Capercaillie and Recreational Disturbance Study

For CNPA, FCS and SNH

Keith Marshall

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EXECUTIVE SUMMARY

This study involved the use of a technique based on the Delphi process to establish the degree of consensus between 15 experts regarding the level of understanding of the impacts of human recreational disturbance on capercaillie in Scotland.

A piloted questionnaire was sent to the respondents investigating the disturbance impacts of different recreational activity types, the timing and frequency of the activity, and the degree of cover afforded by the habitat. The combined results were summarised and returned to the experts for further consideration. This was prior to a workshop, which was convened in order to identify aspects of the issue where there was consensus, areas where there was a lack of understanding, and to suggest priorities for further consideration.

The main findings on which there was a high degree of consensus were:

- Lek and brood rearing times are when disturbance is most critical to capercaillie
- Loose dogs allowed to range away from tracks are a disturbance threat throughout the year
- Good quality habitat that provides cover can mitigate disturbance effects
- Higher levels of activity cause more disturbance than lower levels independent of the activity type, and irregular more so than regular disturbance

There was less consensus regarding specific disturbance situations involving combinations of patterns and level of use, activity types, times of year and habitat characteristics. Site-specific factors such as habitat characteristics, topography, use of interpretative signs for visitors etc. were all considered to influence the impact of recreational use in a given forest area. During the workshop some research proposals and recreational management priorities were raised that received broad agreement. There is scope for further research, using both experimental approaches and historical data, which could contribute to a continued improvement of our understanding of this issue.

The Delphi approach used for this project allowed a range of individuals to freely express their opinions on the issues presented to them, particularly at the well-attended workshop. It may have been beneficial to have carried out an initial round of the process to establish the types of question that they believed were important to find answers too. This, in combination with allowing further time for a full second (postal) round, may have allowed an even clearer picture of the capercaillie and recreational disturbance issue to be presented.

1. INTRODUCTION

Capercaillie numbers in Scotland have reduced significantly over the past 30 years or so from approximately 20,000 to a current figure of approximately 1900 individuals (Eaton & Marshall *in prep*). The main contributing factors are thought to have been poor breeding success (exacerbated by colder, wetter springs); deer fence strikes and poor habitat quality (Baines & Summers 1997, Moss *et al.* 2000, Moss *et al*. 2001). Another of the contributing factors mentioned in some studies is the effect of human disturbance on local populations in winter and the breeding season (Storch 2001). However, research into the causes, effects and significance of disturbance to capercaillie are scarce, and may be confounded by anecdotal evidence (Mueller 1981, Zeitler 2000). A review of the relevant literature is contained in Appendix 1.

The Cairngorms National Park Authority, Forestry Commission Scotland and Scottish Natural Heritage funded and jointly managed this project. Keith Marshall, who had previous experience of using the Delphi technique for research into capercaillie habitat suitability in Scottish plantation forests, conducted the project. The project's aim was to establish the current level and diversity of understanding of the effects of different types of recreational disturbance on capercaillie. This study has a broad scope and is of relevance throughout the capercaillie range in Scotland.

The Delphi technique was developed during the Cold War in order to evaluate the outcome of actions in scenarios where absolute answers were unavailable or compromised by a lack of data from which to calculate a solution (Crance 1987, Linstone & Turoff 1975). Using this method, a consensus between experts may be approached over two or more rounds of investigation. It is based on the assumption that combining the expertise of a group of individuals will provide more accurate results than consulting a single expert. The Capercaillie Biodiversity Action Plan Steering Group agreed that there is merit in conducting a study using a complementary approach, the Delphi, to investigate the issue.

2. METHODS

There is considerable expertise on capercaillie in Scotland and a body of understanding, based on field experience, of the effects of disturbance on capercaillie.

The Delphi technique, as adapted for use here, has enabled the combined knowledge relating to disturbance, from a cross section of individuals involved in the study or management of areas where capercaillie exist, to be brought together. The objective of using this technique was to establish the extent to which the understanding of disturbance effects of recreation on capercaillie in Scotland is diverse or whether there was a common understanding across a sample of those individuals with relevant experience.

The contributing experts were drawn from three groups based on individual's predominant experience: land managers & gamekeepers, capercaillie ecologists & conservation managers, and recreation managers. This was particularly important in that views from all parties with relevant experience were represented. All experts had experience of working in areas with capercaillie and their habitat. Fifteen individuals, five from each of the above groups (plus reserves), were selected by the steering group. This was following consultation with representatives of the Capercaillie BAP group and a wider group of stakeholders. Potential respondents were initially contacted by phone, informed of the rationale behind the project and then invited to participate. A list of the contributing experts is found in Appendix 6.

2.1 The consultation process

First Round: July 2004
A draft questionnaire was developed to which improvements were made following consultation with the Capercaillie LIFE Project Officer and two experts. The completed questionnaire (Appendix 4) was then sent, along with instructions (Appendix 3), to the experts. Fourteen of the 15 participants responded on the basis of their own experience and perceptions. The questionnaire was designed to obtain the experts' views on the level of disturbance experienced by capercaillie in response to a combination of different factors, which were:

- 10 different types of recreation activities
- 'Frequent' and 'Occasional' frequency of disturbance
- 'High' and 'Low' levels of cover provided by habitat
- 5 time periods over the period of a year

Participants were advised to consider a group size of 2-3 participants per disturbance event, where "Occasional" = <10 times per day, and "Frequent" = >10 times per day.

The ability of respondents to answer the questions is dependent on their level of experience of a given situation. Respondents were able to indicate this for each of their responses by stating whether they were confident, less confident or had no opinion.

Disturbance was defined as follows:
a) Temporary: i.e. if disturbance is infrequent then birds return to area in quiet periods. This may involve individual stress/energy costs and subsequent reduction in breeding success and/or survival but not long-term avoidance of suitable habitat.
b) Long term: i.e. avoidance of areas within a distance of used tracks, resulting in reduced or fragmented habitat availability.

Temporary and long term disturbance were considered to be equally important in the questionnaire. The questionnaire also attempted to quantify the degree of disturbance in terms of the distance from the track at which capercaillie would be affected. This was done using four distance bands where the most severe score, 1, meant that birds were disturbed at distances up to and beyond 75m from the track.

Second Round: August 2004
Following the return of the questionnaire the results were collated. Summary results, comments and a literature review were sent to each of the participants to allow them to assess the combined responses (the literature review contained in this report has been expanded, Appendix 1). There was not sufficient time available to allow each expert to respond in writing to the points raised in this document, so their views were sought in the first stage of the subsequent workshop.

Third Round: half-day workshop 31st August 2004
A capercaillie and recreational disturbance workshop was held at Glenmore Visitors' Centre on the 31st August, from 10am until 2pm. It was attended by 11 of the 14 questionnaire respondents, and was facilitated by Keith Marshall. The project steering group and the Capercaillie LIFE Project Officer also attended primarily as observers, although they helped to clarify some issues in the later stages of the workshop.

The discussion followed a brief introduction and a reminder of the rationale of the study. The first round results were then presented to the group in sequence, establishing the flow of the debate. Following discussion, each participant was asked to describe the three aspects of interactions between capercaillie and recreation that they considered the most important and in need of attention. The topics and issues put forward were recorded, along with an indication of the support for each suggestion from the group.

3. RESULTS

Six charts that illustrate the main findings from the questionnaire are displayed in the following pages, along with further information derived from related points that were discussed during the workshop. The graphs represent results as a percentage of the total number of responses within a category (e.g. activity, time period). The degree of disturbance caused is represented by the extent (distance from the track) to which an activity affects capercaillie (>75m, 25-75m, <25m and not significant). A brief explanation follows each chart highlighting the main findings along with comments on the level of agreement between respondents.

Following the review and discussion of the results at the workshop, the debate widened to include mitigation methods, research possibilities and priority issues. Since these topics do not fall within the direct remit of this main report, a summary of outputs from this discussion is included in Appendix 2.

3.1 The relative impacts of different recreation activities

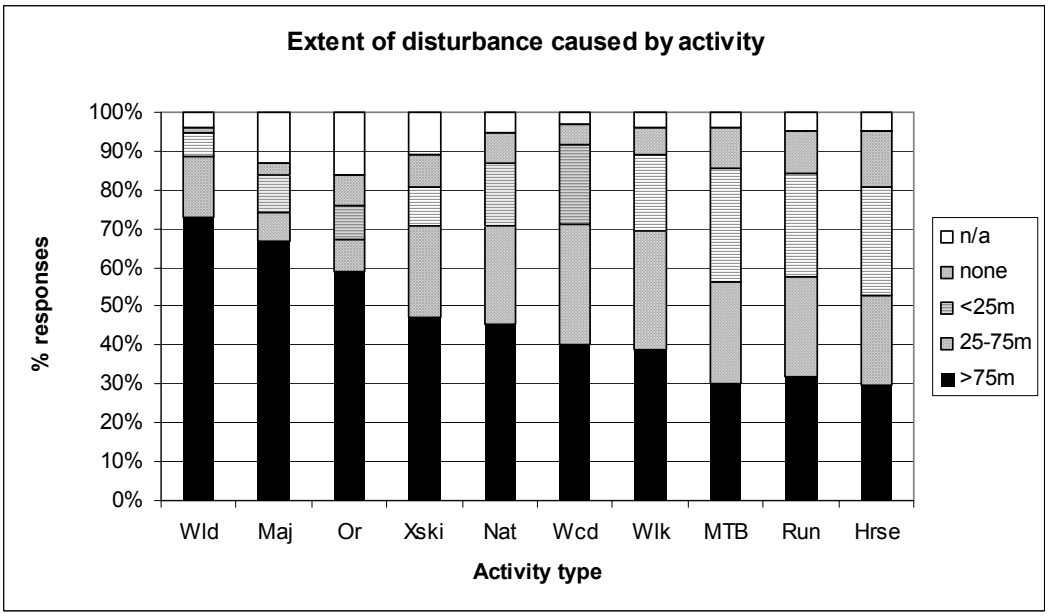

Figure 1. Key: Wld = walking with loose dog; Maj = major events; Or = orienteering; Xski = x-country skiing; Nat = nature watching; Wcd = walking with dog under control; Wlk = walking; MTB = mountain biking; Hrse = horseriding. Legend: >75 = disturbance significant beyond 75m; 25-75m = disturbance significant beyond 25m; <25m = disturbance significant to 25m; none = disturbance not significant; n/a = not applicable.

Comments on first round consensus and results

Figure 1 shows the results for each activity type, for time of year, frequency and habitat density combined. Nearly 75% of all responses relating to walking with a loose dog (Wld) rate this activity as causing the highest level (>75m) of disturbance. Where a dog was under close control (Wcd) the overall results were very similar to walking without a dog (Wlk). The majority of responses for orienteering and major events scored in the highest category. However, in both of these cases, it was frequently noted by the respondents that these activities are often carefully planned so as to avoid sensitive areas or times of year, hence the relatively high proportion of 'not applicable' responses.

The results and comments indicate that the level of disturbance is dependent on the specific conditions, group number, disturbance regularity and noise levels. Horse riding was seen as the activity causing least disturbance, perhaps reflecting the perception, as mentioned by one respondent, that wild animals recognise horses as less of a threat than humans.

The greatest consensus reached was that the activities walking with loose dog, major events and orienteering, resulted in disturbance to capercaillie beyond a distance of 75m. There was less consensus on the impacts of other activities but in very few situations did results indicate that an activity had no effect. It should be noted that because of the small sample sizes involved that there is no statistical difference in the results between the various categories.

Related issues raised and discussed during the workshop

It was generally agreed that variation of peoples' behaviour within activity types make it difficult to predict the level of disturbance that may be caused. For instance,

birdwatchers may make little noise, but they may remain for some time in a sensitive area, or leave the track to explore, thereby increasing the likelihood of causing disturbance. Several thought that dogs off of a leash were likely to range more widely and cause disturbance if their owner was moving slowly, e.g. walking rather than cross-country skiing or cycling.

The first round results suggest that biking causes less severe disturbance than some other activities. However, the point was made by some that larger areas are likely to be affected by cyclists because they are able to cover more ground in a given time, thereby affecting areas of forests that would otherwise be little used.

It was agreed by all that departure of individuals from tracks, or dogs allowed to range off the tracks increases the risk of serious disturbance. Uncontrolled dogs and people looking, intrusively, for capercaillie are thought to cause the most significant disturbance, particularly to lekking and nesting birds.

There was also consensus regarding major events: these are usually of a relatively short period of time and infrequent. Therefore they generally cause limited long-term disturbance to capercaillie as long as they occur outside the most vulnerable periods of spring and early summer. Control of spectators, or bystanders, to minimise their influence through the forest is important to reduce disturbance.

3.2 Disturbance related to frequency and cover

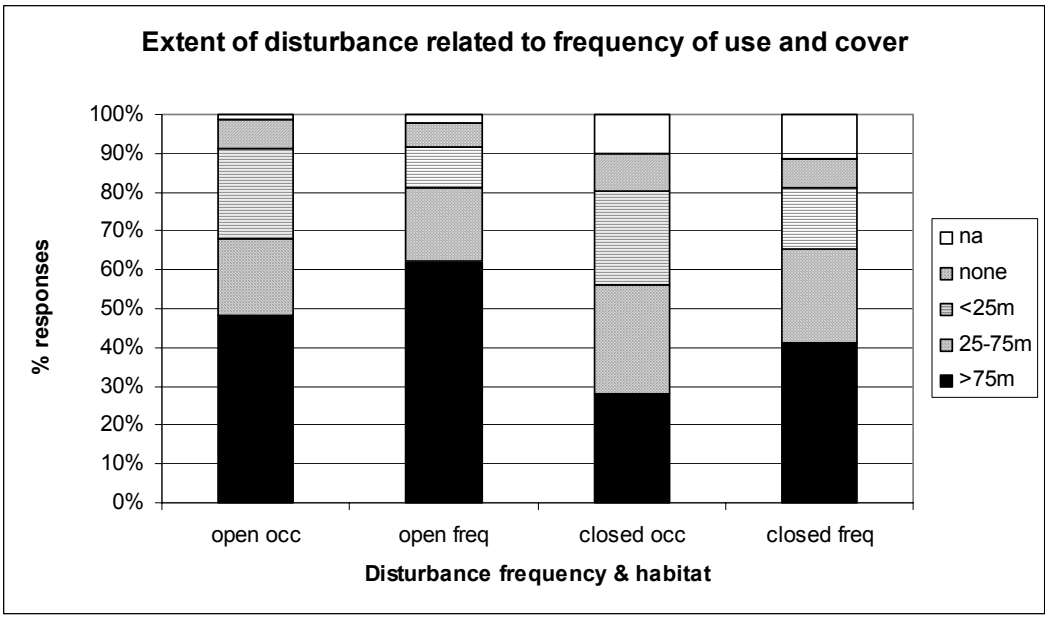

Figure 2. Key: open, closed refer to habitat; occ = occasional disturbance; freq = frequent disturbance. Legend: >75 = disturbance significant beyond 75m; 25-75m = disturbance significant beyond 25m; <25m = disturbance significant to 25m; none = disturbance not significant; n/a = not applicable.

Comments on first round consensus and results

Figure 2 indicates that both the frequency of disturbance and the degree of cover provided by the habitat were thought by most to affect the degree to which the birds are disturbed. Disturbance is considered to be more likely to be caused by frequent use of tracks in more open habitat (giving less cover and greater visibility). It was noted by some that lekking behaviour was less likely to occur in dense habitat, hence the higher proportion of 'not applicable' responses in this category.

Related issues raised and discussed during the workshop

The above picture is further complicated by the suggestion that the predictability of disturbance is more important than the nature of disturbance: birds can adapt to routine disturbance much better than unpredictable events. There was some agreement on this, but the effect was thought to be influenced by the timing and duration of activities.

Mention was made of the capercaillie on the Loch Lomond islands, where relatively dense ground vegetation may be one of the reasons why capercaillie persist there despite high numbers of human visitors on the beaches of the islands. It was also pointed out, by one expert, that topography can also affect the level of disturbance experienced by birds: small scale ridges and gullies offer a degree of refuge while flat ground increases the area in which birds may be exposed to disturbance. It was agreed by a majority that this was a further example of the site-specific nature of the impacts of disturbance.

Figure 3 (below) shows that this relationship is to some extent reflected within individual activities. This chart compares three activities (walking, walking with loose dog, and mountain biking) across the alternative disturbance frequencies and varying amounts of cover.

3.3 Comparison of 3 activity results regarding frequency/habitat density

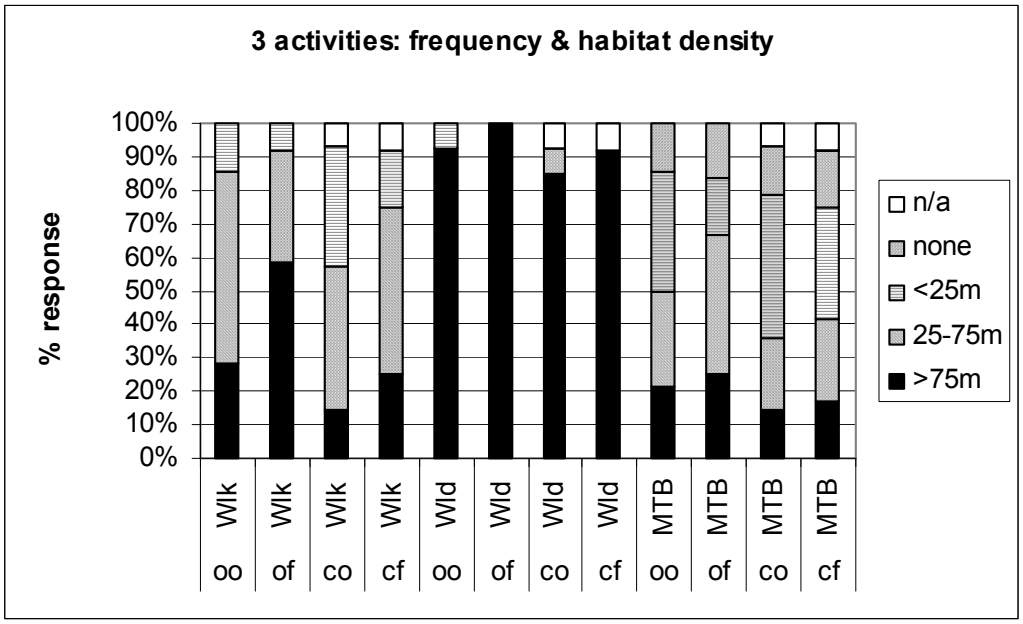

Figure 3. Key: oo = open, occasional: of = open frequent: co = closed occasional: cf = closed frequent. Wlk = walking; Wld = walking with loose dog; MTB = mountain biking. Legend: >75 = disturbance significant beyond 75m; 25-75m = disturbance significant beyond 25m; <25m = disturbance significant to 25m; none = disturbance not significant; n/a = not applicable.

Comments on first round consensus and results

The results in figure 3 reveal the perceived variation within these three activities caused by habitat and disturbance frequency. Variation of results is more exaggerated for walking (wlk), with the majority of responses indicating that frequent use in open habitat has a much greater disturbance effect than at lower levels of use. All of the responses involving walking (Wlk) or loose dogs (Wld) suggest disturbance being caused at some level, whereas approximately 15% of mountain-biking (MTB) responses indicated situations where disturbance was not believed to result from the activity.

Related issues raised and discussed during the workshop

There was general consensus that low level, long-term disturbance (a track continually used by walkers) is more detrimental to local capercaillie populations than rare/occasional high levels of disturbance (e.g. drive counts of capercaillie within the forest). It was noted by some experts that if the habitat provides good cover (mature trees, developed ground layer, windthrow, thicket etc.), birds might habituate more readily. Others countered this, noting that the extent to which habitat may mitigate disturbance impacts is not well understood.. Several experts spoke of anecdotal experience that suggested that screens or strips of unthinned trees alongside tracks might reduce the level of disturbance to birds in the forest beyond.

3.4 The effect of timing on the extent of disturbance

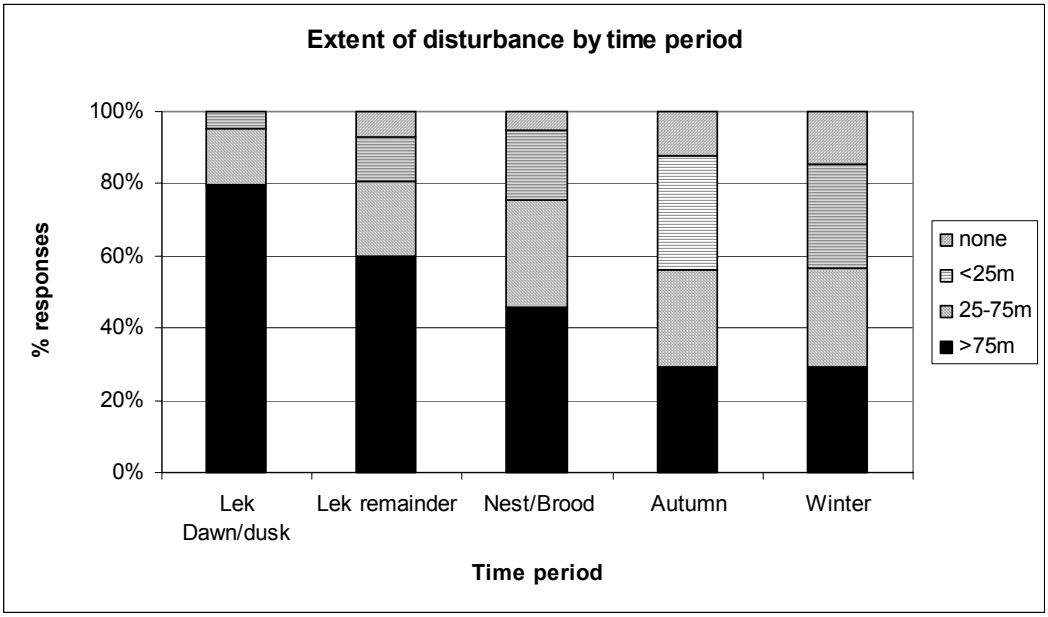

Figure 4. Legend: >75 = disturbance significant beyond 75m; 25-75m = disturbance significant beyond 25m; <25m = disturbance significant to 25m; none = disturbance not significant; n/a = not applicable.

Comments on first round consensus and results

The extent of the impact of a disturbance event was believed by most to vary depending upon when it occurs. The results (Figure 4) indicate that lekking, nesting and brood rearing are the times when the birds are considered by most to be most vulnerable. Capercaillie behavioural responses at these different times, for different sexes, and for different activity types, were discussed further at the workshop (see below).

There is large degree of agreement that some disturbance at least, is a year round issue. Over 80% of responses in each of the time periods relate to some degree of disturbance, and this increases to over 90% for the lekking, nesting and brood rearing times.

Related issues raised and discussed during the workshop

It is generally accepted that disturbance of displaying males at a lek may lead to a decline in the local population. One expert suggested that this might be because young males do not recruit to disturbed leks, and these leks therefore decline over time. Subsequently, young hens may not be attracted to the area because of the lack of displaying cocks.

Disturbance during winter is thought likely to be an important issue where sports such as cross-country skiing are common. It was pointed out that capercaillie are large birds with high physiological demands and, in winter, a correspondingly difficult balance between the energy provided by their diet and the amount required for growth and activity. This means that winter disturbance that disrupts their feeding habits or causes additional energy expenditure (escape flights) may result in a reduction in health and the bird not being able to achieve breeding condition.

It was felt by some individuals that capercaillie are more sensitive to disturbance at leks than other lekking grouse species. If this is the case then the study by Baydack

and Hein (1987) on sharp-tailed grouse is particularly relevant. It is difficult to assess the exact numbers of females present at a capercaillie lek as they may sit in trees unnoticed, and individuals will move between leks. The presence of males at a traditional lek may obscure the fact that breeding opportunities have been reduced, perhaps because of disturbance.

It was noted by one individual that few activities, apart from bird watching and dog walking, take place in the early morning when leks are most vulnerable to disturbance.

Nest disturbance may not be as likely as brood disturbance (nests are regularly found near to busy foot paths and other tracks). Hens are unlikely to leave a nest unguarded unless approached to within a few metres. Disturbance of females with a nest is of a different nature to that of a female with a brood: this relates both to her response (sit tight, escape flight) and the potential effect on the young (e.g. nest predation, exposure of young).

3.5 Frequent disturbance in open habitat during lekking

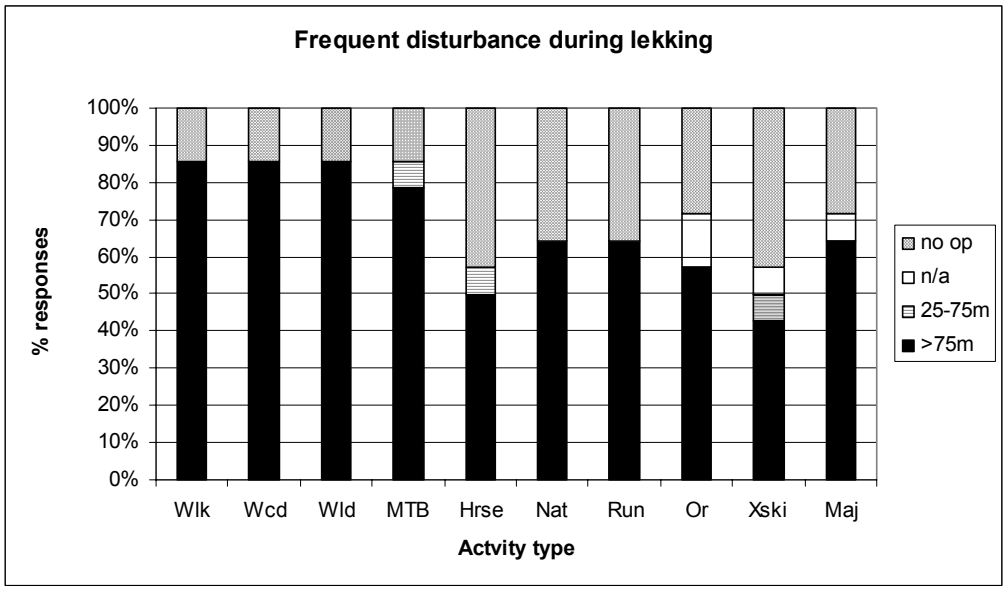

Figure 5. Key: Wld = walking with loose dog; Maj = major events; Or = orienteering; Xski = x-country skiing; Nat = nature watching; Wcd = walking with dog under control; Wlk = walking; MTB = mountain biking; Hrse = horseriding. Legend: >75 = disturbance significant beyond 75m; 25-75m = disturbance significant beyond 25m; n/a = not applicable; no op = no opinion.

Comments on first round consensus and results

The above chart relates to specific results for frequent disturbance in open habitat during the display period of the lek. This is the combination of factors that resulted in the highest levels of disturbance across the range of activities.

This set of results shows a general agreement amongst those who had an opinion. that disturbance during the main lek period is severe, regardless of the activity type. A lack of experience of the impact of activities such as horse riding, cross-country skiing and running meant that up to 50% of the respondents were unable to assess the disturbance caused by these activities.

3.6 Confidence in scores

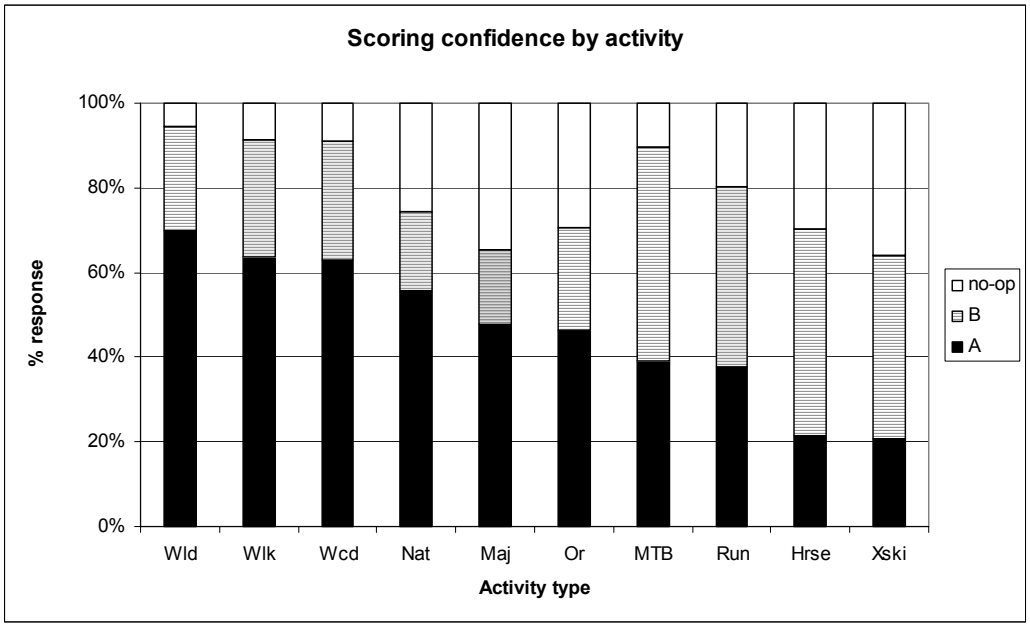

Figure 6. Key: Wld = walking with loose dog; Maj = major events; Or = orienteering; Xski = x-country skiing; Nat = nature watching; Wcd = walking with dog under control; Wlk = walking; MTB = mountain biking; Hrse = horseriding.
Legend: A = confident; B = limited grounds for opinion; no-op = no basis for opinion

Comments on first round consensus and results

The confidence with which the experts were able to respond to questions relating to the different activity types is indicated in Figure 5. The confidence of responses in general varied both with time of year, and to some extent with habitat density and disturbance frequency. However, the most important effect was related to the different activity types in question. More than 80% of responses to walking (with or without dog), mountain biking or running were the result of some informed opinion.

The proportion of confident scores (A) was much lower for mountain biking, running, horse riding and cross-country skiing than for walking, because the respondents had less experience of these activities and so disturbance was judged by extrapolation from more familiar activities.

Related issues raised and discussed during the workshop

It was noted that because of the complex interrelationships between the different components of the disturbance issue (activities, timing, habitat, level of use) and the small sample size, there was no difference statistical between the consensus results.

Summary of main results

Main findings achieving full consensus:

- Lek and brood rearing times are when disturbance is most critical to capercaillie
- Loose dogs allowed to range away from tracks are a disturbance threat throughout the year
- Good quality habitat that provides cover can mitigate disturbance effects
- Higher levels of activity cause more disturbance than lower levels independent of the activity type, and irregular more so than regular disturbance

Key areas of disagreement:

There were no major areas of disagreement, where two or more opposing views were expressed. However, there were differences of opinions relating to specific issues, as some of the results presented above show.

4 DISCUSSION

Issues

The workshop attendees agreed in principle with the project findings as stated above, although caution was urged in the use of the results, given the many site and time specific variations that can influence the level of disturbance caused by an activity. However, there appeared to be two main views as to what the priorities for action were. There were those who believed that more evidence was required as to the precise causes, effects and significance of disturbance, and those who felt that certain actions to mitigate disturbance effects (known or suspected) should be taken as soon as possible. Mitigation methods could then be further improved in light of results emerging from ongoing research.

Consensus was reached regarding the importance of disturbance as a general issue. However a lack of real knowledge prevented answers to more specific questions relating to the nature of disturbance. Opportunities for looking at some issues such as research using historical data, initiating further dialogue on the better understood impacts and dissemination of information regarding methods of disturbance mitigation were raised.

It was agreed that there are different reactions to a disturbance event. If these are infrequent (the definition of 'infrequent' varies with type of disturbance event), then in most cases it is unlikely that the bird(s) concerned will be adversely affected. Again there are exceptions, where any disturbance might have a detrimental effect: during the lek where mating opportunities may be lost, if a hen is moved off of her eggs and she does not return, or if a hen is separated from her brood. Other factors may come into play, such as birds may be less likely to abandon an area of good quality habitat for an area of less disturbed, but poorer quality habitat.

The issue of disturbance is a complicated one. The degree to which individual experience varies, and the varied level of technical understanding of the many ecological and human interactions involved, means that a clear picture is currently not available.

Process

The questionnaire and workshop approach used in this study provided some useful outputs, as well as raising issues for further consideration. Information was collected on nine of the ten areas that were originally proposed in the project proposal (seasonal effects, time of day effects, level of use effects, type of use effects, width of disturbance zones, interaction effects with habitat, differences between sexes/ages of birds, effects of predators and impacts on leks). One topic, climate (as opposed to weather), was not possible to incorporate.

The project has achieved its stated aim of revealing, to some degree, the level of understanding of capercaillie disturbance and the degree to which this is shared over a cross-section of interested parties. The detailed nature of the questionnaire made it possible to identify where the differences of opinion lie, and these could be explored further at the workshop. Such differences reflect the complexity of the issue, the variety of experience held by members of the group, and the confidence with which individuals express their opinions.

In summary, there is a strong consensus amongst this group of experts that capercaillie in Scotland are adversely affected by recreational disturbance. The likely growth in numbers of people pursuing recreational activities in some forests containing capercaillie have the potential both to reduce the area of available habitat (through avoidance of areas by capercaillie) and inhibit growth of the population (through reduced breeding success and increased mortality). Management of these forests should seek to develop reasonable measures in order to be able to take these disturbance effects into account.

APPENDIX 1: LITERATURE REVIEW

This is an updated and extended review, based on that provided to the experts in the 'Second Round: feedback' document prior to the workshop.

A limited amount of research has been carried out on human disturbance of capercaillie and related grouse species. Much of the work relates to observations of possible effects and extrapolation from a few observed cases to general assumptions, from which mitigation methods that appear to work are derived. These findings are grouped, by topic, below.

Track avoidance during winter
Recent work carried out in the winter 2003/04 in RSPB Abernethy and FC Glenmore, Scotland, tested the extent to which capercaillie avoid using trees (for feeding and roosting) near to forest tracks. A high (>10 people/day) and a low level (<10 people/day) use track were selected in each forest, in stands with broadly similar structures. The presence or absence of capercaillie droppings under trees 250m transects perpendicular to the tracks was used to indicate capercaillie use. Tree use was always less close to tracks and track avoidance increased with increased human use. The effective loss of habitat caused by disturbance amounted to 1 hectare per 64-82m of track. In forests such as these, with high track densities (approx 2.25km per km^2), this effectively represents 20-30% habitat loss. This may in turn mean that the area of forests used by capercaillie, in winter at least, is limited by disturbance. (Summers *et al*, submitted).

Other research, carried out in the French Pyrenees, has looked at winter populations between 1989 and 1997 following the construction of a cross-country ski centre in 1988. The local population in the ski area declined at an average of 9% per year compared to a stable control population away from skiing activity. It was calculated that 18% of the capercaillies' total winter range in this area was lost. (Brenot & Menoni 1999).

In a study of three Alpine regions capercaillie were observed to remain near areas of high disturbance rather than be displaced, but to become scarcer in the locality as individual birds die (Meile 1981). This suggests a detrimental effect of long-term disturbance, but does not acknowledge other factors that may have been involved such as habitat degradation.

Locally capercaillie may avoid areas frequented by off-piste skiers for several months. The impact of skiing on grouse thus may equal a temporal loss of habitat. (Zeitler & Glanzer 1998).

Cross-country ski trails may locally reduce available winter range. This has explained the decline of some sub-populations of capercaillie in the Vosges, Jura and Pyrenees. The construction of tracks in forests since the 1950s has increased human pressure on capercaillie habitats in all seasons. Except in winter and spring, it is difficult to show that the subsequent disturbance causes local capercaillie populations to decline. Disturbance in summer and autumn is probably less important than that in winter. (Menoni & Magnani 1998).

Of the many types of human activity in capercaillie habitat, activities such as cross-country skiing, hiking and orienteering in late winter, spring and early summer are likely to be the ones with the most severe effects. (Mollet).

Predation
Trained dogs were used to simulate the searching for nests and broods of capercaillie by mammalian predators. A dog will detect a capercaillie nest if closer than 1.6m and a capercaillie brood if closer than 39m. Nests were distributed in all habitat types, whereas broods were restricted to specific brood habitats. (Storaas, Kastalden & Wegge 1999). So, while nest disturbance may have serious consequences, disturbance of broods by dogs is more likely, especially if dogs are loose in areas known to be used by hens with broods.

Hens tend to stay on nests until approached closely. Disturbance of hens with broods is particularly serious in that their feeding is disrupted, and separation from the hen may increase the likelihood of predation or exposure. (Porkert 1978).

The dominant cause of disturbance to adult red grouse is free ranging dogs. Studies have shown that they are seven times more likely to be disturbed (flushed) when dogs are not on a short leash. (Hudson). The confidence with which this may be applied to capercaillie is not known.

The presence of mountain huts, and associated humans, in the Bavarian Alps attracts corvids (which will take eggs from exposed nests and will also take small chicks) and therefore may conflict with conservation efforts for threatened species such as grouse. (Storch & Leidenberger 2003).

Behaviour patterns
Lek behaviour of the sharp-tailed grouse in North America was studied in relation to various types of disturbance. Males were found to be site faithful despite nearby human disturbance. However, females would abandon such leks in favour of undisturbed ones. (Baydack & Hein 1987).

A Norwegian study on habitat use by male capercaillie in spring found that they preferred roosting sites where a mature canopy provided good cover, but where tree density was lower than in young plantations allowing a better outlook and more flightpaths. (Finne, Wegge & Eliassen & Odden 2000).

'Rogue' males appear to be more common in disturbed areas, suggesting a link between disturbance and this behaviour. (Menoni & Magnani 1998).

An 11 year study of black grouse during winter and the display season in downhill, off-piste and cross country skiing areas showed that: when in good cover, they continued their behaviour until the person approached to distances of <10-30m. In the open response distances increased to >30-100m. Closer approaches were followed most often by escape flights over distances of 50m->1.5km. Frontal approaches to 5->100m usually led to escape flights. The observed short response and escape distances relate to disturbance from only one direction. When disturbance stimuli appeared from two or more directions, escape flights were longer (>200m). Frequent but irregular disturbance was found to have a greater impact than low levels of activity. (Zeitler, 2000).

APPENDIX 2: MANAGEMENT & MITIGATION SUGGESTIONS

This section is derived from the second session of the workshop where the discussion developed to include possible mitigation measures and the scope for complimentary scientific research.

All who attended the workshop agreed that education and the transfer of reliable information should be facilitated at all levels (public, managers, landowners, responsible agencies and policy-makers). Recreation management should be founded upon the best available evidence, including expert advice, results from future targeted research, and where necessary, the application of the 'precautionary' principle.

Where public access is available to areas of woodland that contain a lek, efforts should be made to avoid disturbance during the lekking season, and in particular the early morning (approx. 3am-9am) when display activity is at its peak. It is likely that the diversion of birdwatchers to good lek viewing facility such as the one at the RSPB Loch Garten Osprey Centre will reduce potential disturbance from birdwatchers at other lek sites.

In capercaillie areas where tracks are abundant then information and signs can be used to encourage the use of tracks through less sensitive areas, thereby reducing the impact on important capercaillie areas such as known brood habitat. In certain cases it may be possible to decommission certain tracks, and this may be done for little cost. Opportunities for doing this are likely to be limited, not least because of landowners needs for tracks for access to perform various management activities, although temporary closure could be an option. An overriding need in all such cases is to recognise the need to act with the legislation contained within the Land Reform Act.

Levels of disturbance are related to how close an area is to good roads providing ease of access by car. Any opening of forest tracks in capercaillie areas for public vehicle use allows recreational activities to penetrate further into the forest area, with the potential to disturb more capercaillie. Sports such as mountain biking that allow people to travel further into a forest for their recreation may have a similar effect. Unlike the informal use of forest roads, formal mountain-bike routes may be constructed away from sensitive areas.

<u>IMMEDIATE ACTION</u>
The workshop agreed with the results from the questionnaire and further emphasised the potential impact of dogs not under control in capercaillie areas. This work has shown that uncontrolled dogs can cause severe disturbance to capercaillie during the lek and breeding season. Investigating ways of more effectively providing information and guidance on this issue to dog-walkers would be of benefit.

<u>CAPER SANCTUARY AREAS</u>
Establish sanctuaries with the aim of creating a co-ordinated network. These may use current designated sites as their basis, or could take the form of smaller scale areas of habitat known to be important to the local capercaillie population. Where sensitive capercaillie sites are identified, efforts should be made to encourage recreational activities away from the immediate area. However, this is complicated by the fact that the number of recreational users is increasing and concentrating them in areas away from 'sanctuaries' may not meet the needs of the users, and may cause other problems to be exposed.

In specific cases diverting people to less sensitive areas may create larger areas with lower levels of recreational impact. This may be the best way of managing access in crucial sites such as lek areas. Given that it is believed that disturbance affects capercaillie at distances of greater than 75m, then it could be argued that this would be the very minimum distance to which human activity should approach a known lek. Although some may see this as a desirable objective throughout the capercaillie' range, there is a need to develop such approaches with the cooperation of users if they are to succeed, and would be best dealt with at a local planning level, taking into account site-specific issues.

Smaller more informal sanctuaries may be 'created' by leaving areas of windthrown trees and juniper scrub. Such areas are used by capercaillie, while humans and dogs are unlikely to enter. Any site-specific active management such as this should follow consultation on the proposal.

LEGISLATION & INFORMATION

The recent changes in access and nature conservation legislation in Scotland need to be fully understood by all concerned.

A consistent approach to advice on managing recreational activities is essential to avoid unnecessary confusion, whilst recognising that the precise mitigation methods need to be tailored to the site. Increased use of signs giving clear reasoning and indicating sensitive sites/times would help the majority of users to better understand the capercaillie management aims at given sites. Recreational experts should continue to develop ways of managing people and dogs more effectively in designated areas (reserves, NNRs, SPAs, SACs), and areas with capercaillie populations and to persuade individuals who do not cooperate with local 'bylaws' or agreed management arrangements.

RESEARCH

The possibility of analysing existing spatial data of bird and brood (and lek distribution) over time (data held for past 15 yrs) and track density and visitor numbers was raised. A comparison of the population distribution and population dynamics in areas of different forest habitat types with 'high' versus 'low' levels of disturbance may reveal useful reference material.

Publication of quality findings in easily accessible formats will allow improved understanding of the situation not only by scientists, but by forest managers, recreational managers and policymakers. For example, making use of the relationship between winter disturbance frequency, foraging time and bird condition (stress, from hormone levels in faeces) from current Finnish studies to derive parameters to guide decision-making regarding buffer zones and refuges (Baines *pers com*).

Other areas of potential research include:

Trials of managing/diverting current recreation from known capercaillie areas.

Investigation into whether or not there is evidence of changes in capercaillie numbers or distribution following access restrictions during the Foot & Mouth crisis.

Further research where capercaillie has persisted despite perceived high levels of visitor usage (if suitable sites can be identified) could be used to explore mechanisms capable of mitigating the effects of disturbance.

APPENDIX 3
Questionnaire explanation

The exercise
The structured questionnaire that follows is repeated for 10 separately defined recreational activities. The activities are:

- Walking
- Walking with dog under control (**to heel or on leash at all times**)
- Walking with dog not under control (**free to roam from path out of sight of owner**)
- Mountain biking
- Horse riding/pony trekking
- Nature watching
- Running
- Orienteering
- X-country skiing
- Major events (occasional events involving many participants plus spectators).

Because of the complicated nature of this issue, some simplification and clarification of terms is required. Please refer to the definitions below, which will help avoid confusion about what it is that you are being asked to do at this stage. *Specific issues relating to these generalisations will be explored later in the project..*

General Definitions
DISTURBANCE EFFECTS
These may be:
a) Temporary: i.e. if disturbance is infrequent then birds return to area in quiet periods. This may involve individual stress/energy costs and subsequent reduction in breeding success and/or survival but not loss of habitat.
b) Long term: i.e. avoidance of areas within a distance of used tracks, resulting in reduced or fragmented habitat availability.

For the purposes of this questionnaire please treat temporary and long term disturbance (as defined above) as equally unacceptable.

MALE / FEMALE
Disturbance will in some scenarios have a different level of effect depending on the sex of the bird (e.g. hens with broods vs. lone males). Rate the severity according to the sex most adversely affected in each scenario.

TRACKS / TRAILS
Assume that all activities are confined to trails *except*:
a) orienteering, which involves navigation throughout a forest not necessarily related to established tracks, and
b) walkers with dog not under control.
In these two situations please score the level of disturbance in relation to the undefined route of the orienteers / dog.

Forest tracks or trails used for recreation range from single-track footpaths and cycleways through to forest roads engineered to support forestry operations machinery. At this stage of the process please score disturbance relating purely to the activity, not the type of track.

Questionnaire definitions

Please refer to *example* questionnaire sheet and scores on page 4

HABITAT

This has been separated into two categories to be considered separately. These are 'open' (line of sight >25m) and 'closed' (line of sight <25m). This is on the basis that birds may be less susceptible to disturbance where dense cover (either canopy or ground-cover) is available.

If you feel some combinations of habitat and bird behaviour are not likely (e.g. lekking and dense habitat) then please type **n/a** in the box to show that you have considered a response and deemed that one is not applicable.

LEKKING (DAWN/DUSK)

This refers to the periods when male capercaillie are involved in display activities at the lek centre. This allows you to score it differently to the rest of the day if necessary.

GROUP NUMBER

2-3 people

For the purposes of this study please score the disturbance level for each scenario assuming that each disturbance event involves only 2-3 people.

When scoring walkers with a dog, please assume that one dog is present.

EVENT FREQUENCY:

This is the number of disturbance events per day.

Occasional = < 10 times/day

Frequent = > 10 times/day

A section is available at the end of the questionnaire to allow you to state, briefly and clearly, please, other factors that you consider to be of significance in this particular debate. These may be incorporated, either into the second 'feedback' round, or raised as a topic for further discussion at the final workshop.

Scoring system

LEVEL OF DISTURBANCE CAUSED BY ACTIVITY:

The distance ranges act as a guide when considering the extent, and therefore area, over which the activity causes disturbance to capercaillie (in both 'open' and 'dense' habitat).

1 = high (>75m this us the most significant, with birds affected up to and beyond 75m from the track).

2 = medium (25-75m significant, but not beyond approx 75m).

3 = low (0-25m birds not disturbed beyond 25m).

4 = no significance

WEIGHT OF OPINION:

Given that you will be answering on the basis of your own judgement and experience it is not expected that you will be able to answer all questions with the same level of confidence. Please ignore sections where you feel unable to provide an assessment, otherwise:

1 = confident
2 = limited grounds for opinion

Completion of form
Please complete the questionnaire in the manner most appropriate to you. If possible, please return electronically.
a) enter your responses directly into the tables in 'Word' and return as an email attachment.
b) print off the questionnaire and complete by hand, returning by post.

Please return at your earliest convenience, Monday 19th July being a target date.

EXAMPLE RESPONSE

4WD driving

Habitat	Disturbance frequency	Lekking (dawn/dusk)		Lekking (remainder)		Nesting/brood rearing		Late summer / autumn		Winter	
		Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Weight (1-4)	Level (a,b)	Level (1-4)	Weight (a,b)
Open: line of sight >25m	Occasional (<10 times per day)	1	b	1	b	1	a			3	a
	Frequent (>10 times per day)	1	a	1	a	1	a			2	a
Closed: line of sight <25m	Occasional (<10 times per day)	N/a		2	b	N/a				2	a
	Frequent (>10 times per day)	N/a		2	a	N/a				3	b

LEVEL OF DISTURBANCE (SIGNIFICANT AT):
1 = high (>75m)
2 = medium (25-75m)
3 = low (0-25m)
4 = not significant

WEIGHT OF OPINION:
a = confident
b = limited grounds for opinion

In the above example:

During the lek, any disturbance level was considered significant at over large distances from the track in open habitat. The n/a entered in the 'Closed habitat' section during the lek indicates that dense habitat was not used.
The 'late summer / autumn' column is left blank indicating that the respondent had no experience on which to base an assessment of disturbance.
Disturbance was seen as generally less significant in winter.
In most cases the respondent was confident with their understanding of the scenario (weight of opinion = a).

APPENDIX 4
Questionnaire
Walking (without dog)

Habitat	Disturbance frequency	Lekking (dawn/dusk)		Lekking (remainder)		Nesting/brood rearing		Late summer / autumn		Winter	
		Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Weight (1-4)	Level (a,b)	Level (1-4)	Weight (a,b)
Open: line of sight >25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										
Closed: line of sight <25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										

LEVEL OF DISTURBANCE (SIGNIFICANT AT):
1 = high (>75m)
2 = medium (25-75m)
3 = low (0-25m)
4 = not significant

WEIGHT OF OPINION:
a = confident
b = limited grounds for opinion

Walking (with dog under control)

Habitat	Disturbance frequency	Lekking (dawn/dusk)		Lekking (remainder)		Nesting/brood rearing		Late summer / autumn		Winter	
		Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Weight (1-4)	Level (a,b)	Level (1-4)	Weight (a,b)
Open: line of sight >25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										
Closed: line of sight <25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										

LEVEL OF DISTURBANCE (SIGNIFICANT AT):
1 = high (>75m)
2 = medium (25-75m)
3 = low (0-25m)
4 = not significant

WEIGHT OF OPINION:
a = confident
b = limited grounds for opinion

Walking (with loose dog)

Habitat	Disturbance frequency	Lekking (dawn/dusk)		Lekking (remainder)		Nesting/brood rearing		Late summer / autumn		Winter	
		Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Weight (1-4)	Level (a,b)	Level (1-4)	Weight (a,b)
Open: line of sight >25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										
Closed: line of sight <25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										

LEVEL OF DISTURBANCE (SIGNIFICANT AT):
1 = high (>75m)
2 = medium (25-75m)
3 = low (0-25m)
4 = not significant

WEIGHT OF OPINION:
a = confident
b = limited grounds for opinion

Mountain biking

Habitat	Disturbance frequency	Lekking (dawn/dusk)		Lekking (remainder)		Nesting/brood rearing		Late summer / autumn		Winter	
		Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Weight (1-4)	Level (a,b)	Level (1-4)	Weight (a,b)
Open: line of sight >25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										
Closed: line of sight <25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										

LEVEL OF DISTURBANCE (SIGNIFICANT AT):
1 = high (>75m)
2 = medium (25-75m)
3 = low (0-25m)
4 = not significant

WEIGHT OF OPINION:
a = confident
b = limited grounds for opinion

Horse riding / pony trekking

Habitat	Disturbance frequency	Lekking (dawn/dusk)		Lekking (remainder)		Nesting/brood rearing		Late summer / autumn		Winter	
		Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Weight (1-4)	Level (a,b)	Level (1-4)	Weight (a,b)
Open: line of sight >25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										
Closed: line of sight <25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										

LEVEL OF DISTURBANCE (SIGNIFICANT AT):
1 = high (>75m)
2 = medium (25-75m)
3 = low (0-25m)
4 = not significant

WEIGHT OF OPINION:
a = confident
b = limited grounds for opinion

Nature watching

Habitat	Disturbance frequency	Lekking (dawn/dusk)		Lekking (remainder)		Nesting/brood rearing		Late summer / autumn		Winter	
		Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Weight (1-4)	Level (a,b)	Level (1-4)	Weight (a,b)
Open: line of sight >25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										
Closed: line of sight <25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										

LEVEL OF DISTURBANCE (SIGNIFICANT AT):
1 = high (>75m)
2 = medium (25-75m)
3 = low (0-25m)
4 = not significant

WEIGHT OF OPINION:
a = confident
b = limited grounds for opinion

Running (restricted to tracks)

Habitat	Disturbance frequency	Lekking (dawn/dusk)		Lekking (remainder)		Nesting/brood rearing		Late summer / autumn		Winter	
		Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Weight (1-4)	Level (a,b)	Level (1-4)	Weight (a,b)
Open: line of sight >25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										
Closed: line of sight <25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										

LEVEL OF DISTURBANCE (SIGNIFICANT AT):
1 = high (>75m)
2 = medium (25-75m)
3 = low (0-25m)
4 = not significant

WEIGHT OF OPINION:
a = confident
b = limited grounds for opinion

Orienteering (not restricted to tracks)

Habitat	Disturbance frequency	Lekking (dawn/dusk)		Lekking (remainder)		Nesting/brood rearing		Late summer / autumn		Winter	
		Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Weight (1-4)	Level (a,b)	Level (1-4)	Weight (a,b)
Open: line of sight >25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										
Closed: line of sight <25m	Occasional (<10 times per day)										
	Frequent (>10 times per day)										

LEVEL OF DISTURBANCE (SIGNIFICANT AT):
1 = high (>75m)
2 = medium (25-75m)
3 = low (0-25m)
4 = not significant

WEIGHT OF OPINION:
a = confident
b = limited grounds for opinion

X-country skiing

Habitat	Disturbance frequency	Winter		Lekking (dawn/dusk)		Lekking (remainder)	
		Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)
Open: line of sight >25m	Occasional (<10 times per day)						
	Frequent (>10 times per day)						
Closed: line of sight <25m	Occasional (<10 times per day)						
	Frequent (>10 times per day)						

LEVEL OF DISTURBANCE (SIGNIFICANT AT):
1 = high (>75m)
2 = medium (25-75m)
3 = low (0-25m)
4 = not significant

WEIGHT OF OPINION:
a = confident
b = limited grounds for opinion

Major events

Habitat	Disturbance frequency	Lekking (dawn/dusk)		Lekking (remainder)		Nesting/brood rearing		Late summer / autumn		Winter	
		Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Level (1-4)	Weight (a,b)	Weight (1-4)	Level (a,b)	Level (1-4)	Weight (a,b)
Open: line of sight >25m	Frequent (>10 times per day)										
Closed: line of sight <25m	Frequent (>10 times per day)										

LEVEL OF DISTURBANCE (SIGNIFICANT AT):
1 = high (>75m)
2 = medium (25-75m)
3 = low (0-25m)
4 = not significant

WEIGHT OF OPINION:
a = confident
b = limited grounds for opinion

Any other points of direct relevance to this work:

1)

2)

3)

APPENDIX 5

Feedback to respondents following questionnaire

Second Round: feedback and other issues.

In the first round you completed a questionnaire that allowed you to assess the disturbance caused to capercaillie by a range of activities at different times of year, at 'high' and 'low' frequencies and in 'open' or 'closed' habitat.

Disturbance was defined as follows:

a) Temporary: i.e. if disturbance is infrequent then birds return to area in quiet periods. This may involve individual stress/energy costs and subsequent reduction in breeding success and/or survival but not loss of habitat.

b) Long term: i.e. avoidance of areas within a distance of used tracks, resulting in reduced or fragmented habitat availability.

Temporary and long term disturbance were defined as equally unacceptable. The assessment of disturbance significance was based upon the distance at which the birds were affected.

What follows is a round up of the general views expressed by the expert group, using graphs of the results with additional notes. Comments relating to particular issues are inserted following the appropriate results. Section 2 outlines the main findings of work on capercaillie (and other grouse species) and disturbance, predominantly from European work. A brief summary, Section 3, follows. Finally, Section 4 contains some questions and issues for you to consider prior to the workshop, so that these can be explored further in-group discussion. References used are listed at the end of the document.

1. RESULTS

First round results show a broad consensus of opinion as to which activities cause extreme levels of disturbance, and at what time/season these effects are greatest. Charts showing the frequency of responses (by percentage) in each category are displayed. The graphs represent combined results as a percentage of the total number of responses within a category (e.g. activity, time period). The chart is annotated with the number of actual responses that were recorded in each category. A brief explanation follows each chart, highlighting the main findings.

Note: results relate to a group size of 2-3 participants per disturbance event, where "occasional" = <10 times per day, and "frequent" = >10 times per day.

<u>Activities</u>

Figure 1 (below) shows the results for each activity type, for time of year, frequency and habitat density combined. There is a degree of consensus regarding walking with a loose dog (Wld) with nearly 75% of responses rating this activity as causing the highest level (1) of disturbance. Where a dog was under close control (Wcd) the results were very similar to walking without a dog (Wlk). The majority of responses for orienteering and major events scored 1's. However, in both of these cases, it was frequently noted by the respondents that these activities are often carefully planned so as to avoid sensitive areas or times of year, hence the relatively high proportion of 'not applicable' responses.

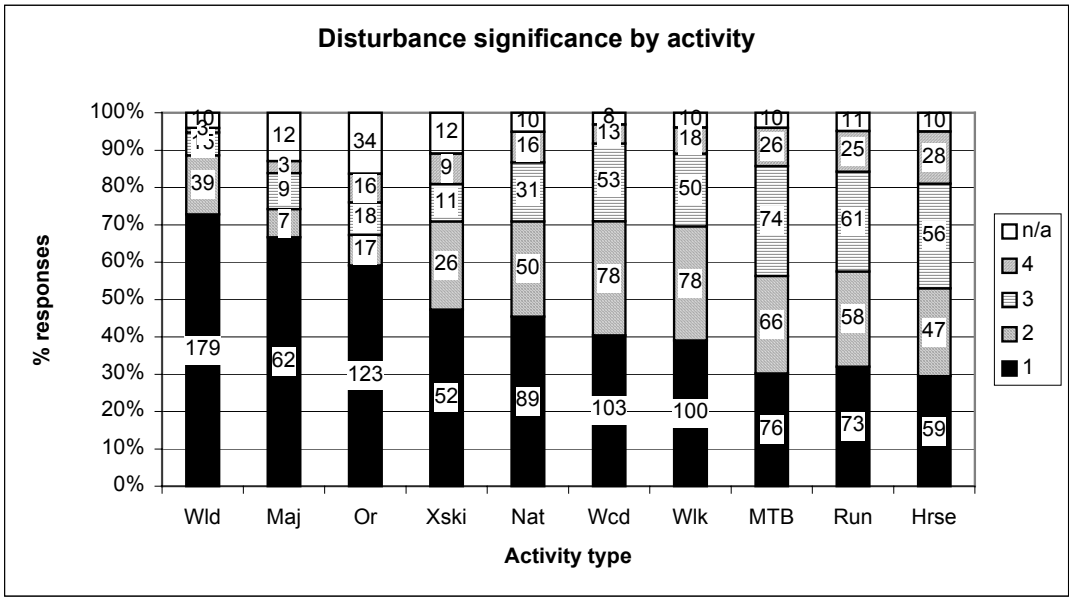

Figure 1. **Key: Wld = walking with loose dog; Maj = major events; Or = orienteering; Xski = x-country skiing; Nat = nature watching; Wcd = walking with dog under control; Wlk = walking; MTB = mountain biking; Hrse = horseriding. Legend: 1=disturbance significant beyond 75m; 2=disturbance significant beyond 25m; 3=disturbance significant to 25m; 4=disturbance not significant; n/a = not applicable.**

The overall results for other activities were broadly similar. However, a closer look at the results (see below) and the respondents' comments highlight the fact that actual disturbance impacts are dependent on the specific conditions, group number, disturbance regularity and noise levels. Horse riding was seen as the activity causing least disturbance, perhaps reflecting the perception that wild animals recognise horses as less of a threat than humans.

Related comments
Uncontrolled dogs and people looking, intrusively, for capercaillie cause the most significant disturbance, particularly to lekking and nesting birds.

Nest disturbance may not be as significant as brood disturbance (nests are regularly found near to busy foot paths and other tracks). Hens are unlikely to leave a nest unguarded unless approached to within a few metres.

Frequency & cover

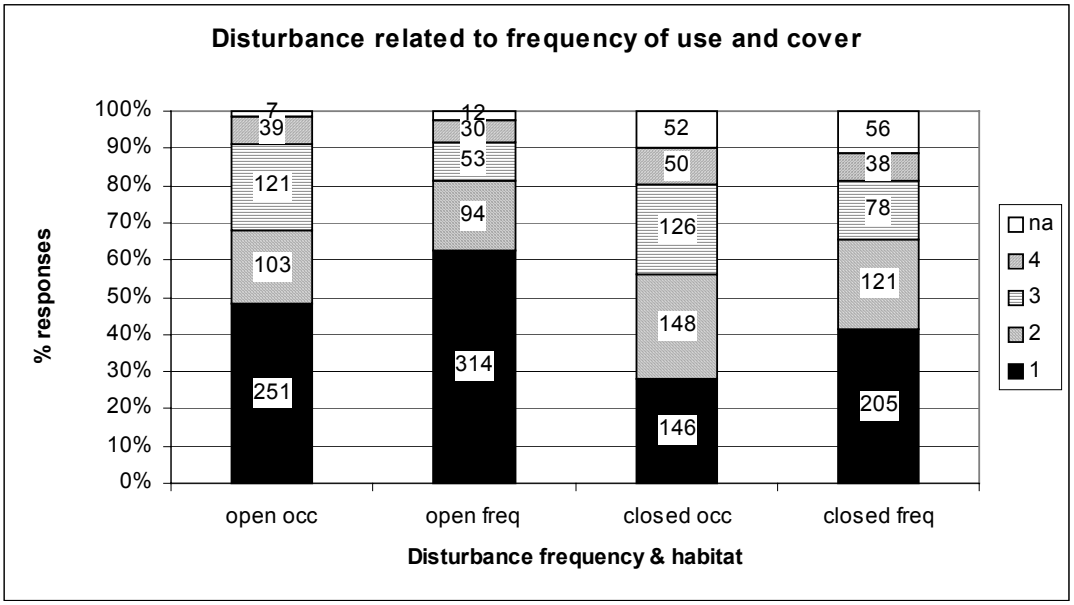

Figure 2. Key: open, closed refer to habitat; occ = occasional disturbance; freq = frequent disturbance. Legend: 1=disturbance significant beyond 75m; 2=disturbance significant beyond 25m; 3=disturbance significant to 25m; 4=disturbance not significant; n/a = not applicable.

Results in figure 2 indicate that both the frequency of disturbance and the degree of cover provided by the habitat affect the degree to which the birds are disturbed. Frequent activity in a more dense habitat rates similarly to occasional use in more open habitat. It was noted by some that lekking behaviour was unlikely to occur in dense habitat, hence the higher proportion of 'not applicable' responses.

Figure 3 (below) shows that this relationship is to some extent reflected within individual activities. This chart compares three activities (walking, walking with loose dog, and mountain biking) across the alternative disturbance frequencies and habitat densities.

Comparison of 3 activity results regarding frequency/habitat density

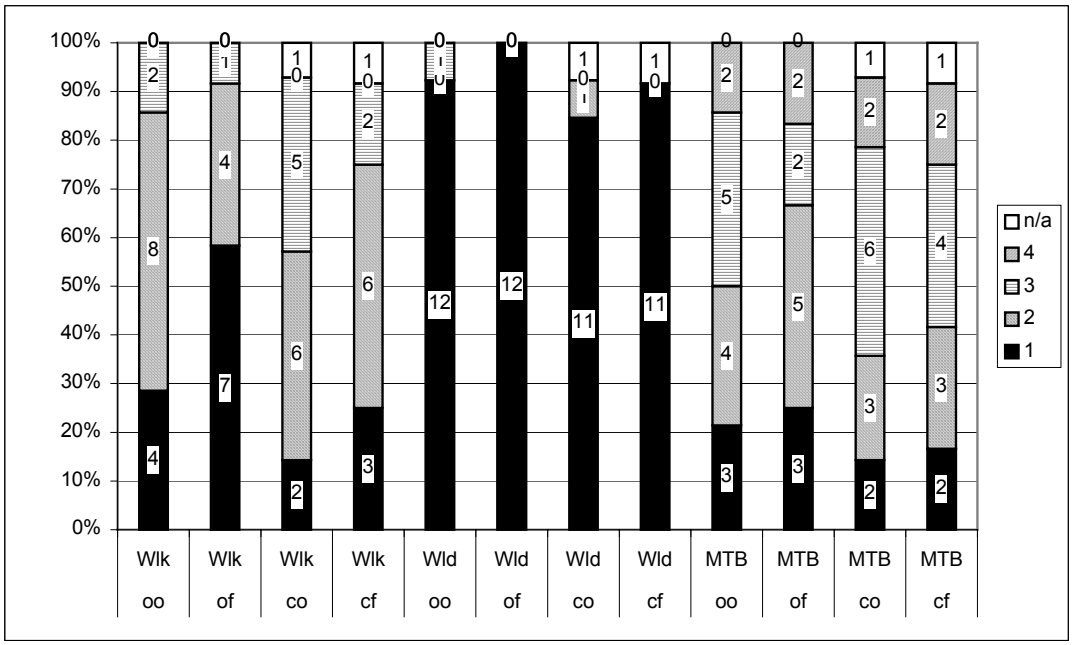

Figure 3. Key: oo = open, occasional: of = open frequent: co = closed occasional: cf = closed frequent. Wlk = walking; Wld = walking with loose dog; MTB = mountain biking. Legend: 1=disturbance significant beyond 75m; 2=disturbance significant beyond 25m; 3=disturbance significant to 25m; 4=disturbance not significant; n/a = not applicable.

The results in figure 3 reveal the variation within these three activities. The effects of variation in habitat density and disturbance frequency do not appear to affect the severity of disturbance caused by walking with a loose dog (Wld). Variation of results appears more exaggerated for walking (wlk). The results for mountain biking (MTB) reflect a fairly even spread of opinion as to the level of disturbance that it causes, regardless of the habitat or disturbance frequency (shown by the similar number of responses in each of the disturbance categories, 1-4).

Related comments

Predictability of disturbance is more important than the nature of disturbance: birds can adapt to routine disturbance much better than unpredictable events.

<u>The effect of timing on the severity of disturbance</u>

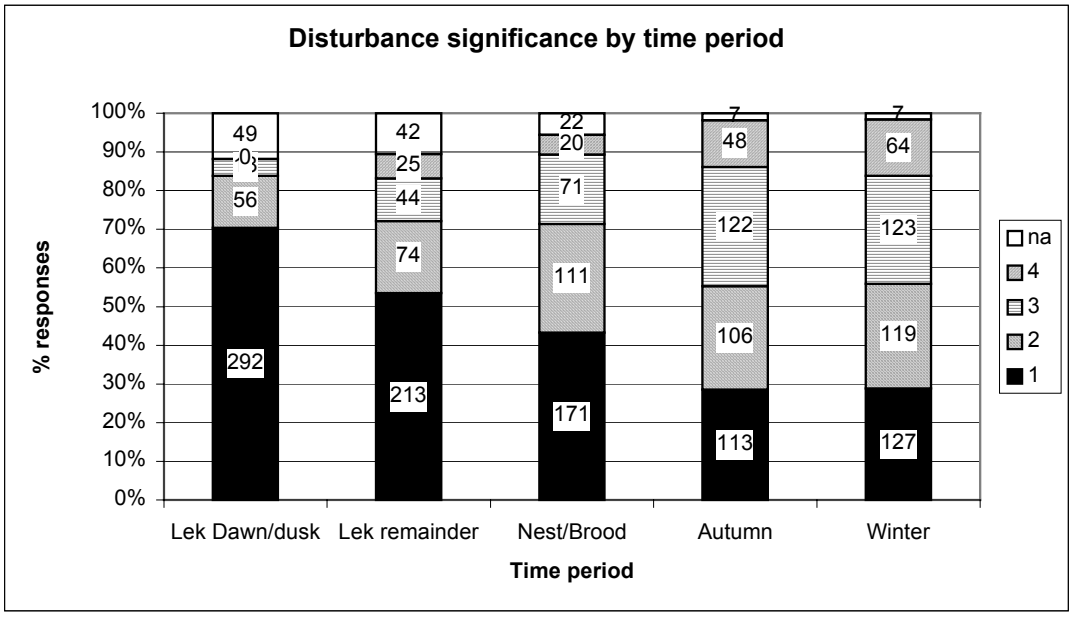

Figure 4. Legend: 1=disturbance significant beyond 75m; 2=disturbance significant beyond 25m; 3=disturbance significant to 25m; 4=disturbance not significant; n/a = not applicable.

The impact of a disturbance event varies depending upon when it occurs. The results (figure 4) indicate that lekking, nesting and brood rearing are when the birds are most vulnerable.

Related comments

Disturbance of females with a nest is of a different nature to that of a female with a brood: this relates both to her response (sit tight, escape flight) and the potential effect on the young (e.g. nest predation, exposure of young).

Major events are usually of a relatively short nature (e.g. one day's rally driving) and infrequent, therefore they generally cause limited long-term disturbance to capercaillie when taking place outside the most vulnerable periods of spring and early summer. Control of spectators, or bystanders, at major events, to prevent them spreading their influence through the forest is important to avoid disturbance.

Few activities, apart from bird watching and dog walking, take place in the early morning when leks are most vulnerable to disturbance.

Confidence in scores

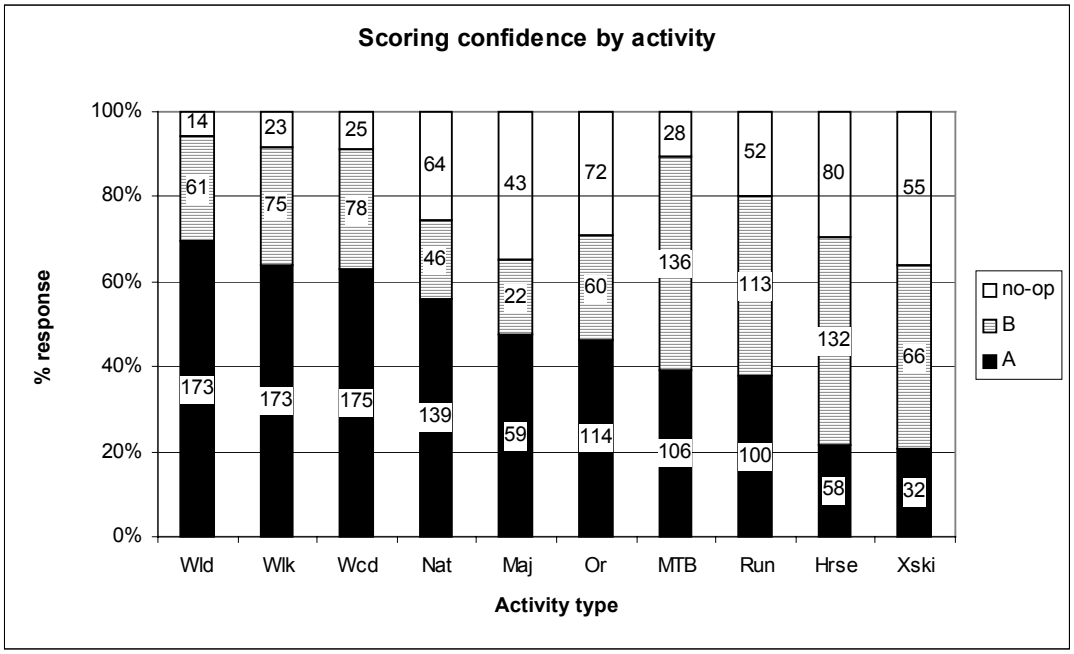

Figure 5. Key: Wld = walking with loose dog; Maj = major events; Or = orienteering; Xski = x-country skiing; Nat = nature watching; Wcd = walking with dog under control; Wlk = walking; MTB = mountain biking; Hrse = horseriding. Legend: A = confident; B = limited grounds for opinion; no-op = no basis for opinion.

The ability of respondents to answer the questions was dependent on their level of experience of a give situation, indicated by the codes A, B & no opinion (figure 5). This varied both with time of year, and to some extent with habitat density and disturbance frequency. However, the most important effect was related to the different activity types in question. More than 80% of responses to walking (with or without dog), mountain biking or running were the result of some informed opinion. However, the proportion of the mountain biking and running scores that were confident (A), was much lower than for walking.

2. RELEVANT REFERENCES

During the workshop the results produced by the first questionnaire will be discussed. It will be useful to do this with some knowledge of the findings of other work looking at aspects of the same problem. Some results from quantitative work are available, either on capercaillie or other grouse species. Much of the work relates to observations of possible effects and extrapolation from a few observed cases to general assumptions, from which mitigation methods that appear to work are derived. These findings are grouped, by topic, below.

Activities

Cross-country ski trails may locally reduce available winter range. This has explained the decline of some sub-populations of capercaillie in the Vosges, Jura and Pyrenees. The construction of tracks in forests since the 1950s has increased human pressure on capercaillie habitats in all seasons. Except in winter and spring, it is difficult to show that the subsequent disturbance causes local capercaillie populations to decline. Disturbance in summer and autumn is probably less important than that in winter. (Menoni & Magnani).

Of the many types of human activity in capercaillie habitat, activities such as cross-country skiing, hiking and orienteering in late winter, spring and early summer are likely to be the ones with the most severe effects. (Mollet).

Capercaillie were observed to remain near areas of high disturbance rather than be displaced, but to become more and scarcer over time. (Meile 1982).

Locally capercaillie may avoid areas frequented by off piste skiers for several months. The impact of skiing on grouse thus may equal a temporal loss of habitat. (Zeitler & Glanzer, 1998).

The dominant cause of disturbance to (red) grouse is free ranging dogs. Studies have shown that grouse are seven times more likely to be disturbed when they are not on a short leash. (Hudson).

Predation
Dogs were used to simulate the searching for nests and broods of capercaillie by mammalian predators. A dog will detect a capercaillie nest if closer than 1.6m and a capercaillie brood if closer than 39m. Nests were distributed in all habitat types, whereas broods were restricted to specific brood habitats. These results show the level of risk that dogs pose for young capercaillie. (Storaas, Kastalden & Wegge, 1999).

Hens tend to stay on nests until approached closely. Disturbance of hens with broods is particularly serious in that their feeding is disrupted, and separation from the hen may increase the likelihood of predation or exposure. (Porkert, 1978).

The presence of humans, and associated mountain huts, in the Bavarian Alps attracts corvids and therefore may conflict with conservation efforts for threatened species such as grouse. (Storch & Leidenberger, 2003).

Behaviour patterns
'Rogue' males appear to be more common in disturbed areas, suggesting a link between disturbance and this behaviour. (Menoni & Magnani).

An 11 year study of black grouse during winter and the display season in downhill, off-piste and cross country skiing areas showed that: when in good cover, they continued their behaviour until the person approached to distances of <10-30m. In the open response distances increased to >30-100m. Closer approaches were followed most often by escape flights over distances of 50m->1.5km. Frontal approaches to 5->100m usually led to escape flights. The observed short response and escape distances relate to disturbance from only one direction. When disturbance stimuli appeared from two or more directions, escape flights were longer (>200m). The pattern of disturbance was also found to be important. (Zeitler, 2000).

3. SUMMARY

Whilst there is a general consensus about the types of activity that cause the most substantial disturbance to capercaillie, the first round results and comments indicate that disturbance relates to a combination of many factors. Significant disturbance is caused by irregular but frequent use by noisy individuals or groups in more open habitat (less cover, greater visibility and noise travel). Departure from tracks or dogs allowed to run uncontrolled significantly increases the risk of serious disturbance.

Disturbance is a particular problem during the lekking season, with the birds being affected throughout the day despite the main displays occurring in the early morning when use by humans is less (except those watching the displays). Regular

disturbance of a lek may result in reduced access of dominant males to females for breeding in a given year, or lead to abandonment of the lek.

4. POINTS TO CONSIDER PRIOR TO WORKSHOP

Track & construction effects

New tracks in an undisturbed area of forest may provide a significant resource to capercaillie in terms of gritting and flight paths. Are these benefits always outweighed by the costs of human disturbance? Is predation risk likely to increase as a result of predators exploiting capercaillie using a track?

Tracks are a valuable habitat component and even low levels of use deny them this habitat. In forests with dense and tall heather small paths are frequently used by capercaillie. In forests of dense stands the tracksides and rides are often the best places for heather (and/or blaeberry) and are therefore important habitats for the birds.

Effects of disturbance on predation impact

Disturbance of capercaillie may result in increased mortality through predation by crows & foxes. Is this effect significant throughout the year, or only during nesting and brood rearing?

What happens to the number/distribution of predators of capercaillie (and broods and nests) when recreational disturbance is occurring? For instance, do crow densities increase with increased human presence, leading to increased nest predation at a given locality?

Stress

Is stress caused by disturbance likely to increase a capercaillie's susceptibility to disease or parasites? Could this be monitored?

Climate

Very cold winters, or ones with ice and hard snow result in increased energy costs and possibly reduced food availability. Cool, wet conditions in the breeding season increase the risk of exposure to young birds following a disturbance event.

Noise and visibility

The distance over which any disturbance may be described as severe is likely to be related to the distance the birds can see and hear, as defined by the local habitat and topography.

Results show that birds are somewhat less likely to be disturbed if good cover is available. However, is this still the case if noise is viewed as a significant component of disturbance? Can activity types be described as inherently noisy or quiet? Would this be a useful way of considering the impact of recreational disturbance?

Variation within activity

Group size (this was not covered in the first questionnaire): Do more people always equal more disturbance? This relates back to the last point - will a small noisy group cause as much, or more disturbance than a large group?

Tolerance / avoidance

Do birds become tolerant of certain types of activity? Are they more tolerant of regular activity than infrequent activity? Does this vary at different times of the year?

Please consider the above points, and your views on them, prior to the workshop.

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APPENDIX 6 Experts who participated in the study

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