Red squirrel monitoring: the potential of hair-tubes for estimating squirrel abundance

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UNPUBLISHED REPORT

Introduction

Well over a century ago, in 1876, the American grey squirrel (*Sciurus carolinensis*) was first introduced to Britain at Henbury Park, Cheshire (Middleton, 1930). As the grey squirrel has spread there has been an apparently parallel contraction in the range of the native red squirrel (*Sciurus vulgaris*; Gurnell and Pepper, 1993; Kenward and Holm, 1993). This process is still continuing today and the red squirrel has been listed as a priority species for conservation by the UK Government in the Biodiversity Action Plan. A key task in this conservation strategy is the determination of the status and trends of red squirrel populations throughout the UK.

Public participation surveys which provide records of red and grey squirrels can be used to highlight the threat to the native species and to obtain data on grey squirrel spread. Monitoring of squirrels involving methods to estimate population size is vital to determine population viability and the impact of forest management in red squirrel conservation areas. Distribution surveys generally rely on sightings indicating the presence of a particular squirrel species where as population estimates are generally based on intensive research projects involving live-trapping. The accuracy of the former depends on visibility and habitat type. The success of the latter can vary with natural seed food availability (Dubock, 1979) and work is generally very labour intensive.

Hair-tubes involving the collection of squirrel hair (Gurnell and Pepper, 1994), have been used extensively to determine the presence and relative status of red and grey squirrels in different types of woodland in the upper Clyde Valley (Garson and Skelcher, 1994), Clackmannan, Sterling (Garson and Lurz, 1996a) and the Border Forest Park (Garson and Lurz, 1995, 1996b). This project combined hair-tube surveys for red squirrels with live-trapping in order to calibrate the technique and to allow population estimates to be made.

Methods

'Hair-tube' survey

For the purpose of this project, five sites were selected in Spadeadam Forest, Wauchope and Falnash Forest (Table 1). In each site a survey using 'hair-tubes' was carried out and a population estimate was made by live trapping.

The hair-tubes (6.5 x 6.5 x 30 cm square cross section PVC tubing) were placed on a grid at 100 m intervals. The tubes were numbered, tied around tree trunks with wire at about head height and stapled on either side of the tube. Each tube was baited with a mixture of one-third sunflower seeds, maize and peanuts and equipped with 2 wooden blocks (2.5 x 2.5 x 0.5 cm) covered by double sided sticky tape (Scotch 'pressure

sensitive' tape; Stock reference no: 465; North British Tapes Ltd; Killingworth, Tyne & Wear). The blocks were placed on the inside roof at either end of each tube, approximately 3 cm in from the entrance. Tapes were retrieved and numbered after 14 days.

The sticky surfaces were protected at collection and later examined for squirrel hairs under a microscope. The hairs contained on the blocks were identified using a reference collection of red and grey squirrel hair and by staining a sample of hairs with ink if this was required (Gurnell and Pepper, 1994). Red squirrel hair contains a groove which is absent from grey squirrel hair (Teerink, 1991) and the ink-filled groove is visible under the microscope.

Table 1. Tree species composition (by percentage) of five study sites at Spadeadam, Wauchope and Falnash.

Site	Sitka spruce	Norway spruce	Lodgepole pine	Size* (ha)	Location
1	30	45	18	28	Spadeadam
2	31	0	69	30	Spadeadam
3	70	0	30	32	Wauchope
4	100	0	0	34	Wauchope
5	70	22	8	30	Falnash

* allowing a 50 m edge strip.

Trapping

Animals were trapped using modified Fuller mink traps (Fuller Engineering Ltd, Felcourt, West Sussex) that had a wooden nest box attached at the back. These were placed on supportive branches in trees and secured with wire 1-2 m above the ground. A trap density of 1 per two hectares was routinely employed. Traps were prebaited with a mixture of shelled hazel nuts, peanuts and sunflower seeds for 7 days and successively set for 5 days. At each capture a squirrel was held using a wire-mesh 'handling cone' so that information on weight and sex could be collected whilst causing a minimum of stress. Every squirrel was individually marked by clipping fur of its tail.

Trapping efficiency in conifer plantations at Spadeadam Forest has been found to be high (Lurz, 1995) and population estimates are based on the number of different individuals trapped. Trapping was carried out prior to the hair-tube survey in Sites 1 and 2 and following the survey in Sites 3,4 and 5.

Results

Red squirrels were found to be present in all five sites and were most abundant in the spruce plantations containing a proportion of pine (Table 2). There was a significant relationship between the number of tubes used (i.e. containing hair) and the number of different individuals trapped in each site (Fig. 1; Spearman Rank r_s= 0.975). A regression equation predicting the number of different red squirrels present in a site based on the number of tubes used is given below (df=3; P=0.024):

Equation I: No. Squirrels = -0.77 + 0.955 * No. tubes used

If the number of different squirrels is expressed as a density (here based on a 50 m edge around survey grid) a second equation can be calculated (df=3; P=0.034):

Equation II: Squirrel density = -0.0138 * 0.0302 * No tubes used

Table 2. Data on the number of squirrels (M=male; F=female) in five different sites in relation to the number of hair-tubes that were found to contain red squirrel hair. Each site contained a transect line of 20 tubes.

Site	No. used tubes	No. Squirrels	M	F	Weight (g)
1	12	11	6	5	250 - 400
2	6	5	3	2	270 - 330
3	18	16	10	6	255 - 315
4	5	1	-	1	315
5	6	8	4	3*	250 - 295

* 1 individual escaped, sex unknown

Discussion

The results from this study suggest that it may be possible to derive population estimates as well as presence/absence data from hair-tube surveys. It is our view that hair-tubes have the potential of being a cheap and useful technique for monitoring squirrel and other mammal populations (e.g. pine

martens; *Martes martes*). Their use allows long-term monitoring over many years and across large areas covering different habitat types (Garson and Lurz, 1995, 1996b). They are particularly useful in conifer woodlands where visibility is poor and other methods such as drey counts (Wauters and Dhondt, 1988) and line transects (Bryce, 1994) are inappropriate. In contrast, population estimates derived from live-trapping (capture-mark-recapture) are labour intensive and thus costly and require licensing in the case of the red squirrel. The use of live-trapping as a method is therefore likely to be limited to research projects only.

Our findings indicate that it is possible to estimate the number of squirrel in a given area using hair-tubes, thus allowing changes in population size to be monitored (e.g. on an annual basis). However, the present study was based on only five study sites and in order to make reliable and confident predictions the project would need to be repeated with at least another five sites. In addition, the present results are restricted to low-density habitats in the absence of grey squirrels. If this technique is to be applied to areas where red and grey squirrels are present or where grey squirrels are the only species further calibration would be required.

For the purpose of monitoring, we suggest that hair-tube surveys should be carried out on an annual basis and combined with an assessment of natural seed food availability. This could best be done in the autumn when conifer cone crops can be estimated (Petty et al., 1995). However, habitat quality and variations in seed availability could influence the results with squirrels ignoring baited tubes in years when natural food is abundant. It may therefore be appropriate in some areas to carry out the hair-tube surveys at the end of spring/early summer when seed food availability is low and trapping success of squirrels is highest (Wauters and Dhondt, 1990).

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Fig. 1. Relationship between the number of squirrels trapped and the number of tubes used (i.e. containing red squirrel hair) in each of the five study sites.