

The installation of the export cables close to shore could take a matter of days so that mitigation, or avoidance, of impacts to smolts could be possible by timing the work to avoid peak smolt runs (if the timing of these can be established). This mitigation should be progressed in post-consent discussions between MS-LOT, MSS, the ASFB, the SNCBs and developers. In relation to potential cumulative impacts arising from the **EMF** around intra-array and export cables, proposed mitigation to shield / bury cables will help to reduce EMF. For Atlantic salmon, it is recommended that deeper burial depth or directional drilling removes the risk of any operational effect (the SNCBs advised up to 3m, where possible) i.e. for export cables in shallower water approaching landfall (water depths of up to ~20m). Where cable burial or directional drilling is not possible, rock armouring or a similar protective layer should be considered.

It is considered that potential impacts from cable installation can be reduced or avoided and that while there may be some noise disturbance to individual salmon, the effects do not risk the integrity of SAC populations; but do merit further research and quantification. The SNCBs have advised that operational noise will not result in likely significant effects to salmon.

Having considered advice from the SNCBs and MSS, MS-LOT concludes that the BOWL development and MORL proposal, in combination or individually, will not adversely affect site integrity of these eight SACs with respect to Atlantic salmon provided that conditions detailed in 3d are complied with.

In-combination Impacts

MS-LOT has also considered the in-combination impacts with the MeyGen Phase 1 development. MeyGen was identified as having LSE on the qualifying features from the river SACs identified above. The AA concluded that the MeyGen development **will not adversely affect site integrity** if conditions designed to reduce impacts were adhered to. Collision risk with the tidal turbines was identified as an issue; however the limit of the first phase to 6 turbines will mitigate this. **MS-LOT concludes that the BOWL development and MORL proposal in-combination with MeyGen will not adversely affect site integrity of the protected sites above with respect to Atlantic salmon provided that the conditions detailed in section 3d are complied with.** A further AA for additional phases of the MeyGen development will be required prior to any consent being determined. This will evaluate in the in-combination impacts from these additional phases with BOWL and MORL.

Due to the limited knowledge surrounding Atlantic salmon migration routes and behaviour there is some uncertainty regarding the natal rivers that potentially affected Atlantic salmon belong to. For the purposes of this assessment, MS-LOT have followed the advice of the SNCBs and consider that in showing that the proposed developments will not adversely affect site integrity for the rivers closest to the developments, this addresses Natura concerns which other consultees may have regarding further afield River SACs.

Freshwater Pearl Mussel SACs

River Evelix, Moriston, Oykel, Spey, Borgie, Dee and Naver

Potential indirect impacts to FWPM populations will be addressed via mitigation to avoid adverse impacts to Atlantic salmon populations as outlined above. As there will not be population level effects to Atlantic salmon, nor significant effects to other salmonid species, the SNCBs advised that there will be no indirect effects on FWPM in the Rivers Evelix, Moriston, Oykel and Spey SACs.

Having considered advice from the SNCBs and MSS, MS-LOT concludes that the BOWL development and MORL proposal, in combination or individually, will not adversely affect site integrity of the seven River SACs with respect to the FWPM provided that the conditions detailed in section 3d are complied with.

In-Combination Impacts

MS-LOT have also considered the in-combination impacts with the MeyGen Phase 1 development and due to the reasons detailed above concludes that **the BOWL development and MORL proposal in-combination with MeyGen will not adversely affect site integrity of the protected sites above with respect to FWPM provided that the conditions detailed in section 3d are complied with.**

River Spey SAC – Sea Lamprey

The assessment considers the commitment from MORL and BOWL to adopt soft-start piling methods to help mitigate any noise disturbance during construction and burial of cables to reduce EMF during operation. These mitigation methods will further reduce impacts to individuals. The relevant conservation objective to consider is whether or not the proposed MORL and BOWL developments would result in any impacts on the viability of the sea lamprey population of the River Spey SAC. While there may be some level of noise disturbance to individuals during construction, and the potential for EMF to be detectable by sea lamprey, it is concluded that the MORL and BOWL developments will not adversely affect site integrity with respect to sea lamprey once the mitigation measures are incorporated. MS-LOT is satisfied that operational noise would not result in likely significant effects to sea lamprey.

Having considered advice from the SNCBs and MSS, MS-LOT concludes that the BOWL development and MORL proposal, in combination or individually, will not adversely affect site integrity of the River Spey SAC with respect to sea lamprey, either alone or in combination with other regulated activities provided that the conditions detailed in section 3d are complied with.

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In the light of the assessment, ascertain whether the proposal will not adversely affect the integrity of the site for the European interests. If SAC and/or SPA and/or Ramsar site, give separate conclusions. If conditions required, proceed to 3d.

The proposed Beatrice Offshore Wind Farm, in the Outer Moray Firth, will not adversely affect site integrity of the ECC SPA, NCC SPA, Hoy SPA, Dornoch Firth & Morrich More SAC, Moray Firth SAC, Berriedale & Langwell Waters SAC, River Evelix SAC, River Moriston SAC, River Oykel SAC, River Spey SAC, River Thurso SAC, River Borgie SAC, River Dee SAC and River Naver SAC, either alone or in combination with the MORL proposal, and other projects which have already been consented provided that the conditions detailed in section 3d are complied with.

3d. Conditions proposed.

Indicate conditions/modifications required to ensure adverse effects are avoided, & reasons for these.

<i>Condition:</i>	<i>Reason:</i>
<p>1.) The Company must, no later than 6 months prior to the Commencement of the Development, submit a Construction Programme ("CoP"), in writing, to the Scottish Ministers for their written approval. Such approval may only be granted following consultation by the Scottish Ministers with the JNCC, SNH, SEPA, MCA, NLB, RSPB Scotland, the Planning Authority and any such other advisors or organisations as may be required at the discretion of the Scottish Ministers. The CoP must be in accordance with the ES. The Development must, at all times, be constructed in accordance with the approved CoP (as updated and amended from time to time by the Company). Any updates or amendments made to the CoP by the Company must be submitted, in writing, by the Company to the Scottish Ministers for their written approval.</p> <p>The CoP must set out:</p> <ul style="list-style-type: none"> a. The proposed date for Commencement of Development; b. The proposed timings for mobilisation of plant and delivery of materials, including details of onshore lay-down areas; c. The proposed timings and sequencing of construction work for all elements of the Development infrastructure; d. Contingency planning for poor weather or other unforeseen delays; and e. The scheduled date for Final Commissioning of the Development. 	<p>To confirm the timing and programming of construction.</p>

<p>2.) The Company must, no later than 6 months prior to the Commencement of the Development submit a Construction Method Statement ("CMS"), in writing, to the Scottish Ministers for their written approval. Such approval may only be granted following consultation by the Scottish Ministers with the JNCC, SNH, SEPA, MCA, NLB, RSPB Scotland, the Planning Authority and any such other advisors or organisations as may be required at the discretion of the Scottish Ministers. The CMS must set out the construction procedures and good working practices for installing the Development. The CMS must be in accordance with the construction methods assessed in the ES and must include details of how the construction related mitigation steps proposed in the ES are to be delivered. The Development must, at all times, be constructed in accordance with the approved CMS (as updated and amended from time to time by the Company). Any updates or amendments made to the CMS by the Company must be submitted, in writing, by the Company to the Scottish Ministers for their written approval.</p> <p>The CMS must, so far as is reasonably practicable, be consistent with the DS, the EMP, the VMP, the NSP, the PS, the CaP and the LMP.</p>	<p>To ensure the appropriate construction management of the Development, taking into account mitigation measures to protect Natura interests.</p>
<p>3.) In the event that pile foundations are to be used, the Company must, no later than 6 months prior to the Commencement of the Development, submit a Piling Strategy ("PS"), in writing, to the Scottish Ministers for their written approval. Such approval may only be granted following consultation by the Scottish Ministers with the JNCC, SNH and any such other advisors as may be required at the discretion of the Scottish Ministers. The Development must, at all times, be constructed in accordance with the approved PS (as updated and amended from time to time by the Company). Any updates or amendments made to the PS by the Company must be submitted, in writing, by the Company to the Scottish Ministers for their written approval.</p> <p>The PS must include:</p> <ul style="list-style-type: none"> a. Full details of the proposed method and anticipated duration of pile-driving at all locations; b. Details of soft-start piling procedures and anticipated maximum piling energy required at each pile location; and 	<p>To mitigate the underwater noise impacts arising from piling activity</p>

- c. Details of mitigation and monitoring to be employed during pile-driving, as agreed by the Scottish Ministers.

The PS must be in accordance with the ES and reflect any surveys carried out after submission of the Application. The PS must demonstrate how the exposure to and / or the effects of underwater noise have been mitigated in respect of the following species: bottlenose dolphin; harbour seal; Atlantic salmon; cod; and herring.

The PS must, so far as is reasonably practicable, be consistent with the EMP, the PEMP and the CMS.

4.) The Company must, no later than 6 months prior to the Commencement of the Development, submit an Environmental Management Plan ("EMP"), in writing, to the Scottish Ministers for their written approval. Such approval may only be granted following consultation by the Scottish Ministers with the JNCC, SNH, SEPA, RSPB Scotland and any such other advisors or organisations as may be required at the discretion of the Scottish Ministers. The Development must, at all times, be constructed and operated in accordance with the approved EMP (as updated and amended from time to time by the Company). Any updates or amendments made to the EMP by the Company must be submitted, in writing, by the Company to the Scottish Ministers for their written approval.

The EMP must provide the over-arching framework for on-site environmental management during the phases of development as follows:

- a. all construction as required to be undertaken before the Final Commissioning of the Development; and
- b. the operational lifespan of the Development from the Final Commissioning of the Development until the cessation of electricity generation.

The EMP must be in accordance with the ES as it relates to environmental management measures. The EMP must set out the roles, responsibilities and chain of command for the Company personnel, any contractors or sub-contractors in respect of environmental management for the protection of environmental interests during the construction and operation of the

To mitigate the impacts on the Natura interests during construction and operation.

Development. It must address, but not be limited to, the following over-arching requirements for environmental management during construction:

- a. Mitigation measures to prevent significant adverse impacts to environmental interests, as identified in the ES and pre-consent and pre-construction surveys, and include the relevant parts of the CMS;
- b. Pollution prevention measures and contingency plans;
- c. Management measures to prevent the introduction of invasive non-native marine species;
- d. Measures to minimise, recycle, reuse and dispose of waste streams; and
- e. The reporting mechanisms that will be used to provide the Scottish Ministers and relevant stakeholders (including, but not limited to, the JNCC, SNH, SEPA, RSPB Scotland, MCA and NLB) with regular updates on construction activity, including any environmental issues that have been encountered and how these have been addressed.

The Company must, no later than 3 months prior to the Final Commissioning of the Development, submit an updated EMP, in writing, to cover the operation and maintenance activities for the Development to the Scottish Ministers for their written approval. Such approval may be given only following consultation with the JNCC, SNH, SEPA, RSPB Scotland and any such other advisors or organisations as may be required at the discretion of the Scottish Ministers. The EMP must be regularly reviewed by the Company and the MFRAG over the lifespan of the Development, and be kept up to date (in relation to the likes of construction methods and operations of the Development in terms of up to date working practices) by the Company in consultation with the MFRAG.

The EMP must be informed, so far as is reasonably practicable, by the baseline surveys undertaken as part of the ES and the PEMP.

5.) The Company must, no later than 6 months prior to the Commencement of the Development, submit a Vessel Management Plan ("VMP"), in writing, to the Scottish Ministers for their written approval. Such

To mitigate disturbance or impact to marine mammals and birds

approval may only be granted following consultation by the Scottish Ministers with the JNCC, SNH, and any such other advisors or organisations as may be required at the discretion of the Scottish Ministers. The Development must, at all times, be constructed and operated in accordance with the approved VMP (as updated and amended from time to time by the Company). Any updates or amendments made to the VMP by the Company must be submitted, in writing, by the Company to the Scottish Ministers for their written approval.

The VMP must include, but not be limited to, the following details:

- a. The number, types and specification of vessels required;
- b. Working practices to minimise the unnecessary use of ducted propellers;
- c. How vessel management will be co-ordinated, particularly during construction but also during operation; and
- d. Location of working port(s), how often vessels will be required to transit between port(s) and the site and indicative vessel transit corridors proposed to be used.

The confirmed individual vessel details must be notified to the Scottish Ministers, in writing, no later than 14 days prior to the Commencement of the Development, and thereafter, any changes to the details supplied must be notified, as soon as practicable, to the Scottish Ministers prior to any such change being implemented in the construction or operation of the Development.

The VMP must, so far as is reasonably practicable, be consistent with the CMS, the EMP, the PEMP, the NSP, and the LMP.

6.) The Company must, no later than 3 months prior to the Commissioning of the first WTG, submit an Operation and Maintenance Programme ("OMP"), in writing, to the Scottish Ministers for their written approval. Such approval may only be granted following consultation by the Scottish Ministers with the JNCC, SNH, SEPA, MCA, NLB, RSPB Scotland, the Planning Authority and any such other advisors or organisations as may be required at the discretion of the Scottish Ministers. The OMP must set out the procedures and

To safeguard Natura interests during operation of the offshore generating station.

good working practices for the operations and maintenance of the WTG's, substructures, and inter-array cable network of the Development. Environmental sensitivities which may affect the timing of the operation and maintenance activities must be considered in the OMP.

Operation and maintenance of the Development must, at all times, proceed in accordance with the approved OMP (as updated and amended from time to time by the Company). Any updates or amendments made to the OMP by the Company must be submitted, in writing, by the Company to the Scottish Ministers for their written approval.

The OMP must, so far as is reasonably practicable, be consistent with the EMP, the PEMP, the VMP, the NSP, the CaP and the LMP.

7.) The Company must, no later than 6 months prior to the Commencement of the Development, submit a Cable Plan ("CaP"), in writing, to the Scottish Ministers for their written approval. Such approval may only be granted following consultation by the Scottish Ministers with the JNCC, SNH, MCA and any such other advisors or organisations as may be required at the discretion of the Scottish Ministers. The CaP must be in accordance with the ES. The Development must, at all times, be constructed and operated in accordance with the approved CaP (as updated and amended from time to time by the Company). Any updates or amendments made to the CaP by the Company must be submitted, in writing, by the Company to the Scottish Ministers for their written approval.

The CaP must include the following:

- a. Details of the location and cable laying techniques for the inter array cables;
- b. The results of survey work (including geophysical, geotechnical and benthic surveys) which will help inform cable routing;
- c. Technical specification of inter array cables, including a desk based assessment of attenuation of electro-magnetic field strengths and shielding;
- d. A burial risk assessment to ascertain if burial depths can be achieved. In locations where this is not possible then suitable protection measures

To ensure Natura issues are considered for the location and construction of the inter array cables.

<p>must be provided;</p> <ul style="list-style-type: none"> e. Methodologies for over trawl surveys of the inter array cables through the operational life of the wind farm where mechanical protection of cables laid on the sea bed is deployed; and f. Measures to address exposure of inter array cables. <p>8.) The Company must, no later than 6 months prior to the Commencement of the Development, submit a Project Environmental Monitoring Programme (“PEMP”), in writing, to the Scottish Ministers for their written approval. Such approval may only be granted following consultation by the Scottish Ministers with the JNCC, SNH, RSPB Scotland, WDC, ASFB and any other ecological advisors as required at the discretion of the Scottish Ministers. The PEMP must be in accordance with the ES as it relates to environmental monitoring.</p> <p>The PEMP must set out measures by which the Company must monitor the environmental impacts of the Development. Monitoring is required throughout the lifespan of the Development where this is deemed necessary by the Scottish Ministers. Lifespan in this context includes pre-construction, construction, operational and decommissioning phases.</p> <p>Monitoring should be done in such a way as to ensure that the data which is collected allows useful and valid comparisons as between different phases of the Development. Monitoring may also serve the purpose of verifying key predictions in the ES. Additional monitoring may be required in the event that further potential adverse environmental effects are identified for which no predictions were made in the ES.</p> <p>The Scottish Ministers may agree that monitoring may cease before the end of the lifespan of the Development.</p> <p>The PEMP must cover, but not be limited to the following matters:</p> <ul style="list-style-type: none"> a. Pre-construction, construction (if considered appropriate by the Scottish Ministers) and post-construction monitoring surveys as relevant in terms of the ES and any subsequent surveys for: <ul style="list-style-type: none"> 1. Birds; 	<p>To ensure that appropriate and effective monitoring of the impacts of the Development is undertaken.</p>
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<p>2. Cod; 3. Herring; 4. Sandeels; 5. Diadromous fish; 6. Benthic communities; and 7. Seabed scour and local sediment deposition.</p> <p>b. The participation by the Company in surveys to be carried out in relation to marine mammals as set out in the Marine Mammal Monitoring Programme ("MMMP"); and c. The participation by the Company in surveys to be carried out in relation to regional and strategic bird monitoring.</p> <p>All the initial methodologies for the above monitoring must be approved, in writing, by the Scottish Ministers and, where appropriate, in consultation with the MFRAG. Any pre-consent surveys carried out by the Company to address any of the above species may be used in part to discharge this condition.</p> <p>The PEMP is a live document and must be regularly reviewed by the Scottish Ministers, at timescales to be determined by the Scottish Ministers, in consultation with the MFRAG to identify the appropriateness of on-going monitoring. Following such reviews, the Scottish Ministers may, in consultation with the MFRAG, require the Company to amend the PEMP and submit such an amended PEMP, in writing, to the Scottish Ministers for their written approval. Such approval may only be granted following consultation with MFRAG and any other ecological, or such other advisors as may be required at the discretion of the Scottish Ministers. The PEMP, as amended from time to time, must be fully implemented by the Company at all times.</p> <p>The Company must submit written reports of such monitoring surveys to the Scottish Ministers at timescales to be determined by the Scottish Ministers in consultation with the MFRAG. Subject to any legal restrictions regarding the treatment of the information, the results are to be made publicly available by the Scottish Ministers, or by such other party appointed at their discretion.</p> <p>9.) The Company must participate in any Moray Firth Regional Advisory Group ("MFRAG") established by the</p>	<p>To ensure effective environmental monitoring and</p>
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<p>Scottish Ministers for the purpose of advising the Scottish Ministers on research, monitoring and mitigation programmes for, but not limited to, ornithology, diadromous fish, marine mammals and commercial fish. Should a SSMEG be established, the responsibilities and obligations being delivered by the MFRAG will be subsumed by the SSMEG at a timescale to be determined by the Scottish Ministers.</p>	<p>mitigation is undertaken at a Regional scale.</p>
<p>10.) The Company must participate in any Scottish Strategic Marine Environment Group ("SSMEG") established by the Scottish Ministers for the purpose of advising the Scottish Ministers on research, monitoring and mitigation programmes for, but not limited to, ornithology, diadromous fish, marine mammals and commercial fish.</p>	<p>To ensure effective environmental monitoring and mitigation is undertaken at a National scale.</p>
<p>11.) Prior to the Commencement of the Development, the Company must at its own expense, and with the approval of the Scottish Ministers in consultation with the JNCC and SNH, appoint an Ecological Clerk of Works ("ECoW"). The term of appointment for the ECoW shall be from no later than 9 months post consent until the Final Commissioning of the Development.</p>	<p>To ensure that appropriate and effective monitoring of the impacts of the Development is undertaken</p>
<p>The responsibilities of the ECoW must include, but not be limited to:</p> <ul style="list-style-type: none"> a. Quality assurance of final draft version of all plans and programmes required under this consent; b. Provide advice to the Company on compliance with consent conditions, including the conditions relating to the CMS, the EMP, the PEMP, the PS (if required), the CaP and the VMP; c. Monitor compliance with the CMS, the EMP, the PEMP, the PS (if required), the CaP and the VMP; d. Provide reports on point c) above to the Scottish Ministers at timescales to be determined by the Scottish Ministers; and e. Inducting site personnel on site / works environmental policy and procedures. 	
<p>12.) The Company must, to the satisfaction of the Scottish Ministers, participate in the monitoring</p>	<p>To ensure effective monitoring of the effects on migratory fish at a</p>

<p>requirements as laid out in the ‘Scottish Atlantic Salmon, Sea Trout and European Eel Monitoring Strategy’ so far as they apply at a local level (the Moray Firth). The extent and nature of the Company’s participation is to be agreed by the Scottish Ministers in consultation with the MFRAG.</p> <p>13.) The Development must be constructed in accordance with the following wind turbine parameters except to the extent approved, in writing, by the Scottish Ministers under the second part of this condition:</p> <ul style="list-style-type: none"> a. up to a total of 125 turbines; b. a hub height of between 104.64 metres and 115.9 metres (measured from LAT); c. a rotor diameter of up to 154 metres; d. a blade speed of up to 11 revolutions per minute; e. a blade width of up to 5 metres; and f. a maximum blade pitch of 20 degrees. <p>Should the turbine parameters exceed any of those listed in a. to f. above, but remain within the limits of Annex 1, then the Development must only be constructed following approval by the Scottish Ministers, in writing, within 28 days. The Company must demonstrate that any proposed alterations to parameters a. to f. above would not, taken together, increase the predicted annual collision mortality rate of the East Caithness Cliffs SPA great black-backed gull population attributable to the Development above a predicted 7 per annum, calculated using the agreed Collision Risk Model using the data gathered to prepare the Application.</p>	<p>local level (the Moray Firth).</p> <p>To ensure there is no adverse effect on the integrity of the East Caithness Cliffs SPA in relation to great black-backed gulls.</p>
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4. RESPONSE

a) Marine Scotland's Comments

For Marine Scotland advice to other authorities:

Will not adversely affect integrity of the sites
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For Marine Scotland response to request for opinion on effects of permitted development:

Will not adversely affect integrity of the sites
--

For Marine Scotland response to application:

Licence process will continue

Name of assessor:	Finlay Bennet
Date:	29/01/2014
Name of approver:	Gayle Holland
Date:	04/02//2014

Appropriate Assessment Appendix 1

Collision Risk – Common Currency by species

GBBGU = great black backed gull, HERGU = herring gull

1		GBBGU, ECC		GBBGU, ECC		HERGU, ECC		HERGU, ECC	
2	CRM	MORL		BOWL		MORL		BOWL	
3	Bird Parameters								
4	Bird Length	0.71		0.71		0.61		0.61	
5	Wing span	1.575		1.575		1.44		1.44	
6	Flight speed	13.7		13.7		12.8		12.8	
7	Noct Activity	2		2		2		2	
8	Flap/Glide	Flapping		Flapping		Flapping		Flapping	
9	Option 1, 2, 3	3		3		3		3	
10	Breeding season	May-Aug		May-Aug		May-Aug		May-Aug	
11	Avoidance Rate	98%		98%		98%		98%	
12	Windfarm scenario	S3.6, M&T 5MW		MLS		S3.6, M&T 5MW		MLS	
13	Annual Collisions	105.2		109.3		136.1		182.09	
14	Breeding Season Collisions	22.6		25.43		20.4		12.72	
15	Non breeding season Collisions	82.6		83.87		115.7		169.37	
16									
17	Collision Apportioning (summer)	morl	Running Tot	bowl	Running Tot	morl	Running Tot	bowl	Running Tot
18	CRM collisions (breeding season)	22.6	22.56	25.43	25.43	20.4	20.40	12.72	12.72
19	Boat-based bias	2	11.28	2	12.72	2	10.20	2	6.36
20	Prop from SPA	0.5	5.64	0.633	8.05	0.375	3.83	0.851	5.41
21	Prop immature birds	0.51	2.88	0.625	5.03	0.43	1.64	0.625	3.38
22	Prop adults	0.49	2.76	0.375	3.02	0.57	2.18	0.375	1.32
23	exclude sabatical adults	0.35	1.80	0.35	1.96	0.35	1.42	0.35	0.46
24	Sub-Total SPA birds (breeding season)		5.64		8.0		3.83		5.41
25									
26	Collision Apportioning (winter)	morl	Running Tot	bowl	Running Tot	morl	Running Tot	bowl	Running Tot
27	CRM collisions (non-breeding season)		82.63	83.87	83.87		115.70	169.37	169.37
28	Boat-based bias	2	41.32	2	41.94	2	57.85	2	84.69
29	Prop from SPA	0.0136	0.56	0.0136	0.57	0.375	36.16	0.139	11.77
30	Prop immature birds	0.51	0.29	0.625	0.36	0.43	15.55	0.43	5.06
31	Prop adults	0.49	0.28	0.375	0.14	0.57	20.61	0.57	4.36
32	exclude sabatical adults	0.35	0.18	0.35	0.05	0.35	13.40	0.35	1.53
33	remove winter influx adults	1	0.18	1		0.2	2.68	1	
34	remove winter influx immatures	0.5	0.14	0		0.5	7.77	0	
35	Sub-Total SPA birds (breeding season)		0.56		0.57		11.90		11.77
36	Total (SPA birds, all age classes)		6.20		8.62		15.72		17.18
37									
38	For use with BOWL PVA outputs		6.20		8.62		15.72		17.18
39	For use with MORL PVA outputs		4.03		5.60		7.19		11.17
40									
43	SUMMARY								
		Project total (all SPA birds, all age classes)	Cummulative total (all SPA birds, all age classes)	Project total (adults excluding sabaticals)	cummulative total (adults excluding sabaticals)	Comparison with PBR values (assuming PBR calculations are based on adult breeding birds excluding sabaticals) should be made with cummulative values in grey cells			
44									
45	BOWL (MLS) GBBGU	8.62	14.82	2.01					
		6.20		1.94	3.95				
46	MORL GBBGU								
47	BOWL (MLS) HERGU	17.18	32.90	1.99	11.18				
48	MORL HERGU	15.72		9.19					

Displacement - Common Currency by species

GU = guillemot, RA = razorbill, PU = puffin

ECC = East Caithness Cliffs SPA, NCC = North Caithness Cliffs

	GU, ECC, NPC	GU, ECC, MG	RA, ECC, NPC	RA, ECC, MG	PU, ECC	PU, ECC	PU, NCC	PU, NCC
Displacement	MORL running total	BOWL running total	MORL running total	BOWL running total	MORL running total	BOWL running total	MORL running total	BOWL running total
Breeding season months	Apr-Jul		Apr-Aug		Apr-Jul		Apr-Jul	
Abundance	11475	5187.5	2639	879.6	2033	389.6	2033	389.6
mean peak vs mean adjustment	1.00	5188	1.00	880	1.00	390	1.00	390
All birds/ birds on water adjustment	1.00	5188	1.00	880	1.00	390	1.00	390
Turnover adjustment	1	5188	1	880	1	390	1	390
Proportion displaced	0.6	3113	0.6	528	0.6	234	0.6	234
Prop SPA	0.60	2913	0.75	509	0.05	116	0.75	59
Prop immature	0.0	2127	0.0	351	0.35	75	0.35	39
prop birds non breeding	0.5	1382	0.5	228	0.50	49	0.50	25
Total	2066	1382	594	228	30	49	457	25
SUMMARY	Displaced birds failing to breed succesfully (each bird represent distinct pair)							
GU ECC BOWL	1382							
GU ECC MORL	2066							
GU ECC	3448							
RZ ECC BOWL	228							
RZ ECC MORL	594							
RZ ECC	822							
PU ECC BOWL	49							
PU ECC MORL	30							
PU ECC	79							
PU NCC BOWL	457							
PU NCC MORL	25							
PU NCC	483							

Appropriate Assessment Appendix 2 **Explanation of Common Currency Appraisal**

Ornithology assessment

The common currency approach was developed iteratively, as part of a process to inform the assessment of those species at sites where initial consideration of WCSs indicated a concern. The common currency approach is used to assess the magnitude of effects where a range of potential values could influence the outcome of the assessment. This approach involved MORL and BOWL, JNCC, SNH, and MSS agreeing the parameters which were most appropriate when predicting the levels of impact that MORL and BOWL were likely to have on the bird populations. The common currency allowed numbers to be generated for collision and displacement effects for each species of concern giving a cumulative impact from the two developments. The approach informed changes from WCS to scenarios with lesser effects.

This assessment draws together the key conclusions reached as part of the iterative appraisal process including the development of a 'common currency' for BOWL and MORL.

MSS led on the development of a 'common currency' for these projects and as such the below summarises MSS advice in relation to this approach.

Displacement Effects

The wind farm location coincided with areas regularly used by a range of seabird species; this includes birds on the surface (and therefore assumed to be using the site for foraging or other maintenance activities), and birds in flight. The SNH and JNCC advice on 8 July 2013 identified a number of outstanding issues relating to displacement effects and these were addressed during the common currency discussions between MORL, BOWL, SNH, JNCC and MSS. Based on the SNH advice of 8 July 2013, species and SPAs of concern due to potential displacement effects were common guillemot at East Caithness Cliffs, razorbill at East Caithness Cliffs and Atlantic puffin at both East Caithness Cliffs and North Caithness Cliffs.

Breeding season

As the SPAs are protected for the breeding populations it is important to establish when the breeding season is. Whilst no differences in approach were identified between the developers and SNCBs, it became apparent that the inclusion of August within the breeding season for puffin was not appropriate due to cessation of provisioning of chicks by adults prior to August and the influx of non-breeding individuals to breeding colonies during August. This increase in numbers was apparent from the at sea abundance estimates during August, and so it was agreed that August should be excluded from the breeding season. Therefore the breeding season was agreed to be April – July for puffin for the purposes of this assessment.

Mean seasonal peak

Both developers used the mean abundance estimates in their assessment rather than the mean seasonal peak advised by the SNCB's. whilst the latter is likely to

overestimate abundance, it provides a precautionary estimate that also aims to address the issue of turnover (see below) and mean seasonal peak has therefore been used in this assessment.

All birds vs birds on the water

There were different opinions between the developers and SNCBs as to the most appropriate number to be used in the assessment. The developers argument being that birds in flight are not subject to displacement. The SNCBs advised that all birds should be used in the displacement assessment whilst BOWL and MORL considered that birds on the water or birds “using the water” would be more appropriate. Due to difficulties in objectively assigning birds in flight to ‘using the water’ or transiting, the precautionary value of all birds have been used in this assessment.

Turnover

It was agreed that there is no clear method for accounting for turnover of individuals at sea in any assessment (i.e. the number of individuals using a site and therefore potentially displaced as opposed to the ‘snap-shot’ abundance estimate derived from the boat based surveys. Instead, the precautionary mean seasonal peak and all birds values are used.

Proportion displaced

The displacement values advised by the SNCBs have been used in this assessment. This has not taken account of the near doubling of turbine spacing associated with BOWL moving from WCS to MLS, nor of the effects of habituation to the presence of turbines that is expected to occur over the lifetime of the wind farm. These levels of displacement are therefore viewed as precautionary. Owing to conflicting advice on the displacement rate, with advice being 50% and 60% at different points in time, the higher displacement rate is used in the assessment. This makes no difference to the overall conclusions.

Proportion SPA

BOWL applied an apportioning tool similar to that being developed by SNH to assign effects to colonies whilst MORL used bird flight data. These methods both have merit and have been used in the assessment. However, the approach used by MORL makes it more difficult to assign birds to non-SPA colonies in comparison to the approach being developed by SNH and used by BOWL in the common currency. For puffin, MSS therefore advised MS-LOT that approximately 25% of displacement effects at MORL should be assigned to non-SPA populations following the approach being developed by SNH.

Proportion of birds that fail to breed successfully

This has been assumed to be 100% as an absolute worst case scenario.

Barrier Effects

The wind farm location coincided with areas regularly used by a range of seabird species; this includes birds on the surface (and therefore assumed to be using the site for foraging or other maintenance activities), and birds in flight. Due to the difficulties in assessing barrier effects and the difficulty in disentangling them from

displacement effects, they are being dealt with as part of the assessment of displacement .

Collision Effects

Based on the SNCB advice of 8th July 2013, collision risk to great black-backed gull and herring gull at East Caithness Cliffs were still of concern. A number of outstanding issues relating to collision effects were identified in the SNCB advice and these were addressed during the common currency discussions between MORL, BOWL, SNH, JNCC and MSS. Most of these were captured in the MSS advice to LOT dated 4th September 2013.

Bird parameters

There was agreement on the bird parameters (wingspan, flight speed etc.) used in the collision risk models, as detailed in the collision risk common currency spreadsheet above.

Nocturnal activity

Differences in opinion between the SNCBs and BOWL and MORL existed in the degree of nocturnal activity exhibited by the two gull species. The approach taken in this assessment is that set out and justified in the MSS advice of 4th September 2013, with nocturnal activity levels of 2 used (this equates to 25% of the daytime values being at risk from collision). This reduction in nocturnal activity is due to fewer individuals being present in the vicinity of the wind farms at night or spending more time on the water at night and therefore at less risk from collision.

Extended Band Model (Option 3) and Avoidance Rates

As per the Renewables Scientific Advisory Group (RSAG) (SNCB & MSS) advice, this assessment is based on the use of the extended version of the Band collision risk model (option 3).

Arguments presented by the developers for increasing avoidance rates were considered but RSAG do not consider that the case for increasing avoidance rates is currently merited.

Breeding season

The breeding seasons for both gulls of May-August used in the common currency are those used in the ES submitted by BOWL and MORL. This reflects the median date of laying of mid-May and also ensures that birds wintering or passing through the region during April are not assigned to the breeding population.

Wind farm scenario

Initial advice was based only on BOWL and MORL WCS but the common currency spreadsheet results are based on BOWL MLS combined with MORL WCS.

Boat based bias

Gulls and other opportunistic seabird species often utilise discards from fishing activities, with large numbers of gulls and other species often occurring in close proximity to fishing vessels. There is also evidence that a range of seabird species are attracted to survey vessels, presumably due to the perception of foraging

opportunities, and that abundance estimates can therefore be artificially inflated. The developers estimated that a correction factor of 4 should be applied to account for this based on comparisons between boat based and aerial survey data. For this assessment a correction factor of 2 is used to account for gull attraction to survey vessels as although the bias is highly likely to occur the magnitude of any overestimate is based on limited data. MSS therefore recommended a correction value of 2.0. This halves the original estimate and is seen as precautionary.

Apportioning to breeding colony

BOWL applied an apportioning tool similar to that being developed by SNH to assign effects to colonies whilst MORL used bird flight data. These methods both have merit and have been used in the assessment. For gulls, both developers assigned effects to SPA and non-SPA colonies.

Accounting for sabbatical birds

Both MORL and BOWL had included 'sabbatical' birds i.e. adult birds within the population that did not breed each year. The common currency process enabled calculation of an "all breeding birds" metric for comparison against PBR values and a metric of "birds of all age classes" for comparison against PVA/ABC values.

Winter influx birds

Large numbers of birds from northern Europe and Russia move into the area for the winter period and this was accounted for by both developers. An appropriate proportion of collisions during the non-breeding season were therefore assigned to this influx population.

Bird Metric Note

A note confirming that the impacts predicted from the common currency spread sheet on the great black backed gull East Caithness Cliffs SPA population was within the thresholds set using both PBR and ABC was agreed between MSS, SNH and JNCC on 22nd November 2013.

Appropriate Assessment Appendix 3

Outline of the Acceptable Biological Change (“ABC”) method for using population model forecasts to inform assessment of managed effects upon populations

Author: Finlay Bennet, MSS

Introduction

This document outlines a tool called Acceptable Biological Change that uses probabilistic forecasts from population models to inform management decisions. ABC is a risk based approach to the management of populations, allowing managers to demonstrate a consistent and transparent approach to risk in the context of the best available evidence and the associated inherent scientific uncertainty. ABC ensures that managers’ actions will not result in significant additional risk to the populations of concern.

The ABC Method

Effects of managed activities can be assessed for their impacts on populations by the construction of models. Data on the historical changes to the population’s size and vital rates (productivity and survival) are processed through the model to provide forecasts of future population change. The additional change as a consequence of any effect can also be forecast. Forecasts can be presented as either a deterministic output (in year x the population size will be y) or as a probabilistic output (in year x the probability that the population size will be y is z).

ABC requires probabilistic outputs from population models and is a risk based approach that is informed by the inherent uncertainty associated with population forecasts and the consequences of managed activities. Population models provide managers with the following outputs that are used in the ABC tool:

- A baseline forecast i.e. the forecast for the population that is as likely as not. This will have a probability of 0.5 (how 0.5 has been calculated being a matter of statistical preference).
- A forecast for the population’s management objective, and a probability estimate for that objective.

Consistent treatment of uncertainty for any given outcome is of importance to managers. ABC is based upon guidance produced by the Intergovernmental Panel on Climate Change (“IPCC”) on the consistent use of language in relation to the treatment of uncertainties <http://www.ipcc.ch/pdf/supporting-material/uncertainty-guidance-note.pdf> (Mastrandrea *et al*, 2010).

There are two factors in any assessment using the probabilistic outputs of population models that need to be clearly agreed:

1. the management objective for the population must be defined (as a quantity over a timescale), and

2. the acceptable change in the likelihood of the objective occurring can be considered.

Each of these steps are considered in turn below.

1. The management objective requires a specified quantity and timescale. This allows assessment using ABC. The appropriate point in time is contained within the period forecast by the population model. It could be when the managed activity ceases, or some agreed point in time after to account of any recovery towards baseline conditions, or some other point within the forecast period. The rationale for the choice of objective timescale should be agreed and presented. The management objective also needs to be quantified e.g. in terms of any level above x, or below y at the appropriate timescale. These targets might be based on a historic population size, or a forecast size. As with timescale, the rationale behind the choice of quantity should be presented.
2. Use can then be made of the IPCC guidance on consistent use of terms that describe uncertainty. The risk of not meeting the management objective would be considered on the basis of the likelihood changing beyond a level considered acceptable, as defined by the ABC tool.

Table 1. IPCC calibrated language for describing and quantifying uncertainty

Likelihood Scale	
Term	Probability (P)
<i>Virtually certain</i>	>0.991
<i>Extremely likely</i>	0.951-0.990
<i>Very likely</i>	0.901-0.950
<i>Likely</i>	0.668-0.900
<i>About as likely as not</i>	0.333-0.667
<i>Unlikely</i>	0.101-0.332
<i>Very unlikely</i>	0.051-0.100
<i>Extremely unlikely</i>	0.011-0.050
<i>Exceptionally unlikely</i>	<0.01

The simplest form of undertaking ABC is to define a management objective using the outputs of the population model. The population size that is as likely as not over the defined forecast period will be identified in the model outputs as the scenario with a probability of 0.5. The probability of the forecast population moving into another likelihood outcome as a consequence of the managed activity can then be considered. The ABC tool allows up to a one third change in probability of the agreed objective to occur, with the probability of decline with the addition of a managed activity remaining in the “about as likely as not” likelihood category i.e. effects that change the probability of decline from 0.5 to anywhere in the range up to 0.667 would be considered acceptable.

The ABC tool also allows managers to select a management objective that is different to the baseline forecast population size. The reasons for doing this should always be clearly presented, given the important influence the choice of objective has on the outcome of an assessment.

When the probability of achieving an agreed management objective differs from the “as likely as not” 0.5 forecast for the population, the need to consistently treat the acceptable level of change arises. Managers would need to accept increasingly less change if an objective is already unlikely to occur, and would be expected to accept greater levels of risk if an objective is highly likely to occur. If the starting point for identifying an acceptable level of change is to accept a one third additional change when the probability of the objective occurring is 0.5 (e.g. the change from 0.5 to 0.667), then we can formally express this relationship as:

$$ABC = P + (1 - P) / 3$$

Where P is the probability of the management objective. If P is 0, then ABC = 0.333

Table 2 below outlines use of the ABC tool when the management objective differs from 0.5. The method enables a consistent and seamless transition across risk categories as defined by IPCC.

Table 2. ABC in relation to an objective*

Likelihood Terminology	Probability (P) range for management objectives	P range for the Acceptable Biological Change
Virtually certain	>0.991	>0.994
Extremely likely	0.951-0.990	0.967-0.993
Very likely	0.901-0.950	0.934-0.967
Likely	0.668-0.900	0.779-0.933
About as likely as not	0.333-0.667	0.555-0.778
Unlikely	0.101-0.332	0.401-0.555
Very unlikely	0.051-0.100	0.367-0.400
Extremely unlikely	0.011-0.050	0.341-0.367
Exceptionally unlikely	<0.01	<0.340

* the ABC equation of $P + (1 - P) / 3$ assumes the IPCC terminology are being applied in relation to the risk of an outcome not occurring e.g. in table 1 applying ABC to the “likely” category using $P + (1 - P) / 3$ would mean that it was considered “likely” the objective would not be achieved. The equation can be reversed to $ABC = P - (P / 3)$ if the IPCC likelihood terms are reversed e.g. the same outcome is then derived as above based an objective that is “unlikely” to occur.

