



## RESULTS OF SPRING 2013 SQUIRREL SURVEYS



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# **RESULTS OF SPRING 2013 RED AND GREY SQUIRREL SURVEYS**

## **1. SUMMARY**

This report details the results of monitoring of red and grey squirrels organised by Saving Scotland's Red Squirrels (SSRS) in Spring 2013. The results for the northern half of Scotland were compared to similar surveys undertaken in Spring 2011 and Spring 2012, and we set out results from the first set of surveys in South Scotland. In comparison with Spring 2012, the 2013 results for the north show a slight, but not significant, decrease in the distribution of red squirrels and a larger though also not significant, decline in grey squirrels. When compared with 2011, however, the 2013 results showed a small increase in red squirrels but a significant decrease in grey squirrel occurrence.

The first set of tetrads for South Scotland revealed that red squirrels are still very widespread, especially in Dumfries and Galloway and the Western Borders, with grey squirrels having surprisingly limited spread across the region.

A small number of sightings transect squirrel counts were carried out in North East Scotland in Spring 2011, Spring 2012 and again in Spring 2013. Comparisons of the spring showed large decreases in the number of both species between 2012 and 2013, supporting the tetrad findings. It is probable that the poor showing for both species of squirrel was due to weather conditions combined with poor mast crops in autumn 2012. This provides an opportunity to sustain pressure on grey squirrels while they are reduced in populations, to secure future advantages for red squirrels.

## **2. AIM OF THIS REPORT**

Saving Scotland's Red Squirrels (SSRS) is a project to stop the decline of Scotland's core red squirrel populations, to contain or significantly slow the progress of squirrelpox spread in South Scotland and to improve conditions for viable red squirrel populations across Scotland. North of the Central Belt we aim to prevent the further replacement of red squirrels by grey squirrels by working to stop the spread of grey squirrels outwards from Aberdeen and northwards from the Central Lowlands. This is achieved through a co-ordinated network of grey squirrel control at the interface between the red and grey squirrel distributions. In Aberdeenshire grey squirrel control began in 2007, 2010 for the Central Lowlands.

Squirrelpox has been present in South Scotland since 2005. A Red Squirrel Protection Network across Dumfries and Galloway and the Scottish Borders works to reduce grey squirrel numbers, making it possible for red squirrel populations to survive in areas where Squirrelpox virus is present. We also aim to prevent the disease from spreading as far as the Central Belt, with the aim of protecting Scotland's still widespread red squirrels to the north.

Monitoring in the area north of the Central Belt was set up in 2011 to provide evidence on which to assess the effects of grey squirrel control on both red and grey squirrel populations. This document reports the results of the Spring 2013 surveys and compares them to results

obtained in 2011 and 2012. We provide estimates of the level of change and assess whether the results suggest that our Red Squirrel Protection Network is achieving benefits for red squirrels.

In South Scotland, distribution monitoring was set up in Phase 2 of the Project, when SSRS merged with Red Squirrels in South Scotland, and was carried out for the first time in Spring 2013.

### **3. METHODS**

The monitoring was based upon three scales of data collection:

- i. Broad-scale: use of sightings data to record Scotland-wide distributions. We do not report these here.
- ii. Medium-scale: use of feeder-box monitoring or sightings transects in tetrads to provide presence/absence data.
- iii. Fine-scale: sightings transects in a limited number of woodland sites to provide squirrel counts.

Here we report on the tetrad and sightings transect methods of monitoring red and grey squirrels in the North East of Scotland and the Central Lowlands (Tayside and Argyll & Trossachs) and the tetrad monitoring in South Scotland.

### **4. TETRAD PRESENCE/ABSENCE MONITORING**

To determine whether red and grey squirrels are present or absent in a particular area, monitoring tetrads (2 x 2km squares) were set up in 2011 for the north, Spring 2013 for the south. In each tetrad four feeder-boxes were positioned to sample right across the square, each with a squirrel hair-collecting pad or 'sticky'. Each feeder-box was visited by volunteers a total of three times, over a period of six weeks and three hair samples collected from each box. Hairs were identified under a microscope. Each tetrad was then allocated to one of the following four categories: red squirrels only, grey squirrels only, both species or neither species.

In a number of tetrads where other groups had already established long-term sightings transect surveys we adopted these as a substitute for feeder-boxes as a method of determining presence/absence. This occurred mainly in the Loch Lomond and the Trossachs National Park, where transects of a recognised standard methodology were carried out by Park staff and volunteers in Spring and Autumn of each year. There were also a number of tetrads in North East Scotland surveyed by this method.

In Spring 2011 the Project set up 47 tetrads in North East Scotland and the Central Lowlands. We continued to set up further tetrads during the Summer of 2011, and in Spring 2012 a total of 93 tetrad surveys were completed. In 2013 we set up 120 tetrads of which the number completed was 95. This allows a direct comparison with two previous Spring surveys.

Of the 95 tetrads completed correctly in 2013, 40 of these had been surveyed in Spring 2011 and 73 in Spring 2012 to allow direct comparison between years at a similar point in the life-cycle of the squirrel populations (winter survivors before recruitment of spring juveniles).

Also in the Spring of 2013 we carried out 102 new tetrad surveys in South Scotland, of which 88 were completed correctly. These provide base-line data on the distribution of red and grey squirrels in the area. The locations were chosen by systematically dividing South Scotland area into 50x20km-squares, from each of which we randomly selected 1 tetrad with >20% woodland cover to provide 50 tetrads across the whole geographical area. In addition we selected 2 further tetrads per 20km-square from the southernmost 25 20km-squares, where most of the project operations are located, to provide 50 additional sample sites.

### The Spring 2013 surveys

| Project Area        | Completed tetrads | Incomplete tetrads |
|---------------------|-------------------|--------------------|
| North East Scotland | 35                | 8                  |
| Central Lowlands    | 60                | 17                 |
| South Scotland      | 88                | 14                 |

The table above shows the number of tetrad surveys set up in Spring 2013. Of the 120 tetrads set up in North East Scotland and the Central Lowlands, a total of 95 were completed, which gives us a good total to compare with the previous Spring. Unfortunately 39 of the total tetrads that were set up across Scotland were not fully completed, and although some of them detected squirrel presence, the incomplete data were unsuitable for inclusion in the analysis. In some cases the sticky pads went missing, boxes were inaccessible due to forestry operations or removed with the trees they were installed upon and in one case the feeder box was tampered with. In a few cases the tetrads were not done at all or only partially done as the volunteer was unable to complete the survey.

### Results

The following table sets out the squirrel species detected at each tetrad in each year.

| Project Area | Survey season | Red squirrels only | Grey squirrels only | Both Species | Neither species | Total no. of tetrads |
|--------------|---------------|--------------------|---------------------|--------------|-----------------|----------------------|
| North        | Spring 2011   | 18                 | 4                   | 18           | 7               | 47                   |
|              | Spring 2012   | 55                 | 8                   | 26           | 4               | 93                   |
|              | Spring 2013   | 64                 | 7                   | 12           | 12              | 95                   |
| South        | Spring 2013   | 44                 | 15                  | 7            | 22              | 88                   |

For those people who are interested to see the results obtained closer to home, we have split the results into the three Project areas: (Maps and tables showing the results of the 2013 surveys appear at the back of this report.)

### North East Scotland

| Survey season | Red squirrels only | Grey squirrels only | Both Species | Neither species | Total no. of tetrads |
|---------------|--------------------|---------------------|--------------|-----------------|----------------------|
| Spring 2011   | 3                  | 2                   | 6            | 3               | 14                   |
| Spring 2012   | 19                 | 5                   | 6            | 1               | 31                   |
| Spring 2013   | 20                 | 5                   | 2            | 8               | 35                   |

### Central Lowlands

| Survey season | Red squirrels only | Grey squirrels only | Both Species | Neither species | Total no. of tetrads |
|---------------|--------------------|---------------------|--------------|-----------------|----------------------|
| Spring 2011   | 15                 | 2                   | 12           | 4               | 33                   |
| Spring 2012   | 39                 | 3                   | 20           | 3               | 65                   |
| Spring 2013   | 44                 | 2                   | 10           | 4               | 60                   |

## Replacement Index

One way to compare the results of pairs of tetrad surveys is to calculate a Replacement Index using a table showing the changes that occurred in each tetrad between two surveys. The following Replacement Index table compares the results for the 73 tetrads that were completed in both the Spring 2012 and Spring 2013 surveys.

### North East and Central Lowlands Combined – Spring 2012-Spring 2013

|             |         | Spring 2013 |      |         |      |       |
|-------------|---------|-------------|------|---------|------|-------|
|             |         | Red         | Both | Neither | Grey | Total |
| Spring 2012 | Red     | 36          | 5    | 6       | 0    | 47    |
|             | Both    | 10          | 3    | 2       | 0    | 15    |
|             | Neither | 2           | 0    | 1       | 0    | 3     |
|             | Grey    | 1           | 1    | 1       | 5    | 8     |
|             | Total   | 49          | 9    | 10      | 5    | 73    |

The table presents all the possible changes to the tetrads and how many fall into each of four categories: red squirrels only, both red and grey squirrels, neither species, grey squirrels only. The rows describe the state of the tetrad in the Spring 2012 survey and the columns the tetrads in the Spring 2013 survey. For example, 10 tetrads had both species of squirrel in Spring 2012 but only reds in Spring 2013; and 3 tetrads had both red and grey squirrels in both the 2012 and 2013 surveys. Five tetrads gained grey squirrels where in 2012 only red squirrels were detected: these were Peterculter on Deeside, Callander in Argyll & Trossachs and three within Tayside (Crieff, on the River Earn, and Ballathie and Dunsinnan just north of Perth). None of these is surprising, all being places where project grey squirrel control is still focussed as known grey squirrel hotspots.

The shaded diagonal represents no change. Above the shaded diagonal, the changes represent changes in favour of grey squirrels; below the diagonal they represent changes in favour of red squirrels. We can calculate a Replacement Index as follows:

$$\frac{(\text{sum of values above the diagonal}) - (\text{sum of values below the diagonal})}{(\text{the sum of all values in matrix except the "neither-neither" value})}$$

A positive index represents a change in favour of grey squirrels and a negative index represents a change in favour of red squirrels. The Replacement Index comparing Spring 2013 with Spring 2012 is calculated to be -0.03. This is an index showing a small but positive change in favour of red squirrels, largely due to the 11 squares that lost grey squirrels to become home to red squirrels only. Statistical tests show that the change was not significant.

For the change over the two-year period Spring 2011 to Spring 2013, we had a smaller sample of tetrads that were monitored in both surveys.

*North East and Central Lowlands Combined – Spring 2011-Spring 2013*

|             |         | Spring 2013 |      |         |      |       |
|-------------|---------|-------------|------|---------|------|-------|
|             |         | Red         | Both | Neither | Grey | Total |
| Spring 2011 | Red     | 17          | 0    | 0       | 0    | 17    |
|             | Both    | 7           | 4    | 2       | 0    | 13    |
|             | Neither | 4           | 1    | 2       | 0    | 7     |
|             | Grey    | 0           | 1    | 2       | 0    | 3     |
|             | Total   | 28          | 6    | 6       | 0    | 40    |

In this case, the larger numbers of changes (15) were beneficial to red squirrels, mostly through a loss of grey squirrels from tetrads previously with both species (7), or red squirrels now being detected in squares that had previously not detected any squirrels (4). It is interesting to note that only two tetrads appear above the shaded diagonal, in this case demonstrating a change from "both species" to "neither species". The Replacement Index for this survey period was calculated as -0.34, which was found to be a statistically significant change in favour of red squirrels.

The question arises as to whether this smaller sample is representative of the changes seen in the wider sample of the later years. In Aberdeenshire, the 2011 sample was biased towards sampling an area where there was a much higher probability of recording grey squirrels (Figure 1). The enlarged sample would be biased towards seeing no change in the form of red-only to red-only in many of the new tetrads, which of course is a "no-change" we like to see.

On the other hand, across the Central Lowlands (Figures 2 & 3), the samples from all years were sited in places where grey squirrels could be expected. Spatially the 2011 tetrads were biased towards the Loch Lomond and Trossachs end of the Central Lowlands, but in fact change appears to be ongoing across the whole Central Lowlands red-grey interface.



### *South Scotland*

For South Scotland we cannot calculate a Replacement Index as we only have one sample. Out of 88 tetrads, 51 (58%) had red squirrels present and 22 tetrads (25%) had greys present. Figure 4 shows the distribution of tetrads assigned to the red only, both species, neither species and grey only categories. The 14 incomplete tetrads that returned some results are included as empty squares with the appropriate colour outline in Figure 4.

The tetrads show red squirrels to be remarkably widespread still, despite impressions of a decline in South Scotland, suggesting the situation may not be as bad for red squirrels as is generally perceived. There was a change from red squirrels in the south and west to greys to the north and east. The interface stretches from north Galloway Forest to New Cumnock; then to Sanquhar; on to just north of Moffat; north of Eskdalemuir Forest; on to Selkirk; then curving down to Jedburgh and south to the English border. North and west of the interface mainly grey squirrels were detected, with a few exceptions north of the line where there were both species (near Innerleithen and Biggar). Pleasingly we detected red squirrels at Ladykirk, Berwick-upon-Tweed, not far from the Squirrelepox disease outbreak at Paxton last year. South of the cross-over line, exceptions included finding both species in the Annan area, the Esk between Cannonbie and Langholm and the Thornhill.

Red-squirrel-only tetrads were relatively clustered around Galloway Forest, east of the Glenkens, Ae Forest and the area surrounding Lockerbie in Dumfries and Galloway. In the Borders similar clusters of red squirrel tetrads occurred between Hawick and Moffat and between Hawick and Kielder Forest.

A distinct area of eight tetrads between Coldingham, Duns, Lauder, Galashiels, Selkirk and Stanhope had no squirrel species detected. These results may be because of grey squirrel control efforts and possible landscape barriers, but it could also be part of a UK-wide observation of very low levels of grey squirrels everywhere in 2013. This is probably attributable to a complete failure of autumn mast crops, notably of beech and oak, and the prolonged and exceptionally wet winter. Red squirrels are also thought to have been affected by the winter conditions, but conifer habitat appears to have been less affected than deciduous.

## **Discussion**

The changes that the surveys have detected over the year Spring 2012 to Spring 2013 suggest a small but positive change in favour of red squirrels, although with losses for both species. The winter had been particularly long, exceptionally cold and very wet, following a very wet 2012, a combination that favours neither squirrels nor their food crops. Trapping for grey squirrels was noticeably slow in the early months of 2013, and an absence from many feeder-boxes during the first weeks of the surveys was noted.

Thus in a difficult year for squirrels we had a greater number of “empty” tetrads than last year, yet red squirrels remain distributed across the same area overall as in 2012. A more positive result for red squirrels was found between the Spring 2011/Spring 2013 data which is expected as larger differences are expected to occur over longer periods of time.

In 2013 we completed the first systematic tetrad survey in South Scotland. Although the data could not be used to evaluate squirrel distribution change over time, the survey indicated that Dumfries and Galloway and the south-western regions of the Borders are still red



squirrel havens. Grey incursion from the south and from Ayrshire in the north continues, but the results illustrate a clear change in species presence between the central belt and South Scotland. With a relatively large number of tetrads detecting neither species this year, especially in the Scottish Borders, it will require annual repeats of the surveys to determine whether these are poor zones for squirrels, or whether the poor weather over 2012 and the winter 2012-13 led to unusually low numbers or activity of squirrels.

## **5. THE TRANSECT SURVEYS**

In an effort to discover whether the Project's trapping network was having a measurable effect on the abundance of grey and red squirrels in a group of functionally connected woodlands in western Aberdeen, we carried out standardised walked sightings transects. Nine transects approximately 1km in length (total of 10km) were walked a total of three times by staff or volunteers over the space of a fortnight. Transects were walked in the early morning – the time when virtually all the squirrels in the population are active – and were done in a standard way involving slow walks and five-minute stops, so that the whole kilometre would take 1¾ hours. The transect area was known as the 'Countesswells Complex'. This area consists of nine distinct sites; Blacktop, Foggieton, Murtle Den, Gairnhill, Kingshill, Hazlehead Crematorium, Hazlehead Den Wood, Newton Dee and the Hutton Institute.

### **2013 Results**

The transect surveys were carried out in Spring 2011, Spring 2012 and again in Spring 2013 and the results compared in Table B.

Red squirrel average count declined significantly between 2012 and 2013, after a significant rise in numbers between 2011 and 2012. Even when compared with 2011, the Spring 2013 results for red were evidence of a significant decline in abundance over the two-year period. Grey squirrels also declined, although with such low numbers counted and the number of zero counts, the change from 2012 to 2013 was not statistically significant. However, following a decrease from 2011 to 2012, the two-year change for greys from 2011 to 2013 was significant.

Therefore the decline of both species in Spring 2013 occurs after an initial increase for red squirrels in 2012, but represents a continuing decrease for grey squirrels. The exceptionally low counts for red squirrels and poor counts for greys this year is likely a result of the poor food crops of autumn 2012 and an exceptionally cold, wet winter, both of which would have impacted greatly upon the survival and early spring activity of both species. The autumn 2012 food abundance transects found that there was no oak crop, very little beech seed, no hazel, a little Scots pine and Sitka, a good smattering of larch and very little else in any of the Countesswells Complex woods. The scarcity or complete absence of deciduous seed has been commented on more generally across Scotland and other parts of the UK.

Overall, the results point to the low detectability of squirrels by the transect count method, with weather, canopy cover, seasonal food distribution and timing in relation to the annual breeding cycle affecting the likelihood of seeing squirrels along the transect route.

**Table B. Spring sightings transect squirrel counts (per kilometre of transect line) for 2011, 2012 and 2013**

| Region                          | Location                | Length (km) | Red Squirrel Count per Km |                      |                      |                                    | Grey Squirrel Count per Km |                      |                      |                                    |
|---------------------------------|-------------------------|-------------|---------------------------|----------------------|----------------------|------------------------------------|----------------------------|----------------------|----------------------|------------------------------------|
|                                 |                         |             | Spring 2011               | Spring 2012          | Spring 2013          | Spring 2013-Spring 2012 Difference | Spring 2011                | Spring 2012          | Spring 2013          | Spring 2013-Spring 2012 Difference |
| <b>NE Countesswells Complex</b> | Blacktop                | 1.30        | 6.15                      | 14.62                | 3.0 (1.0)            | -11.62                             | 0.77                       | 1.54                 | 0.00 (1.0)           | -1.54                              |
|                                 | Foggieton               | 0.50        | 2.00                      | 2.50 (0.8)           | 0.00 (0.8)           | -2.50                              | 0.00                       | 1.25 (0.8)           | 0.00 (0.8)           | -1.25                              |
|                                 | Murtle Den              | 1.00        | 0.00                      | 0.00                 | 0.00                 | 0.00                               | 3.00                       | 0.00                 | 1.00                 | +1.00                              |
|                                 | Gairnhill               | 1.00        | 17.00                     | 9.00                 | 3.00                 | -6.00                              | 0.00                       | 0.00                 | 0.00                 | 0.00                               |
|                                 | Kingshill               | 0.60        | 1.67                      | 20.00                | 0.00                 | -20.00                             | 0.00                       | 0.00                 | 0.00                 | 0.00                               |
|                                 | Hazlehead (Crematorium) | 2.00        | 0.50                      | 3.00 (1.0)           | 0.00                 | -3.00                              | 4.50                       | 0.00 (1.0)           | 0.00                 | 0.00                               |
|                                 | Hazlehead (Den Wood)    | 1.60        | 0.00                      | 2.00 (1.0)           | 0.00 (0.8)           | -2.00                              | 5.63                       | 0.00 (1.0)           | 0.00 (0.8)           | 0.00                               |
|                                 | Newton Dee              | 1.00        | 0.00                      | 0.00                 | 0.00                 | 0.00                               | 14.00                      | 6.00                 | 1.00                 | -5.00                              |
|                                 | Hutton Institute*       | 1.00        | 0.00                      | 0.00*                | 0.00                 |                                    | 0.00                       | 0.00*                | 0.00                 |                                    |
|                                 | <b>AVERAGE</b>          |             | <b>3.04</b><br>(n=9)      | <b>6.39</b><br>(n=8) | <b>0.67</b><br>(n=9) | <b>-5.64</b><br>(n=8)              | <b>3.10</b><br>(n=9)       | <b>1.10</b><br>(n=8) | <b>0.22</b><br>(n=9) | <b>-0.85</b><br>(n=8)              |

\*only 1 repetition for Hutton Institute in 2012; n is the total number in the sample used to calculate the average, omitting Hutton Institute for calculations involving 2012  
 () = length of transect if different from other years.

## 6. USING MONITORING CAMERAS

In 15 tetrads in Argyll and Trossachs we used motion-sensitive cameras to see whether they conferred any advantage in detecting and identifying squirrel species when compared with hair identification alone. The results are reported more fully elsewhere. However, it was clear that both volunteers and staff enjoyed seeing the images rather than hair samples, and there were several instances where the images were very useful for confirming results of hair samples where they were difficult to identify confidently. Along with squirrels, pine martens were found to be regular visitors to some of the boxes, as were a variety of birds.

With the greater expense of the camera equipment and the greater carbon footprint caused by the manufacturing process and the energy source required, it is unlikely that the SSRS project will use these cameras routinely in place of hair pads, but they will continue to be used where a quick result or greater certainty is required.

## 7. SUMMING UP

The results of both the tetrad and transect surveys have been affected by weather conditions and food availability over the preceding 12 months and by the unusually wet and cold spring weather in 2013. Nevertheless the tetrad surveys point to red squirrels holding their ground overall, although suffering apparently large losses in the Countesswells Complex, after evident increases over the preceding year 2011 to 2012.

Grey squirrels, meanwhile, have continued a decline. Whilst the size of decline from spring 2012 to spring 2013 may have been at least partially caused by climatic conditions, it comes after a decline from 2011 to 2012 which was more likely to have been brought about by the project trapping in that year. Sustained trapping effort may therefore prevent this species from re-bounding, whilst allowing red squirrels to take advantage of any improvements in food availability by autumn 2013.

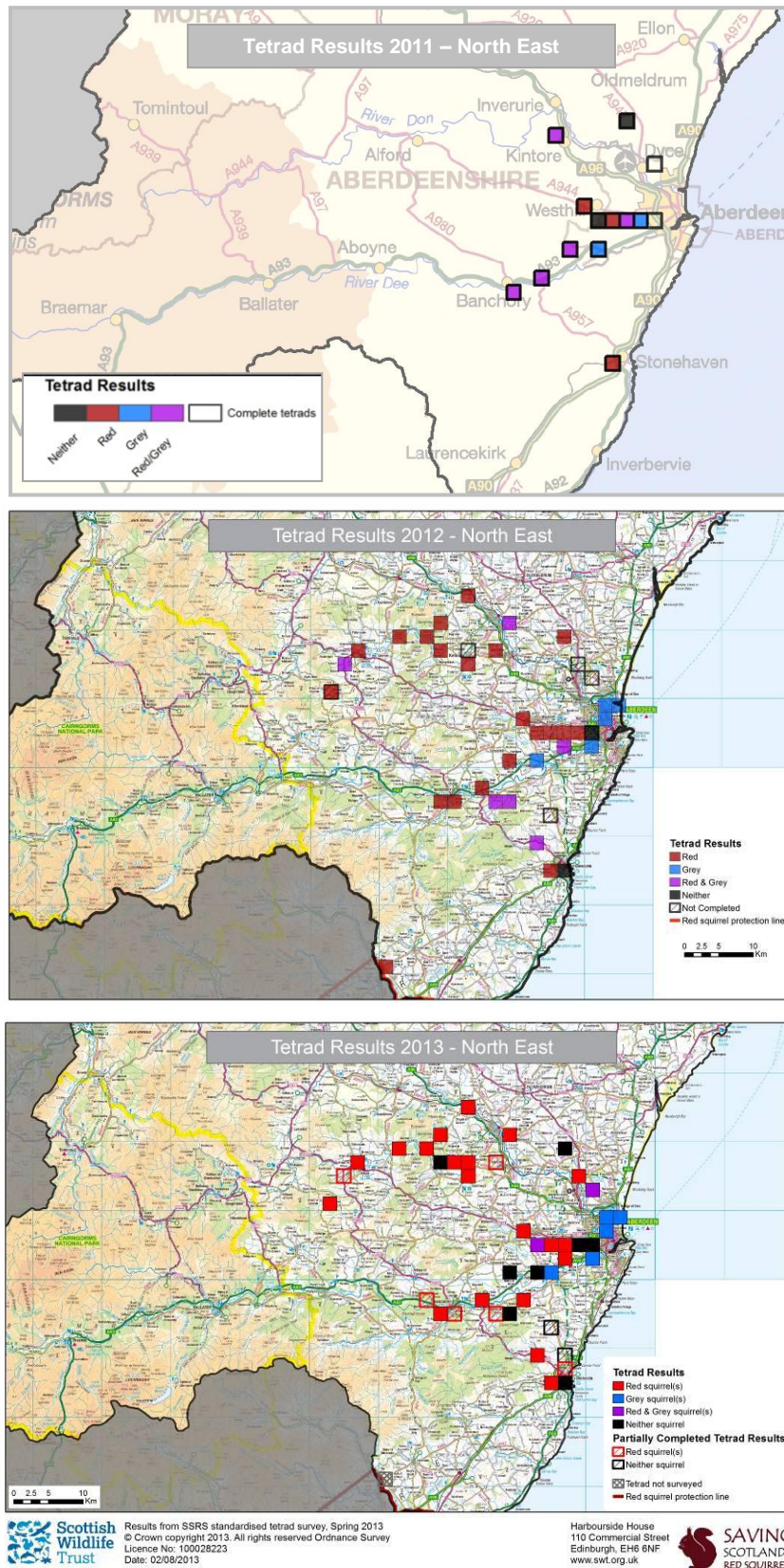
As in previous reports for our transect surveys, the results vary from site to site making general conclusions difficult to draw. The data further highlight the year-to-year variation in squirrel numbers even within sites, which most likely reflects variation in food availability; this changeability of squirrel numbers is a well-established phenomenon in squirrel population dynamics.

The baseline survey results for the south of Scotland provided evidence that red squirrels are still very widespread across Dumfries and Galloway and south-western regions of the Borders. Grey squirrels were detected at far fewer tetrads overall, although they are clearly established in the central and eastern Borders, much of Ayrshire and in all other counties to the north of Dumfries and Galloway and the Borders.

In Spring 2014 we plan to repeat the feeder box and sighting transect surveys carried out in established tetrads in both the north of Scotland (north-east, Tayside, Argyll & Trossachs) and the newly established areas in the South (Scottish Borders, Dumfries & Galloway and South Ayrshire). This data will allow us to continue to monitor changes in both red and grey squirrel numbers across Scotland and to adapt grey squirrel control in order to protect our native red squirrels in the future.

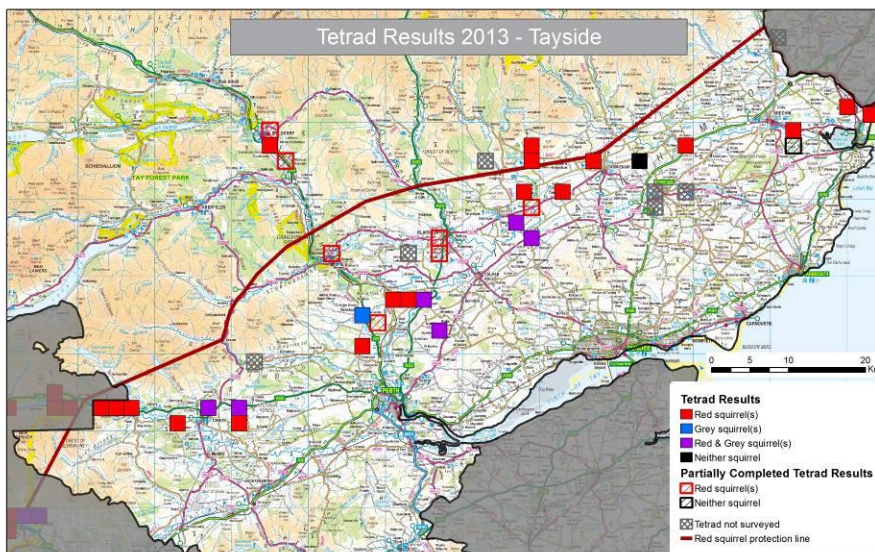
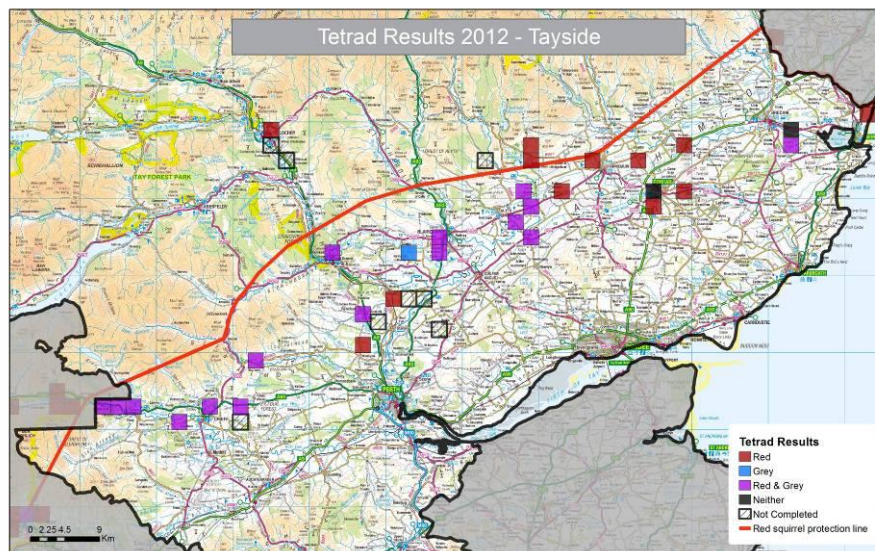
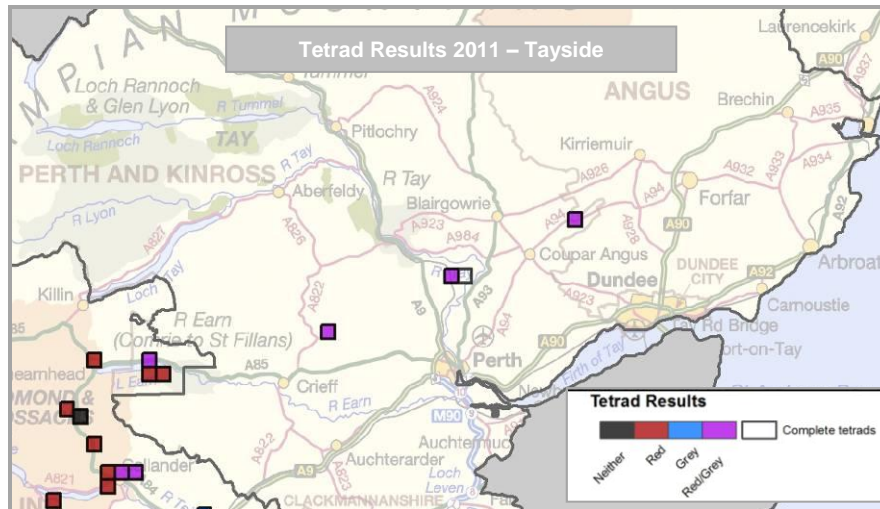
Saving Scotland's Red Squirrels wishes to thank all the volunteers who gave up their time to help us collect this data, and all those landowners who co-operated by allowing us access to their land.

**Figure 1. Maps comparing the results of tetrads for North East Scotland for Spring 2011/2012/2013**





**Figure 2. Map comparing the results of tetrads for Tayside for Spring 2011/2012/2013**





**Figure 3. Map comparing the results of tetrads for Argyll & Trossachs for Spring 2011/2012/2013**

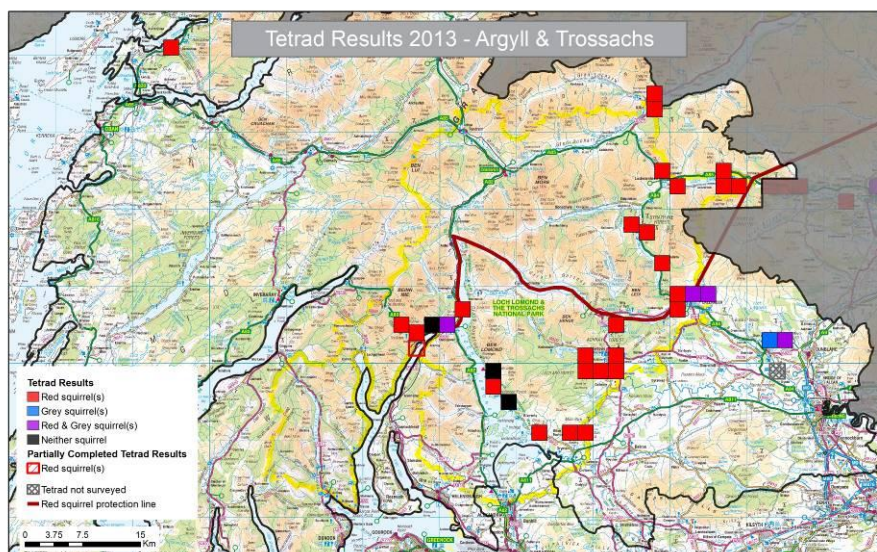
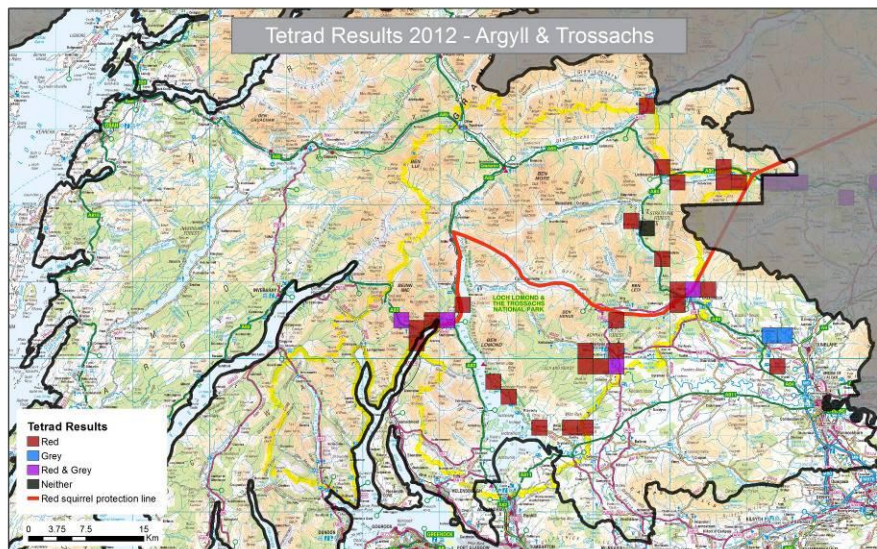
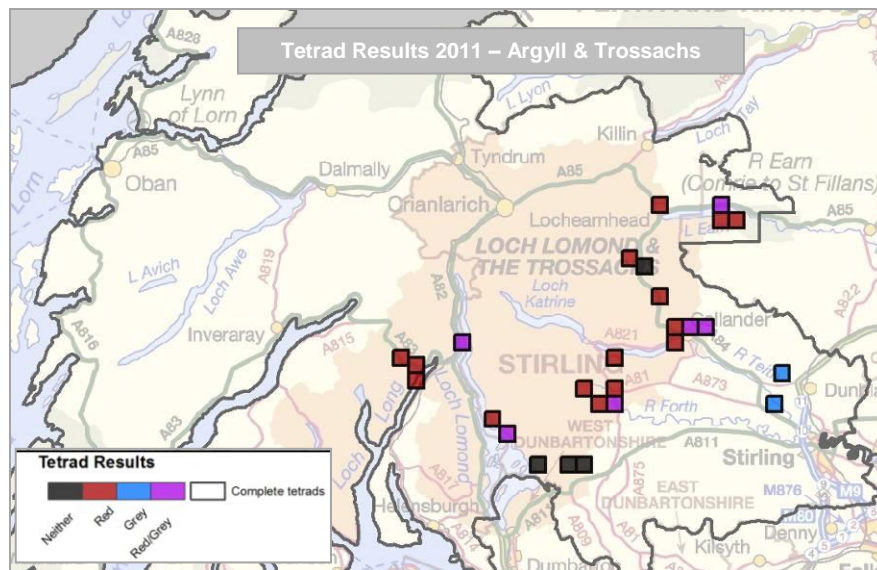
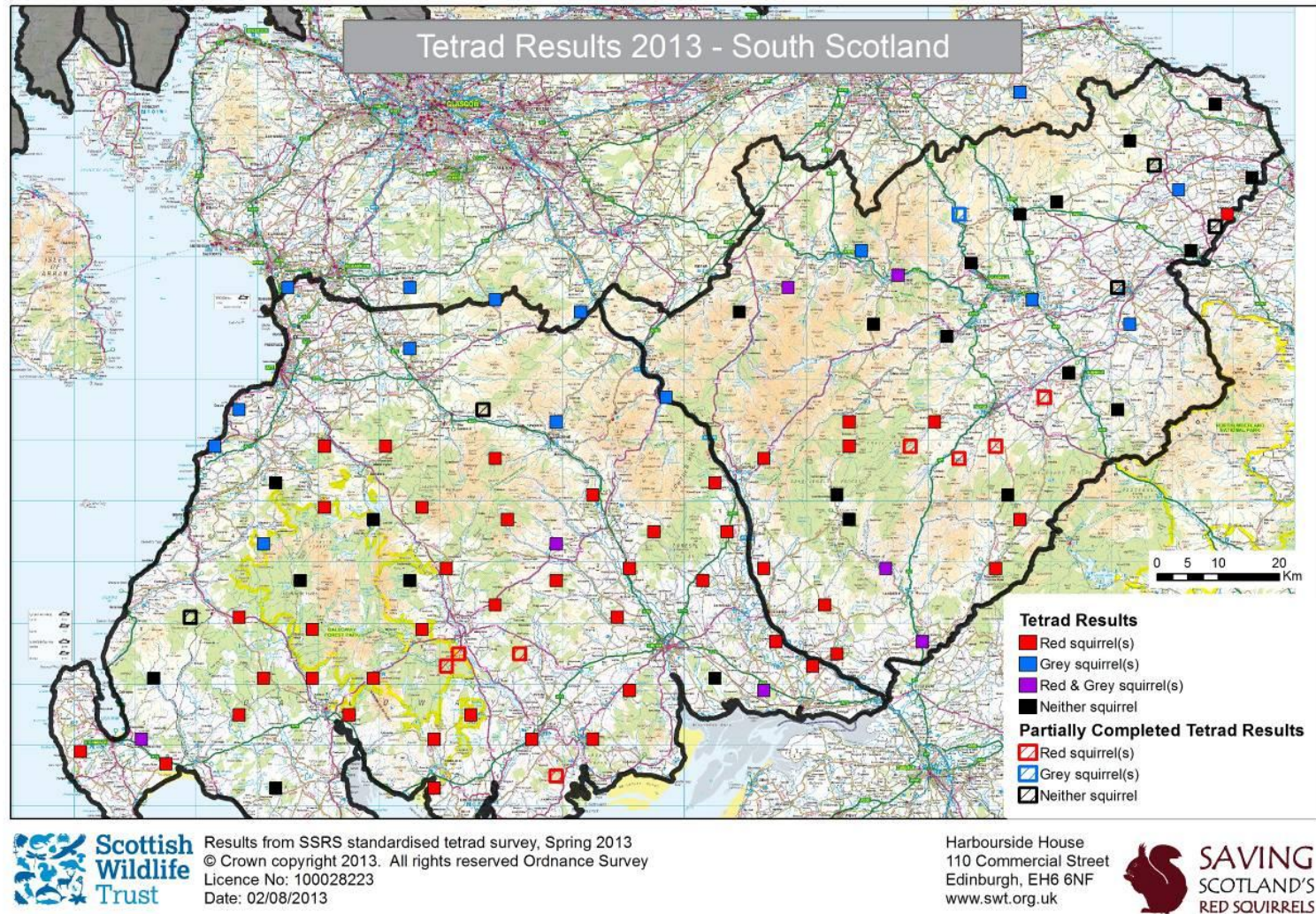




Figure 4. Map comparing the results of tetrads for South Scotland for Spring 2013



# Tetrad Results 2013

| North East |              | Argyll & Trossachs |              | Tayside |              |
|------------|--------------|--------------------|--------------|---------|--------------|
| Tetrad     | Species      | Tetrad             | Species      | Tetrad  | Species.     |
| NJ5210     | Red only     | NM9440             | Red only     | NN7222  | Red only     |
| NJ5616     | Red only     | NN2404             | Red only     | NN7422  | Red only     |
| NJ6218     | Red only     | NN2603             | Red only     | NN7622  | Red only     |
| NJ6618     | Red only     | NN2804             | Neither      | NN8220  | Red only     |
| NJ6816     | Neither      | NN3004             | Both species | NN8622  | Both species |
| NJ6820     | Red only     | NN3206             | Red only     | NN9020  | Red only     |
| NJ7016     | Red only     | NN4800             | Red only     | NN9022  | Both species |
| NJ7214     | Red only     | NN5200             | Red only     | NN9456  | Red only     |
| NJ7216     | Red only     | NN5204             | Red only     | NO0630  | Red only     |
| NJ7224     | Red only     | NN5417             | Red only     | NO0634  | Grey only    |
| NJ7800     | Neither      | NN5616             | Red only     | NO1036  | Red only     |
| NJ7820     | Red only     | NN5732             | Red only     | NO1236  | Red only     |
| NJ8006     | Red only     | NN5734             | Red only     | NO1436  | Both species |
| NJ8200     | Neither      | NN5812             | Red only     | NO1632  | Both species |
| NJ8204     | Both species | NN5824             | Red only     | NO2646  | Both species |
| NJ8400     | Grey only    | NN6006             | Red only     | NO2750  | Red only     |
| NJ8404     | Red only     | NN6008             | Red only     | NO2844  | Both species |
| NJ8602     | Red only     | NN6022             | Red only     | NO2854  | Red only     |
| NJ8604     | Red only     | NN6208             | Both species | NO2856  | Red only     |
| NJ8618     | Neither      | NN6408             | Both species | NO3250  | Red only     |
| NJ8804     | Neither      | NN6622             | Red only     | NO3654  | Red only     |
| NJ8814     | Red only     | NN6624             | Red only     | NO4254  | Neither      |
| NJ9002     | Grey only    | NN6822             | Red only     | NO4856  | Red only     |
| NJ9004     | Neither      | NN7202             | Grey only    | NO6258  | Red only     |
| NJ9012     | Both species | NN7402             | Both species | NO6961  | Red only     |
| NJ9206     | Grey only    | NS3696             | Red only     | NO7260  | Red only     |
| NJ9208     | Grey only    | NS3698             | Neither      |         |              |
| NJ9408     | Grey only    | NS3894             | Neither      |         |              |
| NO6894     | Red only     | NS4290             | Red only     |         |              |
| NO7496     | Red only     | NS4690             | Red only     |         |              |
| NO7894     | Neither      | NS4890             | Red only     |         |              |
| NO8096     | Red only     | NS4898             | Red only     |         |              |
| NO8288     | Red only     | NS5098             | Red only     |         |              |
| NO8484     | Red only     | NS5298             | Red only     |         |              |
| NO8684     | Neither      |                    |              |         |              |

| South Scotland |              |        |              |        |              |
|----------------|--------------|--------|--------------|--------|--------------|
| Tetrad         | Species      | Tetrad | Species      | Tetrad | Species.     |
| NS2208         | Grey only    | NT7258 | Neither      | NX8880 | Red only     |
| NS2614         | Grey only    | NT8050 | Grey only    | NX9068 | Red only     |
| NS3202         | Neither      | NT8240 | Neither      | NX9088 | Red only     |
| NS3434         | Grey only    | NT8664 | Neither      | NX9494 | Red only     |
| NS4008         | Red only     | NT8846 | Red only     | NY0286 | Red only     |
| NS5008         | Red only     | NT9252 | Neither      | NY0470 | Neither      |
| NS5424         | Grey only    | NX0058 | Red only     | NY0694 | Red only     |
| NS5434         | Grey only    | NX1060 | Both species | NY1268 | Both species |
| NS6806         | Red only     | NX1270 | Neither      | NY1288 | Red only     |
| NS6832         | Grey only    | NX1456 | Red only     | NY1476 | Red only     |
| NS7812         | Grey only    | NX2664 | Red only     | NY2072 | Red only     |
| NS8230         | Grey only    | NX2680 | Red only     | NY2282 | Red only     |
| NS8400         | Red only     | NX3070 | Red only     | NY2474 | Red only     |
| NS9616         | Grey only    | NX3092 | Grey only    | NY2696 | Neither      |
| NT0402         | Red only     | NX3252 | Neither      | NY3288 | Both species |
| NT0830         | Neither      | NX3686 | Neither      | NY3876 | Both species |
| NT1206         | Red only     | NX3870 | Red only     | NY5088 | Red only     |
| NT1634         | Both species | NX3878 | Red only     | NY5496 | Red only     |
| NT2400         | Neither      | NX4098 | Red only     |        |              |
| NT2608         | Red only     | NX4464 | Red only     |        |              |
| NT2612         | Red only     | NX4870 | Red only     |        |              |
| NT2840         | Grey only    | NX4896 | Neither      |        |              |
| NT3028         | Neither      | NX5486 | Neither      |        |              |
| NT3436         | Both species | NX5678 | Red only     |        |              |
| NT4012         | Red only     | NX5698 | Red only     |        |              |
| NT4226         | Neither      | NX5852 | Red only     |        |              |
| NT4638         | Neither      | NX5860 | Red only     |        |              |
| NT5200         | Neither      | NX6088 | Red only     |        |              |
| NT5446         | Neither      | NX6464 | Red only     |        |              |
| NT5466         | Grey only    | NX6882 | Red only     |        |              |
| NT5632         | Grey only    | NX7096 | Red only     |        |              |
| NT6048         | Neither      | NX7460 | Red only     |        |              |
| NT6220         | Neither      | NX7886 | Red only     |        |              |
| NT7014         | Neither      | NX7892 | Both species |        |              |
| NT7228         | Grey only    | NX8460 | Red only     |        |              |