Water Vole Survey the Forest of Birse Commonty 2003

Report to the Birse Community Trust

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Introduction

The water vole has been identified as the fastest declining mammal in the UK during the last century. The water vole is a priority species for the UK Biodiversity Action Plan. The stated objectives for this species are to:

- Maintain the current distribution and abundance of the water vole.
- Ensure water voles are present throughout their 1970s range by the year 2010, considering habitat management and possible translocation of populations to areas from where they have been lost.

These objectives have been endorsed by Britain's government. Its agencies, including Scottish Natural Heritage, are required to facilitate the implementation of these objectives together with the voluntary sector.

Research by Aberdeen University has detected relatively large clusters of water voles in the headwaters of the catchment of the River Dee (Aars et al., 2001; Lambin et al., 1998). Because they cover extensive areas and are located in an area where predator control is implemented for shooting and fishing interests, these clusters may be more likely than lowland populations to survive Britain's invasion by American mink and hence be of national significance. However, available evidence suggests that upland water voles are declining, albeit at a slower rate than in more productive lowland areas that are not managed for shooting and fishing. Thus, water vole persistence is not yet secured and may require more targeted management interventions if the stated goals of the UK and Local Biodiversity Action Plan are to be fulfilled.

The River Dee is a candidate area for a catchment-wide mink eradication project. The area has also been the target of substantial investment aimed at improving habitats for Atlantic salmon and sea trout, and these may be beneficial in the long-term to water voles. In the context of potential future management action, establishing a baseline against which the success of management strategies aimed at improving the fate of water voles is therefore desirable. The present document reports the outcome of a survey of the upper reaches of the sub-catchment of the Water of Feugh of the River Dee.

The issues to be addressed in this contract were as follows:

1. Are water voles still present in the area, and if so, which areas do they use?
2. If there is no evidence of current presence, is there any indication as to when they became extinct and the mechanism of this extinction?
3. Measures that could be taken to conserve water voles (if present) or encourage recolonisation (if absent)

No prior information was available on the presence of water voles in the area, although water voles were present in 1989 at 3 sites surveyed as part of the first UK-wide water vole survey performed by the Vincent Wildlife Trust (Strachan & Jefferies, 1993), as well as in the headwaters of the nearby sub-catchments of the Rivers Dye and Tanar (Lambin et al unpublished).

This document reports upon the outcome of a survey of all waterways in the Forest of Birse Commonty, as well as some of the adjacent areas. In addition, information on the distribution of mink collated from game-keepers is reported. The distribution of European rabbits, an important prey for American mink is also reported as it may contribute to making the areas particularly prone to recurrent invasion by American mink. The information on rabbits and mink was collected as part of an EU-funded Marie Curie fellowship project by Dr Juan-Jose Luque-Larena investigating the determinants of the distribution of mink in the upland. Consequently, we are able to produce a much more comprehensive assessment of the status of water vole in the area than would have been possible on basis of the remit of the survey alone.

2. Survey methodology

2.1. Water voles: availability of suitable habitat and occupancy of patches

The upper reaches of the sub-catchment of the Water of Feugh considered here flows through heather moorland managed by rotational burning, with small number of fields grazed by sheep on low ground adjacent to the Water of Feugh. Mixed pine woodlands are present on the north slope of the valley and alder woods border the Water of Feugh in the downstream part of the area.

We chose to survey the whole length of the watershed potentially suitable for water voles. On that basis, a complete map of those of the sites potentially recently or presently occupied by water voles was drawn. Surveying took place during May-June 2003. Suitable habitat patches were located by continuously surveying most of the burns and tributaries of Water of Feugh included within the boundaries of the Forest of Birse Commonty. Watercourses were surveyed on foot during daylight. Every time a patch of suitable habitat was encountered, we recorded its shape and geographical reference (i.e. starting and ending point, and connection points between branches) by using a GPS receiver (precision error when obtaining coordinates ca. $\pm$ 6-9 m).

In previous studies, we found that many of the waterways occupied by water voles are narrow burns flowing slowly on peaty or fine gravel substrates and with grassy fringe separating heather from the waterways. Water voles are never found in areas where the slope gradient is steep or where the river-bank is rocky and soils non-penetrable (Aars et al., 2001). As these criteria are well established and have been validated statistically (Aars et al., 2001), we relied on visual inspection for site classification.

Besides obtaining geographical information, we assigned are relative suitability score (α or β) to each suitable patch. Patches scored as α were those showing uninterrupted suitable habitat. Those scored as β had discontinuities in suitable habitat. The latter category typically contains a few sections of up to 10 m of unsuitable rocky habitat interspersed along suitable habitat. Unsuitable sections within β-patches, however, were generally < 5-6 m long. Whenever two sections of suitable habitat were separated by more than 15 m of unsuitable habitat, we recorded them as different patches. Thus patches as recorded here do not necessarily represent sites of distinct colonies as voles may on occasion use patches up to 300 m apart.

In addition to geographical and qualitative characteristics, we evaluated both the past and present occurrence of water voles for each habitat patch. Current occupancy was only confirmed when at least one of the following signs of water vole presence was found: fresh droppings, fresh latrines or recently used burrows. Evidence of past presence of water vole (over a time scale of a few month to up to 5 years) included above-ground nests and feeding remains from the previous winter, as well as old burrows which may remain visible for several years.

2.2 Rabbit relative abundances in pasture and spread in moorland distribution

European rabbits constitute an important prey for American mink (sometimes being the principal prey item (Yamaguchi et al., 2004). Besides its importance as a food resource, rabbits may also provide alternative benefits to mink. In the Upper Thames region, for example, the single most important feature to influence habitat preference of mink was the presence of rabbit warrens, which were the exclusive den site for breeding females (Yamaguchi et al., 2004). Our working hypothesis is that the distribution of rabbit warrens, itself influenced by farmland management, will be the main determinant of the distribution of American feral mink in Uplands of NE Scotland, with the furthest encroachment in the uplands taken place in those sub-catchments with dense rabbit populations.

In order to assess the rabbit holding potential of the Birse Community Trust area (relative to other sub-catchments in NE Scotland), we estimated rabbit and rabbit burrow density during May -July 2003. Sampling was conducted in pastures, where rabbits are typically most abundant. Rabbit burrows yield good estimates of distribution and relative number of rabbits e.g. (Ballinger & Morgan, 2002; Palomares, 2001). In the present study, we classified burrows as used or non-used (Palomares, 2003) and also recorded the number of rabbits spotted during the sampling for each pasture. Additionally, we took into account the time of day in which the sampling was conducted (which may affect the number of rabbits spotted), the surface area covered, and whether pasture were surrounded by forests or scrublands (as it may affect both the number of burrows and rabbits within pasture fields; (Kolb, 1994; Lombardi et al., 2003).

2.3 Mink presence

The occurrence of American mink in sub-catchment of the Water of Feugh, and thus within the Forest of Birse Commonty, was assessed from information by gamekeepers culling mink as part of their keepering activities. In addition, as part of our investigation in mink distribution in the wider area, we deployed 2 “mink rafts” designed by The Game Conservancy Trust (see Appendix I) within the area concerned by the survey. Mink tracks are recorded very clearly on the raft’s tracking cartridge, and they can be rapidly and easily re-set to obtain new prints. Therefore, the rafts can not only be used to record the current presence of mink, but repeated scoring makes it possible to evaluate mink persistence, and the impact of control activities, in the area.

3. Results and discussion

3.1. Water vole presence and distribution

The survey results are displayed graphically in the annotated map (Figure 1). The most important features and their implications are highlighted and discussed below.

Evidence of current water vole presence (active burrows, latrines and isolated droppings) was detected at a single site, in the headwaters of the Glaspits Burn on the South-East edge of the survey area (Figure 1 and Table 1). The site was probably occupied by a single pair of over-wintered water voles at the time. Three other sites, 1-2 km away had signs of past water vole presence in the headwaters of the Rough Burn and the Hawknest Burn to the south of the survey area. Overall, there is a relatively high density of suitable habitat patches (>16 in adjacent 9 km^2) within water vole dispersal distance of the single occupied patch. Given the likely presence of further suitable habitat in the non-surveyed Rowantree Burn and Black Burn to the south, this part of the Commonty probably contains the best habitat for water voles. There is no suitable habitat directly to the East of the cluster of habitat patches, although some suitable habitat can be found in the vicinity of the Water of Feugh (Holland Burn, The Stripe and Burn of Bogturk).

A second cluster of suitable water vole habitat patches is discernible in the Western-most part of the Forest of Birse Commonty and includes sections of the Burn of Corn and Burn of Auldmad, as well as the headwaters of the adjacent sub-catchment. In the survey area however, sections of suitable habitat tended to be small and often interrupted by less suitable sections and, hence, most had a low suitability score. One site (Burn of Auldman) had 3 old burrows, indicative of at least temporary use of the area by water voles in the past.

The Upper reaches of the Water Feugh Burn flowing along the Fungle road were only surveyed in part. The tributaries that are most likely to be suitable for water voles were the Emmerty Burn and the Burn of Tarsan. Whereas it appears unlikely that sufficient habitat is present in that tributary to support a self-sustained cluster of water vole colonies, habitat quality is probably sufficient to provide a degree of connectivity between the two clusters of habitat patches described above.

Even though the detection of even a small number of water voles in the area is a positive development, the presence of such a small number of individuals is of great concern. This colony is indeed probably only a small remnant of what must have been a much more extensive set of colonies, straddling the watersheds. Our studies have demonstrated that isolated water vole colonies are not expected to persist, as a high proportion of local juveniles emigrate and colony persistence requires immigration from adjacent colonies. The extinction rate of water vole colonies in adjacent upland area is approximately 30 %/year. Thus persistence of a set of colonies is only possible where individual colonies go extinct asynchronously and if new colonies are founded by dispersers. As a result, viable entities for water voles are clusters of several (typically 8-10) colonies over areas comparable in size the Forest of Birse Commonty. Even though the prospect for water

voles in the area are at present grim, based on the present survey, the area and its surroundings appears to contain a sufficient number of patches such that water vole recovery and subsequent persistence ought to be possible. As habitat show now evidence of degradation, reasons for the low water vole prevalence must be sought elsewhere.

3.2. American mink presence and distribution

Game-keepers working in the Estates included in the Forest of Birse Commonty operate cage traps and Fenn traps for controlling mustelids, including American mink. Trapping is concentrated on the winter months. At least 3 American mink were caught between January and April 2003, with a further 4 caught in late summer. Whereas such information does not amount to any estimate of density, it provides some qualitative information on mink distribution, although obviously constrained by the location of traps. The location of mink captures shown in Figure 1 establishes that American mink have colonised most of the sub-catchment and exploit some of the waterways that flow through moorland at least up to 400 m a.s.l., in close proximity to patches suitable for water voles. Given the high mobility and dispersal ability of American mink, one must assume that all water voles colonies in the area are at risk of American mink predation.

Mink footprints were not detected on either rafts in mid-July but signs were present in mid-August and October. The absence of mink footprints on the raft in July might be taken as evidence that control activities eliminated breeding American mink. Their appearance of footprints in mid-August is clear evidence of re-colonisation, possibly from the lower reaches of the sub-catchment of the Water of Feugh. Based on the sparse data available at the time of writing this report, it appears that recurrent American mink invasions take place in the Forest of Birse Commonty, in spite of the trapping effort deployed.

3.3. The distribution of European rabbits

Three closely-grazed sheep pastures are located on the low ground near the headwaters of the Water of Feugh. Each hold high densities of rabbits and hence represent highly productive hunting ground for large mustelids. Rabbit also occur, although at much lower density in rough grassland that lies between farmed areas and moorland. Signs of rabbit activity were found up to 400 m a.s.l. along tracks, although there was no evidence of presence of rabbit away from tracks in moorland. According to the working hypothesis outlined in section 2.2., the situation with respect to rabbits that prevails in the Forest of Birse Commonty is the worse possible scenario. High density of rabbits is hypothesised to favour encroachment by mink and incidental heavy impact on water voles by American mink. The close proximity (2-3 km) between areas where dense rabbits ought to favour successful mink reproduction and sites suitable for water voles is hypothesised to be highly detrimental to water vole persistence. Whereas the hypothesis still needs formal testing at the scale of several catchments, if true, it would suggest that rabbit control, or habitat management unsympathetic to rabbits, including rabbit culling, arable cropping of fields, or reversion to rough grassland, may contribute to the recovery of water voles. Conversely, any further spread of rabbit along land-rover tracks into

moorland would be detrimental as it would bring food resources necessary for mink reproduction even closer to water vole habitat than at present.

4. Conclusions and recommendations

The impact of American mink on water voles is well documented and all available evidence indicates that coexistence of both species is not possible with water voles disappearing after some time (months to years). In spite of limited data, it is tempting to attribute the extremely low prevalence of water vole in the area and the tentative evidence of a recent decline to the gradual impact of American mink. Preliminary evidence from our study of the determinants of mink distribution in the area may be tentatively summarised as follows:

- Seasonal mink trapping, as presently practised in the area may be effective in removing breeding individuals from the Forest of Birse Commonty area.

- Mink control is limited seasonally to the winter month and spatially to a fraction of catchment of the river Dee or even the sub-catchment of the Water of Feugh. This leaves great scope for successful reproduction by mink in the lower reaches of the river and hence provide scope for recolonisation. This accordingly may result in a likely impact on water voles and other riparian species such as green winged teals and wigeons. By preventing the establishment of permanent mink populations, trapping effort has probably reduced the magnitude of the impact of American mink.

- The presence of exceptionally dense rabbit population right up to the headwaters of the Water of Feugh may contribute to the attractiveness of the area to dispersing mink.

- Although the presence of rabbit may make the area attractive to native stoats, and to a lesser extent weasels, their lower reduced dispersal ability relative to American mink is tentatively proposed as the main reason for their lesser impact on water voles.

The presence of ample suitable habitat for water voles in a spatial configuration conducive to water vole persistence (clusters of patches in close proximity to each other) offers scope for pro-active management action that may reverse the decline of water voles and also serve as a feasibility study for sub-catchment-scale, and maybe later catchment-scale management of mink, with the view to restore the conditions for persistence of the native fauna. We propose that larger-scale control of mink, aided by the use of mink rafts, represents a feasible, cost-effective and pragmatic option that will yield benefits for conservation, grouse management and fishing interests. Larger-scale, and probably more cost-effective mink control than presently achieved could be implemented if mink rafts were systematically deployed along the entire sub-catchment at a density of one raft every 2 to 3 kilometres) and would allow the effective detection of mink presence in all seasons, but most critically prior to mink reproduction. Operating

such rafts requires limited time investment, as they must only be checked every two weeks (Reynolds et al., 2004). Where mink are detected, targeted live trapping with cages set directly on the rafts is an effective way to maximise trapping effort and, if implemented on a sufficiently large scale, will result in a reduction in the impact of mink of key areas for water voles. Under such circumstances, targeted trapping is most likely to be performed humanely and legally, with traps being checked daily. Furthermore, if performed on a sufficient large scale, it will reduce re-colonisation of the key areas in the upland by dispersing mink. Whereas the initial investment in purchasing or building such rafts is likely to be non negligible, the precarious status of water voles in the forest of Birse area suggest that only the large scale management it would make possible is likely to yield conservation and game and fish management results that are sought by all. Further benefits are likely to accrue from collaboration by groups that have been at loggerheads over the recent years are likely to accrue in a joint effort toward a common goal.

Table 1. Details of the sections of waterways found to be suitable for water voles during the May –June 2003 survey, including the date of survey, a score reflecting site quality (see text), whether signs of current or past water vole presence were detected (Table continued on the next page).

Patch code	Burn/River	Date	COOX1	COOY1	COOX2	COOY2	Quality Score	Current Presence/ Absence	Current signs type	No. of current signs	Old signs	Old signs type	No. of old signs
01F	Burn of Auldmad	23/05/2003	NO49491	BNG88836	NO49560	BNG88896	β	0	-	-	0	-	-
02F	Burn of Auldmad	23/05/2003	NO49623	BNG89063	NO49710	BNG89292	β	0	-	-	0	-	-
03F	Burn of Auldmad	23/05/2003	NO50083	BNG89489	NO49945	BNG89077	β	0	-	-	1	Burrows	Low (3/4)
04Fa	Burn of Corn	24/05/2003	NO48925	BNG89504	NO49099	BNG89876	β	0	-	-	0	-	-
04Fb	Burn of Corn	24/05/2003	NO48877	BNG89557	NO48983	BNG89628	β	0	-	-	0	-	-
05F	Burn of Corn	24/05/2003	NO49018	BNG90125	NO49039	BNG90053	α	0	-	-	0	-	-
06F	Burn of Corn	24/05/2003	NO49167	BNG89902	NO49262	BNG89891	β	0	-	-	0	-	-
07F	Burn of Corn	24/05/2003	NO49534	BNG89893	NO49545	BNG89894	α	0	-	-	0	-	-
08Fa	Burn of Corn	24/05/2003	NO49715	BNG89838	NO49651	BNG89799	β	0	-	-	0	-	-
08Fb	Burn of Corn	24/05/2003	NO49651	BNG89799	NO49671	BNG89739	β	0	-	-	0	-	-
09F	Burn of Corn	27/06/2003	NO49922	BNG90331	NO50037	BNG90360	α	0	-	-	0	-	-
10F	Burn of Corn	27/06/2003	NO50053	BNG90380	NO49942	BNG90381	β	0	-	-	0	-	-
11F	Burn of Corn	27/06/2003	NO49764	BNG90814	NO50041	BNG90436	α	0	-	-	0	-	-
12F	Burn of Auldgarney	27/06/2003	NO51539	BNG92307	NO50626	BNG92188	α	0	-	-	0	-	-
13F	Pamphel Burn	29/06/2003	NO50327	BNG85453	NO50310	BNG85327	β	0	-	-	0	-	-
14F	Burn of Kalfrush	03/06/2003	NO53711	BNG90217	NO53775	BNG90583	β	0	-	-	0	-	-
15F	Burn of Kalfrush	03/06/2003	NO53215	BNG89871	NO53220	BNG90117	α	0	-	-	0	-	-
16F	Badenhall Burn	25/05/2003	NO55114	BNG89090	NO55138	BNG89126	β	0	-	-	0	-	-
17F	Badenhall Burn	25/05/2003	NO55265	BNG89093	NO55231	BNG89235	β	0	-	-	0	-	-
18F	Badenhall Burn	25/05/2003	NO55155	BNG89659	NO55137	BNG89708	β	0	-	-	0	-	-
19F	Badenhall Burn	25/05/2003	NO54976	BNG89359	NO55036	BNG89467	β	0	-	-	0	-	-
20Fa	Badenhall Burn	25/05/2003	NO54907	BNG88704	NO54891	BNG89036	β	0	-	-	0	-	-

20Fb	Badenhall Burn	25/05/2003	NO54960	BNG88728	NO54950	BNG88815	β	0	-	-	0	-	-
21F	Rough Burn	26/05/2003	NO54205	BNG90251	NO54188	BNG90304	α	0	-	-	0	-	-
22F	Rough Burn	26/05/2003	NO54595	BNG88583	NO54623	BNG88517	β	0	-	-	0	-	-
23F	Rough Burn	26/05/2003	NO54730	BNG88466	NO54725	BNG88385	α	0	-	-	0	-	-
24F	Rough Burn	26/05/2003	NO54627	BNG88508	NO54633	BNG88302	α	0	-	-	0	-	-
25Fa	Rough Burn	26/05/2003	NO54105	BNG88064	NO54447	BNG88512	α	0	-	-	1	Burrows	High (>10)
25Fb	Rough Burn	26/05/2003	NO54219	BNG88213	NO54044	BNG88168	α	0	-	-	1	Burrows	Low (3/4)
26F	Holland Burn	26/05/2003	NO55794	BNG90585	NO55904	BNG90729	β	0	-	-	0	-	-
27F	Burn from WF	26/05/2003	NO55794	BNG90707	NO55787	BNG90782	α	0	-	-	0	-	-
28F	Burn of Bogturk	26/05/2003	NO55592	BNG90877	NO55475	BNG90954	α	0	-	-	0	-	-
29Fa	Burn of Bogturk	26/05/2003	NO55382	BNG91521	NO55363	BNG91814	α	0	-	-	0	-	-
29Fb	Burn of Bogturk	26/05/2003	NO55059	BNG91821	NO55377	BNG91586	α	0	-	-	0	-	-
29Fc	Burn of Bogturk	26/05/2003	NO55363	BNG91814	NO55406	BNG91715	α	0	-	-	0	-	-
30F	The Stripe	26/05/2003	NO55902	BNG90835	NO55932	BNG90880	β	0	-	-	0	-	-
31F	The Stripe	26/05/2003	NO56022	BNG91072	NO56081	BNG91190	β	0	-	-	0	-	-
32Fa	Glaspits Burn	28/05/2003	NO56307	BNG88853	NO56040	BNG88760	α	1	Burrows/ Droppings/ Latrines	2-3 Burrows	0	-	-
32Fb	Glaspits Burn	28/05/2003	NO56272	BNG88704	NO56290	BNG88705	α	1	Burrows/ Droppings/ Latrines	1 Burrow	0	-	-
33F	Hawknest Burn	28/05/2003	NO54009	BNG87128	NO54646	BNG87038	α	0	-	-	1	Burrows	High (>10)
34F	Hawknest Burn	28/05/2003	NO54776	BNG87046	NO55073	BNG87098	α	0	-	-	1	Burrows	High (>10)
35F	Hawknest Burn	28/05/2003	NO54414	BNG87309	NO54422	BNG87165	β	0	-	-	0	-	-
36F	Shaw's Shiel	28/05/2003	NO56067	BNG87660	NO56185	BNG87424	β	0	-	-	0	-	-
37F	Burnt Burns	28/05/2003	NO56493	BNG87501	NO56447	BNG87719	β	0	-	-	0	-	-
38F	Burnt Burns	28/05/2003	NO54453	BNG87112	NO55073	BNG87098	β	0	-	-	0	-	-

Figure 1. Map of the Forest of Birse Commonty showing the waterway network. All waterways highlighted in blue have been surveyed but were found to be non-suitable for water voles. Sections of waterways highlighted in red are suitable for water voles. Numbers refer to the patch code in Table 1. The section with a filled red star was occupied by water voles at the time of the survey. The 4 sections highlighted with an empty star had signs of past but not present water vole occupancy. Areas in green were not surveyed but a fraction of these may be suitable for water voles. Drawings of mustelids depict the location of recent capture of American mink by local gamekeepers. The circles with the letters MR denote the location of mink rafts used for establishing the presence and persistence of this species in the area. The dashed surfaces are the pastures where rabbit density was assessed. The black dotted lines with the letters the locations of transects where the presence of rabbits was recorded, with the rabbit symbol reflecting the highest elevation where evidence of rabbit activity was encountered.

References

Aars, J., Lambin, X., Denny, R., & Griffin, A. (2001) Water vole in the Scottish uplands: distribution patterns of disturbed and pristine populations ahead and behind the American mink invasion front. Animal Conservation, 4, 187-194.

Ballinger, A. & Morgan, D.G. (2002) Validating two methods for monitoring population size of the European rabbit (Oryctolagus cuniculus). Wildlife Research, 29, 431-437.

Kolb, H.H. (1994) Rabbit Oryctolagus-Cuniculus Populations in Scotland since the Introduction of Myxomatosis. Mammal Review, 24, 41-48.

Lambin, **X.**, Fazey, I., Sansom, J., Dallas, J., Stewart, W., Piertney, S., Palmer, S., Bacon, P., & Webb, A. (1998). Aberdeenshire Water vole survey: The distribution of isolated water vole populations in the upper catchments of the rivers Dee and Don., Rep. No. C/LF1/BAT/97/2. Scotish Natural Herritage.

Lombardi, L., Fernandez, N., Moreno, S., & Villafuerte, R. (2003) Habitat-related differences in rabbit (Oryctolagus cuniculus) abundance, distribution, and activity. Journal of Mammalogy, 84, 26-36.

Palomares, F. (2001) Comparison of 3 methods to estimate rabbit abundance in a Mediterranean environment. Wildlife Society Bulletin, 29, 578-585.

Palomares, F. (2003) Warren building by European rabbits (Oryctolagus cuniculus) in relation to cover availability in a sandy area. Journal of Zoology, 259, 63-67.

Reynolds, J.C., Short, M.J., & Porteus, t. (2004). The GCT mink raft. The Game conservancy Trust, Fordinbridge.

Strachan, R. & Jefferies, D.J. (1993) The water vole *Arvicola terrestris* in Britain 1989-1990: its distribution and changing status The Vincent Wildlife Trust, London.

Yamaguchi, N., Rushton, S., & Macdonald, D.W. (2004) Habitat preferences of feral American mink in the Upper Thames. Journal of Mammalogy, 85, 000-000.