AGENDA ITEM 6

APPENDIX 2

2019/0134/DET

HRA

SNH NATURA APPRAISAL PROFORMA: BADDENGORM WOOD – ERECTION OF HUT AND SITING OF COMPOSTING TOILET 2019/0134/DET

Appraisal in Relation to Regulation 48 of the Conservation (Natural Habitats, &C.) Regulations 1994 as Amended[1] (Habitats Regulations Appraisal)

Casework Management System Ref. CDM155553

NATURA SITE DETAILS

Name of Natura site(s) potentially affected:

1. Abernethy Forest SPA (Current)
2. Anagach Woods SPA (Current)
3. Cairngorms SPA (Current)
4. Craigmore Wood SPA (Current)
5. Kinveachy Forest SPA (Current)

Name of component SSSI if relevant:

1. Abernethy Forest SPA: Abernethy Forest SSSI
2. Anagach Woods SPA: Anagach Woods is not designated as a SSSI
3. Cairngorms SPA: Glenmore Forest, Cairngorms, Northern Corries and North Rothiemurchus Pinewood SSSIs.
4. Craigmore Wood SPA: there is no SSSI underpinning Craigmore Wood
5. Kinveachy Forest SPA: Kinveachy Forest SSSI

Natura qualifying interest(s) & whether priority/non-priority:

1. **Abernethy Forest SPA**
   Capercaillie (Tetrao urogallus)
   Osprey (Pandion haliaetus)
   Scottish crossbill (Loxia scotica)

2. **Anagach Woods SPA**
   Capercaillie (Tetrao urogallus)

3. **Cairngorms SPA**
   Capercaillie (Tetrao urogallus)
   Merlin (Falco columbarius)
   Osprey (Pandion haliaetus)
   Golden eagle (Aquila chrysaetos)
   Dotterel (Charadrius morinellus)
   Scottish crossbill (Loxia scotica)
   Peregrine (Falco peregrinus)

4. **Craigmore Wood SPA**
   Capercaillie (Tetrao urogallus)

5. **Kinveachy Forest SPA**
   Scottish crossbill (Loxia scotica)

[1] Or, where relevant, under regulation 61 of The Conservation of Habitats and Species Regulations 2010 as amended, or regulation 25 of The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 as amended.

Capercaillie (Tetrao urogallus)

Conservation objectives for qualifying interests:

1. Abernethy Forest SPA

To avoid deterioration of the habitats of the qualifying species (listed below), 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:

- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species
- Population of the species as viable component of the site

Osprey (Pandion haliaetus)
Scottish crossbill (Loxia scotica)
Capercaillie (Tetrao urogallus)

2. Anagach Woods SPA**

To avoid deterioration of the habitats of the qualifying species (listed below), 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:

- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species
- Population of the species as viable component of the site

Capercaillie (Tetrao urogallus)

3. Cairngorms SPA

To avoid deterioration of the habitats of the qualifying species (listed below), 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:

- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species
- Population of the species as viable component of the site

Scottish crossbill (Loxia scotica)
Dotterel (Charadrius morinellus)
Golden eagle (Aquila chrysaetos)
Peregrine (Falco peregrinus)
Osprey (Pandion haliaetus)
Merlin (Falco columbarius)
Capercaillie (Tetrao urogallus)

4. Craigmore Wood SPA

To avoid deterioration of the habitats of the qualifying species (listed below), 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:

- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species
- Population of the species as viable component of the site

Capercaillie (Tetrao urogallus)

5. Kinveachy Forest SPA

To avoid deterioration of the habitats of the qualifying species (listed below), 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:

- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species
- Population of the species as viable component of the site

Capercaillie (Tetrao urogallus)
Scottish crossbill (Loxia scotica)

STAGE 1: WHAT IS THE PLAN OR PROJECT?

Proposal title:

Erection of hut and siting of composting toilet Gabhean Baddengorm Wood, Carrbridge

Date consultation sent:	20 May 2019
Date consultation received:	20 May 2019
Name of consultee:	CNPA (planning application called in)
Name of competent authority:	CNPA
Type of case:	Planning

Details of proposal (inc. location, timing, methods):

The proposal is to site a hut and composting toilet within Baddengorm Wood, Carrbridge. The location is at approximately NH 890 238, near a forest track within the wood. The hut is described as “a low impact hut constructed under the SPP hutting guidelines using sustainable materials that blend into the environment and that will not have a detrimental effect on the environment but would offer a temporary base to appreciate the immediate woodland and wider environment and carry out best practice in its management and biodiversity.”

Baddengorm Wood is not a designated site, but is home to capercaillie.

STAGE 2: IS THE PLAN OR PROJECT DIRECTLY CONNECTED WITH OR NECESSARY TO SITE MANAGEMENT FOR NATURE CONSERVATION?

No.

STAGE 3: IS THE PLAN OR PROJECT (EITHER ALONE OR IN COMBINATION WITH OTHER PLANS OR PROJECTS) LIKELY TO HAVE A SIGNIFICANT EFFECT ON THE SITE?

1.Capercaillie.

Yes, likely significant effect on all five SPAs listed above, for the following reasons:

- Capercaillie are known to live and breed in Baddengorm Wood
- Capercaillie are sensitive to human disturbance (see evidence in Annex 1)
- This proposal is likely to increase disturbance to capercaillie in Baddengorm Wood.
- Increased disturbance to capercaillie in Baddengorm Wood could affect the populations of these birds in all 5 SPAs listed above, which are designated to protect the Strathspey capercaillie meta-population (see evidence in Annex 1).

2.Scottish crossbill, osprey, dotterel, golden eagle, merlin, osprey and peregrine falcon.

No. The proposal would have no effect, either direct or indirect, on any of these species within the SPAs classified for them.

Mitigation or modifications required to avoid a likely significant effect & reasons for these:

Mitigation:	*Reason:*

STAGE 4: UNDERTAKE AN APPROPRIATE ASSESSMENT OF THE IMPLICATIONS FOR THE SITE IN VIEW OF ITS CONSERVATION OBJECTIVES

Capercaillie use of Baddengorm Wood

Baddengorm Wood, in common with many of the Scots pine woodlands in Badenoch and Strathspey, hosts a population of capercaillie. Capercaillie sightings, and signs, such as feathers and dropping, have been found throughout most of the wood over a period of some 19 years. There is a stable lek, suitable brood habitat, and broods have been found in the wood. Capercaillie are present all year. It is therefore part of the functioning meta-population of capercaillie in Badenoch and Strathspey.

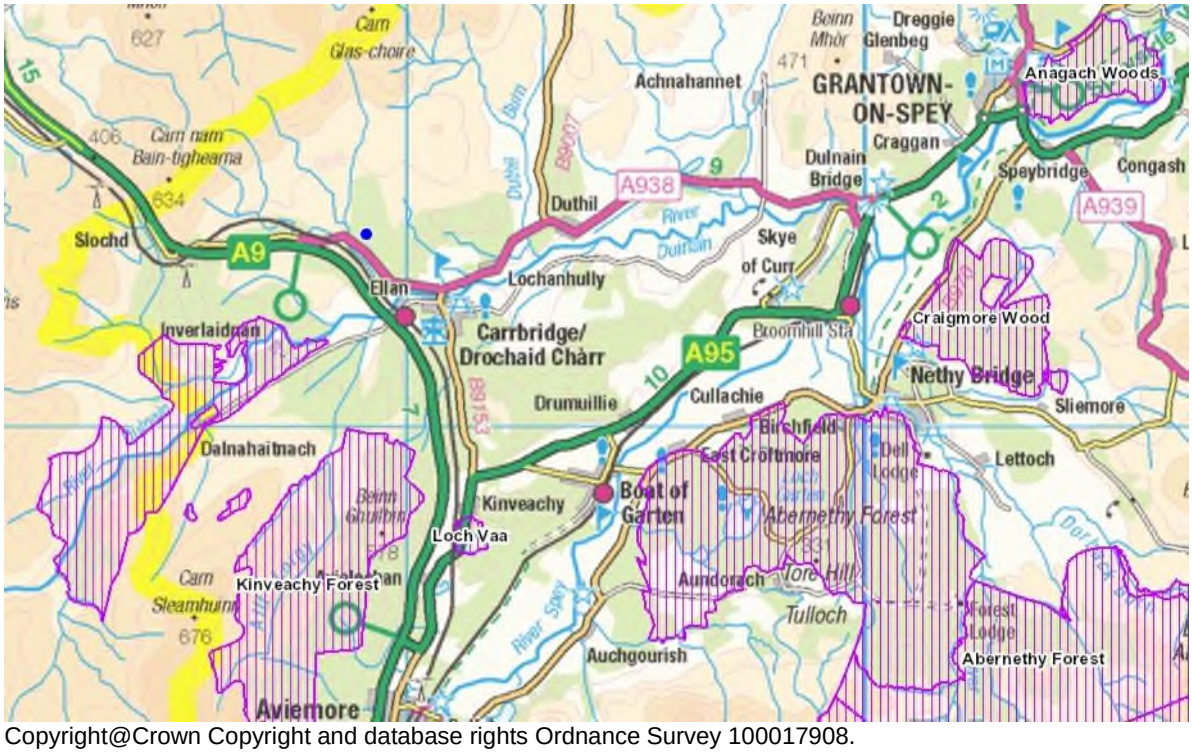
A meta-population consists of a group of spatially separated populations of the same species which interact. The population of capercaillie in Scotland exhibits a meta-population structure, with six meta-populations. Baddengorm Wood is part of the Strathspey meta-population, which is the largest of the six holding approximately 83% of the total. Maintenance of the Strathspey population is therefore critical to the long term survival of the species in Scotland.

Location

The location of the development and the surrounding SPAs is shown below.The distances are approximately:

Anagach Woods SPA: 14 km
Cairngorms SPA 11 km
Kinveachy Forest SPA 2 km
Abernethy Forest SPA 8 km
Craigmore Wood SPA 12 km

These are well within the capercaillie dispersal distances identified in Annex 1. The location and size of Baddengorm Wood means it is likely to play an important function within the Strathspey capercaillie meta-population. For example it provides connectivity between populations in SPAs and other woods used by the birds, and is a potential 'stepping stone' facilitating movement between them.



Copyright@Crown Copyright and database rights Ordnance Survey 100017908.

Approximate location of site shown by blue dot

Effects of proposal on the conservation objectives of the five SPAs

For each of the conservation objectives, the requirement is 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 objectives are maintained in the long term - each of these is considered in the table below.

Conservation objective	Comment	Conclusion
Distribution of the species within sites	There is potential for the distribution of capercaillie within the SPAs to be affected, if the population density is	Objective will be met only if the population of the

	affected.	species in each site is maintained.
Distribution and extent of habitats supporting the species	There would be no change in the distribution and extent of habitats within the SPAs, because the development is a distance away from the sites, there would be no direct or indirect effects.	Objective will be maintained.
Structure, function and supporting processes of habitats supporting the species	There would be no change in the structure, function and supporting processes of the pine woodland in the SPAs, because the development is a distance away from the sites, and there would be no direct or indirect effects.	Objective will be maintained.
No significant disturbance of the species	Capercaillie are likely to be disturbed by this proposal. These capercaillie are part of the Strathspey meta-population that includes the SPAs. Given the proximity to the SPAs, some of the birds present at any time in Baddengorm are likely to be part of the populations within the SPAs. Disturbance is considered further below.	See below.
Population of the species as viable component of the sites	This depends on the indirect effects of disturbance. This is considered below.	Objective will be met if the previous objective is met.

It is concluded that disturbance is the key issue potentially arising from this development.

No significant disturbance of the species

At present, Baddengorm Wood is thought to be only lightly used by people, and is relatively undisturbed compared to other local woods around Carr-bridge. This is likely to be one of the key factors that mean capercaillie can live and breed here successfully.

New buildings in woodland would cause increased noise and activity levels. This would be a permanent effect. Evidence outlined at Annex 1 shows that capercaillie tend to avoid such sources of disturbance, therefore disturbance can render apparently suitable habitat unavailable to the birds. Erecting, occupying and undertaking recreation from the proposed hut would all increase disturbance. The lek is close to the proposed location of the hut and is within the range of flight initiation and alert distances for lekking capercaillie described in Annex 1; disturbance here could therefore affect breeding success. Given the low levels of disturbance in the woods at present, and the proximity to the lek, such disturbance would be significant, having a range of effects on the birds, as detailed in Annex 1.

Conclusion: this conservation objective will not be met.

Population of the species as viable component of the sites *and* Distribution of the species within sites

The proposed development will not have direct effects on the maintenance of either of these conservation objectives. However, there is potential for indirect effects, as described below.

Capercaillie move from site to site, sometimes over large distances (Moss et al, 2006). Anything that affects the population in one place may also affect it elsewhere, for example, on designated sites. Given its location, structure and size, Baddengorm Wood can be considered to function as a potential 'stepping stone' for capercaillie, e.g. by facilitating movement between SPAs and also with other capercaillie woods. It provides a link between Kinveachy, Craigmore, Cairngorms (Glenmore) and Abernethy SPAs, all of which support significant elements of the Strathspey meta-population. It is part of the un-designated woodlands which together are a key element for breeding, dispersal and relocation of birds and are therefore important for the species.

Some authors suggest that woodland fragments separated by 5 – 10 km might retain enough genetic diversity to avoid inbreeding depression (Segelbacher et al 2003 cited in Moss et al 2006) and others (Moss et al. 2006) recommend that landscape design should take account of the shorter distances moved by dispersing males, citing 'stepping stone' woods as an aid to this dispersal.

It is concluded above that capercaillie are likely to be subject to significant disturbance from this proposed development, which would affect that part of the meta-population resident in, or passing through, Baddengorm Wood. This could render part or all of the wood unsuitable for capercaillie to use, live and breed at current levels. This means that the *population of capercaillie as a viable component of the Special Protection Areas*, and the *distribution of capercaillie within the SPAs*, could be indirectly adversely affected by the proposals.

Conclusion: these conservation objectives will not be met.

Overall Conclusion
Three of the conservation objectives will not be met by this proposal, so it cannot be shown that this proposal will not adversely affect the integrity of the five SPAs.

STAGE 5: CAN IT BE ASCERTAINED THAT THE PROPOSAL WILL NOT ADVERSELY AFFECT THE INTEGRITY OF THE SITE?

No. It cannot be shown that there would be no adverse effect on the integrity of the 5 Strathspey SPAs classified for capercaillie.

Mitigation or modifications required to ensure adverse effects are avoided, & reasons for these.

Mitigation:	*Reason:*

ADVICE SOUGHT

Debbie Greene, Operations Manager
Evidence in Annex 1 based on that provided by Sue Haysom, SNH Ornithologist, in relation to previous similar proposals.

CONCLUSION/ADVICE IN RELATION TO PLAN OR PROJECT

When SNH is advising the competent authority

Natura model response position:

Appropriate assessment has not demonstrated that there will not be an adverse effect on the integrity of the sites.

Development management response type:

SNH should object to this proposal.

Appraised by	Anne Elliott
Date	23 May 2019
Checked by	Debbie Greene
Date	30 May 2019

Annex One: Scientific rationale

1. Effects of disturbance on capercaillie

Disturbance can affect capercaillie by reducing the availability of otherwise suitable habitat (including habitat used for roosting, feeding, nesting and brood rearing), displacing the birds from leks, disrupting behaviour patterns and increasing the risk of predation. These effects can occur separately or additively. Capercaillie are sensitive to disturbance at all life stages but especially so when attending leks, incubating eggs (late April to mid-June) or rearing broods (late May - late August but critically during June and July when the chicks are small and dependent on the hen for warmth).

Research has recorded numerous examples of individuals reacting to disturbance, for example through short-term changes in behaviour and long-term shifts in habitat use, however, population-level effects are difficult to demonstrate so their importance remains unclear (Storch, 2013). Reported responses include a decline in local capercaillie numbers (Brenot *et al*., 1996 cited in Thiel *et al*., 2007) and abandonment of lek sites (Labigand & Munier, 1989 cited in Thiel *et al*., 2007).

Much of the continental European research on disturbance has focussed on off-path recreational use. A study of the behavioural response of capercaillie to off-trail hikers demonstrated that flushing distance varied between male and female birds, visibility of hiker, intensity of winter tourism, and hunting pressure (Thiel *et al*., 2007). Males tended to flush at greater distances than females and longer flushing distances were recorded in more open woodland. Birds also flushed more easily in areas with high intensity of winter tourism or hunting pressure compared to undisturbed areas. The authors noted that the unpredictable nature of off-trail tourism meant that birds are less likely to habituate to it. The mean flushing distance in this study was 27 ± 0.6 m (SE, n = 752; range 1 – 104 m) and 90% of all flushing events were at less than 50 m. The authors recommended the establishment of regulations requiring hikers to stay on trails and closing trails where inter-trail distances fall below 100m. An example of such management in the Bayerischer Wald National Park, Bavaria, resulted in capercaillie returning to the surrounding woodland (Scherzinger 2003 cited in Summers *et al*., 2007).

A recent radio-telemetry study in south-western Germany found that whilst outdoor recreation did not affect home range selection, strong effects on habitat use within the home range were detected. Distance to recreation infrastructure (e.g. hiking and cross-country skiing trails, ski

pistes) was the main determinant of habitat selection in winter; in summer, mountain bike trails and hiker's restaurants were avoided up to an average distance of 145m (CI: 60-1092m). Relative avoidance of winter-infrastructure, was recorded up to 320m (CI: 36-327m), this reduced when dense understory provided visual cover. Between 8- 20% (summer) and 8- 40% (winter) of the population area was affected by outdoor recreation (Coppes *et al.* 2017).

Capercaillie need to compromise between shelter and outlook. A study by Finne and co-workers (Finne *et al*., 2000) indicated that males prefer good cover at the expense of a good overview of the surrounding area when selecting daytime roosting sites. They noted that to be suitable as male habitat, areas surrounding capercaillie leks should contain forest with a high vertical cover close to the ground, i.e. with low canopies. They indicated that this could be achieved by thinning young even aged plantations at an early stage, or rejuvenating forests by selection cutting and natural regeneration instead of clear felling and planting. Habitat structure has been shown to modify the alert distance of a number of bird species, with increasing bird tolerance associated with greater availability of escape cover (Fernandez-Juricic *et al*., 2001). In the specific case of capercaillie, Thiel and co-authors (2007) recommended planting or preserving evergreen conifer trees in dense rows along critical parts of disturbance sources thus reducing the degree of visibility between capercaillie and recreationists – this would increase the habitat available to capercaillie in forests with predictable recreation activities.

In the UK, expert opinion also states that capercaillie in Scotland are adversely affected by recreational disturbance and that disturbance is most critical during lekking and brood rearing times (Marshall, 2005). This report, which was based on the opinions of 15 experts, suggested a minimum 75 m buffer for exclusion of human activity at known leks but recognised the need for more field-based empirical research.

A more recent report (Ruddock & Whitfield, 2007) also collated the views of experts and calculated the median alert distance (AD) and flight initiation distance (FID) for the species as ascertained from expert opinion, and these are tabulated below.

Alert distance

	Median distance (metres)	Sample Size	80% range values* (metres)
Incubating	75	11	<10 – 150
Chick rearing	75	4	<10 - 150
Lekking	125	9	100 - 750

* The 80% range value is the range in opinion values after the lower 10% and upper 10% of opinions were excluded.

Flight initiation distance

	Median distance (metres)	Sample Size	80% range values* (metres)
Incubating	5	11	<10 – 100
Chick rearing	30	5	<10 - 50
Lekking	75	5	50 - 500

* The 80% range value is the range in opinion values after the lower 10% and upper 10% of opinions were excluded.

In Scotland, research on recreational disturbance has provided evidence of the effects of paths and tracks on capercaillie. Summers and co-workers (2004) found that in winter capercaillie avoided woodland close to tracks and suggested that human disturbance may displace capercaillie and reduce the amount of woodland available. This led them to suggest that removal or closure of tracks might benefit capercaillie and a further study was undertaken. This follow-on study in four forests stands at Glenmore and Abernethy also concluded that the use of trees by capercaillie was

lower close to tracks (Summers *et al.*, 2007). The authors estimated that 21-41% of woodland may be avoided by capercaillie as a result of disturbance and again recommended that sources of disturbance, such as unnecessary tracks, should be removed, re-routed, or their promotion and maintenance reduced.

A separate study which used droppings as an inexpensive way of mapping the distribution of capercaillie at a fine-grained resolution in three woodlands in Badenoch & Strathspey, found that capercaillie droppings were less likely to be found near the existing houses and tracks, and it is assumed that the birds choose to avoid these areas, i.e., an avoidance response to human disturbance (Moss *et al*., 2014). Anecdotal information suggests that capercaillie use of forests within 100m of housing is negligible.

In summary, capercaillie are vulnerable to disturbance. They nest on the ground and their most vulnerable stage is considered to be as eggs or chicks. At this stage, they can be directly killed by dogs, or killed by predators such as crows when the hen is flushed from the nest or brood, or killed by exposure if a hen is flushed. Capercaillie are also vulnerable to disturbance on the lek. Some cock birds become over-aggressive and lose their fear of humans, but the vast majority of males are very easily driven away. Adult birds can fly away from disturbance and to that extent, are less vulnerable than eggs and chicks. However, even adult birds can be vulnerable to collapse and death in winter. This is thought to happen when the weather is windy and wet, because in winter they mostly eat low calorie Scots pine needles, and exposure plus repeated disturbance may mean that they run out of energy. The precise ways in which disturbance affects different aspects of capercaillie ecology (e.g. courtship, breeding, rearing, dispersal, foraging, winter energy expenditure) are, however, not fully understood.

2. Links between the SPAs, and between the SPAs and non-designated woodlands in Badenoch and Strathspey

After a period of rapid and significant decline (Eaton *et al.*, 2007) the national population of capercaillie has been estimated to be between 1000 and 2000 birds by each national survey undertaken since the first in 1992 - 1994. Thus, the national population is small and remains vulnerable. Conservation of capercaillie requires consideration at the meta-population scale as well as at the scale of individual sites.

Within Badenoch & Strathspey there are five SPAs with capercaillie as a qualifying interest: Abernethy Forest; Anagach Woods; Craigmore Wood; Cairngorms; and Kinveachy Forest. The distances between these SPAs are well within maximum capercaillie dispersal distances known from the literature. These are:

- Storch (1995) radio-tracked 40 capercaillie in the Bavarian Alps and found that throughout the year distances of females from the leks they attended in spring averaged 1.3 km (Standard Error = 0.1 km). In winter and spring males aggregated within a 1 km radius of the lek, but dispersed within a 3 – 4 km radius during summer;
- Storch (2001 cited in Moss *et al*., 2006) concluded that most males settle close to their chick range but young female dispersal distances were typically 5 – 10 km;
- A radio-tracking study of males at leks in Russia and Norway recorded average dispersal distance of males to summer range of 2.3 km, SE = 0.37 (Russia 2.2.km, SE = 0.70; Norway 2.4 km, SE = 0.43) (Hjelford *et al*., 2000)
- Storch & Segelbacher (2000) summarised known movements as average seasonal movements of 1 – 2 km for adults and median dispersal distances of < 10 km for juveniles;

The distances recorded in a Scottish study (Moss *et al*., 2006) are somewhat longer than those above, and this may be related to the fragmented nature of Scottish forests compared with those on the continent, or possible incomplete natal dispersal in some of the Storch studies:

- the natal or first-winter dispersal distances of 13 hens radio-tracked by Moss *et al*. (2006) ranged within 1 – 30 km (median: 11, mean 12.3, SD 9.8).

We conclude that effects on the capercaillie population in any one of these SPAs could potentially affect the population in the others. Similarly, the effects on the capercaillie population within undesignated woods in Badenoch & Strathspey could affect the populations in the five SPAs.

Annex 2: References

Coppes, J., Ehrlacher, J., Suchant, R. & Braunisch, V. (2017). Outdoor recreation causes effective habitat reduction in Capercaillie *Tetrao urogallus*: a major threat for geographically restricted populations. Journal Avian Biology doi:10.1111/jav.01239

Eaton, M.E., Marshall, K.B. & Gregory, R.D. (2007) Status of Capercaillie *Tetrao urogallus* in Scotland during winter 2003/4. Bird Study 54: 145 – 153.

Ewing, S.R., Eaton, M.A., Poole, T., Davies, M., & Haysom, S. (2012) The size of the Scottish population of capercaillie Tetrao urogallus: results of the fourth national survey. Bird Study Vol.59(2): 126 – 138.

Fernandez-Juricic, E., Jimenez, M.D. & Lucas, E. (2001) Alert distance as an alternative measure of bird tolerance to human disturbance: implications for park design. Environmental Conservation 28(3): 263 – 269.

Finne, M.H., Wegge, P., Eliassen, S. & Odden, M. (2000) Daytime roosting and habitat preferences of capercaillie *Tetrao urogallus* males in spring – the importance of forest structure in relation to anti-predator behaviour. Wildlife Biology 6(4): 241 – 249

Hjelford, O., Wegge, P., Rolstad, J., Ivanova, M. & Beshkarev, A.B. (2000) Spring-summer movements of the male capercaillie *Tetrao urogallus*: A test of the 'landscape mosaic' hypothesis. Wildlife Biology 6(4): 251 – 256.

Highland Council (2014) Report No NBS/02/14 Population Change in Nairn and Badenoch & Strathspey 2001 to 2011, by Director of Planning and Development.

Marshall K. (2005). Capercaillie and recreational disturbance study. Unpublished report for CNPA, FCS and SNH.

Moss, R., Picozzi, N., Catt, D.C. (2006). Natal dispersal of capercaillie *Tetrao urogallus* in northeast Scotland. Wildlife Biology 12(2): 227 – 232.

Moss, R., Leckie, F., Biggins, A., Poole, T., Baines D. & Kortland, K. (2014) Impacts of human disturbance on capercaillie *Tetrao urogallus* distribution and demography in Scottish woodland. Wildlife Biology 20: 1 - 18.

Picozzi, N., Catt, D.C. & Moss, R. (1992). Evaluation of capercaillie habitat. Journal of Applied Ecology 29: 751 - 762.

Poole, T. (2010). Capercaillie conservation in Scotland – importance of Strathspey meta-population. Unpublished report.

Ruddock, M. & Whitfield, D.P. (2007). A Review of Disturbance Distances in Selected Bird Species. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.

Scherzinger, W. 2003. Artenschcutzprjekt Auerhuhn in Nationalpark Bayerischer Wald von 1985 – 2000. Nationalpark Bayerischer Wald. Wissenschaftliche Reihe – Heft 15.

Storch, I. (1995) Annual home ranges and spacing patterns of capercaillie in Central Europe. Journal of Wildlife Management 59(2): 392 – 400.

Storch, I. (2013) Human disturbance of grouse - why and when? Wildlife Biology, 19(4):390-403.

Storch, I. & Segelbacher, G. (2000). Genetic correlates of spatial population structure in central European capercaillie *Tetrao urogallus* and black grouse *T. tetrix*: a project in progress. Wildlife Biology 6(4): 305 – 310.

Summers, R. W., McFarlane, J., & Pearce-Higgins, J. W. (2004). Measuring Avoidance of Woodlands Close to Tracks by Capercaillies in Scots Pine Woodland. Report to Forestry Commission Scotland, Scottish Natural Heritage and the Royal Society for the Protection of Birds.

Summers, R. W., McFarlane, J. & Pearce-Higgins, J.W. (2007) Measuring avoidance by capercaillies *Tetrao urogallus* of woodland close to tracks. Wildlife Biology 13(1): 19 – 27

Summers, R. W., Proctor, R., Thornton, M. & Avey, G. (2004) Habitat selection and diet of the Capercaillie *Tetrao urogallus* in Abernethy Forest, Strathspey, Scotland. Bird Study 51: 58 – 68.

Thiel, D., Menoni, E., Brenot, J.-B. & Jenni, L. (2007) Effects of recreation and hunting on flushing distance of capercaillie. The Journal of Wildlife Management 71(6): 1784 – 1792.

Thiel, D.T., Jenni-Eidermann, S., Palme, R., Jenn, L. (2011) Winter tourism increases stress hormone levels in the Capercaillie Tetrao urogallus. Ibis (2011), 153, 122–133