# An experimental study investigating the ability of volunteers to identify squirrel species from tail–hair samples

## L. Shearer, R. Bray & C. Toner

**Abstract**

*An experimental study investigating the ability of volunteers to identify squirrel species from tail–hair samples.*— Hair–tubes, collecting nape hairs, are widely used for establishing the presence of red (*Sciurus vulgaris*) and grey (*Sciurus carolinensis*) squirrels. However, it is time–consuming and prone to identification errors. An alternative is to collect tail hairs from sticky pads on baited poles. However, there is no evidence concerning identification accuracy of tail hairs. This study reports an experiment in which subjects underwent a short training session before identifying hair samples from four species. There was a 96.5% correct identification rate for grey squirrel hairs, and 77.5% for red squirrels, which suggests that tail hairs collection may provide a quick, easy and accurate method of identification for both species.

Key words: Squirrel, Identification, Accuracy, Experiment, Training

**Resumen**

*Un estudio experimental sobre la capacidad de los voluntarios de reconocer las especies de ardilla a partir de muestras de pelo de la cola.*— Las trampas de pelo, que permiten recoger los pelos de la nuca, se utilizan ampliamente para establecer la presencia de la ardilla común (*Sciurus vulgaris*) y la ardilla gris (*Sciurus carolinensis*). No obstante, es un método que requiere mucho tiempo y se presta a errores de identificación. Una alternativa es recoger pelos de la cola mediante cintas adhesivas colocadas en postes que sostienen un cebo en la parte superior. Sin embargo, no existen datos sobre la precisión de la identificación del pelo de la cola. En este estudio se informa de un experimento en que se ofreció una breve sesión formativa a las personas antes de que identificaran las muestras de pelo de las cuatro especies. El índice de identificación correcta fue del 96,5 % para los pelos de la ardilla gris y del 77,5% para los de la ardilla común, lo que sugiere que los pelos de la cola pueden proporcionar un método rápido, fácil y preciso de identificar ambas especies.

Palabras clave: Ardilla, Identificación, Precisión, Experimento, Formación

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## Introduction

The red squirrel (*Sciurus vulgaris*) is under threat in the UK, as reflected by its designation as a priority species in the UK Biodiversity Action Plan (BAP, 2007). This is due, in part, to habitat loss and degradation but also because of competition from the non–native grey squirrel (*Sciurus carolinensis*) (Gurnell et al., 2011). Grey squirrels have been known to establish themselves quickly in new areas and pose a significant threat to the native red from the transmission of the Squirrel Pox Virus (Tompkins et al., 2002). There is, therefore, a clear need for a survey method that can quickly establish the presence or absence of the two species in a given area, so that control methods can be introduced if necessary.

Currently, one of the most widely used surveying methods for squirrels uses hair–tubes (Bertolino et al., 2010; Finnegan et al., 2007; Mortelliti & Boitani, 2008). This involves using sticky pads to collect nape–hairs when squirrels enter baited feeder tubes. Hairs collected need to be subjected to microscopic analysis to determine the presence of red or grey squirrels (Bertolino et al., 2010; Gurnell et al., 2004). Although nape–hairs from both species may be similar in colour and scale patterns (Gurnell et al., 2009), the shape of the nape–hair cross section differs: red squirrel hair is concave or dumbbell shaped and grey squirrel hair is round (Gurnell & Pepper, 1994). Furthermore, after staining, red hairs show a continuous dark band along the widest part of the hair (Gurnell et al., 2009).

Gurnell & Pepper (1994) estimated that ninety–five percent of nape hair specimens that showed a continuous dark band when viewed under the microscope would be red squirrel hairs. However, there is little published evidence evaluating the accuracy of identification for such microscopic analyses in field studies, and anecdotal evidence suggests it may be more limited. Errors in identification using this method may occur for a number of reasons. First, at certain times of the year, the first guard hair from grey squirrels may also be concave and, second, broken or damaged grey squirrel hairs may be mistaken for red squirrel hairs (Gurnell & Pepper, 1994; Gurnell et al., 2009). Moreover, microscopic analysis is time consuming and expensive as it requires skilled, trained operatives (Gurnell et al., 2009). As a result, considerable delays may occur before identification can be completed. Furthermore, the method may not be suitable for monitoring procedures that are dependent on volunteers, as it is unlikely they would be able to interpret the data themselves (Harris & Yalden 2004). Other methods of identification, such as visual counts along feeding transects and feeding signs, also have significant disadvantages (see Gurnell et al., 2004 for a full discussion).

An alternative method, developed and trialled in the Borders and Galloway areas of Scotland, employed tail–hair instead of nape–hairs for identification (Toner, 2011). Tail–hair can be much more easily identified with the naked eye: although red squirrel tail–hair may vary from blonde to brown/red, they appear to be easily distinguishable from grey tail–hairs, which show a distinct 'agouti' type pattern with grey, black and white banding (Gurnell et al., 2009). In the trials, feeder boxes were baited with maize and peanuts and then mounted on posts at a height of 2 m above ground level. Sticky pads were attached to all faces of the post at intervals along the length of the post. Squirrels that ran up the post to access the bait left tail–hairs behind on the sticky strips. Poles were periodically inspected and pads with hairs were removed for visual analysis. The trial established that the method was effective in collecting tail–hairs (Toner, 2011).

This study reports on an experimental study designed to establish the extent to which simple visual inspection of tail–hairs is effective in discriminating between the two species and thus how useful the method might be for identifying the presence of red and grey squirrels.

## Method

Hair samples from both squirrel species were collected from baited poles and positively identified by comparing them with dead specimens (Toner, 2011). In addition to the squirrel hairs, cat and human hair samples (from the researchers and their domestic pets) were used as control groups. Hair samples were mounted on small (3 x 5 cm) sticky pads. Forty pads were used in total —ten of each type of hair. To test whether the colour of the pad itself affected identification accuracy, half of the pads provided a brown background and half provided white.

Twenty participants were recruited for the study. All were post–graduate students enrolled in environmental studies courses. None of the participants had previous experience of working with squirrels or of mammal identification from hair samples. The sample was selected as suggested by standard quota sampling (Haynes, 1982).

Participants were given a short training session (lasting approximately 10 minutes). They were first asked to read an information sheet explaining the main aims of the project. Next, they were shown physical samples of each type of tail hair and the differences in colour and banding were explained and demonstrated by the researcher. They were then allowed to use a hand lens (magnification x 4) to identify the differences between all four types of hair sample.

Each session of the study used a group of up to five participants and lasted approximately 30 minutes. Pads were numbered 1–40 and randomised before being placed in trays, each containing eight pads. Each tray remained in a designated workstation, while participants moved from one to another in sequence. At the start of the experiment, each participant was assigned to a tray in a workstation and asked to complete the record sheet for the eight samples in the tray. For each sample, a response of 'red squirrel', 'grey squirrel', 'cat', 'human' or 'not sure' was required. Participants could pick up pads and examine them with the magnifying lens if required.

After five minutes the researcher asked participants to move on to the next workstation. At the end of the

test period, time was allowed for participants to revisit any samples that they had been difficult to identify. Participants were allowed to refer to the original test samples throughout to confirm their decisions. Participants were asked not to confer with each other during the experiment.

## Results

Of the total of 800 identifications that were made, 647 were correct, giving a mean of 32.35 out of 40 (80.88%) for each participant. The range of total correct identifications by participants varied from 28/40 (70%) to 38/40 (95%), with a mean of 30.81/40 (SD = 3.13). There was a small difference in correct identifications between white pads (mean correct 16.65/20; 83.3%) and brown pads (mean correct 15.70/20; 78.5%), with white pads showing greater accuracy of identification (sample size = 20). A paired samples $t$–test was carried out on this data and this showed that the difference was statistically significant ($t$(19) = 2.50, $p$ = 0.022).

Identification of grey squirrel hairs showed the highest level of accuracy of the four samples, with 193 of the 200 samples correctly identified (96.5%); red squirrel hair showed second highest accuracy with 155/200 (77.5%) followed by cat hair (76.5%) and human hair (73.0%).

## Discussion

The results show evidence that the visual identification of red and grey squirrel tail hair can be highly accurate after non–expert participants receive a short training session. Accuracy was particularly high for grey squirrel hair samples and when using white, as opposed to brown, pads.

The collection of squirrel tail–hair samples has been trialled successfully and appears to be a straightforward procedure (see Toner, 2011). This method seems, therefore, to offer several advantages over traditional identification approaches, being quicker and more reliable, and requiring fewer resources.

This study has shown that the provision of a short, straightforward training session can result in good levels of identification accuracy of squirrel tail–hairs. Future studies could investigate the possibility that accuracy would improve with longer training and/or with further practice. The tail–hair method described here therefore merits further investigation and development as an effective, inexpensive and less time consuming alternative to traditional methods of identifying the presence of red and grey squirrels. The method may also be appropriate for other arboreal rodents.

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