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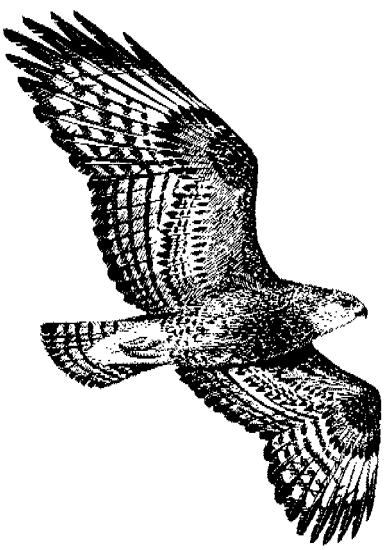
A pilot study in northern England



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1. Contents

2. Summary

1. Yorkshire Water, English Nature and the RSPB have recently begun re-introducing red kites into West Yorkshire. During the consultation process, grouse moor interests expressed concern about the potentially disturbing effects of red kites and other raptors on driven grouse shooting.

2. In order to access levels of raptor disturbance to driven grouse shooting, systematic observations were carried out during a total of 63 grouse drives in North Yorkshire and Durham during September and October 1999.

3. Raptors were observed by the project officer on nine drives, but there was only one drive where a raptor was considered to have caused disturbance to grouse.

4. The survey work showed that raptors caused very little disturbance to drives (2% disturbed). A larger percentage of drives were cancelled due to bad weather (3%).

5. When casual observations from gamekeepers were combined with data collected systematically by the project officer, the proportion of drives where disturbance was recorded increased, but was still relatively low. Gamekeepers who took part in the project agreed that disturbance of driven grouse by raptors appeared to be minimal during the 1999 shooting season.

6. Grouse numbers were generally low during the 1999 shooting season. In years when grouse densities are higher, incidents of disturbance involving raptors may be higher as high grouse densities may attract more raptors. Further studies, particularly in years when large numbers of grouse are available for shooting, would be valuable in testing this hypothesis.

3. Introduction

Moorland managed for red grouse *Lagopus lagopus* generally consists of a mosaic of different aged patches of heather *Calluna vulgaris* and other habitat patches such as grassland and wet flushes. Such diversity is known to be beneficial to red grouse (Miller 1980) and may also benefit other species (see Mowforth & Sydes 1989, Sutherland & Hill 1995, Robson 1998, and Watson 1977 for example).

Red grouse shooting provides a major source of income to rural economies in many areas of upland Britain. Hudson (1992) estimated that approximately 450,000 grouse are shot each year in Britain and at a (then) current value of £70 per brace (on driven days) would generate a gross income of £35 million. Although this is likely to be an over-estimate, as not all grouse are shot during organised drives, upland economies also benefit from the money spent by shooters visiting the area during the season (Hudson 1992). A report by Strathclyde University (mentioned in Hudson 1992) estimated that the total expenditure on grouse shooting in Scotland alone was £21 million.

One of the major issues currently concerning grouse moor owners and managers in northern England is the perceived impact of raptors on driven grouse shooting. Whilst the major concern is the effect of direct predation on adult and juvenile red grouse, particularly by hen harrier *Circus cyaneus* and peregrine *Falco peregrinus*, many owners and managers are also concerned that raptors may disturb grouse being driven over the guns on shoot days.

Such concerns were voiced most recently during the consultation process for the Yorkshire Water/English Nature/RSPB red kite *Milvus milvus* re-introduction programme, which began in summer 1999. During discussions between English Nature staff, moor owners and gamekeepers it became clear that, although scientific studies had been carried out to determine the impact of raptor predation on grouse numbers, there was little information on the impact of raptor disturbance. There was general agreement that it would be useful to try to assess the effects of disturbance by red kites and other raptors on driven grouse shooting and the present study was established.

Hudson (1992) carried out a study of disturbance by hen harriers on grouse moors, but the current study is the first to attempt to assess general raptor disturbance to driven grouse shooting and should be viewed as a pilot study. One of the main aims was to develop a suitable, and repeatable, methodology for use in future studies.

It was originally intended that the study should take place on moorland in Nidderdale, North Yorkshire, focusing on estates closest to the southern boundaries of the East and West Nidderdale Sites of Special Scientific Interest (SSSI), as these estates were relatively close to the site chosen for releasing red kites (Harewood House, to the south of Harrogate). However, following initial consultations with these estates in August 1999, it became apparent that this was a very poor year for grouse production and most estates were either shooting very little or not at all. Therefore, additional estates, in both North Yorkshire and Durham, were approached.

These estates were further north than originally intended for the research, but most claimed to have experienced some disturbance from raptors during shoot days in the past and therefore provided viable alternatives to the estates that were originally approached. Radio tracking also showed that the majority of these estates were still within the known ranging distance of the red kites released at Harewood (Doug Simpson pers. comm.).

3.1 Aims

The aims of this pilot study were two-fold:

1. To develop and use standard methods to record the number of raptors present during driven grouse shoots on moorland in North Yorkshire and Durham.

2. To quantify the effects of raptor disturbance on grouse during drives.

4. Methods

A standard survey form was designed specifically for this project in order to record information on numbers of birds of prey seen and any disturbance caused during grouse drives. The survey form also accommodated the recording of other types of disturbance, including dogs, vehicles and walkers, in order to help put the effects of disturbance from raptors into context. A sample survey form is included at appendix 1.

The project officer visited shoots by arrangement with estates and used the survey form to record information on the raptors and disturbance events witnessed during drives. To provide additional information, gamekeepers were also encouraged to use the survey form to record disturbance.

The study was carried out on moorland owned and managed by seven different estates, two of which allowed access onto two geographically separate moorland blocks. In all, the work was carried out on nine different moorland blocks and 63 drives were surveyed. Within each block there was often a rotation of drives throughout the season so that different areas were covered during visits on different days.

Each shoot day consisted of a number of drives (generally 4 or 5) and each drive involved a line of beaters walking across a moor, directing flushed grouse to a line of grouse butts concealing the 'guns'. The locations from which the project officer made observations were determined by the keepers who generally allowed free access, providing that the officer was not endangered and did not disturb drives himself. In practice, survey locations were largely determined by site topography using one of the two approaches detailed below:

1. Wherever possible, a good vantage point from where all or most of the drive could be observed was selected as the survey location. Locations from where all of the drive could be observed were limited, but most could be observed from a vantage point where the vast majority of the drive was in view. The best vantage point was usually remote from the drive (e.g. on an adjacent hill top), but occasionally was from a grouse butt on the gun line or at a point to one side of the drive.

2. Where no suitable vantage points were available, surveys were carried out while walking with the beaters. This was less satisfactory than observing from a fixed point because the care required while walking over uneven terrain reduced the time available for scanning for raptors. In addition, depending on the topography of the drive, only a limited area could be viewed at any one time.

Moorland owners had suggested that a survey form should be used by keepers to record information about raptors during grouse drives. However, in order to collate information on raptor numbers and disturbance in a consistent way, a project officer was employed to carry out the bulk of the study. This approach reduced the potential for bias that results from variations in individual ability and motivation when many different observers are involved (Bibby *et al* 1992). Keepers are also occupied with organising and taking part in drives and are therefore unable to devote all their time to looking for and recording disturbance incidents. However, the project officer consulted all head-keepers at the end of each shoot day to determine whether anyone who was present (guns, beaters and keepers) had observed any disturbance factors and these were recorded separately.

5. Results

The project officer surveyed a total of 63 drives. The results collected using the standard survey forms are summarised in table 1. Much of the information collected, such as date and drive location, has been omitted at the request of some moorland owners. To give some indication of the distribution of surveys, the code for the SSSI within which the shoots took place is given followed by a Y or D in brackets indicating North Yorkshire or Durham respectively. The name of each SSSI and their corresponding codes are given below table 1. One shoot took place on moorland not designated as a SSSI and therefore only the county code is given.

Table 1 Summary of survey results

Drives are listed in the order in which the work was carried out.

Drive	Location	Bird/animal sighted	Public/dogs sighted	Description of impact
1	e.n.(Y)	none	none	na
2	e.n.(Y)	none	none	na
3	e.n.(Y)	none	none	na
4	l.s.-s.m.(Y)	none	none	na
5	l.s.-s.m.(Y)	kestrel	none	no impact observed or reported
6	l.s.-s.m.(Y)	none	none	na
7	l.s.-s.m.(Y)	none	none	na
8	l.s.-s.m.(Y)	none	none	na
9	u.t. (D)	kestrel & merlin	none	no impact observed or reported
10	u.t. (D)	none	none	na
11	u.t. (D)	none	none	na
12	u.t. (D)	none	none	na
13	l.s.-s.m.(Y)	buzzard	none	no impact observed or reported
14	l.s.-s.m.(Y)	none	none	na
15	l.s.-s.m.(Y)	none	none	na
16	l.s.-s.m.(Y)	none	none	na
17	l.s.-s.m.(Y)	none	none	na
18	l.s.-s.m.(Y)	none	none	na
19	l.s.-s.m.(Y)	none	none	na
20	l.s.-s.m.(Y)	none	none	na
21	l.s.-s.m.(Y)	kestrel	none	no impact observed or reported
22	l.s.-s.m.(Y)	none	none	na
23	b.m.(D)	kestrel	none	no impact observed or reported
24	b.m.(D)	none	none	na
25	b.m.(D)	none	none	na
26	e.n.(Y)	none	none	na
27	e.n.(Y)	none	none	na
28	e.n.(Y)	none	none	na
29	e.n.(Y)	fox	none	no impact observed or reported
30	l.s.-s.m.(Y)	none	none	na
31	l.s.-s.m.(Y)	none	none	na
32	l.s.-s.m.(Y)	kestrel	none	no impact observed or reported

Table 1 Summary of survey results - continued

Drive	Location	Bird/animal sighted	Public/dogs sighted	Description of impact
33	l.s.-s.m.(Y)	none	none	na
34	u.t. (D)	none	none	na
35	u.t. (D)	none	none	na
36	u.t. (D)	none	none	na
37	u.t. (D)	peregrine	none	no impact observed or reported
38	u.t. (D)	none	none	na
39	u.t. (D)	none	none	na
40	u.t. (D)	none	none	na
41	u.t. (D)	none	none	na
42	(Y)	short eared owl & fox	none	no impact observed or reported
43	(Y)	buzzard	none	no impact observed or reported
44	(Y)	none	none	na
45	(Y)	kestrel & hen harrier	none	harrier chased 2 driven grouse away from guns, no other impact observed or reported
46	(Y)	buzzard	none	no impact observed or reported
47	(Y)	none	none	na
48	e.n.(Y)	none	none	na
49	e.n.(Y)	none	2 walkers	drive delayed by 15 minutes
50	e.n.(Y)	none	none	na
51	e.n.(Y)	none	none	na
52	e.n.(Y)	short eared owl	none	no impact observed or reported
53	e.n.(Y)	none	none	na
54	e.n.(Y)	none	none	na
55	e.n.(Y)	none	none	na
56	e.n.(Y)	sparrowhawk & peregrine	none	no impact observed or reported
57	l.s.-s.m.(Y)	peregrine	none	no impact observed or reported
58	l.s.-s.m.(Y)	none	none	na
59	l.s.-s.m.(Y)	none	none	na
60	u.t. (D)	none	none	na
61	u.t. (D)	none	none	na
62	u.t. (D)	kestrel	none	no impact observed or reported
63	u.t. (D)	none	none	na

e.n.= East Nidderdale Moors, l.s.-s.m.= Lovely Seat-Stainton Moor, b.m.= Bowes Moor and u.t= Upper Teesdale

Scientific manes of those species mentioned in table 1 which have not been mentioned previously are kestrel *Falco tinnunculus*, merlin *Falco columbarius*, buzzard *Buteo buteo*, short-eared owl *Asio flammeus*, fox *Vulpes vulpes*, and sparrowhawk *Accipiter nisus*.

Figure 1 Proportion of drives on each survey area.

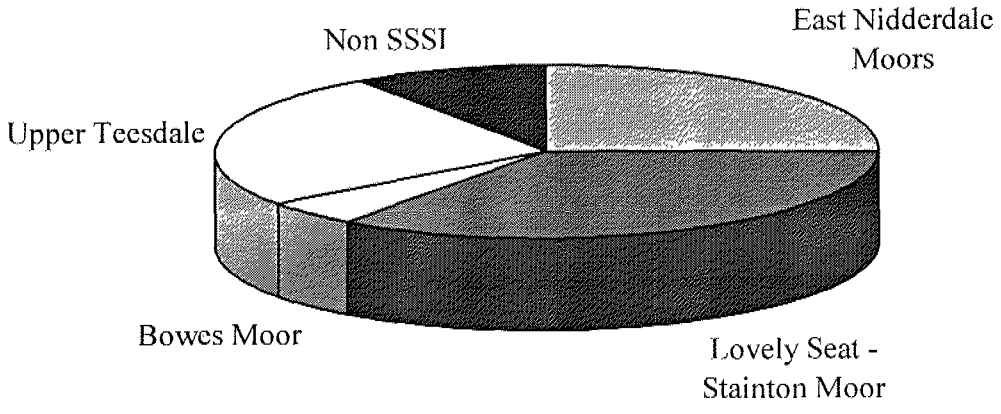

Figure 2 Proportion of drives with potentially disturbing activity

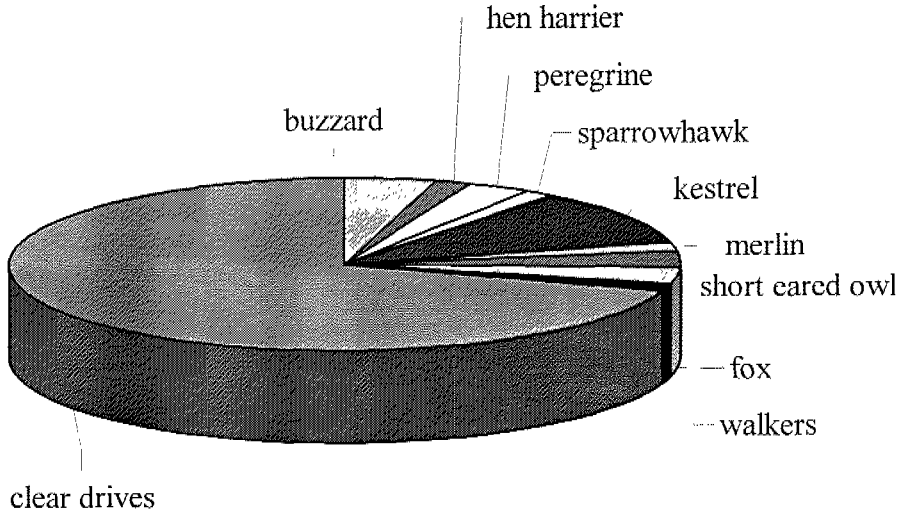

Table 2 Summary of raptor observations reported by keepers

To maintain confidentiality, observations reported by keepers are tabulated separately and no indication of drive location is given. Each drive is labelled with a letter for reference purposes only and does not correspond to the order in which the work was carried out.

Drive	Bird/animal sighted	Description of impact
a	2 stoats	No impact observed or recorded
b	merlin	No impact observed or recorded
c	hen harrier and 2 ravens	Numbers of grouse seen leaving drive and flying to adjacent estate on strong wind prior to initiation of drive. Very low grouse numbers in this and reverse drive. Some of the remaining grouse sat tight.
d	hen harrier	Grouse had taken cover from hen harrier in rushes adjacent to moor.
e	peregrine	No impact observed or recorded
f	peregrine	May have caused a slight reduction in the number of grouse being driven over guns for a few minutes.
g	kestrel	No impact observed or recorded
h	3 ravens	Grouse aggregated into large packs, which were described by keeper as being difficult to handle. Reverse drive was also affected in the same way.
i	buzzard	Shifted grouse from one drive to another (one drive had higher numbers of grouse than expected by keepers while the reverse had lower numbers than expected.
j	hen harrier	Lower numbers of grouse in area than expected by keepers– hen harrier shifted grouse out of area in this and reverse drive.

Scientific names of those species mentioned in table 2 which have not been mentioned previously are stoat *Mustela erminea* and raven *Corvus corax*.

Table 3 Summary of raptors seen and disturbance incidents

The figures in standard text are those derived by using data collected systematically by the project officer. Figures in brackets include data collected by keepers.

Number of drives where raptors/ravens were observed	Percentage of drives where raptors/ravens were observed	Number of drives disturbed by birds	Percentage of drives disturbed by birds
9 (16)	14 (25)	1 (11)	2 (17)

Note that the figures do not include the records of eight kestrels and two merlins as these species are not blamed by grouse moor managers for disturbing drives. All of the other species recorded (hen harrier, peregrine, buzzard, sparrowhawk, short-eared owl and raven) are considered capable of causing disturbance to drives.

6. Discussion

Recording the number of raptors encountered and their location with respect to the grouse drives was relatively straightforward. It was often much more difficult to assess the levels of disturbance caused by raptors to drives as this required subjective interpretation of grouse behaviour.

Incidents where grouse are flushed by a raptor and fly away from the guns or away from the beaters clearly indicate that disturbance has taken place. However, a passing raptor may cause grouse to sit tight and refuse to fly, and this behaviour is much more difficult to observe and therefore quantify. Interpretation is made more difficult because patterns of behaviour in response to a potential predator can vary depending on the type of predator involved, its behaviour in relation to the drive, weather conditions and even the state of alertness of the grouse.

The presence of a hen harrier can cause grouse to aggregate into larger packs, which may fly in all directions and become very difficult to drive (Hudson 1992). Grouse can also be cleared from one area onto adjacent areas by passing harriers (Hudson 1992). Buzzards and ravens can have a similar impact (L. Waddell pers. comm.). A different response may result from the presence of a peregrine over a moor. In this situation grouse may sit tight as they are vulnerable to being taken on the wing by this species. Once grouse have been 'spooked' by a potential predator they may become much more alert and take flight more readily if there are further disturbance factors (L. Waddell pers. comm.).

Hudson (1992) acknowledged the difficulty in quantifying disturbance caused by hen harriers and gave some examples of variables that can affect the response of grouse, such as the direction of flight of the harrier, grouse flight lines on the moor and the history of harrier disturbance. It is equally difficult to quantify disturbance caused by other species for similar reasons. However, by working in close consultation with keepers and using their experience and knowledge of species capable of causing disturbance, the interpretation of disturbance incidents during this study was as accurate as possible.

Before the pilot study was initiated, an arbitrary figure of 50 drives was determined as being the minimum number that should be observed. Having completed the study it is considered that the 63 drives attended does provide an adequate assessment of the extent of raptor disturbance to grouse in the areas covered during the 1999 season.

Excluding kestrels and merlins, species not considered to cause disturbance, raptors were recorded on 14% of the 63 drives and disturbance to grouse was recorded during only a single drive. This incident involved a female hen harrier flying across the line of the drive and pursuing two of the driven grouse. The incident was considered to be relatively minor as a number of grouse packs were driven over the guns both before and after the harrier passed through. The only other recorded disturbance of any kind occurred when two walkers delayed the start of a drive by 15 minutes. Because of the difficulties outlined above, it is possible that on some of the nine drives where raptors were seen, there was some undetected impact on grouse behaviour. However, in most cases, observations and subsequent discussion with the head gamekeeper suggested that, if any disturbance effects had taken place, they were of a minor nature.

The inclusion of the observations reported by keepers during drives attended by the project officer increased the proportion of drives where raptors were observed to 25% and the proportion of disturbed drives to 17%. However, the reported disturbance caused by a peregrine was relatively minor (table 2, drive f) and one disturbance incident caused by a hen harrier (table 2, drive i) resulted in decreased numbers of grouse in one drive, but a corresponding increase in the reverse drive.

Using the combined data from the project officer and from keepers reports, the recorded incidents of disturbance involved one peregrine, four hen harriers, one buzzard and five ravens, affecting a total of 11 drives. Interestingly, keepers from a single estate recorded 82% of these observations. This could be because there were a higher number of raptors in this area but more likely reflects differences between observers, highlighting the potential for bias and the value of an experienced project officer collecting data in a systematic manner.

Some survey sheets have been completed independently by gamekeepers for drives other than those attended by the project officer, although few have been received thus far. However, it is clear from discussions with head-keepers from estates involved in this study, that their experience during the 1999 shooting season reflects the results detailed in this report, i.e. relatively little disturbance by raptors has occurred this season. It is expected that the results from any additional survey forms returned by keepers will confirm this.

Many estates have carried out very little or no shooting this season due to low grouse numbers. Keepers blamed the parasitic nematode threadworm *Trichostrongylus tenuis* as the major cause in the reduction of grouse numbers, the recent series of successive mild winters aiding the spread of this debilitating parasite. Weather conditions also restricted the amount of shooting possible during this study. In fact, during this study, bad weather caused a greater disturbance to drives (3% cancelled) than did disturbance by raptors as surveyed by the project officer (2% with minor disruption).

Predators are likely to concentrate their activities in areas where prey densities are highest and the low incidence of raptor disturbance this year may partly result from the generally low numbers of red grouse. This is only likely to apply to hen harrier and peregrine as these are the only raptors, of those recorded, where adult grouse may comprise a significant proportion of the diet. In years where grouse densities are higher it is possible that incidents of disturbance involving these species may increase, as more raptors may be present.

It would be a valuable exercise to carry out further research on raptor disturbance in the future, particularly in a year when grouse numbers are high, and lessons can be learned from this pilot study. Due to the limited amount of shooting in 1999, the project officer had to observe all drives to which he was invited. While the vast majority of the drive could be observed in most cases, there were drives where sections of it could not be viewed due to site topography. However, in a year with good numbers of grouse it is probable that more estates would take part in the research and those with the best vantage points for viewing the drives could be surveyed preferentially. In addition, the project officer did not observe all drives from the best possible vantage points, as there was little opportunity to visit sites before shoots to determine the best locations. If additional estates take part in future research, it would be valuable for the project officer to visit moorland before shoots take place to assess the topography of the area and determine the best vantage point for viewing each drive.

A number of moorland owners suggested that raptor surveys should also be carried out the day before shoots on the basis that a hen harrier, for example, can cause disturbance which remains in evidence on the shoot day (grouse numbers reduced as they have scattered to adjacent land for example). However, the presence of the project officer walking over the moor the day before a shoot was clearly a potential cause of disturbance and keepers were reluctant to grant access for such a study. Indeed, a number of keepers themselves refrain from visiting moors on the day before a shoot for this reason. It is considered that surveys carried out on shoot days alone will reflect the true situation regarding raptor numbers and disturbance to grouse drives.

In conclusion, systematic observations indicated that very few raptors were present during drives and very few of these caused any disturbance. Keepers occasionally reported raptors that were not seen by the project officer (mainly on drives with a poor vantage point) but concluded that overall, raptor disturbance on drives during this season was minimal. The combined disruption of drives by walkers and weather conditions had a larger impact on the ability to drive grouse than did disturbance by raptors.

We would welcome comments on this pilot study, particularly from those involved in grouse moor management, in order to help plan any further research in this area. Any correspondence should be addressed to Ian Carter at English Nature headquarters in Peterborough.

7. Acknowledgements

English Nature would like to thank those people upon whose estates this project was carried out; Lord Barnard (Raby Estate), Lord Bolton (Bolton Estate), SN & GS Bostock (Dallowgill), Richard Johnson (Staggs Fell Estate), Ministry of Defence, Lord Swinton (Swinton Estate) and the Trustees of Downshire 1992 Settlement (Jervaulx Estate).

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We are particularly grateful to L.G. Waddell for arranging access on to Raby Estate moorland, providing considerable assistance on shoot days and for sharing his expertise on driven grouse shooting.

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9. Appendix 1

Assessing the impact of raptor disturbance on driven grouse shooting

Estate: _____ Shooting date_____ Bag record (as expected(E), lower(L) or higher(H)_____

Drive location	Time	Weather/wind	Bird/animal - sighted	Public/dogs sighted	Description of any impact

NB. Please provide as much detail as possible – e.g. estimate of wind speed: type of bird plus height and time spent over moor: detail of public/dog activity: impact on grouse activity e.g. "little effect noticed" or "most birds flew at least 1km off the drive area and did not return" or "birds sat tight and did not drive well.

Additional information e.g. low flying aircraft observed during drives or predators observed between drives.