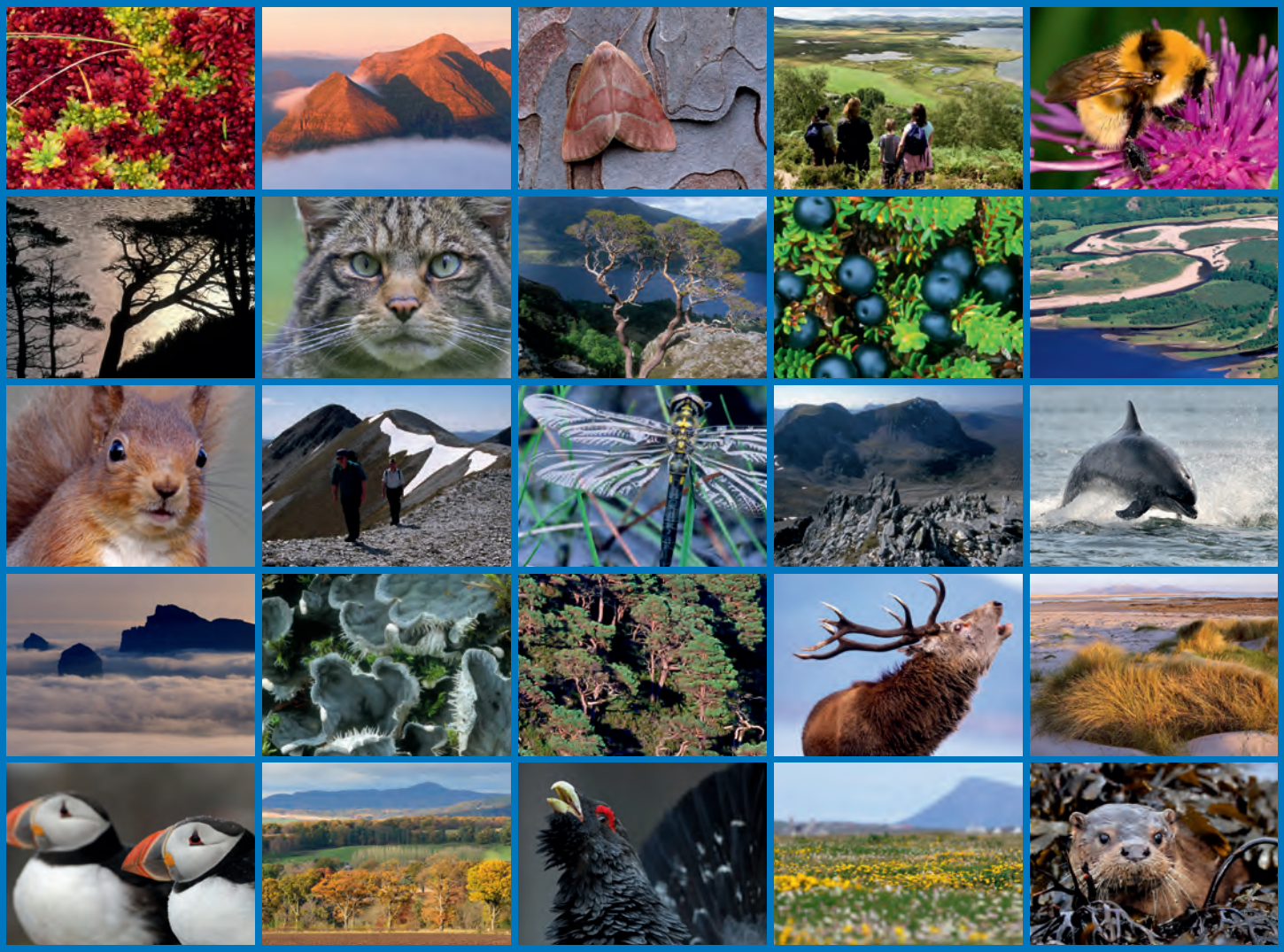
Scottish Natural Heritage
Commissioned Report No. 768

Survey and scoping of wildcat priority areas



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COMMISSIONED REPORT

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Survey and scoping of wildcat priority areas

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COMMISSIONED REPORT

Summary

Survey and scoping of wildcat priority areas

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Wildcat; trail camera; priority areas; genetics; survey; public attitudes.

Background

The Scottish Wildcat (*Felis silvestris*) is in urgent need of action to save remaining populations in the wild. Following habitat loss and persecution through the nineteenth century, the Wildcat is now restricted in the UK to the Scottish Highlands north of the Central Belt of Scotland. Recently, hybridisation of remaining Wildcats with feral and domestic cats has been identified as the main threat to its continued survival. There have been significant advances, over the past 30 years, in developing methods for identifying Wildcats based on pelage characteristics and on genetics. These have revealed that remaining free-living tabby-coated cats show a broad range of characteristics from those associated with domestic cats through to those typically associated with Wildcats.

The Scottish Wildcat Conservation Action Plan aims to implement actions focussed on improving the conservation status of the Wildcat in Scotland. In particular it aims to secure at least five stable populations of Wildcats in the wild. To this end, this project draws together multiple streams of evidence to identify the areas that are likely to be the most suitable for defending and aiding the recovery of existing Wildcat populations. We report on field surveys of nine candidate areas using camera traps and associated assessment of pelage characteristics, on genetic analysis of scats and tissue samples collected during these field surveys and from other sources, and on a questionnaire survey of the attitudes of key stakeholders towards Wildcat conservation in the study areas. We identify six of these areas that are most suited to be established as priority areas for Wildcat conservation.

Main findings

- A Population Viability Analysis was carried out using the best available parameters, albeit many of these had low reliability. The analysis suggested that a Wildcat population of 40 animals (assuming an equal sex ratio at birth) was required to stand a >95% chance of surviving for 50 years. Therefore in each of nine broad study regions that had been selected based on recent verifiable Wildcat records, areas were defined that contained sufficient high-quality habitat to be able to support 20 female Wildcat home ranges.

- Camera trap surveys were carried out for at least three weeks at each of the nine candidate priority areas. They recorded between 1 and 14 free-living cats.

- Using a relaxed ID criteria system, pelage assessment classified Wildcats at six of the study sites. Between one and eight Wildcats were recorded at these sites, representing between 25% and 75% of all cats recorded at these six sites.

- Capture-recapture modelling estimated that the highest density of Wildcats and hybrids combined was at the Angus Glens, with 0.14 cats per km^2 (95% confidence limits 0.06 to 0.34 cats per km^2), although the spatial structure of the data, especially the lack of recaptures of cats at different cameras, means that this estimate is not regarded as robust. Data, especially of recaptures, were too sparse from most sites to produce density estimates.

- A total of 43 faecal samples were collected from seven sites and a further three from outside the study areas but genetic analysis showed that only 5 of these were from cats, highlighting the difficulties in using this sample type for monitoring Wildcats in Scotland. Skin follicles attached to hair samples from three sites were analysed and blood was taken from ten live-trapped cats. Samples analysed showed a broad spectrum of individual genetic introgression by feral domestic cats with all samples from the survey sites being assigned to hybrid categories.

- Questionnaire surveys showed that, from a broad range of respondents, most supported Wildcat conservation. Levels of support were higher from those who reported having seen Wildcats. Support for specific conservation actions was high, though some respondents did not support the subsequent release of feral cats trapped for neutering.

- Although robust data are sparse, there is a need to identify areas for conservation action. Therefore, drawing together the multiple strands presented in this report, we recommend that priority areas for Wildcat conservation are established at Angus Glens, Dulnain, Morvern, Strathavon, Strathbogie and Strathpeffer. Recommended boundaries for each area, based on geographic features such as areas of suitable habitat and potential deterrents to movement and dispersal, are presented.

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1. INTRODUCTION

The European Wildcat (*Felis silvestris*) is found in fragmented populations from Russia to Portugal and from Scotland to the Near East (Nowell and Jackson, 1996). The Scottish Wildcat (*Felis silvestris grampia*), hereafter referred to as Wildcat, has been lost from most of its former range in Britain, with a residual population now concentrated almost entirely in the north of Scotland (Easterbee *et al.,* 1991; Davis & Gray, 2010). Much of this contraction in range has been driven by habitat loss and persecution. With resultant fragmentation of areas occupied by Wildcats, populations have become more genetically isolated. Some populations of European Wildcats have naturally been isolated by aspects of habitat use or geography (e.g. Mattucci *et al.,* 2013). However artificial features associated with human land use have now led to further reductions of gene flow between populations (Hartmann, *et al.,* 2013) thus increasing the chances of local extinctions.

Amidst this challenging conservation situation, hybridisation with domestic and feral cats (*Felis catus*) is now recognised as the primary threat to the survival of the Wildcat in Scotland (Daniels & Corbett, 2003; Kilshaw, 2011; Anon, 2013). Furthermore disease transmission from domestic and feral cats adds further to the pressure on remaining Wildcat populations (Fromont *et al.,* 2000; Millán & Rodríguez, 2009). Recent surveys in Scotland have shown that the majority of wild-living cats that resemble Wildcats now show at least some characteristics more usually associated with domestic cats (e.g. Kilshaw *et al.,*in press).

Recognition that many wild-living cats are indeed Wildcat × domestic cat hybrids has led to considerable effort to develop methods of identifying pure Wildcats in the wild and from museum specimens (e.g. French *et al.,* 1988; Hubbard *et al.,* 1992; Randi *et al.,* 2001; Yamaguchi *et al.,* 2004; Kitchener *et al.,* 2005; Oliveira *et al.,* 2008; O'Brien *et al.,* 2009; Kruger *et al.,* 2009). While much of this research focuses on whether the species may be accurately identified phenotypically, or solely through genetic analysis, central to recent debate is the challenge as to whether the "true" Wildcat is merely conceptual. Hundreds, possibly thousands, of years of introgression with feral and domestic populations may have led to a genetically indistinct species along a "cline" of variation (e.g. Daniels *et al.,* 1998). However, populations of genetically and phenotypically distinct Wildcats do persist and, increasingly in Scotland and elsewhere in Europe, the combined use of camera trapping, (e.g. Anile, *et al.,* 2009; Can *et al.,* 2011) and genetic testing (e.g. Say *et al.,* 2012; Steyer, *et al.,* 2013), along with general acceptance of diagnostic criteria (Beaumont *et al.,* 2001; Kitchener *et al.,* 2005) is enabling animals to be consistently categorised as Wildcats, domestic cats or hybrids.

In light of the Wildcat's perilous conservation status (e.g. Davis & Gray, 2010), it is proposed that modern field and lab techniques are used to assess extant populations of Wildcats. The implementation of conservation management actions, such as minimising the threats from domestic and feral cat populations, could then be prioritised towards the most suitable areas to improve the viability of Wildcat populations (Anon, 2013).

Existing Wildcat records may assist in the shortlisting of potential priority areas, though a systematic assessment of: a) Wildcat populations in such areas and: b) factors that might affect the potential to defend or enlarge these populations, is crucial to focus future action at sites where it will have the greatest benefit.

As part of the Scottish Wildcat Conservation Action Plan (Anon, 2013) The James Hutton Institute, the Wildlife Conservation Research Unit (WildCRU) and the Royal Zoological Society of Scotland were contracted by Scottish Natural Heritage to investigate potential Wildcat priority areas. Nine study areas were defined prior to the start of this project and are shown in Figure 1. These areas were selected based on there being recent verifiable

Wildcat records based on pelage classification. Within each area, fieldwork was carried out to determine the presence of Wildcats, free-living domestic cats and their hybrids, their appearance using a widely-used pelage scoring system, their genetic status and the attitudes of local people to Wildcat conservation. The aim was to use these multiple streams of evidence to recommend six of these areas to be adopted as priority areas for Wildcat conservation. The roles of the respective organisations were as follows. WildCRU: all aspects of design and execution of wildcat field sampling programme; The James Hutton Institute: all social sciences components of the work, spatial planning of wildcat trapping areas, modelling and data analysis and report collation; The Royal Zoological Society of Scotland: DNA analyses of scats and tissue.

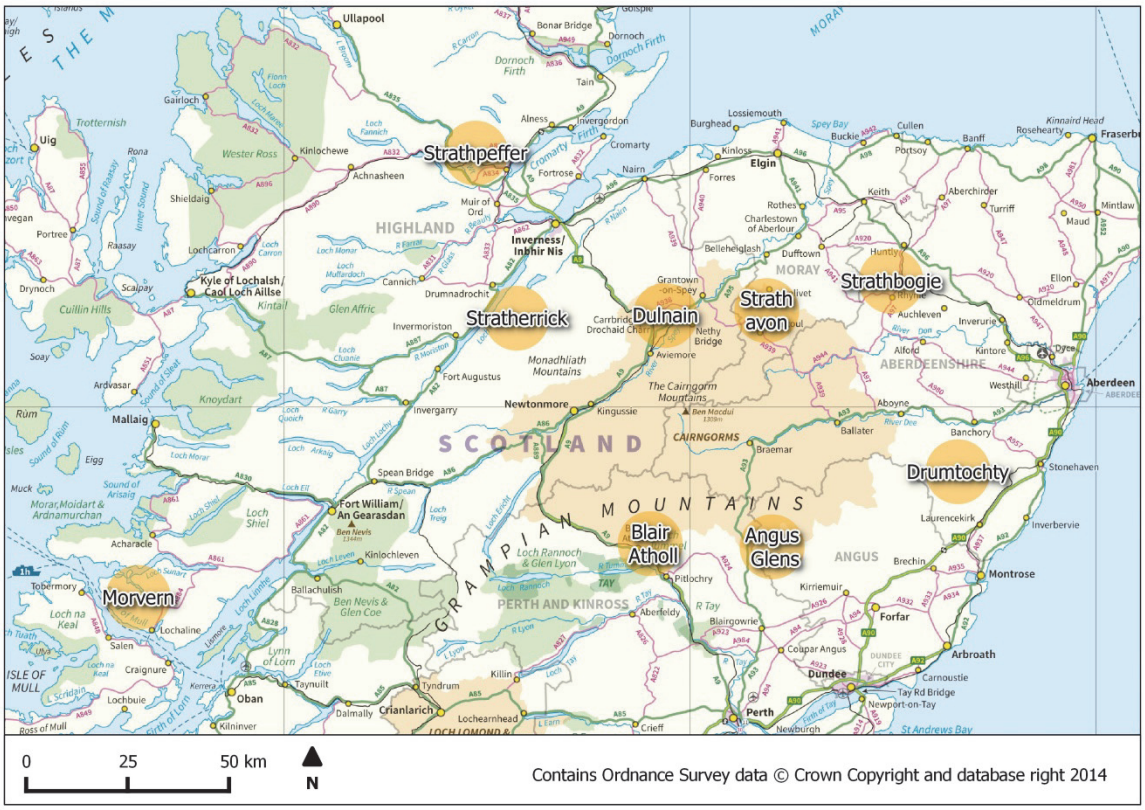


Figure 1. Potential Wildcat priority areas for scoping and survey.

2. ESTIMATING MINIMUM VIABLE WILDCAT POPULATIONS

2.1 Introduction and aims

To determine an area for the conservation of a population of animals, it is necessary to know whether it is large enough to have a good chance of supporting that population in the longer term. We used the software, VORTEX, version 9.99c (Lacy *et al.,* 2005) to estimate the size of a Wildcat population that could survive for 50 years. This was based on estimating a theoretical population size at or close to carrying capacity rather than assessing the likelihood that any existing population in a given location is currently viable. Vortex is an individual-based simulation of deterministic forces which can also incorporate demographic, environmental and genetic stochastic events on wildlife populations. It works by running a series of simulations, each based on the fate of a population, using parameter estimates (and their distributions) for the main factors that influence an individual's survival as set by the user (Lacy, 1993).

2.2 Methods

The parameters required to run VORTEX (Table 1) were primarily taken from Kilshaw & Macdonald (2009). Checks were made of more recent literature but little further information was found to supplement these estimates. These estimates are the best that we were able to find though in some cases they are based on low sample size or on expert opinion of unknown accuracy. For each model run, 200 populations were simulated over 50 years and the results were primarily assessed in terms of the probability of a population of Wildcats surviving for that period (given the starting parameter estimates). We chose a 50 year time period for maintaining a viable population as a reasonable target for the impact of conservation interventions and it is difficult to consider the environmental and policy context for wildcat conservation beyond this time frame.

It is possible to start with any initial population size value and any carrying capacity value. However, we chose a strategy based on the following premise to guide the modelling: We were aiming to use VORTEX to give an indication of what size of population and carrying capacity we would want to aim for and not trying to model existing populations with their particular characteristics or challenges to survival. Therefore we chose starting conditions with an initial population of about 80% of the carrying capacity. In other words, a reasonably healthy population with an appropriate number of individuals relative to the available area as set by the carrying capacity term (k). Given a broad, though arbitrary, rule of thumb for carnivores that a minimum population size for reintroduction is 20 reproductively aged adults (Breitenmoser *et al.,* 2001), we started from a point where the carrying capacity was 20 and the initial population size was 80% of this, i.e. 16. We allowed for some variation in carrying capacity due to the environment by randomly varying this parameter positively or negatively by up to three from year to year.

We essentially explored the population trajectories when the reproductive parameters were allowed to vary within the range reported in the literature and by varying the mortality parameter estimates for young and old age animals. We assumed all females could breed but we included environmental variation that randomly reduced the percentage of breeding females by up to 15% in any one year. We also assumed the number of offspring per female averaged 4.3 but allowed this to vary by around three per litter. We explored the effect of changing the age at first reproduction in both sexes from two to one. The effect of reducing mortality rates of females was explored as described in Section 2.3.3.

Dispersal was not addressed in the modelling. We assumed that we were modelling one population rather than a set of populations that could lose or gain animals through either dispersal or supplementation from captive breeding programmes.

Initial analyses showed that using the baseline parameter estimates from Kilshaw and Macdonald (2009), 99.5% of Wildcat populations went extinct within 40 to 50 years (lambda=0.976, mean time to first extinction was 18.60 years (SD 9.01)) (Figure 2). Analyses were carried out with sequentially altered parameters to determine which features most affected population viability. These alterations of parameters are described below (Section 2.3).

Table 1. Parameters used to run VORTEX analysis of the minimum viable Wildcat population required for persistence.

	Modelled parameter	Data parameter based on	Information source
♂ age at first breeding	1, 2	2 y. 1 m. 6 d.	Captivity (Kilshaw & Macdonald, 2009)
♂ age at first reproduction	1, 2	2 y. 8 m. 30 d.	Captivity (Kilshaw & Macdonald, 2009)
♀ max. reproductive age	10	Can be 10	Balharry & Daniels, 1998
♂ max. reproductive age	10		Kilshaw & Macdonald, 2009
Sex ratio at birth	50:50		Kilshaw & Macdonald, 2009
Mean litter size	2, 2.3, 3. 3.5, 4, 4.3, 5	4.3 (1-6, max. 8). 1 littler/yr	Daniels *et al*., 2002; Kilshaw, 2011; Anon, 2013
Environmental variation of mean littler size	01., 0.2, …2		
Reproductive system	polygamous	One ♂ needed for several ♀♀ to breed	Captivity (Kilshaw & Macdonald, 2009)
♀ mortality 0-1	0.26 (EV = 5%) then 0.8	30% of kittens die in 30 days	
♀ mortality 1-2	0.06 (EV=5%) then 0.4		
♀ mortality >2	0.08 (sd = 7%) then 0.2		
♂ mortality 0-1	0.32 (EV = 5%) then 0.8		
♂ mortality 1-2	0.06 (EV=5%) then 0.4		
♂ mortality >2	0.15 (sd= 17%) then 0.2		
Carrying capacity	15, 20, 30, 40, 30, 50	Set at 224 (estimated from habitat suitability model)	
Initial population size	11-40	20 = minimum number for reintroduction of a carnivore	Breitenmoser *et al.,* 2001
Habitat supplementation (change in carrying capacity)	-5 to +30		

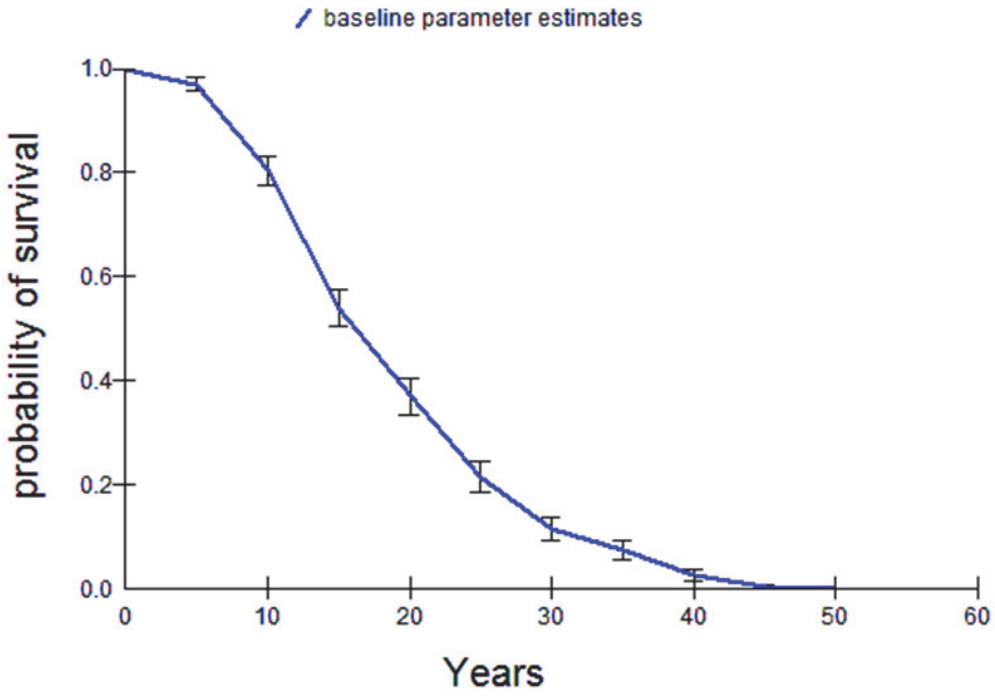


Figure 2. The probability of survival (with SE) of 200 runs of a simulation model using the baseline parameter estimates from Kilshaw and Macdonald (2009).

2.3 Results

2.3.1 Effect of age at first reproduction

Studies in captivity show that Wildcats generally start to breed when two years old. However there is some uncertainty over the age of first breeding of wild populations and, as domestic cats are able to breed from six months of age, first breeding of Wildcats in the wild may be sooner than two years of age. Furthermore, it is entirely possible that age of first breeding may be density dependent with animals breeding younger in less densely populated regions or in those areas where the population is significantly lower than the carrying capacity based on available resources. Hence, the model was re-run with the age of first breeding set to one instead of two years old. This resulted in only a very slight delay in the time taken for populations to go extinct (Figure 3).

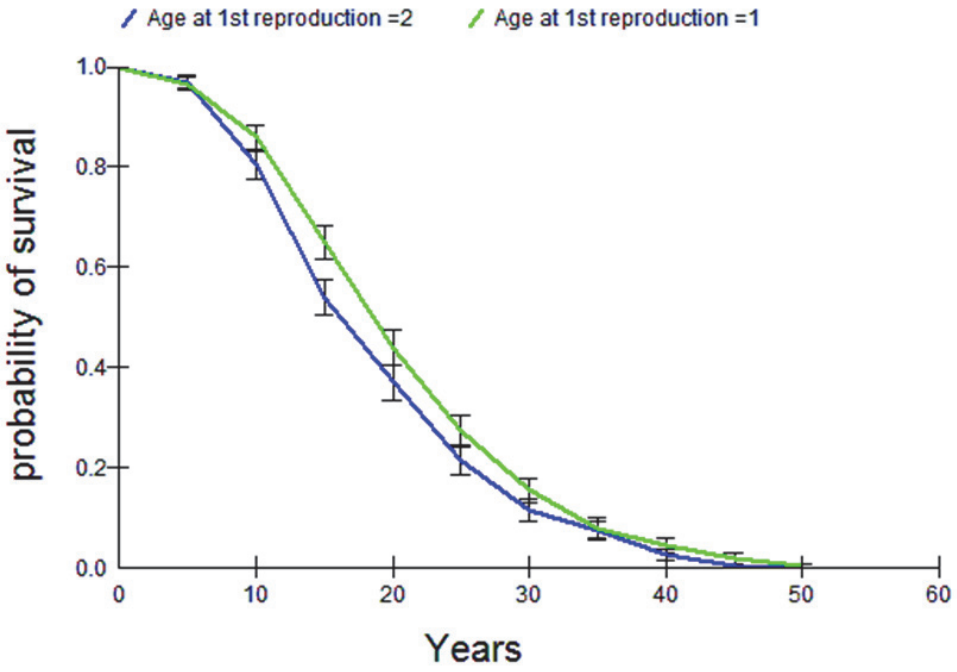


Figure 3. The effect of reducing age at 1st reproduction from 2 years to 1 year old. PE = 0.99.

2.3.2 Effects of initial population and carrying capacity

The next series of runs of the model examined the influence of initial population and carrying capacity on population survival. With a carrying capacity that was set to vary from 15 up to 50 animals, and the starting population set nominally at 80% of this level, most populations still went extinct within 50 years (Figure 4) but a small proportion of larger populations did survive (Figure 5). This demonstrates that regardless of the initial population size, the population nearly always go extinct (see Table 2 for lambda and probability of extinction values). Increasing the initial population size only delays the time to extinction.

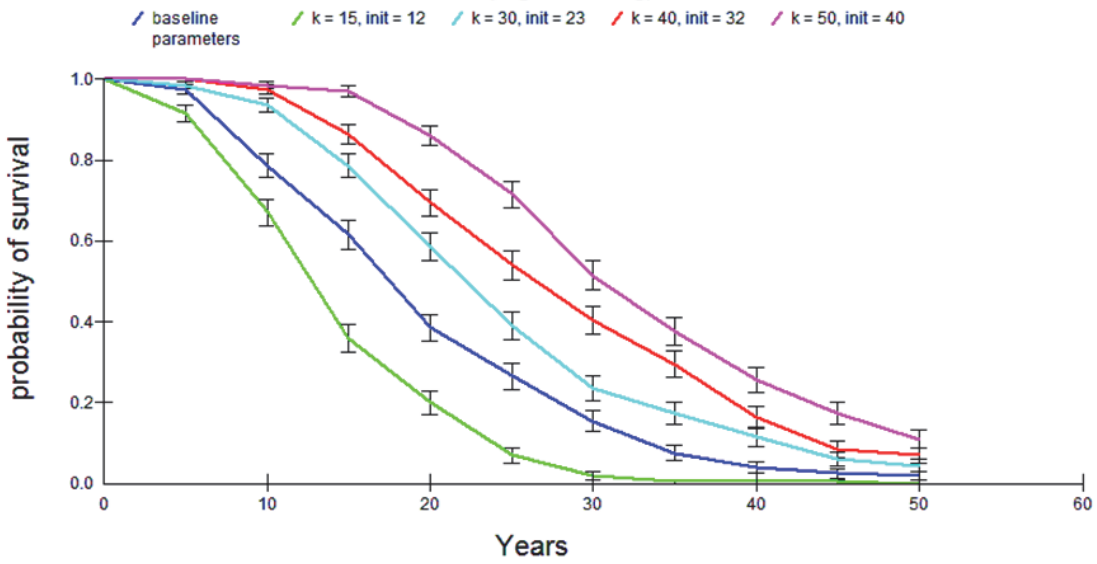


Figure 4. The effect of changing the carrying capacity (k) on probability of survival. k varies from 15 to 50. Initial population size is 80% of k. This assumes starting with a healthy population.

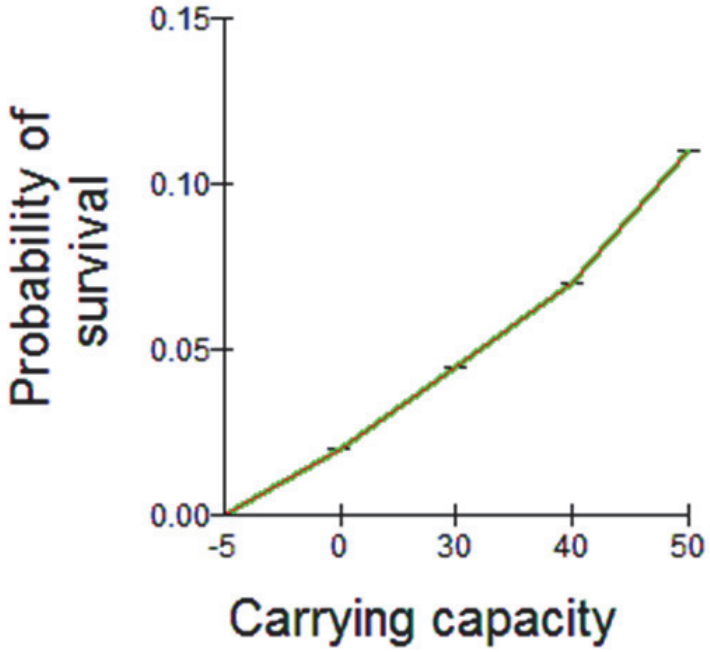


Figure 5. Effect of changing carrying capacity on the Probability of Survival (PS) for five levels of carrying capacity with initial population set at 80% carrying capacity. k=15, initial population = 11; k=20, initial population =16; k=30, initial population = 23; k=40, initial population = 32; k=50, initial population =40.

2.3.3 Effect of survival parameters

To assess the sensitivity of the model to survival parameters, the input estimate of the probability of an adult female dying during any one year was reduced from 0.2 to 0.15 and that of a kitten dying before its first birthday was reduced from 0.8 to 0.7. This markedly increased the probability of populations surviving for 50 years (Figure 6, Table 2). At a carrying capacity of 30 animals and an initial population set at 80% of this figure, around 70% of populations persist whilst >95% populations persist at a carrying capacity of 40 (Figure 7).

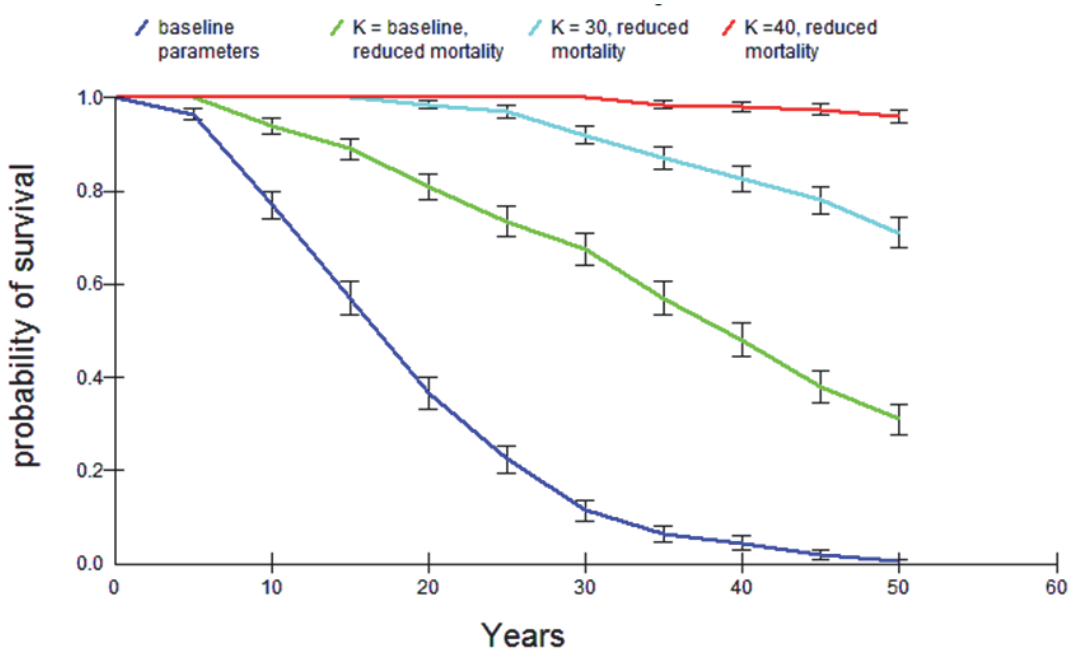


Figure 6. The probability of survival (PS) for different values of k and initial population size with reduced mortality: adult female = -5%; female kitten = -10%. Note that PS is about 75% for k=30, initial pop=23 but is still only about 30% for a k=20, initial pop=16.

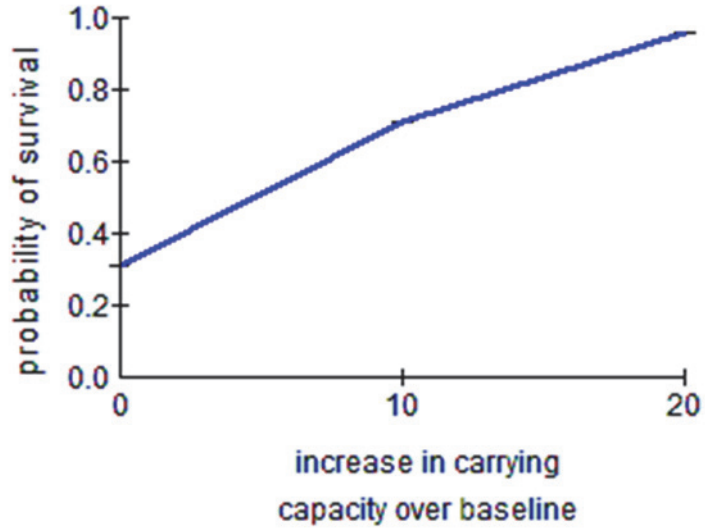


Figure 7. This shows how the probability of survival (PS) varies with change in k when adult female morality is reduced by 5% and kitten mortality is reduced by 10%. Note that baseline is set at k=20. At k=30 (level 10) the PS is close to 70% if mortality for females is reduced.

2.3.4 *Effect of mortality rates at lower age of reproduction*

In the final model run, the reduced mortality rates and age of first reproduction being set to one were combined and assessed based on carrying capacities of 30 and 40. With both factors incorporated and a carrying capacity of 30, the vast majority of populations survived for the 50 years of the simulation and almost all did so with a carrying capacity of 40 (Figure 8).

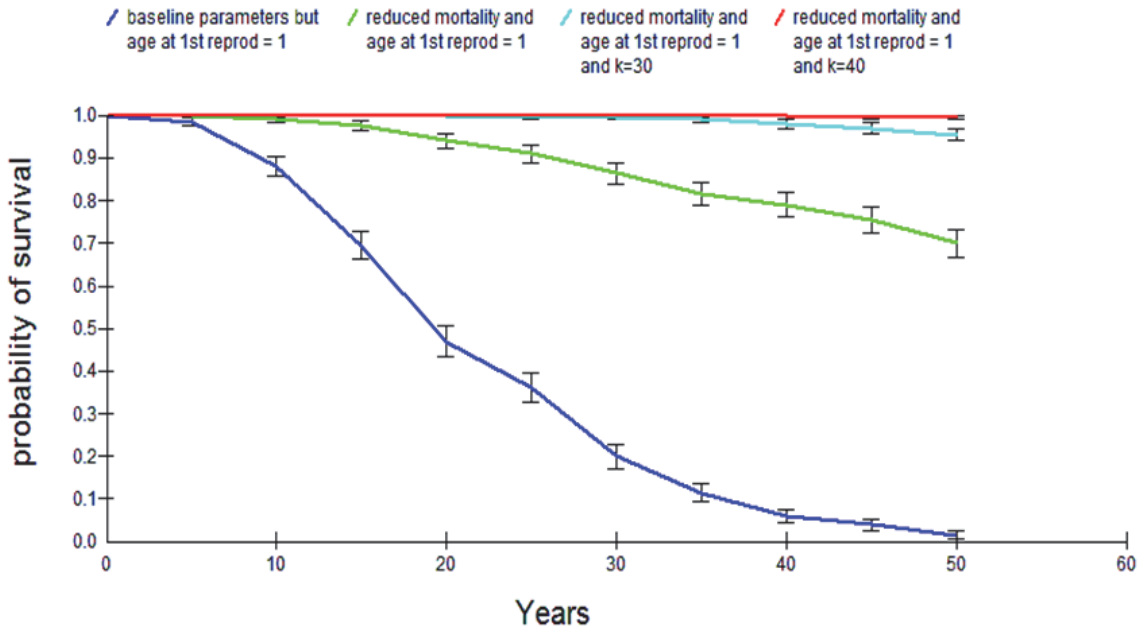


Figure 8. Probability of Survival (PS) for reduced mortality at k=20, 30 & 40 compared to baseline mortality and with age of first reproduction set at one. Note that at k=20 and initial pop=16 with mortality reduced in juvenile females to 70% and in adult (>1) to 25% (mean of yearling and adult was set at 30%) around 65% of populations survive.

Table 2. Estimates for Lambda (the population multiplication factor), the probability of extinction and the mean number of years it takes until the first extinctions occur (with Standard Deviation) for a range of scenarios tested in the analysis

Scenario	**lambda**	**P extinction**	**Mean years to first extinction (SD)**
Baseline	0.976	0.955	18.6 (9.01)
Lower age at 1st reproduction	1.037	0.990	20.80 (10.37)
K = 15	0.976	1.000	14.22 (7.19)
K = 30	0.976	0.955	23.38 (9.64)
K= 40	0.976	0.930	26.73 (9.88)
K = 50	0.976	0.890	30.54 (9.52)
Reduced adult and juvenile mortality k=20	1.104	0.690	30.01 (12.37)
Reduced adult and juvenile mortality k=30	1.104	0.290	36.97 (8.82)
Reduced adult and juvenile mortality k=40	1.104	0.040	40.88 (7.77)
Reduced mortality, lower age at 1st reproduction k=20	1.263	0.350	35.49 (11.04)
Reduced mortality, lower age at 1st reproduction k=30	1.263	0.025	43 (7.18)
Reduced mortality, lower age at 1st reproduction k=40	1.263	0.005	41 (0.0)

2.4 Discussion and Conclusions

These analyses aimed to estimate what size of population might be viable rather than determining whether any of the particular current populations are viable. In some or most regions, the current population might be at an unsustainably low level but intensive management to be carried out as part of the Scottish Wildcat Conservation Action Plan (Anon, 2013) might have the potential to raise the population to a level at which it can persist in the longer term. The results of these analyses are, therefore, intended as a preliminary estimate of what a viable population size of Wildcats might be. In the absence of more robust information, but with a pressing need to focus conservation action, this figure can assist determination of what a minimum area capable of supporting that population at or close to carrying capacity might be.

Bearing these caveats in mind, some broad messages can be drawn:

- Wildcat populations may be viable with 20 adult cats if females first reproduce at one year of age and annual mortality of adult females and kittens is no greater than 25% and 70% respectively.

- However, if age of first reproduction is two, with these mortality parameters the analysis shows that the population would need to be at least 40 adult cats to have a 75% chance of being viable for 50 years.

- It is recommended that priority areas should be designed to be capable of supporting a minimum population of 40 Wildcats, given the uncertainty in parameter estimates.

- Assuming that Wildcats have an even sex ratio, 40 cats equates to 20 males and 20 females.

3. DELINEATING STUDY AREAS

3.1 Introduction and aims

Broad study areas were predetermined by SNH. However we aimed to select more precise locations for field surveys based on a consistently applied methodology. This reduces the risk of inadvertently introducing fieldworker bias or other bias caused by factors such as accessibility.

The study areas that were selected needed to be of a sufficient extent to be at least theoretically capable of holding a viable population of Wildcats. This required that they contained sufficient high quality habitat to support at least the combined home ranges of the target viable population. The study area should also be made up of sample cells that are of a suitable size such that a Wildcat's home range cannot fall directly between the centres of surrounding cells without overlapping at least one of them (see Section 5).

3.2 Methods

Literature was searched and expert opinion was sought to provide an estimate of the land resource required to support a population containing 40 Wildcats (based on the Minimum Viable Population estimates made in Section 2). Male Wildcats have larger home ranges than females (e.g. Daniels *et al.,* 2001; Biró *et al.,* 2004; Monterroso *et al.,* 2009) and have the potential to undertake larger seasonal movements than females (Mermod & Liberek, 2002). However their home ranges overlap with each other to a greater extent than do female home ranges (Biró *et al.,* 2004) whilst each male's home range may overlap with those of several females (Daniels *et al.,* 2001; Germain *et al.,* 2008). This means that fewer males than females are required within the breeding population and that if the sex ratio is indeed equal, some males may not be successful in breeding. Hence subsequent assessment was based on the area required to support 20 adult female Wildcats (with dependent kittens where appropriate).

In an eastern Scotland study area, Daniels *et al.,* (2001) demonstrated that Wildcats show a preference for using certain habitat types, especially woodland and stream-edge, within their home range, whilst Silva *et al.,* (2013a,b) found Wildcats to prefer areas of habitat diversity that include grassland and woodland patches and tend to use areas of dwarf shrubs less frequently. Based on home range estimates available and the relationship of these with habitat availability, we based delineation of study areas on the assumption that each female Wildcat requires 200 Ha of high quality habitat within a non-overlapping home range. Thus, for an area to have the potential to support a viable population of 20 female Wildcats, it would have to contain 4,000 ha of suitable habitat within a matrix of other habitat types. Wildcats are reported to have larger home ranges in the west of Scotland compared to the east (Scott *et al.,* 1993). If this is due to the lower proportion of high quality Wildcat habitat available in a given area, the approach of defining an area on the basis of suitable habitat within the larger matrix should reflect this.

The selection of optimal habitat used the methodology from the SNH Wildcat Habitat Suitability Model (Bryce & Mattisson, 2012). The SNH model focusses on the Wildcat's requirement for suitable cover habitats and adjacent prey areas within 200 m of cover. The SNH model consists of four main habitat classes, namely:

- Cover
- Prey grass
- Prey moor
- Movement

We refined the model by replacing the “cover” class with more detailed information from the latest National Forest Inventory (NFI2012) (Forestry Commission, 2012). The new classes were:

- Coniferous
- Broad-leaved/mixed woodland
- Shrubs
- Young trees
- Felled/prepared ground

For coniferous plantations, only the 50 m outer edge was considered to be optimal habitat as it would provide cover and shelter adjacent to the original “prey grass” and “prey moor” classes. Further we added a “riparian prey” class which was defined as ground 5 m either side of streams

As the proposed sites were all in upland areas, the Land Cover Scotland 1988 (LCS88) (MLURI, 1993) dataset was used to select grassland and moorland prey areas within 200 m of the cover habitats. Areas classified as woodland in the LCS88 data, which fell within 200 m of the NFI2012 cover habitats were classed as prey habitat. Errors in land cover classification were identified by comparing land cover datasets with the latest aerial imagery available from GetMapping. Errors spotted within the data were corrected prior to selecting the areas to be sampled by fieldworkers. Whilst the LCS88 dataset may be considered dated, the relatively slow rate of change of upland habitats meant the data proved to be a useful resource.

Areas around dwellings have been shown to have reduced Wildcat activity with Klar *et al.* (2008) demonstrating that such an effect is largely apparent within 200 m around single houses and 900 m around settlements. Hence we removed areas of otherwise suitable habitat using these distances as buffers.

The survey areas were built up starting from the areas of recent verified Wildcat records that had been used in the initial selection of candidate priority areas identified in the tender specification. A grid of 40 cells measuring 1.4 km x 1.4 km was used. This corresponds to our home range estimate based on the area being entirely suitable habitat and is within the threshold recommended by Kilshaw *et al.,* (in press). An iterative process was then used with cells being added based on the area of optimal habitat they contain, such that, at each stage, cells surrounding the already selected cells were ranked according to the extent of this area and the cell at the top of the rank was added to the area. Where possible, a cell containing a recent verified sighting, that was centrally located in relation to other verified sightings, was used as the starting point of the selection process. In an attempt to maintain a shape approaching a solid block structure for the proposed area, which is desirable for subsequent analyses of trap data, one additional rule was used; where a cell was selected based on the area of optimal habitat, if this created a neighbouring cell that was adjacent to two selected cells, then the neighbouring cell was also selected.

The process was repeated until a total of at least 4000 ha of “optimal habitat” was reached. If the number of cells required to reach this figure was less than 40 (the number of camera traps available for each site) the process was continued until an area of 40 cells was identified. If the 40 selected cells did not contain 4000 ha of optimal habitat, a larger cell size was employed until the target of 4000 ha was reached. Cell sizes nonetheless were within the limits of published recommendations for such work (e.g. Kilshaw *et al*., in press) such that all cats had a least a possibility of encountering a camera.

Potential physical deterrents to cat movement were considered when selecting cells. In the case of the Dulnain study area, the River Spey was regarded as providing a deterrent to

movement. Although the extent to which it does act as an obstacle is not known, high water levels at least are likely to deter crossings. Finally minor adjustments were made for pragmatic reasons, such as following known boundaries of land ownership. Minor adjustments were also made to incorporate neighbouring areas with other Wildcat reports that were thought to have at least a reasonable chance of being reliable, such as from the 2006-08 survey (Davis & Gray, 2010) and the Cairngorms Wildcat Project (Hetherington & Campbell, 2012). Minor changes were also made where permission to carry out fieldwork on land within particular cells was not granted.

3.3 Results

Maps of the cells that were field surveyed in each region are shown in Confidential Annex 1.

Study areas were comprised mainly of woodland (especially conifer woodland), grassland and moor. A summary of the constituent habitats in the study areas is shown in Table 3.

3.4 Discussion and Conclusions

The method used was suitable for spatially defining study areas for assessment of wildcat populations via camera trapping and other aspects of the field-sampling program. For some cells, especially those with extensive coniferous plantations, it subsequently proved to be difficult to find areas of suitable habitat close to the centre of the cell for establishing a camera trap sampling point (see Section 4). At other cells, fieldworkers reported that there was an extensive dwarf shrub layer which is likely to be avoided by Wildcats (Silva *et al.,* 2013a). Fine tuning cell selection to counter these issues would require the availability of finer-resolution and better defined land-cover data than are currently available. Furthermore, following the grid selection as defined here, reduced the risk of bias from *a priori* assumptions about the best Wildcat habitat within the study area.

Table 3. Percentage composition of habitats contained within the areas identified for survey.

Site	% mixed/ deciduous woodland	% conifer woodland	% felled trees	% grass	% misc.	% moor	% riparian	% shrub	% young trees
Angus Glens	1.9	20.9	8.6	32.8	0.7	31.4	1.0	0	2.7
Blair Atholl	14.6	19.0	4.2	33.0	1.5	21.4	0.9	0.3	5.1
Drumtochty	3.9	32.1	11.6	22.0	2.2	17.5	1.3	0.1	9.3
Dulnain	12.7	24.5	0.9	15.0	0.4	36.1	1.0	0.2	9.2
Morvern	12.6	21.1	11.2	23.2	3.0	21.2	1.2	0.1	6.5
Strathavon	6.5	17.0	6.0	38.0	0.6	27.9	1.2	0.4	2.3
Strathbogie	2.3	26.2	15.3	38.4	0.5	10.9	1.0	0	5.5
Stratherrick	17.1	17.5	7.9	22.9	1.3	28.9	0.9	7.5	3.3
Strathpeffer	11.4	25.9	11.7	18.7	1.9	23.0	1.1	0	6.2

4. FIELD SURVEY

4.1 Introduction and aims

Field surveys were carried out in the nine potential priority wildcat areas with the following aims:

i) To determine the presence of Wildcats in each of the nine survey areas through camera trapping, scat and hair surveys and live trapping
ii) To collect genetic samples through scats, hair and blood for RZSS to analyse
iii) To provide a report for each area detailing the findings.

4.2 Methods

4.2.1 Field sites

The nine field sites chosen by SNH as candidate core conservation areas are listed below along with codes used elsewhere in this section. The broad location of these sites is shown in Figure 1.

Angus Glens (ANG)	Glen Isla, Angus
Blair Atholl (ATH)	Blair Atholl, Perthshire
Drumtochty (DRU)	Aberdeenshire
Dulnain catchment (DUL)	Speyside
Morvern (MOR)	Lochaber
Strathavon (SAV)	Speyside
Strathbogie (SBO)	Gartly/Clashindarroch, Aberdeenshire
Stratherrick (SER)	South Loch Ness, Highland
Strathpeffer (SPE)	Highland

Survey squares (cells) for each site were selected as described in Section 3. Forty such cells were selected for sampling for Wildcats at each field site.

4.2.2 Camera trapping

Forty camera traps were located according to the spatial planning described in Section 3, remaining in each area for at least three weeks between October 2013 and March 2014. Previous studies have recommended the use of paired camera traps in order to obtain photos of both sides of an individual cat for identification purposes (e.g. Kilshaw & Macdonald, 2011; Kilshaw *et al.,* in press), but we used single cameras at each location. This was to maximise the area covered during each three week survey period.

In each 2 km^2 (1.4 km × 1.4 km) survey square, one camera was placed in an area of suitable habitat. Placement concentrated on edge-habitat, animal trails, linear features, such as fences or dry stone dykes, and potential bottle-necks to cat movement, such as gaps in otherwise animal-poof fencing (see Electronic Annex 1 for details of habitat associated with each camera trap station). Camera stations were baited using Hawbacker's Wildcat lure (#s 1 & 2), partridge or quail carcasses and valerian tincture (see 4.2.5). Cameras were checked and re-baited after seven to 14 days.

4.2.3 Identification of cats

Photos of captured cats were identified to individuals based on pelage markings along with other distinguishing features. Cameras record dates and times of visits. Any captures of the same cat at the same camera within two hours was classed as a single capture event.

All cat photos were sent to Andrew Kitchener and Charlotte Wagner (National Museums Scotland) for pelage scoring and were double checked by Kerry Kilshaw and Ruairidh Campbell. Photographs of cats were scored for pelage characters (Kitchener *et al.,* 2005) as far as was discernible from the images. A total of 20 pelage characteristics were scored (Table 4; Figure 9). Kitchener *et al.,* (2005) developed a pelage scoring system that defined the Wildcat based on seven different pelage markings which are used to give individuals a seven pelage score (7PS). Kitchener *et al.,* (2005) suggested that any cat with a score of 19 or more for the 7PS and with no scores of 1 should be regarded as a Wildcat unless other data conflict with this. However, this definition could exclude many cats that may have a high proportion of Wildcat genes that may usefully contribute to the restoration of Wildcat populations (Kitchener *et al.,* 2005). Therefore, a more relaxed definition was also proposed whereby any cat that has a minimum 7PS of 14 and does not have a score of one for any of the seven pelage characteristics or for an additional eight pelage characters (white on chin, stripes on cheek, dark spots on underside, white on flank, white on back, colour of tail tip, stripes on hind leg and colour of the back of the ear) could be considered a Wildcat (Kitchener *et al.,* 2005). These additional eight pelage characters are classified as 8PC hereafter. The remaining five characteristics were also examined to be certain of the pelage classification.

All characteristics were given a score of 1 = domestic; 2 = intermediate (hybrid); 3 = Wildcat. Where the character could not be determined from the photograph, it was scored as unknown (U/K). Based on the pelage scores each cat was classified as "Wildcat", "hybrid" or "domestic" using following Kitchener *et al.,'*, (2005) definition; a strict definition (Strict ID), and a more relaxed definition (Relaxed ID), described above, as follows:

Strict ID

1. **Wildcat** = 7PS score of 19 or more, no scores of 1 for any of the 7PS characters and no scores of 1 for any of the 8PC characteristics.
2. **Hybrid** = scores 3 for one or more of the 7PS characters, but may also score 1 for one or more of these characters and may score 1 for one or more of the 8PC.
3. **Domestic** = no scores of 3 for any of the 7PS characteristics (unless it is an obvious domestic e.g. ginger, white, black, tortoiseshell or marbled tabby) and scores of 1 or 2 in most of the other characteristics.

Relaxed ID

Wildcat = 7PS score of 14 or more with no scores of 1 for any of the 7PS characters and no scores of 1 for any of the 8PC.

The scoring system used here means that under the Strict ID, no individuals identified as Wildcats will display any domestic cat traits and no domestic cats will display any Wildcat traits. Under the Relaxed ID, Wildcats will still have no domestic cat characteristics but may have some hybrid traits.

Table 4. Key to the 20 pelage characteristics scored including the 7PS and 8PC (adapted from Kitchener et al., 2005).

Trait			Domestic	Hybrid	Wildcat
Characteristic			1	2	3
7PS	1	**Dorsal line**	Absent/covers entire tail	Continues onto tail	Stop at base of tail
	2	**Tail tip shape**	Tapered to a point	Intermediate	Blunt
	3	**Distinctiveness of tail bands**	Absent/joined by dorsal line	Indistinct or fused	Distinct
	4	**Broken stripes on flank**	>50% broken/no marking	25-50% broken	<25% broken
	5	**Spots on flank & hindquarters**	Many/no marking	some	none
	6	**Stripes nape**	Thin/no stripes	Intermediate	4 thick stripes
	7	**Stripes shoulder**	Indistinct/no stripes	Intermediate	2 thick stripes
8PC	8	**White chin**	White extensive on muzzle	White on chin	Buff or off white on chin
	9	**Stripes cheek**	No dark stripes	Indistinct stripes	3 clear stripes (2 fused)
	10	**Spots underside**	Absent	Indistinct	Distinct
	11	**White flank**	Present	-	Absent
	12	**White back**	Present	-	Absent
	13	**Colour tail tip**	Neither black nor dark	Dark	Black
	14	**Stripes hind**	<4 or >7 stripes	-	4-7 stripes
	15	**Ear colour**	Same colour as head	Weak ochre/reddish	Ochre/reddish
Additional pelage characteristics	16	**White on paw**	White extensive on paw	White tuft on paw	No white on paw
	17	**Alignment of tail bands**	Absent/not aligned	Disjointed	Aligned
	18	**Bands encircling foreleg**	<2 or >3 bands	-	2-3 bands
	19	**Tabby patterns**	Absent/not predominant	-	Predominant pattern
	20	**Stripes on body**	<7 or >11 unbroken stripes	-	7-11 unbroken stripes

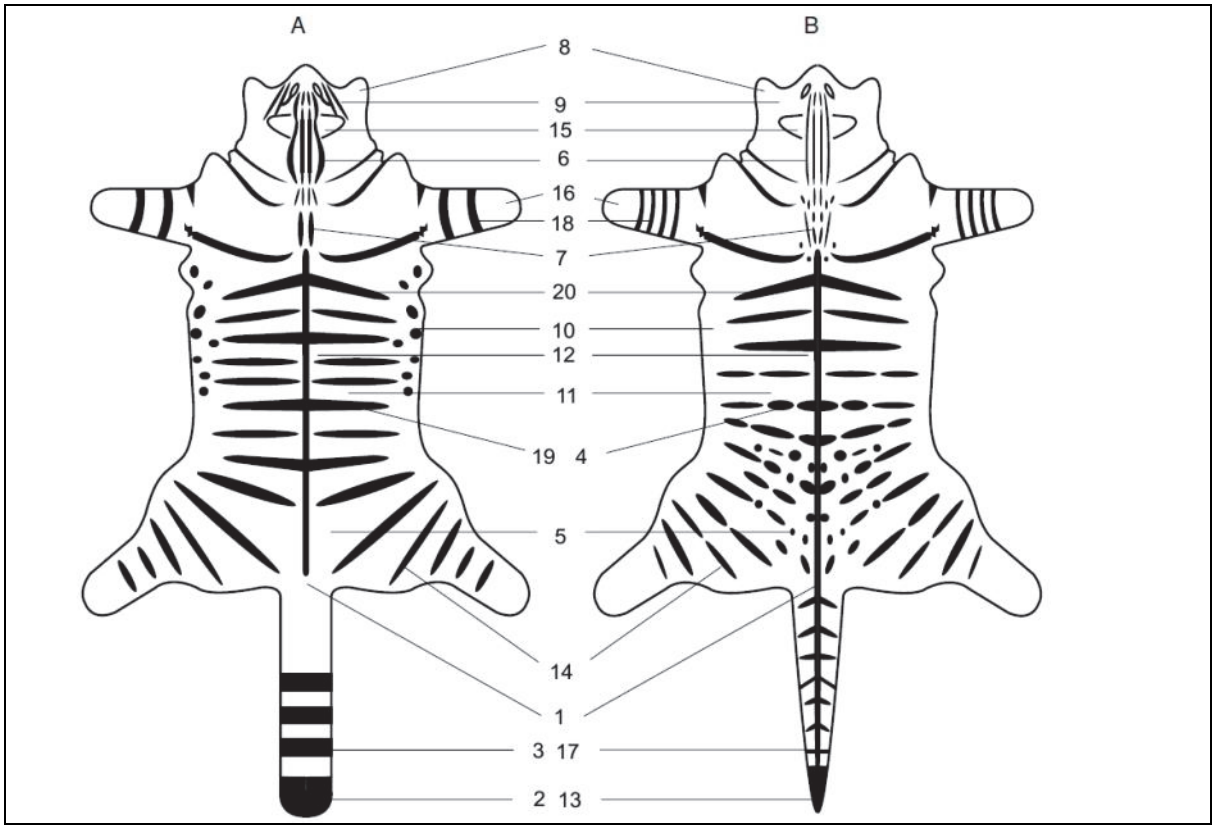


Figure 9. Pelage characteristics 1-20 scored. A = Wildcat, B = domestic cat (adapted from Kitchener et al., 2005). 7PS = 1-7, 8PC = 8-15.

4.2.4 Scat Collection and Analysis

Scats were searched for on an *ad hoc* basis during camera trap set up. Felid scats were primarily identified using morphological characteristics including, size, shape, colour, smell, and composition to distinguish Wildcat scats from Badger (*Meles meles*), Fox (*Vulpes vulpes*), Pine Marten (*Martes martes)*, Domestic Dog (*Canis familiaris)* and Domestic Cat. Particular identifiable characteristics of felid scats include segmented structure, along with positioning and placement, with cats often defecating at the base of grass tussocks and sides of paths. Scats difficult to identify as a result of weathering or age were also collected for DNA identification in order to maximise sample size. Collected scats were stored in 100 ml silica added tubes for preservation, individually labelled with date and location and sent to WildGENES laboratory, RZSS, Edinburgh Zoo for analysis (see Section 6).

4.2.5 Hair Analysis

At each camera location, a hair lure was positioned in view of the camera. This consisted of a roughened wooden post with Velcro attached. Holes were drilled into the post, into which pieces of sponge soaked in valerian tincture (A. Vogel) and set in cut sections of plastic tubing were inserted. Hair samples were collected, stored in paper envelopes and delivered to WildGENES laboratory along with scat samples.

4.2.6 Live trapping

Camera traps were deployed as described above. One cage trap (Trapman, Tomahawk, or standard Tomahawk style medium-mammal trap) was deployed at any camera stations showing evidence of Wildcats or hybrids at the two week camera check or after the camera trap survey had been completed. Cage traps at locations where cats were captured on

camera were pre-baited using partridge/pheasant bait and valerian tincture for >1 week. Hawbacker's Wildcat lure was not used during live-trapping as whilst well-established as a cat-attractant, anecdotally it is thought that it may reduce the probability of a cat actually entering a trap. Once cameras had been collected the cage traps were set. Additional live-traps were added around known cat locations. During the latter phase of live-trapping in March (Dulnain, Strathavon and Strathbogie), bird call emitters were used as additional lures in some traps as warm weather may have reduced the inclination of cats to take dead bait.

Traps were checked every eight hours by the project manager (RC) and assistants under SNH animal licence number 21463.

Once trapped, cats were anaesthetised using a combination of Ketamine/Medetomnidine by a trained member of staff (RC) under HO personal licence (PIL) number 70/25690. While immobilized, the animal's temperature, pulse and respiration was monitored and eye function checked to ensure the animal had had the correct amount of anaesthetic. Animals were processed in the back of the field vehicle to avoid chill from wind and precipitation. A heat-pad was used to help maintain the animals' core temperature.

Individuals were photographed and blood samples were taken. Blood samples were taken from a superficial vessel by venepuncture or venesection. Not more than 10% of circulating blood volume was taken e.g. <3 ml (and, in most cases, much less than this). Some individuals were fitted with a PIT tag prior to release where this would aid future identification. All samples were sent to the WildGENES lab at RZSS, Edinburgh for DNA analysis. Photographs of individuals that had not been caught on camera trap were also sent to Andrew Kitchener, National Museums Scotland, for pelage assessment.

Cats were then injected with Atipamezole to reverse the anaesthesia and after a period of recovery (usually 10-20 minutes), during which individuals were monitored for any potential problems, they were released at the site of capture (again under licence to SNH).

4.3 Results

4.3.1 Result Summaries

A summary of the results from all sites is shown below. Each site is discussed in more detail in the following sections.

4.3.1.1 Camera trap survey summary

A total of 45 different cats were photographed across all sites, of these 6 were classified as Wildcat by their pelage under the Strict ID and 22 as Wildcat under the Relaxed ID. A summary of the findings is shown in Table 5.

Table 5. The total number of cats camera-trapped at each site (MNA = Minimum Number Alive), showing the number of Wildcats, hybrids and domestic cats (as defined under the Strict ID and Relaxed ID pelage criteria) and the number of different trap stations cats were photographed at.

Site	No. Ind. Cats (MNA)	Trap Stations	Strict ID			Relaxed ID	
			Wildcat	Hybrid	Domestic	Wildcat	Hybrid
Angus Glens	14	12	1	8	5	8	1
Blair Atholl	1	2	-	1	-	-	1
Dulnain	2	2	1	-	1	1	-
Drumtochty	1	1	-	-	1	-	-
Morvern	7	7	1	3	3	4	-
Strathavon	4	2	-	3	1	1	2
Strathbogie	10	10	1	6	2	4	3
Stratherrick	1	1	-	1	1	-	1
Strathpeffer	5	5	2	2	1	4	-
TOTAL	**45**	**42**	**6**	**24**	**15**	**22**	**8**

4.3.1.2 Scat and hair survey results summary

In addition to the sites surveyed (Table 6), three scats were collected from outside of the survey areas, one near the Dulnain area, one near the Strathbogie area and one at Glen Affric.

Table 6. No. of scats and hair samples collected across the nine sites surveyed.

Site	No. Scats Collected	Hair Samples Collected
Angus Glens	21	6
Blair Atholl	4	
Dulnain	4	
Drumtochty	1	
Morvern	5	
Strathavon		5
Strathbogie	2	1
Stratherrick	5	
Strathpeffer		
Additional from outside survey areas	3	
TOTAL	46	12

4.3.1.3 Live trapping results summary

Cage traps were deployed at six sites based on the camera trap data. A total of 10 individuals were captured over 312 trap nights, three of which were captured outside, but close to, the Strathbogie survey area (Table 7).

Table 7. No. of cats live-trapped at the nine sites surveyed.

Site	Total no. cats	Male	Female	Recaptures	Total no. trap nights	Cats trapped per 100 trap nights
Angus Glens	1	-	1	-	80	1.25
Blair Atholl	-	-	-	-	-	-
Dulnain	0	-	-	-	20	0
Drumtochty	-	-	-	-	-	-
Morvern	2	-	2	-	63	3.17
Strathavon	0	-	-	-	12	0
Strathbogie	7*	4	3	2	129	6.98
Stratherrick	-	-	-	-	-	-
Strathpeffer	0	-	-	-	8	0
TOTAL	10	4	6	2	312	3.85

*3 individuals trapped outside the survey grid

4.3.2 Site results

4.3.2.1 ANGUS GLENS Results

The Angus Glens were surveyed between November 2013 and March 2014. The results from the survey are detailed below.

4.3.2.1.1 Camera trap survey – ANG

A total of 36 cells was sampled by camera traps across the Angus Glens survey area. Access was refused to land covering six cells in the southern half of the area. Two cells were moved while we were unable to find contiguous habitat to place the remaining four cells. Cameras were active between 30 November 2013 and 17 March 2014. Over this period, seven cameras suffered from battery failure and deployment was extended for these cameras to ensure that at least a minimum standard trapping effort was achieved across all sites. A further five cameras took no photos despite bait being taken. Overall camera traps were active for a total of 806 trap nights.

4.3.2.1.2 Pelage assessment and capture data - ANG

Fourteen cats were captured on camera. Eleven of these (seven, one and three classified respectively under the relaxed definition as Wildcat, hybrid and domestic) were captured at 17 intervals during the three week survey for each camera giving a capture rate of 1.36 individuals and 2.11 captures/100TN (Annex 1). Of all the cats captured on camera, one individual was classified as a Wildcat under the Strict ID and eight as Wildcat under the relaxed pelage definition (Figure 10; Table 8). Notably, cats ANG-B, E, H and N had been detected during a previous survey in 2013 (Kerry Kilshaw, unpublished data). Cats ANG-F, J and M were only detected after the three week survey period.

4.3.2.1.3 Scat and hair survey - ANG

A total of 21 scats was collected from the Angus Glens from ten of the survey squares. Six hair samples were collected from a further four survey squares.

4.3.2.1.4 Live trapping – ANG

Live trapping was carried out at Angus Glens between 27 February 2014 and 12 March 2014 with a total trapping effort of 80 trap days. Cage traps were located at 19 different locations across 10 of the survey squares.

During this period, only one individual female cat was captured on 10 March 2014 at 9am. She was identified as ANG-J, a domestic cat based on pelage and she was subsequently neutered (Figure 11). From discussion with local residents, it is possible that this cat was the offspring of a female tabby (possible Wildcat) and a large black male cat seen in the area.

Figure 10. Each of the 14 individual cats camera-trapped at Angus Glens (ANG).

Table 8. Pelage scores for the individuals captured at Angus Glens (ANG). The table shows total 7PS score and classification of each cat under both the Strict and Relaxed definition; DOM = domestic/feral, HYB = hybrid, WILD = Wildcat, UK = unknown.

	7PS						8PC								Other pelage characteristics									
Cat ID	Dorsal line	Tail tip shape	Tail bands	Broken stripes flank	Spots flank & HQ	Stripes nape	Stripes shoulder	White chin	Stripes cheek	Spots underside	White flank	White back	Colour tail tip	Stripes hind	Ear colour	White Paw	Band alignment	Bands foreleg	Tabby patterns	Stripes body	7PS	TPS	Strict ID	Relaxed ID
ANG-A*	1	2	2	1	3	1	UK	2	2	UK	3	3	3	1	2	3	2	1	1	1	10	34	DOM	DOM
ANG-B	3	3	3	2	2	2	2	2	3	UK	3	3	3	3	3	3	2	3	3	1	17	49	HYB	WILD
ANG-C	3	2	3	2	2	3	2	2	3	2	3	3	3	3	2	3	UK	3	3	1	17	48	HYB	WILD
ANG-D	3	2	3	2	2	3	2	2	3	UK	3	3	3	3	2	3	3	1	3	1	17	47	HYB	WILD
ANG-E*	3	2	3	2	2	3	UK	3	3	UK	3	3	3	3	3	3	3	UK	3	UK	15	45	HYB	WILD
ANG-F*	2	3	3	3	3	3	UK	2	3	UK	3	3	3	3	2	3	3	1	3	3	17	49	WILD	WILD
ANG-G*	UK	3	3	2	2	3	2	3	3	UK	3	3	3	3	3	3	3	1	3	1	15	47	HYB	WILD
ANG-H	1	2	2	1	1	2	2	UK	UK	UK	3	3	3	1	2	2	2	1	1	1	11	30	DOM	DOM
ANG-I*	UK	2	3	2	2	3	2	3	UK	UK	3	3	3	UK	2	3	3	UK	3	1	14	38	HYB	WILD
ANG-J	1	1	1	1	1	1	1	NA	1	UK	3	3	3	1	1	3	1	1	1	1	7	26	DOM	DOM
ANG-K*	UK	3	3	2	2	3	UK	3	3	UK	3	3	3	1	2	3	2	1	3	1	13	41	HYB	WILD
ANG-L	1	1	1	1	3	1	1	3	3	UK	3	3	3	1	3	3	1	1	1	1	9	35	DOM	DOM
ANG-M*	UK	1	2	1	3	1	UK	3	3	UK	3	3	3	1	2	3	2	1	1	1	8	34	DOM	DOM
ANG-N	1	2	1	1	2	2	2	3	3	UK	3	3	3	3	2	3	1	1	3	1	11	40	HYB	HYB

*Not all 7PS or 8PC characters visible, therefore ID represents probable assessment based on all characteristics

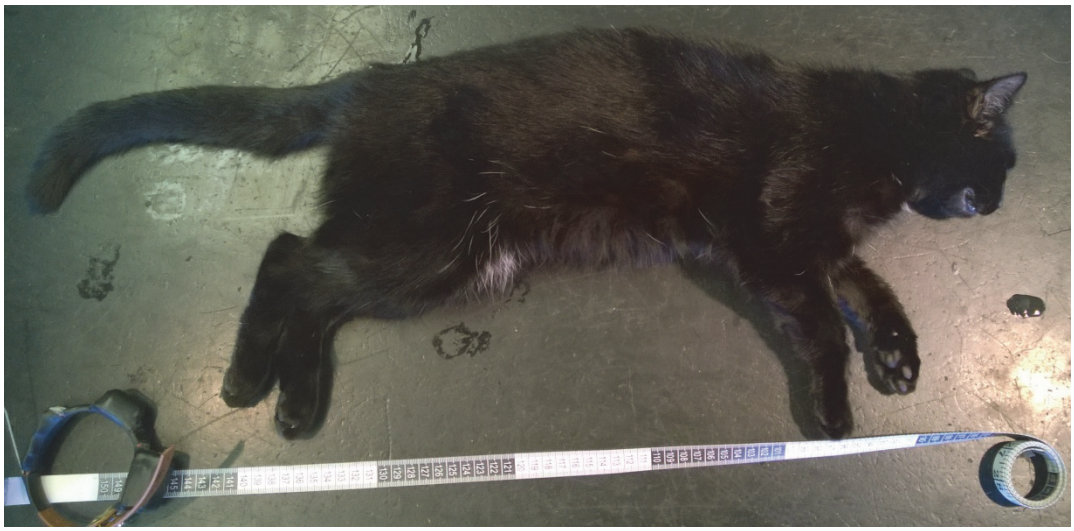


Figure 11. Anesthetised ANG-J - live trapped and photographed under anaesthesia.

4.3.2.2 BLAIR ATHOLL Results

Blair Atholl was surveyed between November and December 2013. The results from the survey are detailed below.

4.3.2.2.1 Camera trap survey - ATH

A total of 40 camera traps was placed across the Blair Atholl survey area. Cameras were active between 5 November 2013 and 9 December 2014. Overall, camera traps were active for a total of 840 trap nights.

4.3.2.2.2 Pelage assessment and capture data - ATH

Only one cat was captured on camera, but was recaptured at a different station giving a capture rate of 0.12 individuals and 0.24 captures/100 trap nights (TN) (Annex 1). This individual was classified as a hybrid under both the Strict ID and Relaxed pelage definition (Figure 12; Table 9).

Figure 12. The individual cat camera-trapped at Blair Atholl (ATH).

4.3.2.2.3 Scat and hair surveys – ATH

Four scats were collected at Blair Atholl across 4 survey squares (though all were later found not to be of cat origin). No hairs were collected on any of the hair lure posts.

4.3.2.2.4 Live trapping – ATH

Due to the low number of photographic captures, live trapping was not carried out at Blair Atholl.

Table 9. Pelage scores for the individual captured at Blair Atholl (ATH). The table shows total 7PS score and classification under both the Strict and Relaxed definition; HYB = hybrid, UK = unknown.

Cat ID	7PS			8PC							Other pelage characteristics													
	Dorsal line	Tail tip shape	Tail bands	Broken stripes flank	Spots flank & HQ	Stripes nape	Stripes shoulder	White chin	Stripes cheek	Spots underside	White flank	White back	Colour tail tip	Stripes hind	Ear colour	White Paw	Band alignment	Bands foreleg	Tabby patterns	Stripes body	7PS	TPS	Strict ID	Relaxed ID
ATH-A	3	3	3	1	2	2	2	2	3	UK	3	3	3	3	3	3	3	1	3	1	16	47	HYB	HYB

4.3.2.3 DRUMTOCHTY Results

Drumtochty was surveyed in February and March 2014. The results from the survey are detailed below.

4.3.2.3.1 Camera trap survey - DRUM

A total of 40 camera traps was placed across the Drumtochty survey area. Cameras were active between 7 February 2014 and 16 March 2014. Overall camera traps were active for a total of 840 trap nights.

4.3.2.3.2 Pelage assessment and capture data - DRUM

Only one possible cat (black cat) was captured on camera on one occasion (Annex 1) giving a capture rate of 0.12 individuals/100TN. This individual was classified as a domestic (Figure 13; Table 109).

Figure 13. The individual cat camera-trapped at Drumtochty (DRUM).

4.3.2.3.3 Scat and hair surveys – DRUM

One scat was collected at Drumtochty. No hair samples were collected.

4.3.2.3.4 Live trapping – DRUM

Due to the low number of photographic captures, live trapping was not carried out at Drumtochty.

Table 10. Pelage scores for the individual captured at Drumtochty (DRUM). The table shows total 7PS score and classification of each cat under both the Strict and Relaxed definition; DOM = domestic/feral, HYB = hybrid, WILD = Wildcat, UK = unknown.

Cat ID	7PS			8PC											Other pelage characteristics						7PS	TPS	Strict ID	Relaxed ID
	Dorsal line	Tail tip shape	Tail bands	Broken stripes flank	Spots flank & HQ	Stripes nape	Stripes shoulder	White chin	Stripes cheek	Spots underside	White flank	White back	Colour tail tip	Stripes hind	Ear colour	White Paw	Band alignment	Bands foreleg	Tabby patterns	Stripes body				
DRUM-A*	UK	UK	UK	1	1	UK	UK	UK	UK	UK	UK	3	UK	UK	UK	UK	UK	UK	1	1	2	7	DOM	DOM

*Not all 7PS or 8PC characters visible, therefore ID represents probable assessment based on all characteristics

4.3.2.4 DULNAIN Results

Dulnain was surveyed between November 2013 and March 2014. The results from the survey are detailed below.

4.3.2.4.1 Camera trap survey - DUL

A total of 40 camera traps was placed across the Dulnain survey area. Cameras were active between 6 November 2013 and 11 December 2013. Overall camera traps were active for a total of 826 trap nights.

4.3.2.4.2 Pelage assessment and capture data - DUL

Two individuals were captured on camera at two different stations on three occasions with an overall capture rate of 0.24 individuals and 0.36 captures/100TN (Annex 1). One was classified as a Wildcat under both strict and relaxed ID criteria and the other as a domestic cat based on pelage (Figure 14; Table 11).

Figure 14. The two individual cats camera-trapped at Dulnain (DUL).

4.3.2.4.3 Scat and hair surveys – DUL

Four scats were collected at Dulnain, in four different survey squares, though genetic testing revealed that none was from a cat. No hair samples were collected.

4.3.2.4.4 Live trapping - DUL

Cage traps were set up at four different locations across three of the survey squares. Live trapping was carried out between 18 and 22 March 2014 with a total trapping effort of 20 days. No cats were live trapped during this period.

Table 11. Pelage scores for the individual captured at Dulnain (DUL). The table shows total 7PS score and classification of each cat under both the Strict and Relaxed definition; DOM = domestic/feral, HYB = hybrid, WILD = Wildcat, UK = unknown.

	7PS						8PC						Other pelage characteristics											
Cat ID	Dorsal line	Tail tip shape	Tail bands	Broken stripes flank	Spots flank & HQ	Stripes nape	Stripes shoulder	White chin	Stripes cheek	Spots underside	White flank	White back	Colour tail tip	Stripes hind	Ear colour	White Paw	Band alignment	Bands foreleg	Tabby patterns	Stripes body	7PS	TPS	Strict ID	Relaxed ID
DUL-A*	2	3	3	3	2	3	UK	3	3	UK	3	3	3	3	3	3	3	1	3	3	16	49	WILD	WILD
DUL-B	1	1	1	1	1	1	1	1	1	UK	1	3	3	1	1	3	1	1	1	1	7	25	DOM	DOM

*Not all 7PS or 8PC characters visible, therefore ID represents probable assessment based on all characteristics

4.3.2.5 MORVERN Results

Morvern was surveyed during January and February 2014. The results from the survey are detailed below.

4.3.2.5.1 Camera trap survey - MOR

A total of 40 camera traps was placed across the Morvern survey area. Camera traps were active between 6 January 2014 and 3 February 2014. Overall, camera traps were active for a total 840 trap nights.

4.3.2.5.2 Pelage assessment and capture data - MOR

Seven individuals were captured on camera with six detected within the three week survey. These six included 11 recaptures giving a total capture rate of 0.71 individuals and 2.02 captures/100TN (Annex 1), one of which was classified as a Wildcat under the Strict ID and four as Wildcats under the Relaxed ID (Figure 15; Table 12).

4.3.2.5.3 Scat and hair surveys – MOR

A total of five scats were collected at Morvern, in five different survey squares. No hair samples were collected.

4.3.2.5.4 Live trapping – MOR

Cage traps were set at 12 different locations across eight of the survey squares. Cage traps were set at a further six locations that looked suitable for live-trapping, that were close to, but just outside of, the survey squares. Live trapping was carried out between 10 February and 19 February 2014 for a total of 63 trap days. During this period two individuals were trapped within the survey area, identified as MOR-B, a hybrid under the Strict ID and MOR-D, a domestic cat (Figure 16).

Figure 15. Each of the 7 individual cats camera-trapped at Morvern (MOV).

Table 12. Pelage scores for the individuals captured at MORVERN (MOR). The table shows total 7PS score and classification of each cat under both the Strict and Relaxed definition; DOM = domestic/feral, HYB = hybrid, WILD = Wildcat.

	7PS						8PC								Other pelage characteristics									
Cat ID	Dorsal line	Tail tip shape	Tail bands	Broken stripes flank	Spots flank & HQ	Stripes nape	Stripes shoulder	White chin	Stripes cheek	Spots underside	White flank	White back	Colour tail tip	Stripes hind	Ear colour	White Paw	Band alignment	Bands foreleg	Tabby patterns	Stripes body	7PS	TPS	Strict ID	Relaxed ID
MOR-A	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	20	59	WILD	WILD
MOR-B	2	2	3	2	2	2	2	2	3	3	3	3	3	3	2	3	3	3	3	3	15	52	HYB	WILD
MOR-C	3	2	3	2	2	3	2	3	3	3	3	3	3	3	2	3	3	3	3	1	17	53	HYB	WILD
MOR-D	2	2	2	1	1	2	1	2	3	3	3	3	3	1	3	3	2	3	1	1	11	42	DOM	DOM
MOR-E	3	2	3	2	2	3	2	2	3	3	3	3	3	3	2	3	3	3	3	1	17	52	HYB	WILD
MOR-F*	2	1	2	2	2	2	UK	2	3	UK	3	3	2	1	2	3	1	3	1	1	11	36	DOM	DOM
MOR-G	2	2	3	2	2	2	1	1	2	1	1	1	1	1	1	1	2	1	1	1	14	28	DOM	DOM

*Not all 7PS or 8PC characters visible, therefore ID represents probable assessment based on all characteristics

MOR-B

MOR-D

Figure 16. Two cats live-trapped at Morvern - photographed under anaesthesia.

4.3.2.6 STRATHAVON Results

Strathavon was surveyed between December 2013 and March 2014. The results from the survey are detailed below.

4.3.2.6.1 Camera trap survey - SAV

A total of 40 camera traps was placed across the Strathavon survey area. Cameras were active between 16 December 2013 and 22 February 2014. Overall camera traps were active for a total of 822 trap nights.

4.3.2.6.2 Pelage assessment and capture data - SAV

Four individuals were captured on camera with six recaptures, all within the three week survey period, giving a total capture rate of 0.49 individuals and 1.22 captures/100TN (Annex 1). One individual was classified as a Wildcat under the Relaxed ID (Figure 17; Table 13).

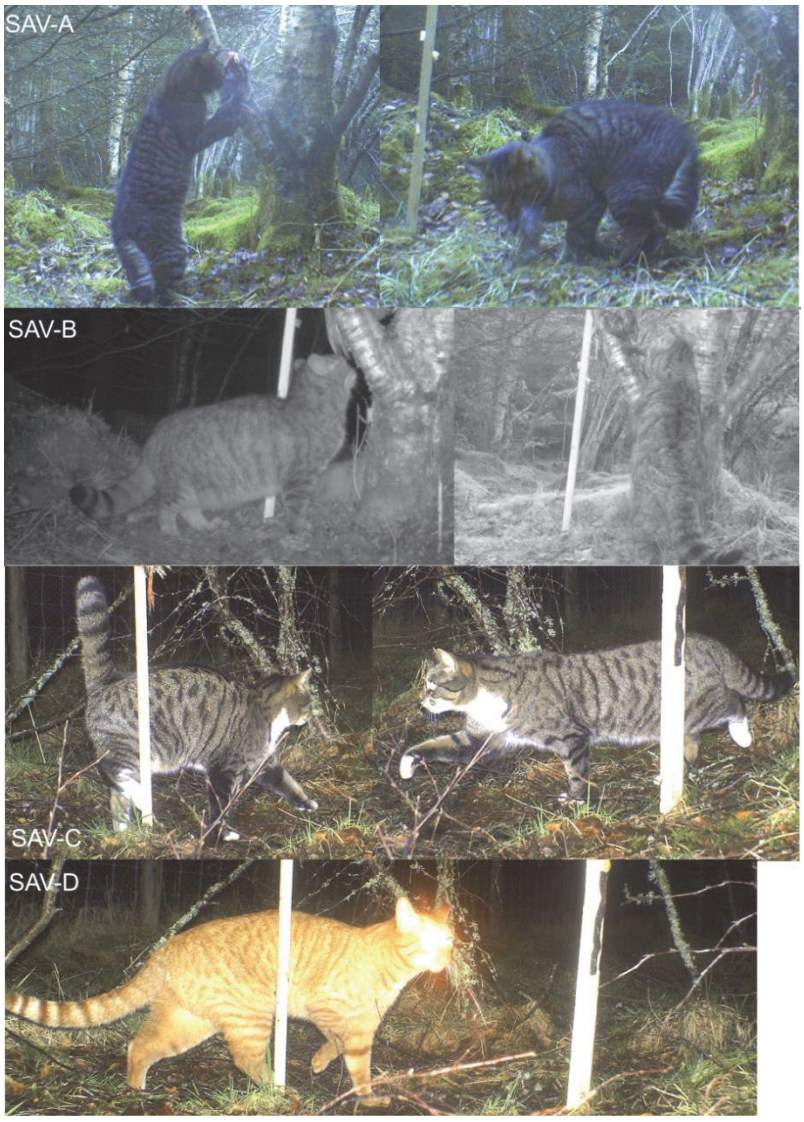


Figure 17. Each of the four individual cats camera-trapped at Strathavon (SAV).

Table 13. Pelage scores for the individuals captured at Strathavon (SAV). The table shows total 7PS score and classification of each cat under both the Strict and Relaxed definition; DOM = domestic/feral, HYB = hybrid, WILD = Wildcat, UK = unknown

Cat ID	7PS			8PC											Other pelage characteristics										
	Dorsal line	Tail tip shape	Tail bands	Broken stripes flank	Spots flank & HQ	Stripes nape	Stripes shoulder	White chin	Stripes cheek	Spots underside	White flank	White back	Colour tail tip	Stripes hind	Ear colour	White Paw	Band alignment	Bands foreleg	Tabby patterns	Stripes body	7PS	TPS	Strict ID	Relaxed ID
SAV-A	1	2	1	3	2	2	2	3	3	3	3	3	3	3	2	3	2	3	3	3	13	50	HYB	HYB
SAV-B	3	2	3	2	2	3	2	2	3	UK	3	3	3	1	2	3	3	3	3	1	17	47	HYB	WILD
SAV-C*	1	2	2	1	1	2	UK	1	3	UK	3	3	3	3	2	3	3	3	3	1	9	40	HYB	HYB
SAV-D*	1	1	2	2	2	UK	UK	2	3	UK	3	3	1	3	1	3	2	1	1	1	8	32	DOM	DOM

*Not all 7PS or 8PC characters visible, therefore ID represents probable assessment based on all characteristics

4.3.2.6.3 Scat and hair surveys – SAV

No scats were collected at Strathavon. A total of five hair samples were collected from four camera stations, but only one was identified as a cat sample by genetic analysis (Table 14).

Table 14. Location and dates of hair samples collected, cat ID's also shown.

Trap ID	Date	Cat ID
SAV19	20/01/2014	More likely SAV-B than SAV-A

4.3.2.6.4 Live trapping – SAV

Cage traps were set at four different locations across three of the survey squares. Live trapping was carried out between 18 and 22 March 2014 for a total of 12 trap days. During this period no cats were trapped.

4.3.2.7 STRATHBOGIE Results

Strathbogie was surveyed between November 2013 and March 2014. The results from the survey are detailed below.

4.3.2.7.1 Camera trap survey - SBO

A total of 40 camera traps was placed across the Strathbogie survey area, adjacent to a site previously surveyed by WildCRU (Kerry Kilshaw, unpublished data) which indicated wildcats were present in the area. A joint WildCRU/RZSS project is currently resurveying this adjacent location and additional results from this survey collected by R. Campbell are presented in Tables 15 and 19. These data are provided to take full advantage of the information available from the wider survey area in order to assess this site as a potential priority area for conservation. Cameras were active between 5 November and 6 December 2013. Overall camera traps were active for a total of 840 trap nights.

4.3.2.7.2 Pelage assessment and capture data - SBO

Ten individuals were captured on camera, with 46 recaptures over the three week survey period, giving a total capture rate of 1.19 individuals and 6.67 captures/100TN (Annex 1). One individual was classified as Wildcat under the Strict ID and a further three Wildcats were identified under the Relaxed ID (Figure 18; Table 16).

4.3.2.7.3 Scat and hair surveys – SBO

One scat and one hair sample was collected from the survey area, a further scat was collected from just outside the survey area. At hair trap location SBO004, two cats were seen on camera, SBO-G and SBO-J, either or both of which could have left hair (Table 16).

4.3.2.7.4 Live trapping – SBO

Cage traps were set at 14 different locations across 10 of the survey squares. Cage traps were also set at a further 9 locations outside of the survey squares based on camera trap data from additional work being carried out as part of the joint WildCRU/RZSS project (see above). Live trapping was carried out between 11 December 2013 and 22 March 2014 for a total of 129 trap days. During this period four individuals were trapped within the survey area; SBO-B, SBO-C and two cats that had not previously been caught on camera trap G-CD and G-CE. SBO-B and was recaptured once. A further three individuals that had not been previously caught on camera were caught outside the survey area (Table 17; Figure 19) of which one (G-CA) was recaptured once. Pelage classification of the individuals not previously caught on camera is detailed in Table 18.

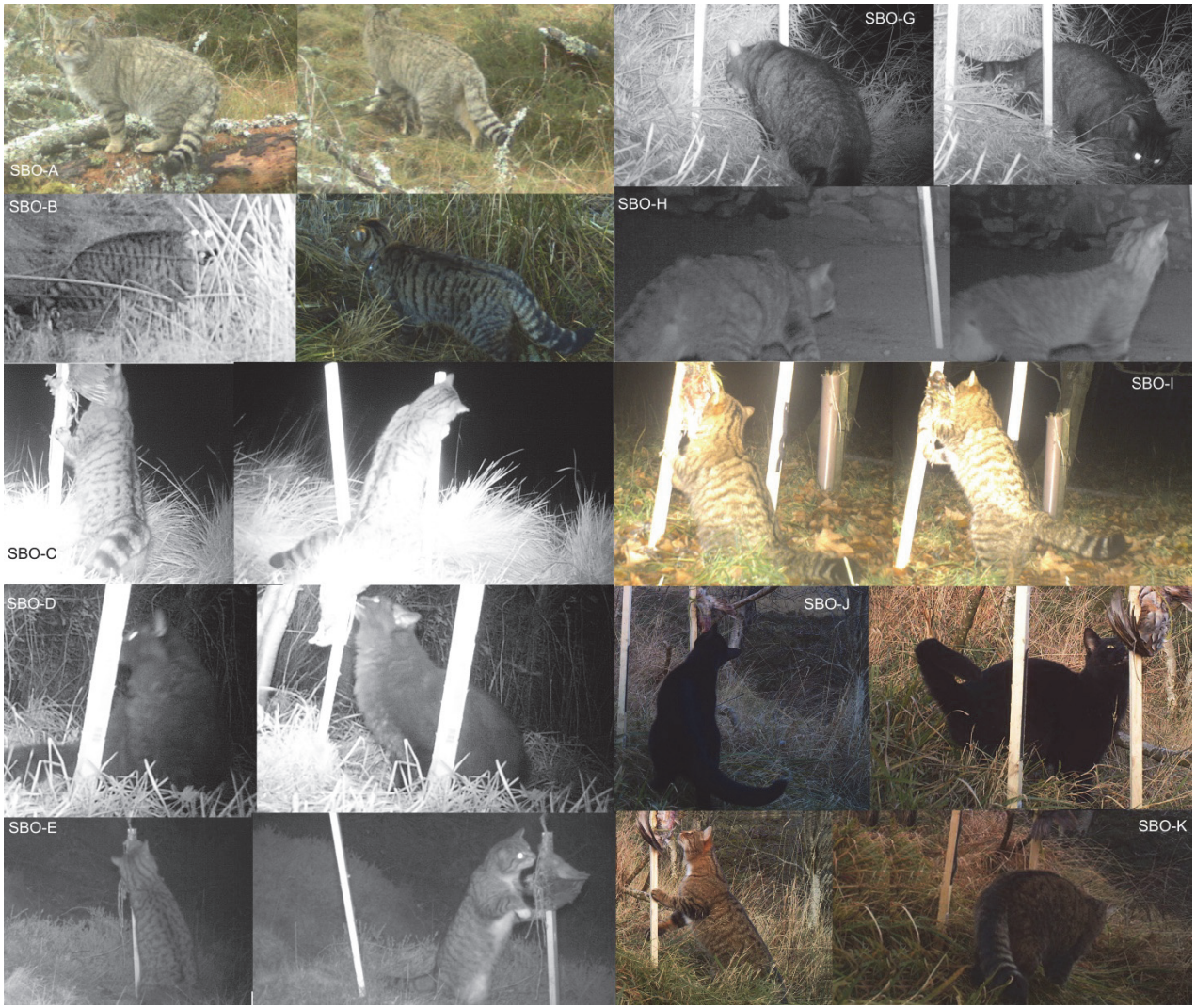


Figure 18. Each of the 9 individuals camera-trapped at Strathbogie (SBO).

Table 15. Pelage scores for the individuals captured at Strathbogie (SBO). The table shows total 7PS score and classification of each cat under both the Strict and Relaxed definition; DOM = domestic/feral, HYB = hybrid, WILD = Wildcat, UK = unknown, NA = Not applicable.

Cat ID	7PS							8PC							Other pelage characteristics										
	Dorsal line	Tail tip shape	Tail bands	Broken stripes flank	Spots flank & HQ	Stripes nape	Stripes shoulder	White chin	Stripes cheek	Spots underside	White flank	White back	Colour tail tip	Stripes hind	Ear colour	White Paw	Band alignment	Bands foreleg	Tabby patterns	Stripes body	7PS	TPS	Strict ID	Relaxed ID
SBO-A	3	3	3	3	3	3	2	2	3	UK	3	3	3	3	2	3	3	3	3	3	20	54	WILD	WILD
SBO-B	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	2	3	3	1	14	50	HYB	WILD
SBO-C	3	2	3	2	1	2	2	3	3	3	3	3	3	3	2	3	3	3	3	1	15	51	HYB	HYB
SBO-D	1	3	1	1	1	1	1	1	1	1	1	3	3	1	1	3	1	1	1	1	9	16	DOM	DOM
SBO-E	3	2	3	1	2	2	2	1	3	3	3	3	3	3	3	3	3	1	3	1	15	48	HYB	HYB
SBO-G	2	2	1	2	2	2	2	2	3	UK	3	3	3	UK	2	3	3	1	3	1	13	40	DOM	DOM
SBO-H*	3	UK	UK	3	2	3	UK	UK	3	UK	3	3	UK	3	2	UK	UK	1	3	3	11	30	HYB	WILD
SBO-I	3	2	3	2	2	3	2	2	3	UK	3	3	3	3	3	3	3	1	3	1	17	48	HYB	WILD
SBO-J	1	1	1	1	1	1	1	NA	1	1	3	3	3	1	1	3	1	1	1	1	7	27	DOM	DOM
SBO-K	2	2	2	2	2	3	2	2	3	UK	3	3	3	UK	3	3	2	1	3	1	15	18	HYB	HYB

*Not all 7PS or 8PC characters visible, therefore ID represents probable assessment based on all characteristics

Table 16. Locations of scat and hair samples collected. Also showing putative cat ID.

Sample	Trap ID	Date	Cat ID
Hair	SBO04	22/11/2013	Prob SBO-G, but may be SBO-J
Scat	SBO1		Not cat
Scat	U1		Not cat

Table 17. Individual cats caught at SBO and surrounding area.

Cat ID	Sex	Date trapped	Time	Camera trap cat ID	Location	Survey square
G-CD	M	17/01/2014	10:30	NA	G32	SBO23
G-CE	F	21/01/2014	23:50	NA	G32	SBO23
G-CA	M	11/12/2013	20:30	NA	G49	NA
G-CA	M	12/12/2013	07:50	NA	G57	NA
G-CC	F	15/01/2014	19:00	NA	G57	NA
G-CB	F	12/12/2013	09:00	NA	G6b	NA
SBO-C2	M	14/01/2014	17:00	SBO-C	SBO36	SBO36
SBO-CA	M	11/12/2013	18:20	SBO-B	SBO36	SBO36
SBO-CA	M	19/03/2014	03:30	SBO-B	SBO39	SBO39

Table 18. Pelage scores for the individuals captured in adjacent survey area at Strathbogie (SBO). The table shows total 7PS score and classification of each cat under both the Strict and Relaxed definition; DOM = domestic/feral, HYB = hybrid, WILD = Wildcat, UK = unknown, NA = not applicable.

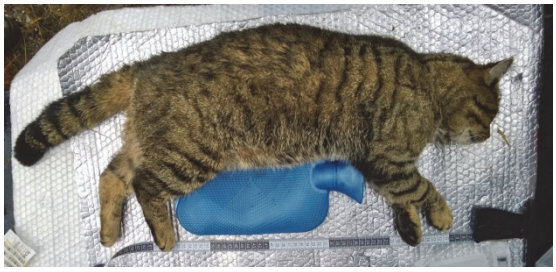
Cat ID	7PS							8PC								Other pelage characteristics									
	Dorsal line	Tail tip shape	Tail bands	Broken stripes flank	Spots flank & HQ	Stripes nape	Stripes shoulder	White chin	Stripes cheek	Spots underside	White flank	White back	Colour tail tip	Stripes hind	Ear colour	White Paw	Band alignment	Bands foreleg	Tabby patterns	Stripes body	7PS	TPS	Strict ID	Relaxed ID
G-CA	1	2	1	1	1	2	2	3	3	3	3	3	3	3	2	3	1	3	3	1	10	44	DOM	DOM
G-CB	3	2	2	3	2	3	1	2	3	3	3	3	3	1	2	3	2	3	3	3	16	50	HYB	HYB
G-CC	2	2	2	1	1	2	2	3	3	3	3	3	3	3	2	3	2	3	3	1	12	47	HYB	HYB
G-CD	2	3	2	2	2	2	2	2	3	3	3	3	3	3	2	3	2	3	3	3	15	51	HYB	WILD
G-CE	1	2	1	1	1	1	1	NA	1	1	3	3	3	1	1	3	1	1	1	1	8	28	DOM	DOM

SBO-B

G-CC

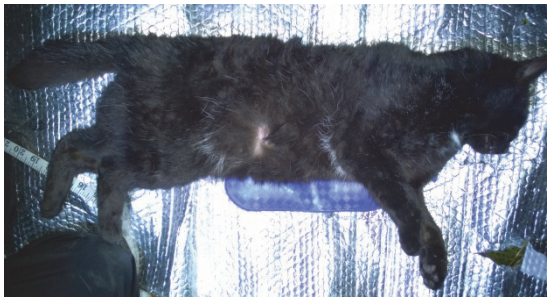
SBO-C

G-CD



G-CA

G-CE



G-CB

Figure 19. Seven individuals live trapped at Strathbogie – photographed under anaesthesia.

4.3.2.8 STRATHERRICK Results

Stratherrick was surveyed between January and March 2014. The results from the survey are detailed below.

4.3.2.8.1 Camera trap survey - SER

A total of 41 camera traps was placed across the Stratherrick survey area. Cameras were active between 31 January and 16 March 2014. Overall camera traps were active for a total of 852 trap nights.

4.3.2.8.2 Pelage assessment and capture data - SER

Only one individual was captured on camera on one occasion, giving a total capture rate of 0.12 individuals/100TN (Annex 1). This individual was difficult to fully identify from the pelage characteristics that were visible on the photograph, but was classified as a hybrid based on those that could be seen (Figure 20; Table 19).

Figure 20. The individual cat camera-trapped at Stratherrick (SER).

4.3.2.8.3 Scat and hair surveys – SER

Single scats were collected from five survey squares, though none was identified later as being of cat origin. No hairs were obtained from the lure posts.

4.3.2.8.4 Live trapping – SER

No live traps were set at Stratherrick due to the low number of cats captured.

Table 19. Pelage scores for the individual captured at Stratherrick (SER). The table shows total 7PS score and classification of each cat under both the Strict and Relaxed definition; DOM = domestic/feral, HYB = hybrid, WILD = Wildcat, UK = unknown.

Cat ID	7PS			8PC										Other pelage characteristics										
	Dorsal line	Tail tip shape	Tail bands	Broken stripes flank	Spots flank & HQ	Stripes nape	Stripes shoulder	White chin	Stripes cheek	Spots underside	White flank	White back	Colour tail tip	Stripes hind	Ear colour	White Paw	Band alignment	Bands foreleg	Tabby patterns	Stripes body	7PS	TPS	Strict ID	Relaxed ID
SER-A*	UK	UK	UK	2	UK	UK	UK	3	3	UK	UK	UK	UK	UK	2	UK	UK	1	3	UK	2	14	HYB	HYB

*Not all 7PS or 8PC characters visible, therefore ID represents probable assessment based on all characteristics

4.3.2.9 STRATHPEFFER Results

Strathpeffer was surveyed from December 2013 to February 2014. The results from the survey are detailed below.

4.3.2.9.1 Camera trap survey - SPE

A total of 40 camera traps was placed across the Strathpeffer survey area. Cameras were active between 5 December 2013 and 6 January 2014. Overall camera traps were active for a total of 833 trap nights.

4.3.2.9.2 Pelage assessment and capture data - SPE

Five individuals were captured on camera, four of which were captured within the three week survey. These four involved 10 recaptures giving a total capture rate of 0.48 individuals and 1.68 captures/100TN (Annex 1). Two individuals were classified as Wildcat under the Strict ID and a further two Wildcats were identified under the Relaxed ID (Figure 21; Table 20). None of the five individuals captured were detected within the survey area, all being detected at two locations 1.5 – 2 km to the south east of the survey area following local information about recent cat sightings. The methods employed in these two additional locations were the same as those deployed elsewhere in the survey.

Figure 21. The five individuals camera-trapped at Strathpeffer (STR).

4.3.2.9.3 Scat and hair surveys – SPE

No scats or hair samples were collected at the Strathpeffer site.

4.3.2.9.4 Live trapping – SPE

Although no cage traps were set within the survey squares, traps were set at five locations outside the survey area for a total period of 8 trap nights. No cats were captured during this time.

Table 20. Pelage scores for the individual captured at Strathpeffer (STR). The table shows total 7PS score and classification of each cat under both the Strict and Relaxed definition; DOM = domestic/feral, HYB = hybrid, WILD = Wildcat, UK = unknown.

Cat ID	7PS						8PC									Other pelage characteristics									
	Dorsal line	Tail tip shape	Tail bands	Broken stripes flank	Spots flank & HQ	Stripes nape	Stripes shoulder	White chin	Stripes cheek	Spots underside	White flank	White back	Colour tail tip	Stripes hind	Ear colour	White Paw	Band alignment	Bands foreleg	Tabby patterns	Stripes body	7PS	TPS	Strict ID	Relaxed ID
STR-A*	2	2	2	1	1	1	UK	2	3	UK	3	3	2	1	1	3	1	1	1	1	9	31	DOM	DOM
STR-B	3	2	3	2	2	3	2	3	3	UK	3	3	3	3	2	3	3	1	3	1	17	48	HYB	WILD
STR-C*	3	3	3	2	2	3	UK	3	3	UK	3	3	3	3	2	3	2	3	3	1	16	46	HYB	WILD
STR-D*	UK	UK	UK	3	3	UK	UK	UK	2	UK	3	3	3	UK	2	UK	UK	UK	3	3	6	20	WILD	WILD
STR-E*	3	3	3	2	2	3	UK	UK	UK	UK	3	3	3	3	UK	3	3	UK	3	1	16	38	WILD	WILD

*Not all 7PS or 8PC characters visible, therefore ID represents probable assessment based on all characteristics

4.4 Discussion and Conclusions

Cats were successfully photographed at all sites, although the number of individuals photographed varied between sites. Wildcats as classified by the Strict and Relaxed ID were found at Angus Glens, Dulnain, Morvern, Strathbogie and Strathpeffer. Domestic cats were found at all sites except Blair Atholl and Stratherrick.

Surprisingly few cats were photographed at Blair Atholl and Dulnain despite these areas showing evidence of Wildcats in previous surveys carried out by Kerry Kilshaw and Ruairidh Campbell. Surveys in both these areas were carried out in November and December 2013 and a mild winter compared to previous years may have delayed movement of cats from the hills to the more protected areas which were surveyed. This may explain the difference in the numbers of cats found from previous years. Alternatively, cat populations in these areas have experienced a series of consecutive bad winters (low temperatures and high snowfall) which may have impacted the local rabbit populations, influencing the cat populations negatively. Angus Glens, Morvern and Strathbogie appeared to support the greatest number of individuals (7-14) including Wildcats (4-8 Relaxed ID) based on camera trap evidence. The two highest scoring cats on pelage characteristics from Strathavon were detected at the same location. Local information indicates that supplementary feeding of cats has occurred nearby, which may have influenced the results of the survey at this site.

Scats were collected from seven of the nine sites and hair was collected from three of the sites. In the three areas where hair samples were collected, the numbers of samples per 100TN (trap nights) were: ANG, 0.62; SAV, 0.24; SBO, 0.12. This compares favourably with 0.07/100TN (Steyer *et al*. 2013) from Germany, while previous surveys in Scotland (Kilshaw & Macdonald, 2011; Kilshaw *et al*., in press) and Switzerland (Anile *et al*., 2012) failed to collect hairs using this method, despite the Swiss study having cats visit the lure posts. The higher success rate here may be due to our use of a combination of other food and scent baits (placed on separate posts) in addition to the Valerian, or the tincture brand used or the survey season. The success rate was however much lower than for camera traps and was comparable to the success from camera-targeted live-trapping (see below). Since hairs provide genetic information and their collection is less invasive and intensive than live-trapping, further development of this method would be useful.

Based on the camera trap results, six sites were chosen for live trapping. Trapping effort totalled 312 trap days, during which 10 individuals were caught, with two recaptures, and blood was taken for DNA analysis, from three of the sites. Overall trap success was 0.038 captures/trap night. In comparison, Daniels (1997) trapped for 8500 trap nights and caught 31 individuals with 24 recaptures giving a trap success of 0.0064 captures/trap night. The trapping success observed here suggests the use of camera traps prior to trapping may improve trapping efficiency and reduce overall trapping effort required.

Genetic data from scats, hair samples and blood samples are given in Section 6.

5. WILDCAT DENSITIES IN POTENTIAL PRIORITY AREAS

5.1 Introduction

The field surveys described in Section 4 provide information on which cats were photographed in each of the survey areas. Based on the photo-identification of individual cats this section describes the analysis used to try to provide estimates of Wildcat and hybrid densities and of Feral Cat densities in each of the survey areas.

5.2 Methods

Details of survey design, camera trap placement and operation are given in Section 4. For the purposes of the following analyses, cats that had been camera trapped were classified into two categories. The first, "Wildcat/ hybrid", included all those classed as Wildcats using relaxed ID criteria along with the five cats classed as "hybrid". This ensured that all cats that showed some Wildcat characteristics were included and also increased the sample size to make it more likely that analysis would give a meaningful result. The second category was of those cats classed in Section 4 as "domestic".

We analysed the camera trap data using non-Bayesian Spatially Explicit Capture Recapture (SECR) methods using the "R" 'secr' library (R Core Team, 2013; Efford, 2014). SECR methods recognise that detection events, in this case capture on a photograph, are a function of both the distribution of individuals and an encounter process that describes whether or not traps are encountered by individuals as a function of their location (Efford, 2004; Borchers & Efford, 2008; Borchers, 2010). By taking into account the capture locations of individuals, SECR methods incorporate spatially explicit capture heterogeneity into the analyses. Additionally, by using data on the movement of individuals between traps, SECR methods can directly estimate the effective sampling area of the survey site and can achieve more precise and accurate density estimates than can traditional non-spatial capture-recapture methods (CR) (Efford, 2004). The "secr" package used also allows for partial survey designs (in this case staggered deployment and retrieval of camera traps) (Efford, Borchers & Mowat, 2013; Efford, 2014).

Camera trap latitude and longitude co-ordinates, which are unsuitable for SECR analysis, were converted to GB National grid references suitable for SECR analysis. Camera trap surveys used a staggered entry design such that in each area the 40 (36 in the case of Angus Glens) cameras were deployed over a period of one or more weeks, left in place for approximately 3-4 weeks, and then removed (Table 21, Annex 2). This survey design means that a variable number of traps were operational in each survey area over the course of each survey. This varying sampling effort was accommodated in the analysis by using an incomplete survey design, whereby for each day we recorded whether a camera trap station was active (if a working camera was in place) or inactive (if no camera was in place, or the camera was known to have failed) (Efford, Borchers & Mowat, 2013; Efford, 2014).

Dates when individual cameras were retrieved were not recorded for all sites. Therefore, for the four sites where the deployment and retrieval dates had been recorded we could use the capture-recapture data from the entire survey period (Table 21); however, for the five sites where the retrieval date was not recorded we assumed that each camera had been left in place for 21 days (see section 4 for details) after deployment and excluded any captures after this time. Recorded information on camera failure was allowed for in the analysis as described above.

Table 21. Summary of camera traps survey dates for each survey area. Total survey duration is the number of days from when the first camera was deployed to when the last camera was retrieved. (Note that for sites where the camera retrieval date was unknown we assumed, within the data analyses, that each camera was deployed for 21 days).

		Deployment		Retrieval		
	Number of cells surveyed	First camera deployed	Last camera deployed	First camera retrieved	Last camera retrieved	Total survey duration (days)
Angus Glens	36	30/11/2013	22/02/2014	21/12/2013	17/03/2014	108
Athol	40	04/11/2013	18/11/2013	28/11/2013	09/12/2013	36
Drumtochty	40	07/02/2014	22/02/2014	02/03/2014	16/03/2014	38
Dulnain	40	06/11/2013	19/11/2013	Unknown	Unknown	36
Morvern	40	06/01/2014	12/01/2014	Unknown	Unknown	28
Strathavon	40	16/12/2013	30/12/2013	15/01/2014	22/01/2014	38
Strathbogie	40	05/11/2013	13/11/2013	Unknown	Unknown	30
Stratherrick	40	31/01/2014	22/02/2014	Unknown	Unknown	45
Strathpeffer	40	05/12/2013	13/12/2013	Unknown	Unknown	30

Wildcats may be active at any time of the day or night, but tend to be more active during evening, night time and early morning (e.g. Hetherington and Campbell, 2012). We therefore divided each survey period into 24 hour "cat days" which ran from noon until noon the following day. Repeat captures of the same individual at the same camera station within one cat day were excluded from the analysis as these captures provide no additional information. The analysis used closed population models and assumes that the populations were not subject to significant losses through deaths or emigration, or gains through immigration or births over the survey period. Given the short time span and time of year the surveys were carried out we believe that these assumptions are valid, but lack sufficient data to be able to test this.

An individual cat's probability of capture may be influenced by individual characteristics, time and previous trap experience, and such heterogeneity in capture probability can influence the reliability of abundance and density estimates based on capture data. Non-spatial and spatial capture-recapture methods can accommodate heterogeneity in capture probability and there is a suite of analytical methods available to cope with different sources of heterogeneity (Otis *et al.,* 1978; Amstrup *et al*., 2005). Such methods, though, require more data as the models become more complex. Indeed, reliable parameter estimates from capture-recapture studies rely on sufficient data on both the number and frequency of individuals captured and recaptured. In addition, SECR methods are dependent on sufficient spatial data arising from recaptures of individuals at different trap locations.

We specified a 3 km buffer around the survey area to account for individuals not resident within the survey area that may have, nonetheless, had a chance of being captured (Kilshaw *et al.,* in press). We used a half-normal detection function. Density estimates were calculated over the entire survey area and also just for the area of suitable habitat (e.g. excluding open water and habitations).

5.3 Results

From the camera trap surveys at nine sites across Scotland, Wildcat or Wildcat hybrids were caught on cameras in all survey areas except Drumtochty (Table 22). Combining Wildcats (relaxed identification criteria) and hybrids, (see section 4.2.3), the highest capture rate was at Angus Glens with 1.12 cats/100 trap nights followed by Strathbogie (0.71 cats/100 trap

nights) and Morvern (0.48 cats/100 trap nights). Based solely on Wildcats (relaxed identification criteria) the same three sites came out with the highest capture rates.

Whilst there was a reasonable number of captures at some sites, the number of recaptures at different camera stations across each site was small. There are no strict rules on the required sample size for capture-recapture analysis, though 10 individuals and 20 recaptures are, depending on the distribution of recaptures among individuals and trap locations, often regarded as a sensible minimum needed for meaningful analysis (Efford *et al*., 2009; Kilshaw *et al.,* in press). In addition to the relatively low number of captures and recaptures, individuals tended to be captured and recaptured at the same trapping station, and thus it was not possible to carry out any robust spatial analysis (Table 23).

The Angus Glens yielded the most recognised individual cats within the survey area and period with eight cats categorised as Wildcat or hybrids. No more than seven Wildcats or hybrids were identified in any of the other areas (Table 23). Only the Morvern and Angus Glens survey areas yielded sufficient capture-recapture data for analysis. However, due to the small number of individuals and recaptures, the analysis has to assume constant probability of capture, and estimates should to be viewed with extreme caution. Domestic or feral cats were caught at low numbers in five of the survey areas, but were not reported at all from Blair Atholl, Stratherrick or Strathpeffer (Table 23). Except for Angus Glens, there were insufficient data to estimate abundance or density estimates for domestic and feral cats.

Table 22. Summary of numbers of cats recorded during the 21 day survey period for each camera trap from the date of deployment. To allow for inter-site variation in active camera periods, the numbers of individual cats per 100 trap-nights are also shown. Additional cats photographed beyond this 21 day period are also given in the final column. "Wildcat" and "hybrid" refer the "relaxed" definitions from pelage.

Site	Relaxed ID Wildcat	Domestic cat	Wildcat + hybrid	Trap-nights	Relaxed Wildcat/100 trap-night	Relaxed Wildcat + hybrid/100 trap-night	Additional cats
Angus Glens	8	5	9	806	0.99	1.12	0
Blair Atholl	0	0	1	840	0	0.12	0
Drumtochty	0	1	0	840	0	0	0
Dulnain	1	1	1	826	0.12	0.12	0
Morvern	4	2	4	840	0.48	0.48	1 domestic
Strathavon	1	1	3	822	0.12	0.36	0
Strathbogie	4	3	7	840	0.48	0.83	0
Stratherrick	0	0	1	852	0	0.12	0
Strathpeffer	3	1	3	833	0.36	0.36	1 wildcat

Table 23. Summary of camera trap survey data and estimated Wildcat/hybrid and domestic cat densities. SE – Standard Error, UCL – Upper Confidence Limit, LCL – Lower Confidence Limit, Survey Days – sum of cameras deployed per day of survey, Occasions – Number of days cameras were deployed (first deployment – to last retrieval date/or 21 days after last deployment), na – Not Applicable. (Where information on camera deployment and retrieval date was available all data from the survey were used. Where only the deployment date was provided it was assumed within the analysis that each trap was deployed for 21 days).

Site	Survey data used	Survey days (Occasions)	Mean trap spacing	Cat category	No. Individuals (caught >1)	No. captures	No. recaptures	Individuals caught at >1 trap	Cats per km^2 (entire survey area) (SE, UCL-LCL)	Cats per km^2 (available habitat only) (SE, UCL-LCL)
Angus Glens	All trapping data	1,120 (108)	1,054 m	Wild/Hybrid	8 (5)	14	6	3	0.14 (0.07, 0.06-0.34)	0.15 (0.07, 0.06-0.37)
				Domestic	5 (4)	9	4	3	0.08 (0.05, 0.03-0.26)	0.09 (0.06, 0.03-0.28)
Athol	All trapping data	967 (36)	1,002 m	Wild/Hybrid	1 (1)	2	2	0	No estimate – too few data	
				Domestic	0 (na)	na	na	Na	na	
Drumtochty	All trapping data	1031 (38)	1,242 m	Wild/Hybrid	0 (na)	na	na	Na	na	
				Domestic	1 (0)	1	0	0	No estimate – too few data	
Dulnain	21 days per camera	881 (36)	1,118	Wild/Hybrid	1 (0)	1	0	0	No estimate – too few data	
				Domestic	1 (0)	1	0	0	No estimate – too few data	
Morvern	21 days per camera	881 (28)	1,142	Wild/Hybrid	4 (4)	9	5	2	0.02 (0.01, 0.01-0.06)	0.03 (0.02, 0.01-0.08)
				Domestic	3 (2)	8	6	0	No estimate – too few data	
Strathavon	All trapping data	1092 (38)	1,157	Wild/Hybrid	3 (1)	4	2	0	No estimate – too few data	
				Domestic	2 (0)	1	0	0	No estimate – too few data	

Strathbogie	21 days per camera	880 (30)	1,130	Wild/Hybrid	7 (5)	19	12	1	Not done – too few recaptures at >1 camera
				Domestic	3 (2)	8	5	1	No estimate – too few data
Stratherrick	All trapping data	1003 (45)	972	Wild/Hybrid	1 (0)	1	0		No estimate – too few data
				Domestic	0	na	na		No estimate – too few data
Strathpeffer	21 days per camera	873 (30)	1,114	Wild/Hybrid	4 (2)	8	6	0	No estimate – too few data
				Domestic	1 (1)	3	2	0	No estimate – too few data

5.4 Discussion and Conclusions

5.4.1 Site comparisons

Obtaining sufficient data for rare, elusive animals is always challenging. In this study, although cats were recorded by camera traps at all sites, the surveys produced too few capture and recapture data, and in particular, recapture at different cameras, for a robust analysis of densities, with no estimates at all being obtainable from most of the study areas. For the two sites where Wildcat density estimates were possible and the one for which domestic/feral cat density was estimated, these figures must be treated with extreme caution. Although hampered here by lack of recaptures at different cameras, SECR analysis is suitable for use within the sample design employed. It may have greater potential to yield useful results for comparing between study sites if employed on data collected over a longer time scale or with smaller distances between camera traps so as to achieve more recapture data from multiple locations.

5.4.2 Comparisons with previous studies

There are few previous published estimates of the density of Wildcats in Scotland. Kilshaw *et al*. (in press) estimated 68.17 (SE 9.47) Wildcats and Wildcat hybrids per 100 km^2 (or 6.8 per 10 km^2) in north-east Scotland on the boundary of the Cairngorms National Park. In comparison to these studies, the density estimates for Wildcats and Wildcat hybrids for Angus Glens (1.4 per 10 km^2) and, especially, that for Morvern (0.2 per 10 km^2) that were found in this study were lower than might be expected. However, the small sample sizes limit the value of direct comparisons.

5.4.3 Factors influencing density estimates

The low number of captures and recaptures in this study may accurately reflect low populations. However it may also be influenced by characteristics of the survey such as camera placement, spacing between cameras, duration of survey and time of year. In this study camera traps were deployed for a minimum of 21 days. Hetherington & Campbell (2012) showed that, during the Cairngorms Wildcat Project, 50% of the total number of individual cats eventually caught by camera trap were caught within the first 21 days of camera trap deployment, though the cumulative increase in captures of individual Wildcats continued beyond 60 days of camera trapping before levelling off (mean of 5 estates; range 30-80 days). The mean period over which each of the camera traps was active in the study covered by this report was around 35 (range 28-45) days (excluding Angus Glens). This easily exceeds the minimum 10 day period recommended by Kilshaw *et al.* (in press) and the overall trapping effort was consistent with recommendations by the same author. The staggered deployment of cameras, though, means that duration over which the whole study area was being surveyed simultaneously was, in most cases, less than 21 days (Annex 2). Future camera trap surveys should be guided by simulation studies to explore how survey design might be expected to influence the number of individuals caught and recaptured. Such a study could be carried out using the data gathered in this, and other studies (e.g. Hetherington & Campbell 2012; Kilshaw et al., in press), to parameterise simulated surveys.

It is possible that the survey under-represents the number of cats present in some survey areas. For example, two of the four cats live-trapped at Strathbogie had not been caught on camera earlier in this study and three additional cats were live-trapped close to the study area with trap placing being guided by knowledge based on previous fieldwork in the area. Live trapping of cats within or close to the survey areas of individuals not caught on camera traps suggests that the number cats was under-recorded by camera trapping. Trap spacing can influence trapping success and, for camera trapping studies, it is recommended that cameras are spaced such that there is at least one camera in each animal's home range such that each individual's probability of capture is greater than zero (Royle *et al.,* 2009; Sun

et al., 2014). Mean inter-camera distances in this study of between around 900-1200 m are consistent with those of other studies and, based on estimates of wild cat home ranges, should have ensured that there was at least one camera in every cat home range (Hetherington & Campbell, 2012; Kilshaw *et al.,* in press). Nonetheless, the camera data showed that most individuals recorded during this study were recorded at only one camera station. This may suggest that either cameras were spaced too far apart (because estimated home ranges of Wildcats in these areas (or published home ranges of Wildcats elsewhere) are over-estimates), that there was high occurrence of false negatives among camera traps (i.e. encounter events were not recorded) or that the survey period was too short for movements between cameras to be obtained.

5.4.4 Suitability of camera traps for Wildcat surveys

Although commercially available camera traps are widely used in ecological studies and have revolutionised field biology, they have a number of limitations for use in professional wildlife research (e.g. Meek & Pittet 2012; McCallum 2013). Sensitivity to movement, size of the animal and shutter activation speed all can influence the probability of a camera triggering and capturing an encounter event successfully. Both sensitivity and shutter activation speed have been shown to vary considerably between camera models, making some types of camera more suited to a particular type of survey than others (Weingarth *et al.,* 2013). A previous Wildcat study (Kilshaw *et al.,* in press) used two cameras simultaneously at each baited station and found that sometimes one of the cameras failed to record an encounter (false negative) that was recorded by the other camera. This demonstrates that cameras may miss true positives and introduce error into surveys. Differences in sensitivity and effectiveness between cameras may introduce bias when different camera types are used to survey different areas. The effectiveness of camera traps can also be profoundly influenced by weather, particularly precipitation and ambient temperature (Meek *et al.,* 2012). Rainfall and fog can 'mask' an animal from camera sensors leading to false negatives and a negative bias in population estimates. Most camera traps, and the ones used in this study, rely solely on detecting a temperature difference between a target object (in this case a cat) and the background to trigger the camera. Cameras can fail to record true positives if there is insufficient difference between body temperature and background temperature (e.g. Meek *et al.,* 2012). This would also result in false negatives and negative bias. In camera trap surveys of rare species, false negatives may have a significant effect on survey results as an unknown proportion of encounter events are unrecorded. If the proportion of false negatives is equal between all sites, then although each population estimate will be too low, a comparison between sites will still be valid, i.e. 'site A has more cats than site B' should be valid. However, where the proportion of false negatives systematically varies between site, for example different camera types are used in different areas (thus confounding site with camera type) or when areas are surveyed at different times (thus confounding site with season), comparisons of population estimates between sites may be problematic. Although the analysis methods described above can account for un-recorded animals, if false-negatives mean that there are insufficient data overall, robust population estimates may not be obtainable.

5.4.5 Implications for Wildcat conservation

The population densities estimated for the two sites for which it was possible to carry out such analysis were low compared with that obtained by Kilshaw *et al*. (in press). In Section 2 it was estimated that to have a good chance of persisting, a Wildcat population should number at least 40 individuals. At the estimated density of wildcats and hybrids combined of 0.14 km^2 in the Angus Glens, this suggests that an area would need to extend across 333 km^2 to be expected to hold 40 animals. For the other study areas, the relative required extent may be considerably higher. It is not known, though, how connected populations of Wildcats are in Scotland and whether or not there is genetic and demographic connection

between the sites studied or across other areas. If such connection does exist, cats in the study areas reported on here may form part of viable populations across a wider area. However the study grids were designed based on areas theoretically capable of supporting a viable population that is at or close to carrying capacity based on metrics of habitat use from other studies. Therefore, if intensive remedial conservation works in the priority areas can reduce or remove threats to the survival of individual Wildcats, these conservation areas may have the potential to support local population persistence in the longer term.

For defining Wildcat priority areas, there is potentially a trade-off between size and practicality. The estimated Wildcat densities presented here imply the need for a large area while information on likely carrying capacities given in Section 2 suggests that a much smaller area may be suitable. The ease or difficulty of Wildcat conservation may be related in part to the number of feral or unneutered domestic cats present in an area and the practicality of managing these. Modelling studies have indicated that to be effective in reducing a feral cat population, TNR (Trap-Neuter-Release) programmes should neuter more than 75% of the fertile population (Anderson *et al.,* 2004). Such rates may be impractical to achieve over large areas. Therefore, in the medium to long term, it may be more realistic to maintain a favourable environment for Wildcats in relatively small areas with close co-operation of a small number of significant landowners, than across larger regions. This may also be more effective at maintaining genetically more pure Wildcats than might be a reduced conservation effort over a larger area. In such a situation, although the number of cats with Wildcat genes may be higher, the proportion that closely resembles Wildcats may gradually decline.

No hard rules can be implied from the results here as to the optimum extent of Wildcat priority areas. The densities suggested by these analyses are very low (compared to previous studies). However it is not known over what area beyond the study grids there may be Wildcats that are functionally connected to (i.e. with potential to come into contact with) those recorded by this survey. Taking an evidence-based approach to apportioning of effort, the initial stages of Action Plan implementation should focus on intensive remedial work in core areas where this survey and other evidence shows that Wildcats persist. Priority area boundaries, though, as presented in Section 9, encompass larger areas of continuous habitat or land contained within natural boundaries in order to allow for population expansion. If Wildcats in core areas can be secured and populations increased, suggested priority areas in Section 9 show where expanded conservation is most likely to be effective and practical in securing viable populations over larger areas.

6. WILDCAT GENETICS IN POTENTIAL PRIORITY AREAS

6.1 Introduction

6.1.1 Project Background

This section describes the genetic analysis of survey samples, performed under a separate SNH contract running in parallel to the survey work. In addition to the biological samples collected within the survey, potential Wildcat samples were also obtained from existing collections and incidental encounters with wild-living cats around Scotland between October 2013 and March 2014.

The primary objective of the genetic analysis was to provide a rapid genetic assessment of biological samples provided from survey work from which to determine the make-up of individuals within and between populations.

6.1.2 Current state-of-the-art in Wildcat genetics

There is a long-history of research into Wildcat genetics and taxonomy, as reviewed by Neaves & Hollingsworth (2013). The overall picture is one of varying levels of genetic introgression between Wildcats and feral domestic cats in wild-living Scottish cat population. The genetic research undertaken to examine the extent of hybridisation has led to the development of several different methods for identifying the genetic make-up of individual cats. Current methods focus on the use of DNA Single Nucleotide Polymorphisms (SNP) markers, partly due the recent discovery of many thousands of such markers in cats and partly because of the utility of SNP markers in the analysis of poor quality samples. Of particular interest is a recent publication by Nussberger *et al.,* (2013), from a Swiss research group that has developed and validated a small panel of SNP markers for the assignment of continental wild living cats to different categories of Wildcat purity. This paper post-dates the Neaves & Hollingsworth (2013) review.

6.2 Methods

6.2.1 Sample collection

A total of 127 samples were received for analysis during the project (Table 24). These samples included blood, tissue hair and faeces originating from presumed wild-living cats in Scotland. Of this total, 81 samples were collected during the project, with the remaining 46 being obtained from sample archives.

Table 24. Summary of samples obtained for analysis during the project. A detailed list of samples is provided in Annex 3.

Sample type	No. samples	Fresh collection	Archived sample
Blood	16	16	0
Tissue	22	5	17
Hair	43	14	29
Faeces	46	46	0
Totals	127	81	46

6.2.2 Genetic Analysis Methods

6.2.2.1 DNA extraction

DNA was isolated from all direct biological sample types using Qiagen Blood and Tissue kits, following the manufacturer's instructions. For faecal samples a combination of the Qiagen Stool kit and a faecal swabbing technique was utilised as this has been demonstrated by

RZSS to be the most effective procedure for isolating the maximum yield of DNA from faecal samples.

6.2.2.2 Identification of faecal samples

From previous surveys, the difficulties associated with field identification of wild-living cat faecal samples have posed a significant problem. To minimise the cost of testing scat samples wrongly believed to be cat, a DNA-based test was employed to ensure scat samples were from wild-living cats rather than species with overlapping scat morphology: principally fox and occasionally pine marten. This test relies on the characterisation of a single nucleotide polymorphism (SNP) present in the 16S Ribosomal gene of mitochondrial DNA to identify cat (wild or domestic). A negative cat result could be obtained from a different species or from a poor quality cat scat yielding no amplifiable DNA.

6.2.2.3 Assessment of maternal lineage of wild-living cats

In order to provide preliminary data on the ancestry of sampled cats, a second mitochondrial DNA test was employed. Mitochondrial DNA is maternally inherited and therefore will only provide information on the maternal lineage and cannot be used in isolation to infer hybrid status. However the presence or absence of European Wildcat haplotypes in a sample is a powerful tool for assessing its ancestry with regard to purity or introgression. Furthermore, when using poor quality or low yield DNA samples, laboratory results may be restricted to mitochondrial DNA markers as there are many more copies of mitochondrial DNA per cell, than nuclear DNA. Driscoll *et al.,* (2011) identified fixed mitochondrial DNA nucleotide positions between the European Wildcat and domestic cats (*Felis* spp). A test to identify one of the fixed nucleotide positions in the mitochondrial genome (McEwing *et al.,* 2012) was employed in this project to identify the maternal ancestry of an individual cat.

6.2.2.4 Assessment of purity of wild-living cats

In order to assess the purity of individual cats, a panel of fourteen nuclear DNA SNP markers was employed to genotype the samples previously identified as cat. These markers were identified from a subset of 96 SNP markers employed to evaluate purity of Wildcats in Switzerland (Nussberger *et al.,* 2013) and subsequently demonstrated to be conservatively diagnostic in relation to Wildcats. First, a selection of Scottish cats of known pedigree were submitted for testing using the 96 SNP based system. A hierarchical approach was then utilised to reduce the number of SNPs with the intention of being suitable solely for gathering information based on Scottish wildcats. SNPs were first discarded from the panel if the diagnostic nature of the SNPs was compromised based on the broader geographic spread of domestic cats (Scottish & German). The panel was further reduced by selecting only SNPs that were informative between wildcat and domestic cats across Scotland, Germany *and* Switzerland. Finally a selection was made on diagnostic SNPs that showed the expected genotype of hybridization in known hybrid samples from captive Scottish wildcats while maintaining their diagnostic status in domestic and wildcats (McEwing *et al.* in prep.).

6.2.2.5 Assessment of individual identity in wild-living cats

Individual identity of wild-living cats was evaluated using the same 14 SNP marker DNA profiles used for assessing genetic purity.

6.2.2.6 Sex determination of wild living cats

Sex determination was attempted in cats showing full or partial SNP DNA profiles. The sex determination test used in this study was provided by Clare Hoollely (National Cancer Laboratory, US) and is based on the presence or absence of a Y chromosome (present in males, absent in females). For wildcat, the specific region of the sex chomosomes targeted

by the test also allows the wildcat or domestic cat ancestry of the DNA marker to be identified, due to the presence of diagnostic SNPs at these sites. Any sample failing to amplify the Y chromosome amplicon is only considered female if the X chromosome amplicon amplifies successfully, avoiding false negatives due to poor quality DNA.

6.2.3 Statistical methods

Evaluation of hybrid status was undertaken using the computer software packages STRUCTURE (Pritchard *et al.,* 2000) and NewHybrids (Anderson and Thompson 2002). Both programmes employ Bayesian approaches to calculate the posterior probability of membership to different groups. In the case of STRUCTURE, samples are assigned to putative populations, while in New Hybrids, samples are assigned to a range of possible hybrid classes, in this case pure wildcat, pure domestic, F1 hybrid, F1 backcrosses, or F2 hybrid. It should be noted that New Hybrids will always assign a sample to one of these classes, therefore the results may mask more historic introgression and this should be considered for all F2 results.

Sample data from the current project were analysed in combination with available Scottish and continental Wildcat reference data, as well as reference domestic cat sample data. Scottish reference samples were obtained from the National Museums Scotland, collected between 1931 and 1958 (mean pelage score = 20); continental wildcats samples were obtained from the Senckenberg Research Institute, Germany, following both photographic and genetic identification; domestic cat samples were obtained from the Royal (Dick) Veterinary School at the University of Edinburgh; samples of known introgressed ancestry were obtained from the RZSS Highland Wildlife Park.

6.3 Results

6.3.1 Identification of faecal samples

Of the 46 faecal samples submitted for analysis, five were identified as originating from cats and were submitted for further analysis. The remaining 41 negative samples were not analysed further.

6.3.2 Assessment of maternal lineage of wild-living cats

Mitochondrial DNA (mtDNA) haplotype data were obtained for 81 cats (16 blood, 22 tissue, 38 hair and five faecal samples. Thirty seven samples (46%) displayed a Wildcat mtDNA haplotype, the remaining 44 samples displayed a domestic cat haplotype. Haplotype results for each sample are shown in Annex 3.

6.3.3 Assessment of purity of wild-living cats

Full 14-marker SNP DNA profiles were obtained for 38 samples. A further 14 samples yielded partial profiles. All profiles were included in the main analysis but samples with profiles consisting of fewer than 10 markers (n=8) are not reported here. SNP DNA profile results for each sample are shown in Annex 3.

The results of the STRUCTURE analysis (Annex 4) revealed a wide range of introgression levels, with assignment scores ranging from 94% Wildcat to 8% Wildcat (mean 54%). The continuous variation observed among the 44 wild living samples under STRUCTURE assignment (Figure 22) is consistent with previous findings summarised by Neaves and Hollingsworth (2013).

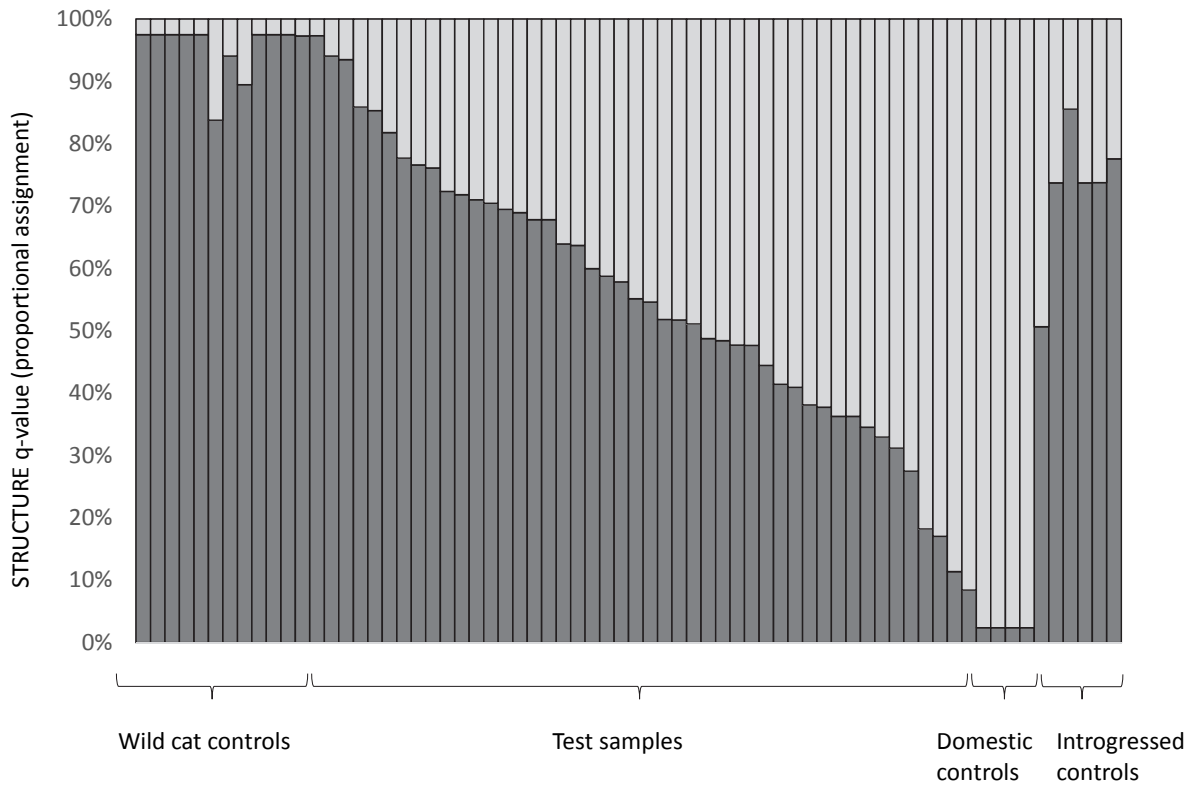


Figure 22. Results of STRUCTURE analysis for the 44 test samples (plus 1 +ve control), compared against Wildcat and domestic reference controls, and additional captive animals known to have mixed ancestry. Dark grey = Wildcat, light grey = domestic. The continuous variation in introgression rate in the wild living cats indicates a continuous distribution of forms from Wildcat to feral domestic.

The results of NewHybrids analysis are broadly concordant with those of STRUCTURE (Table 25). The majority of cats sampled during this study were assigned to an F2 hybrid category, indicative of introgression at least two generations ago and possibly considerably more. The three cats identified as full Wildcats were all sampled from the National Museums Scotland; the highest scoring living cats sampled from the wild were three Wildcat backcross samples (see Annex 5 for full results).

Table 25. Assignment of cats to hybrid category using the programme New Hybrids. The majority of wild living cats sampled in this study were assigned to an F2 hybrid status, indicating introgression between wild and domestic cats at least two generations ago.

Sample Origin	Wildcat	Wildcat backcross	F1 hybrid	F2 hybrid	Domestic backcross	Domestic
Study samples	3	7	1	28	1	4
Wildcat controls	12	1	0	0	0	0
Domestic controls	0	0	0	0	0	4
Known mixed	0	4	0	2	0	0

6.3.4 Assessment of individual identity in wild-living cats

No two samples had matching full SNP DNA profiles. Therefore it can be assumed that all these 38 samples originated from different cats. From the additional 14 samples yielding

partial profiles, several could theoretically have originated from the same individuals. Taking this into account, the minimum number of cats sampled from the wild is conservatively estimated as 48.

6.3.5 Sex determination of individual cats

Of the 52 samples where SNP DNA profile data were obtained, 46 could be confidently sexed, resulting in 21 females and 25 males. Of the females, six had two wildcat sex chromosome markers, seven displayed one sex chromosomal marker for wildcat and one for domestic cat and eight had two domestic cat sex chromosomal markers. For male cats, the numbers were five, eight and twelve, respectively (Annex 3). The data for the sex-linked SNPs is in broad agreement with results of the autosomal SNPs, further reinforcing the overall finding that introgression between two species is widespread.

6.4 Discussion and Conclusions

- Only 11% of faecal samples submitted were identified as originating from wild-living cats, highlighting the difficulties in using this sample type for monitoring Wildcats in Scotland. The remaining samples (negatives) were either from a different species or were from cats but did not yield amplifiable DNA.

- 46% of all cats sampled displayed a Wildcat mitochondrial haplotype, confirming that introgression with domestic cats is widespread in wild-living cats throughout Scotland.

- DNA profiling success varied markedly with sample type as expected. Blood and tissue samples generally resulted in complete profiles, while full or near-complete profiles were obtained from four hairs and one faecal sample.

- The level of genetic purity for individual cats varied widely from near pure Wildcat to near pure domestic, replicating the findings of previous molecular genetic studies in Scotland. Wild-living cats are typically assigned to a generic hybrid status (second generation hybrid or more), with the best living animals sampled being categorised as Wildcat F1 backcrosses. The highest pelage scoring cats genetically tested were museum specimens scoring (7TPS) 18, recent RTA specimens scoring 17 and blood samples of wild-living cats scoring 16.

- The sex determination results indicated a roughly equal sex ratio, with the additional sex chromosome information regarding wildcat or domestic cat ancestry largely tallying with the autosomal SNP markers and providing further evidence of the level of domestic cat introgression throughout the wildcat population in Scotland.

- It is recommended that good quality samples obtained in this study are analysed using a larger panel of SNP markers to provide further confirmation of their genetic status. It is also recommended to revisit samples that show poor correspondence between genetic and pelage scores.

- Overall, this snapshot of the Wildcat population reinforces a picture of few remaining pure Wildcats, with the majority of animals placed across a broad spectrum of individual genetic introgression with feral domestic cats.

7. SURVEY OF VIEWS ON THE CONSERVATION OF WILDCATS

7.1 Introduction

7.1.1 Background

The Scottish Wildcat Conservation Action Plan (Anon, 2013) identifies national priorities for conservation action and proposes to build consensus and co-operation around delivery of this action. To date, no study has specifically explored public attitudes to the protection of Wildcats in Scotland or to individual conservation measures. These attitudes will play a key role in future consensus building efforts.

This section addresses these gaps and aims to collate local knowledge on Wildcat distributions, plus views on Wildcat protection and conservation measures related to domestic and feral cat management. These findings can be used as a baseline to inform future debate on Wildcat protection and to guide the delivery of public awareness campaigns.

7.1.2 Aims and objectives of the study

The main aims of the survey were to gather evidence on existing management arrangements for feral and domestic cats (including control and neutering) and assess the acceptability of policies associated with establishment of priority areas for the conservation of Wildcats.

Objectives:

1. To investigate local knowledge on the abundance and distribution of existing Wildcat and feral cat populations.
2. To assess public attitudes to the protection and the status of Wildcats.
3. To examine public attitudes towards establishing priority areas for conservation of Wildcats and to establish the level of support that exists for specific conservation actions that would minimize risks to Wildcats.
4. To assess existing knowledge of cat management approaches in each area, specifically, to assess knowledge of, and attitudes to, Trap-Neuter-Release programs, predator control methods used for the management of feral cats and awareness of neutering and vaccination of domestic cats.
5. To inform Wildcat conservation strategies and make recommendations for management actions in priority areas.

7.1.3 Public awareness of Wildcats

Public interest in the plight of Wildcats has been fuelled in recent years by awareness-raising campaigns that introduced the brand of “Highland Tiger” as a key part of the Cairngorms Wildcat Project and by the Scottish Wildcat Association. The Cairngorm Wildcat Project involved discussions and workshops on the topic but did not collect any systematic evidence about public beliefs on Wildcat protection. During the course of the project (2009-2012), the Scottish Nature Omnibus that surveyed public views on Scotland’s nature registered an increase in the proportion of people who associated Wildcats with Scotland from 4% to 15% between 2009 and 2011 (Primrose, 2010; Primrose, 2011; Granville & Mulholland, 2013). For the same period, the proportion of people concerned about Wildcats increased from 7% to 17%, ranking the Wildcat 5th among species that people were most concerned about.

This boost in public regard for Wildcats was attributed, at least partially, to the effectiveness of the awareness-raising campaigns (Hetherington & Campbell, 2012). Despite a drop in concern to 9% in 2013, the Wildcat remained the 5th highest-ranked species that people

were concerned about (SNH, 2013). Our findings further expand on some of the concerns and views people hold about Wildcats.

7.1.4 Surveys of Wildcat distribution

An aim of the Scottish Wildcat Conservation Action Plan is to gain a better understanding of the distribution of Wildcats (Anon, 2013). Our survey aimed to explore local knowledge on Wildcat and feral cat distributions to aid in decision-making on the boundaries of potential priority areas. We asked respondents to our questionnaire survey to indicate the location of their sightings of Wildcats and feral cats on maps that covered their local areas.

Several studies have previously contributed to understanding Wildcat distributions through collating data on public sightings of Wildcats. Two surveys conducted on estates in Scotland (Jenkins, 1962; Hewson, 1967) indicated an increase in Wildcat ranges over what had previously been believed to be its extent. Easterbee *et al*. (1991) collated more than 700 records and sightings of Wildcats through questionnaires and interviews with landowners and estates workers. The interviews asked about perceived trends in Wildcat populations; 58% reported no change, 34% thought populations were decreasing and 8% thought they were increasing. A similar methodology was used by Davies and Gray (2010), who reported 482 public sightings of Wildcats. They attempted to assess the accuracy of these records against seven key pelage characters of Wildcats (Kitchener *et al*., 2005). This use of stricter criteria for identifying Wildcats than Easterbee *et al*., (1991) might explain the difference in the total number of obtained sightings. Both surveys highlighted the difficulty of verifying the accuracy of records as most of those who submitted sightings were uncertain about how to distinguish between Wildcats and other cats.

7.1.5 Cat management

The debate on managing feral cat populations often divides scientific and public opinion on the most effective and acceptable control methods. Public acceptance of feral cat management measures may be crucial in securing support for wildlife management policies implemented locally (Wald *et al*., 2013). The most commonly applied approaches for managing feral cats are lethal control and Trap-Neuter-Release (TNR). Whilst different situations generate broad consensus on the acceptance of either method (Longcore *et al*., 2009), TNR has been found to receive higher acceptance among the concerned public than lethal control (Slater *et al*., 2008). There were exceptions; for example those who work with agricultural animals professionally were more supportive of lethal control (Farnworth *et al*., 2010) whilst urban residents preferred TNR (Loyd & Miller, 2010).

7.2 Methods

7.2.1 Survey

A self-completion questionnaire was developed to explore local knowledge of cat management and to benchmark current beliefs and attitudes to Wildcat conservation. A survey questionnaire was deemed to be the most effective method to reach the widest possible sample of respondents across nine rural areas around Scotland (Table 26). Most of these areas consist of large estates and farms and as such, residents are more dispersed and difficult to reach for face-to-face interviews. Within the relatively short time frame for data collection (three months), the use of questionnaires allowed us to encourage potential respondents to participate in the study upon the first point of contact.

7.2.2 Questionnaire

The questionnaire (Annex 6) explored three broad topics relevant to Wildcat conservation. These were:

a) Knowledge of Wildcat and feral cat distribution.
b) Attitudes towards Wildcat protection and beliefs about Wildcats and feral cats.
c) Preferences for establishing priority areas and support for conservation actions.

The questions were grouped under three main parts in line with the objectives of the study:

7.2.2.1 Part A. Wildcats

Respondents were asked whether they had seen evidence of Wildcats in their area in the previous 12 months, asked to give details of this evidence in a multiple choice question and invited to mark the location of their sightings on a map.

To explain what we mean by Wildcat, we provided a field identification guide that shows seven pelage characters that are useful in distinguishing a Wildcat from a tabby feral cat in a field situation, reproduced from Kitchener *et al.*, (2005). This system has been used in public engagement campaigns through the Cairngorms Wildcat Project and as a field identification guide for people working in predator control (Hetherington & Campbell, 2012). The features are also those used for the "relaxed" Wildcat identification definition used in the field survey part of this project (see Section 4).

Attitudes to Wildcat protection were measured by asking "To what extent do you agree, or disagree, with the following statements?" and responses were recorded on a five-point Likert scale, with choices ranging from "strongly agree" to "strongly disagree". Beliefs about the possible advantages and disadvantages of having Wildcats in respondents' local area were obtained through open questions.

7.2.2.2 Part B. Feral cat

Questions in section two asked about sightings or other evidence of feral cats and the advantages and disadvantages of having feral cat populations in their area. Questions on feral cat sightings were designed in the same way as questions on Wildcats (Section 7.2.2.1).

7.2.2.3 Part C. Priority areas for Wildcat conservation

Section three explored respondents' perceptions of the severity of potential risks to Wildcats from transmission of diseases and interbreeding with feral and domestic cats and from accidental killing through legitimate predator control methods. Responses were captured on a five-point Likert scale where risks were rated from "very serious" to "not at all serious". We asked whether respondents thought establishing priority areas was a good response in order to reduce risks to Wildcats. The level of support for eight conservation actions that are proposed to be carried out within priority areas was measured on a five-point Likert scale, through a range of "strongly oppose" to "strongly support" answers. Several conservation actions were explored in more detail. We investigated respondents' awareness of Trap-Neuter-Release programmes in their area and asked a multiple-choice question about their preferences for who should carry out such a programme. Five-point Likert scale questions asked about the feasibility ("not at all feasible" to "very feasible") and support ("strongly oppose" to "strongly support") for Trap-Neuter-Release programmes. Respondents who carry out predator control were asked to give details of the control methods they used and were asked about their willingness to make changes to their predator control methods to reduce risks to Wildcats. Finally, awareness of neutering and vaccination of domestic cats was explored by asking whether respondents thought these were common practices in their areas. This section contained six open-ended questions encouraging respondents to expand on their answers and include any extra comments.

7.2.3 Piloting questionnaire

We received important feedback from 10 respondents in the pilot stage of the survey which served to finalize and improve the clarity of the questionnaire. The pilot respondents included ecologists, social scientists and members of public.

7.2.4 Questionnaire data analysis and reporting

The data from the questionnaire, namely frequencies of particular answers, were analysed in SPSS and Stata for descriptive statistics. Contingency tables were used to investigate underlying relationships, such as differences in attitudes to establishing priority areas by type of respondent and study area, and relationships between support for conservation actions and perceptions of risks to Wildcats and attitudes to Wildcat protection. Contingency tables were used for comparing the proportions of responses and Fisher's tests were applied to test statistical significance of correlations. Additionally, open-ended questions were coded and categorised using NVivo qualitative data analysis software.

The results to several questions where multiple answers could be given are reported using frequencies as the numbers of responses in each category are small and percentages would be less representative of the real spread of responses. For reporting Likert scale questions, we sometimes use aggregate scores, for example combining "tend to agree" and "strongly agree" categories, to report overall levels of agreement. Percentages were rounded to the nearest whole figure which can mean that the component results reported in charts do not add up to 100%.

7.2.5 Survey sample

Respondents were sourced in particular from among stakeholders involved in land and cat management in the nine study areas. Estate managers, gamekeepers, farmers and householders were contacted mainly through project staff working on camera trapping on local estates. Where possible, field staff kept records of the addresses to which they delivered the questionnaires to allow reminders to be sent to those who did not respond in the first instance. In several cases, a batch of questionnaires was handed to agents of estates for distribution to local employees and tenants. Therefore, the precise figure for the total number of recipients contacted by or via field staff is not known.

People who received questionnaires by post rather than from field staff were mainly famers, vets, Cats Protection volunteers and local householders. We received contacts for several farmers living in the target areas from the National Farmers Union of Scotland (NFUS). The remainder of contact details for farmers and householders were obtained online, mainly through map search and business directories. Local Cats Protection volunteers were contacted via national co-ordinators.

Questionnaire recipients were supplied with a cover letter stating the purpose of the study and the funding and research bodies involved (Annex 6) and a postage-paid, pre-addressed envelope.

7.3 Results

7.3.1 Response rate

A total of 104 completed questionnaires were returned (Table 26). Between November 2013 and February 2014, we contacted an estimated 221 people, 140 by post and the remainder through field staff working in study areas.

We received 62 questionnaires in the first instance (early response in Table 25) and after sending out reminders we received a further 42 questionnaires (late response in Table 25). The response rate is estimated to be 47% based on the known numbers of people contacted.

Table 26. Sample of respondents and total numbers of returned questionnaires.

Area	Initial contact	Early response	Late response	Total received by area
		by field staff | by post		
Angus Glens	Unknown|16	7|1	0|6	7|7
Blair Atholl	12|27	2|4	2|5	4|9
Drumtochty	Unknown|9	0|2	0|2	0|4
Dulnain	Unknown|22	3|7	0|5	3|12
Morvern	16|4	6|3	0|0	6|3
Strathavon	21|14	5|2	2|2	7|4
Strathbogie	18|16	7|5	3|4	10|9
Stratherrick	Unknown|9	2|2	0|1	2|3
Strathpeffer	14|23	2|2	2|8	4|10
Total	221*	62	42	104

***** This number relates to the known contact only

The cover letter encouraged respondents to contact us with questions about the study or if they wished to get involved in Wildcat conservation in their area (Annex 6). Thirteen respondents contacted us with further questions, information or left their contact details, and five of them specifically offered their help with the future conservation project.

7.3.2 Distribution and types of respondents

The highest number of responses was from Strathbogie and Dulnain, whilst for Drumtochty and Stratherrick we recorded the lowest response levels (Table 27). This was mainly due to the higher availability of farmer contacts in the former two areas.

For the purposes of the summary in Table 27, seven respondents who identified themselves in more than one category were only counted once. Among these participants were three farmers who also identified themselves as estate manager and gamekeeper, two farmers who were also vets, one farmer who was an estate manager and one estate manager who was also a gamekeeper.

Table 27. The number of respondents by area and respondent type.

Area	Farmer	Crofter	Estate manager	Game-keeper	Vet	Cats Protection	Other	Area total
Angus Glens	2				3	3	5	13
Blair Atholl	4	1	2		2	1	3	13
Drumtochty					3	1		4
Dulnain	8		1	1		3	3	16
Morvern			1	1	2	1	4	9
Strathavon	7	1	2				1	11
Strathbogie	9		1		3	2	4	19
Stratherrick		1		1	3			5
Strathpeffer	5	1	1	2	3	1	1	14
Respondent type total	35	4	8	5	19	12	21	104

Twenty-one people described themselves in the “other” category and among these were several local home or land owners, and others who identified themselves as retired, working in the tourism business or in other professions (Table 28).

Table 28. Number and type of respondent in the "other" category.

Other	Total
House/land owner	7
Retired	5
Tourism business	3
Ex farmer	1
Forest owner	1
Ranger	1
Teacher	1
Unspecified	2

7.3.3 Public sightings of Wildcats and feral cats

Twenty-nine respondents reported seeing evidence of Wildcats in the previous 12 months (Figure 24), compared to 65 who reported seeing evidence of feral cats (Figure 25). Eight people did not know whether they saw any evidence of Wildcats and four were unsure whether they saw evidence of feral cats. From other comments given, it is evident that respondents were unsure whether they had seen evidence of Wildcats due to uncertainty over distinguishing them from other cats, especially hybrids between Wildcats and feral cats.

Several respondents commented they saw evidence of Wildcats and feral cats but not within the previous 12 months. As it was not usually possible to tease apart which records were from within the previous 12 months, these data are included in the response counts .

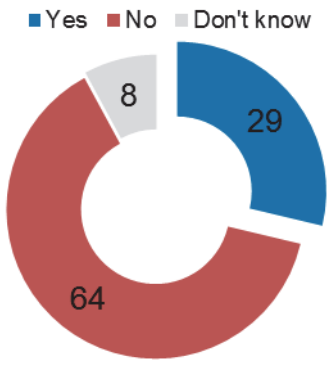


Figure 24. Have you seen evidence of Wildcats? n=101.

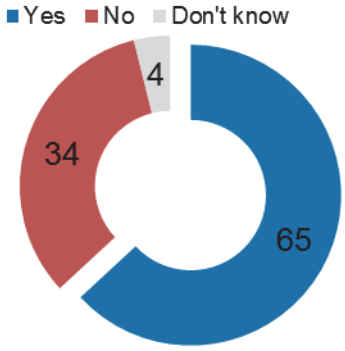


Figure 25. Have you seen evidence of feral cats? n=103.

We asked respondents to further elaborate on the type of evidence they had seen by choosing any relevant evidence from a list of options that also included a category “other”. Almost all respondents who saw evidence of Wildcats reported that these were sightings (Figure 26) though respondents also reported a range of additional evidence. Similarly, for feral cats, most people who saw evidence of feral cats reported sightings (62), though many people also reported seeing feral cats in a trap (23), this being likely accounted for by feral cats trapped whilst conducting TNR or predator control as was described in the “other” response to this question.

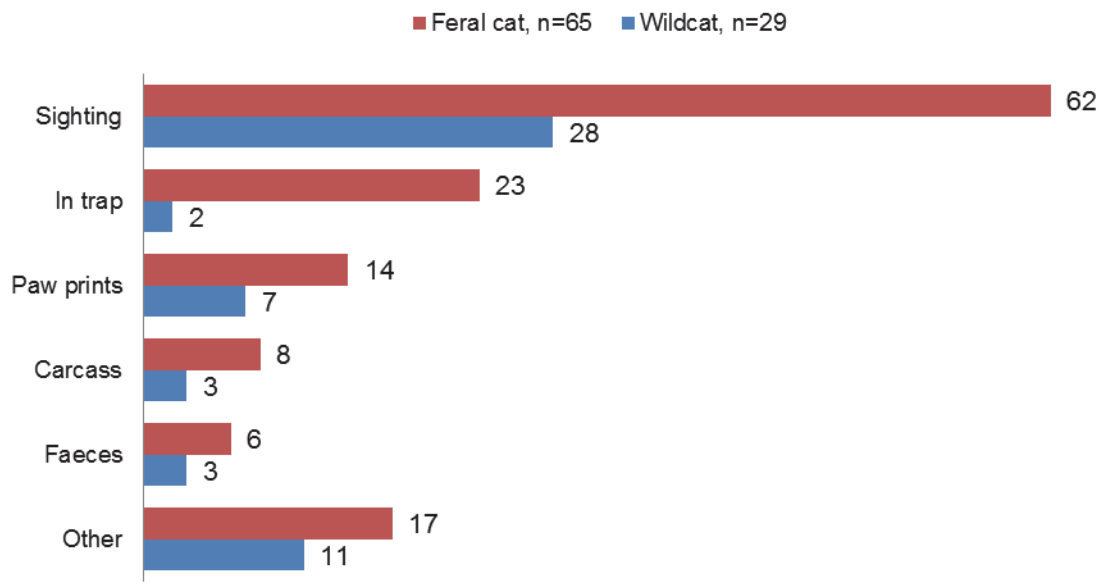


Figure 26. What evidence of feral cats/Wildcats have you seen? Total counts.

Some people commented that they are not aware of Wildcat populations in their area and others thought that Wildcats might only occur in very limited numbers. Comments about seeing Wildcats in the past but not having seen any recently were common. Some thought that numbers of hybrid cats have been increasing, while populations of "pure" Wildcats are declining or becoming extinct.

> *"To my knowledge there are no Wildcats in the XXXX. I used to see them in the past when out spot-lighting for foxes but none in the last 25-30 years."*

> *"We used to see Wildcats fairly frequently 20-30 years ago. More recently sightings have been more like the feral tabby. I hope there are still pure Wildcats in the area - but I'm not sure they still exist here, we haven't seen one for some years. I'm sure feral cats are the problem, but I'm not sure whether or not it's too late to save Wildcats in our area."*

A total of 119 sightings of Wildcats and feral cats were marked on maps by 44 respondents. These comprised 49 reports of Wildcats, 56 of feral cats and seven of cat colonies (Table 29). Seven reports of sightings were also marked as feral cat/Wildcat and are included here as such. The number of individual respondents contributing towards these totals is given in brackets in each case. The highest number of Wildcat sightings was in Dulnain (15) and the highest numbers of feral cats were reported by respondents from Strathbogie (15). No annotation was made on maps by respondents from Drumtochty and Stratherrick.

Table 29. Total counts of Wildcat and feral cat sightings indicated on questionnaire maps.

	Wildcat	Feral/Wildcat	Feral Cat	Cat colony
	No. of cats (no. of individual respondents)			
Angus Glens	5 (2)	4 (1)	12 (5)	1 (1)
Blair Atholl	8 (4)		5 (3)	3 (1)
Dulnain	15 (5)		6 (3)	
Morvern	1 (1)		10 (3)	
Strathavon	3 (1)		5 (3)	
Strathbogie	13 (5)		15 (9)	1 (1)
Strathpeffer	4 (3)	3 (2)	3 (3)	2 (1)
Total	49 (21)	7 (3)	56 (29)	7 (4)

7.3.4 Perceived advantages and disadvantages of Wildcats

Most respondents' perceptions of the advantages of Wildcats can be linked to natural habitats and Scotland's heritage. Wildcats are seen as an iconic species that is part of the Scottish natural heritage and that is *"good for Scotland"* and local areas, including the Highlands. Respondents consider Wildcats a key part of native biodiversity, important for healthy and balanced ecosystems. The Wildcat was perceived as *"Scotland's last remaining predator"* in need of protection.

> *"If there are Wildcats in an area it proves that the ecosystem is functioning as it should. They are part of the natural food chain and help to keep a balance in the ecosystem. They are the last predators in our country, all the rest have been lost, so it's a positive thing to still have the species."*

> *"They are native to Scotland and we should do what we can to protect [them] so that they are here for our children and children's children can enjoy them (although they are pretty invisible)."*

Other perceived advantages included the Wildcat's role in pest control (n=14) and also that presence of Wildcats can help build a case against developments that are unpopular with the respondent, such as wind farms. Almost a quarter (n=20) of respondents view the presence of Wildcats and the prospects of seeing them as valuable in bringing more tourism to local areas.

> *"It could be all that is left - if that were the case then as the iconic species that they are – 'tourist attraction' to bring wildlife tourists to area etc."*

According to some, tourism might present a conflict of interest, when increasing numbers of wildlife watchers could cause disturbance to local Wildcats and habitats. A few people wondered whether we should keep the location of Wildcats confidential.

> *"When it was publicised in the press that we had confirmed sighting of Wildcats here, we had quite a few people walking about on the hill trying to sight them. We believe this extremely detrimental to the local population."*

Around a half of respondents (n=50) think there is no disadvantage to having Wildcats in their area. Twenty three respondents were concerned about Wildcat predation of animals, including game birds, lambs or poultry and the associated costs to local business.

"Another protected species predate on game birds that we will have no control or compensation for losses in rearing areas etc."

Six respondents raised questions on whether Wildcats would contribute to existing problems surrounding predation of other species of conservation interest, such as ground nesting birds or Red Squirrels.

7.3.5 Attitudes to Wildcat protection

Overall, respondents had very positive attitudes to Wildcat protection and considered preserving Wildcats to be important (Figure 27). The overwhelming majority (95%) agreed it was important to protect the Wildcat from extinction, with 80% expressing strong agreement. Slightly fewer agreed that Wildcats should be protected in their local area (89%). There was slightly less consensus about whether it was possible to protect Wildcats in the wild; around three quarters tended to agree (42%) or strongly agree (36%), whilst 1 in 7 were undecided (14%) and 8% disagreed. Three quarters (74%) thought that if the Wildcats we have left are not "pure", it is still important to preserve those that are closest to the native form in appearance and behaviour, with the remainder of respondents split between those who disagreed (14%) and who were undecided (12%).

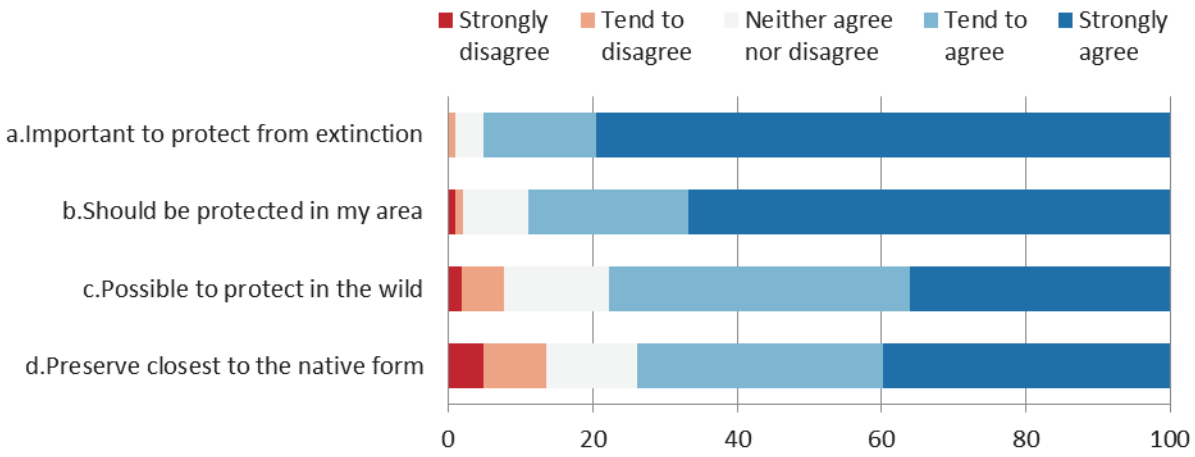


Figure 27. To what extent do you agree or disagree with the following statements? Total % Total sample: a: n = 103, b: n = 99, c: n= 103, d: n= 103.

There was a significant association between having seen evidence of Wildcats and views on preserving cats that are close to a Wildcat but are not "pure" (n=92, p=0.029). Of those who saw Wildcat evidence (n=28) 89% agreed those Wildcats closest to the native form should be preserved, whilst only 67% of those who did not see evidence of Wildcats (n=64) agreed. There was no statistically significant relationship between seeing evidence of Wildcats and the remaining three statements on Wildcat protection described in Figure 27.

Questions were raised about whether Wildcats can still be saved from extinction and whether there are any "pure" Wildcats left. Several respondents considered re-introduction programs as the only or the most feasible option to increase populations of "pure" Wildcats.

"Is re-introduction of pure Wildcats from zoo breeding (i.e. Highland Wildlife Park) being considered/feasible? No evidence of Wildcat in this area been found through various camera trapping projects - all cats photographed are hybrids. Reintroduction may be only possibility if this is actually the case."

Protecting Wildcats was a common theme in the open comments, with many saying that if Wildcat populations are present, we should try to preserve them. Many thought Wildcats needed protection as *"they are becoming a rare animal"* and conservation action cannot be postponed any longer.

> *"Support for a species that is on the verge of extinction is a good idea if a bit late."*

Others would like to see Wildcats survive as they are *"an indigenous Scottish species"* important to the ecosystem and to the present and future generations.

> *"A native mammal to the Highlands, should be protected as the only truly 'wild cat'."*

> *"All rare native species should be conserved - for their own benefit and for the interest and enjoyment of humans now and in the future."*

However, concerns arose over the impact that the presence of Wildcats would have on the local economy, particularly the business of sporting estates.

> *"Wildcats should be protected, but removed if they are killing grouse birds or costing game farms a lot of money or destroying someone's living."*

For some, Wildcats could be preserved in the wild but away from human settlements.

> *"I feel Wildcats can only be protected in remote areas."*

7.3.6 Perceived advantages and disadvantages of feral cats

Nearly half of all respondents did not report any advantages of feral cats (n=48), whilst others thought that the presence of feral cats is advantageous for pest control, including of rodents and rabbits (n=27). The respondents that saw an advantage to feral cats commented that this was as a buffer zone between Wildcats and domestic cats and then only if the feral cats were neutered. A few noted that feral cats keep the balance of wildlife and have the same rights as Wildcats to live in the wild.

> *"Neutered feral cats from a stable population, which serves as a "buffer zone" between lowland production sites (such as kitten farms) and the Scottish Wildcat."*

Several respondents (n=9) thought there were no disadvantages to having feral cats in their area though the majority of respondents could think of at least one disadvantage, including interbreeding with Wildcats (n=36). Some respondents also identified domestic cats as contributing to this problem. Spread of diseases (n=33) to Wildcats and among feral cat populations, mainly FIV (Feline immunodeficiency virus) and FeLV (Feline leukaemia virus), and spread of toxoplasmosis to livestock were also viewed as negatives of feral cats. Concerns were raised over predation of other species (n=20), especially songbirds and ground nesting birds. Several respondents mentioned that feral cats were a nuisance and risk to native wildlife due to competition for territory and food resources (n=8). These concerns are reflected in the following comments:

> *"They pose a predation threat to birds, mammals and the eggs of birds - which one accepts for Wildcats but not for these."*

> *"We have found that many of the "rogue" toms in the area carry the FIV virus and this can endanger not only Wildcat populations but domestic populations."*

One respondent mentioned the need to distinguish between feral cats and hybrids:

> *"If they are hybrids with strong Wildcat genes, they may be the best we have and they have the same advantages as Wildcats."*

7.3.7 Creating priority areas to manage risks to Wildcats

Due to the small number of respondents in some areas, the purposive nature of the sample and the uneven distribution across respondent categories and areas, the results presented here should be viewed with caution and might not be representative of the general public living in these areas. It is also important to note that for the analysis of support for designation by group of respondent, several respondents were counted multiple times. As we were interested in the views of different types of respondents, the responses of those who identified themselves in more than one category were counted for each respondent group.

7.3.7.1 Perceptions of risks to Wildcats

More than three quarters of respondents considered interbreeding with feral cats (83%) and transmission of diseases from feral cats (79%) were serious risks to Wildcats (Figure 28). In contrast, only half of respondents thought that interbreeding with domestic cats (55%) and transmission of diseases from domestic cats (48%) were serious risks to Wildcats, and one in three thought these were not serious (29% and 33% respectively). Perceptions of the risk to Wildcats from accidental killing (e.g. shooting and/or snaring) as part of legitimate predator control were also mixed; just under a half considered this to be a serious risk (47%), whilst only a quarter (25%) thought this was not a serious risk.

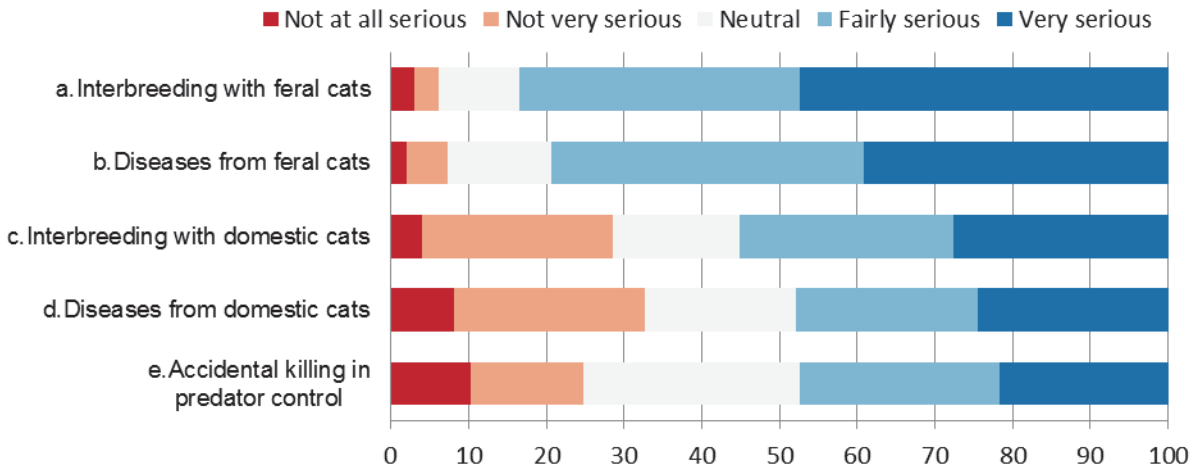


Figure 28. How serious a problem are the following potential risks to Wildcats? Total % Total sample: a: n=97, b: n=97, c: n=97, d: n=98, e: n=98.

Besides interbreeding and transmission of diseases, lack of food resource for Wildcats resulting from habitat degradation and increased competition from other species, including feral cats, was recognised as a potentially serious risk to Wildcats.

> *"If it was introduced in an area with a minimal interference from feral cats or even on an island with suitable habitat and food source to ensure no interbreeding with feral."*

> *"With the large increase in the pine marten population there is a decrease in the food*

available for the Wildcat. There is also a very large population of badgers which could have a bearing on the food supply. Could it also have a bearing on the health of the Wildcat?"

7.3.7.2 Support for creating priority areas for Wildcat conservation

More than half of all respondents (57%) agreed that creating priority areas for Wildcat conservation would be a good response in the face of risks to Wildcats in their area. One in seven thought it was not a good response whilst nearly one third (29%) answered don't know (Figure 29).

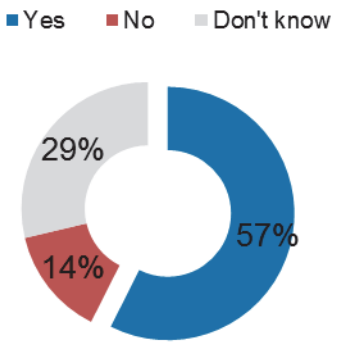


Figure 29. Is establishing a priority area a good response to the risks to Wildcats in your area? n=101.

Vets, estate managers and "other" respondents were the most supportive of setting up priority areas within all respondent groups, with three quarters in each group saying "yes" (76%, n=21; 75%, n=12 and 75%, n=20 respectively) (Table 30). Farmers, the most numerous group (n=34 responses), had the most diverse views and were least likely to favour priority areas, with only 29% in favour, 32% undecided and 38% in opposition. Caution needs to be taken when interpreting these results due to the small counts in some respondent groups and multiple counts of responses for several individual respondents.

Table 30. Support for priority areas by respondent group. n=100.

	Yes	No	Don't know	Total
Vet	76%	0%	24%	21
Estate manager	75%	17%	8%	12
Other respondent	75%	10%	15%	20
Crofter	67%	0%	33%	3
CP volunteer	58%	8%	33%	12
Gamekeeper	56%	22%	22%	9
Farmer	29%	32%	38%	34

Again, when comparing the level of support for establishing priority areas by study area, the different number of respondents in each area needs to be considered. Table 31 indicates that residents in Morvern were the most supportive of their establishment (78%) and for

Dulnain we registered the most mixed range of opinions; only 1 in 3 (38%) endorsed priority areas and the same number (38%) were opposed.

Table 31. Support for priority areas by respondent's area. n=101.

Area	Yes	No	Don't know	Total n
Morvern	78%	11%	11%	9
Strathpeffer	71%	0%	29%	14
Angus Glens	62%	23%	15%	13
Blair Atholl	62%	15%	23%	13
Strathbogie	56%	6%	39%	18
Strathavon	50%	10%	40%	10
Stratherrick	50%	0%	50%	4
Drumtochty	50%	0%	50%	4
Dulnain	38%	38%	25%	16

7.3.7.3 Relationship between perceptions of risk to Wildcats and support for priority areas

There was a highly significant positive relationship between views on the severity of interbreeding of Wildcats with feral cats and support for priority areas (Fisher's Test, n=68, $p<0.001$). Of respondents who considered this risk to be serious, 90% were supportive of establishing priority areas, while only 10% were against. Likewise, those who thought transmission of diseases from feral cats was a serious risk were significantly more likely to embrace setting up of priority areas (Fisher's Test, n=69, $p=0.007$), with 88% in favour and only 12% against.

Responses were more split on the risks of accidental killing of Wildcats within legitimate predator control activities. There was, though, a highly significant association between views on the severity of this risk and support for priority areas (Fisher's Test, n=70, $p=0.001$). Within those who considered this risk to be serious, the majority (94%) would endorse priority areas and only 6% would oppose. There were some mixed opinions and greater uncertainty specifically over how the killing of feral cats within legitimate predator control activities might impact on Wildcats. These opinions might explain the support of some respondents to establishing priority areas where Wildcat-friendly predator control methods would be employed.

There was no statistically significant relationship between support for priority areas and perceptions of the severity of risk to Wildcats from transmission of diseases and interbreeding with domestic cats.

7.3.7.4 Relationship between attitudes to Wildcat protection and support for priority areas

There was a highly significant positive relationship between a preference for Wildcat protection in respondents' local areas and agreement with setting up priority areas to achieve this (Fisher's Test, n=70, $p<0.001$), with 92% of those who thought Wildcats should be protected locally saying "yes" to priority areas and 8% saying "no". There was also a significant relationship between regarding Wildcat protection as important and saying "yes" to a priority area (Fisher's Test, n=71, $p = 0.005$); 85% of those who agreed protecting Wildcats was important would support priority areas, whilst only 15% would oppose. Most respondents who though conserving those cats that are closest to the Wildcat in appearance and behaviour was a worthy cause would endorse priority areas (Fisher's Test, n=71, $p = 0.006$) with 90% supporting and 10% opposing their establishment. No significant

association was found for perceptions on the likelihood of protecting Wildcats in the wild and support for priority areas.

Overall, this suggests there is a strong support for priority areas among people who regard protecting Wildcats as a worthwhile cause. This is also evident in the sentiments expressed by respondents:

> *"If nothing is done there will be no Wildcats left."*
>
> *"Anything which can be done to protect and increase the Wildcat population is good. I would support this idea."*
>
> *"I do believe there may be Wildcats in our area but in extremely limited numbers. I think any measures which would help protect them are worth considering."*
>
> *"I am very afraid it could already be too late for the Wildcat!! Conservation areas would be a great thing and I would be happy to get involved."*
>
> *"Due to the very small or even zero population of the true Wildcats, efforts to create conservation areas where additional protection exists should be encouraged."*
>
> *"As they are endangered it may be the only way to protect the small remaining population."*

7.3.7.5 Information on priority areas

Another important factor that might explain the greater mix of responses to creation of priority areas is a desire for more information about what priority areas might entail. There was also uncertainty about whether any Wildcats were present in areas that would be established as priority. This is evident in several comments:

> *"Would want to know more about how the area would be set up."*
>
> *"Again, it would depend on what exactly it involved and if it implicated on our farming business/methods."*
>
> *"I would need to understand where there were Wildcats within the area and at what risk they were as a result."*

7.3.7.6 Management actions in priority areas

All eight proposed management actions to aid Wildcats were supported or strongly supported by a majority of respondents with provision of more publicly available information about Wildcat protection being the most strongly supported and discouraging the feeding of feral cats being the least supported (though with more than half of respondents still supporting or strongly supporting this (Figure 30).

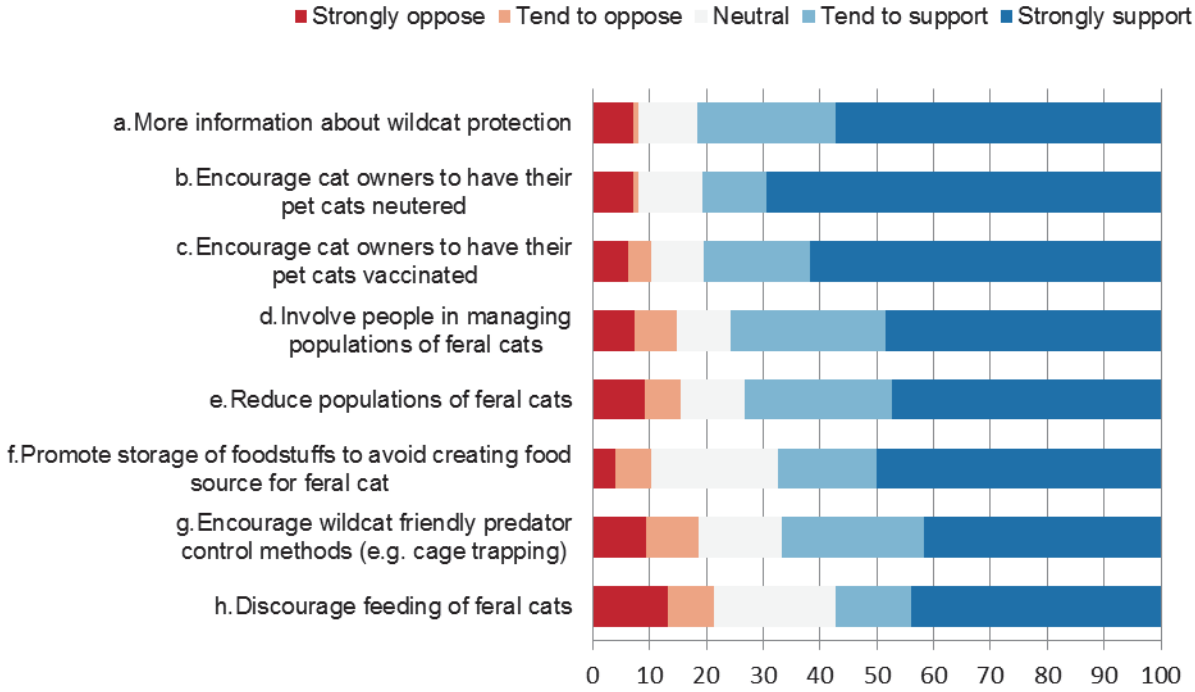


Figure 30. To what extent would you oppose or support each management action? Total % Total sample: a: n=98 b: n=98; c: n=97; d: n=95; e: n=97; f: n=98; g: n=96; h: n=98.

7.3.7.7 Relationship between perceptions of risk to Wildcats and support for management actions

There was a significant association between support for reducing populations of feral cats and regarding interbreeding with feral cats to be a serious risk to Wildcats (Fisher's test, n = 94, p= 0.007). Among respondents who recognized this risk to be serious, 80% supported measures that would reduce populations of feral cats and just 13% opposed. Similarly, those who considered interbreeding with feral cats to be a threat to Wildcats were significantly more likely to support (80%) than oppose (15%) measures that would encourage people to get involved in managing feral cat populations (Fisher's test, n=92, p = 0.012). There was a significant relationship between concerns over transmission of diseases and support for reducing feral cats (Fisher's test, n=94, p= 0.004), with 81% of respondents who regarded this risk to be serious in favour and just 11% against this measure. A significant relationship was also found for transmission of diseases from feral cats and encouraging people to get involved in their management (Fisher's test, n= 92, p= 0.047). Among respondents who thought transmission of diseases from feral cats was a serious threat to Wildcats, 82% would support the measure, whilst 13% would oppose it. Those who thought transmission of diseases from feral cats was a serious threat would be significantly more likely to embrace (64%) than oppose (16%) discouraging feeding of feral cats (Fisher's test, n=95, p = 0.034). The associations between the risks from feral cats and the remaining measures on managing feral cats were not significant.

There was only one significant relationship between perceptions of risks from domestic cats and attitudes towards actions to reduce these risks. The respondents who perceived interbreeding with domestic cats to be a serious risk to Wildcats were significantly more likely to support (84%) than oppose (14%) encouraging cat owners to have their pet cats vaccinated (Fisher's test, n=94, p = 0.039).

Concerns about the threats existing populations of feral and domestic cats can pose to Wildcats and the desirability to take conservation action within priority areas to minimise these threats are also evident from open comments:

> *"Any area that has Wildcats should be a priority area, as the situation is so urgent. However, areas like this one, with a large human population in towns, villages and rural areas with farms will have a large domestic cat population, which will make it difficult because unneutered cats will breed with Wildcats."*

Some respondents welcomed the opportunity for establishing priority areas but suggested that relying on voluntary uptake of conservation measures would not be sufficient in taking Wildcat conservation forward:

> *"…voluntary appeals alone will not be sufficient to change people's behaviour. To ensure that un-neutered domestic cats are not leaked into the environment. Human behaviour will have to be changed by legislation and regulations over breeding of cats. 99.9% of the population would welcome this!"*

> *"All Scotland has to be restored to Wildcat safe habitat. This will take a lot more than the excellent idea of Wildcat protection zones. It will be necessary to stop the over-production of domestic cats (which causes the seepage into all parts of Scottish countryside); 'voluntary' will not succeed."*

Many people reacted strongly to concerns on how cat management measures potentially applied in priority areas would impact on the wellbeing of feral cats and feared this might involve unnecessary culling:

> *"The reason I strongly oppose getting rid of feral cats is that pet cats could also get caught in traps or shot. Feral cats also have a right to live in the wild! I strongly oppose any culling of cats. They do good, not harm."*

> *"I am concerned that feral cats may be slaughtered needlessly in the drive to save the Wildcat. Healthy, neutered feral colonies post no threat to the Wildcat."*

> *"I would like to see Wildcats in the area but... Why should feral cats be the ones to suffer. It doesn't follow that Wildcats will multiply simply because feral cats have been dispensed with."*

The issue of who would be involved in managing feral cat populations was also of importance:

> *"…getting the correct people involved to avoid the 'bunny huggers' who will clash with those involved in legitimate control of feral cats."*

> *"Wouldn't want locals to take feral cat control into their own hands."*

Further uncertainty around the effect of wildcat conservation actions on local pet cat populations and their owners was demonstrated in several responses:

> *"I agree that Wildcats should be conserved. However, I am not sure how that should be done. My concern is how the management of Wildcat conservation would affect domestic cats in the areas concerned."*

"… people - especially older folk – may incur extra vet costs by having to get their pet (domestic cat) vaccinated and/or neutered. This additional cost would also affect anyone on a low income."

7.3.7.8 Concerns about priority areas

Many people said they had no concerns over their area becoming a priority area. There was, though, uncertainty on how local communities may be affected, especially if establishing these areas involved placing any restrictions on current activities.

"None, provided there was no impacts likely to be imposed on the local communities other wildlife management and economics to the area. The cats are there possibly because of the way it is currently managed."

"Depends what constraints it puts on other legitimate uses of land area."

"More imposed legislation on an already strictly controlled environment (no go areas or restricted game bird release sites etc."

Some respondents expressed concern over the potential impact of increased wildlife tourism on local areas:

"From experience we know that we have Wildcat population in the immediate area surrounding XXXX. …my worry would be members of the public specifically entering areas publically identified thereby disturbing their environment. XXXX for example is a well-known walking/hiking area, especially for dog owners."

"No benefits apparent to landowners. The general public have right of access which is used to a great extent. To increase activity for people looking for Wildcats is not very owner friendly."

"So long as it has teeth and is effective not just in name only. Plus, need to be mindful not to turn the area into a Wildcat circus - endless film crews, increase in folk out looking/disturbing, trying to photograph etc. Take care of raising the profile to the Wildcat's detriment."

Views on the potential boundaries of priority areas differed, depending on whether people thought that concentrated effort in a local area would be more effective than conservation action involving the whole country:

"The whole country should be applying the conservation measures. If there are some designated areas, people in non-designated areas will/may not take any management action."

"A priority area would be easier to manage rather than "blanket measures" which cover huge areas."

"If we can concentrate on certain areas where Wildcats are known to be…pure, then we can have a chance trying to preserve them. Over large swathes of the country is probably a lost cause."

7.3.7.9 Public involvement in awareness-raising

Raising awareness of Wildcat conservation was seen as beneficial to wider conservation for both wildlife and to nature enthusiasts:

"The public should be made aware the area supports wildlife and for that reason notices should be installed locally. A large number of the public seek pleasure with nature and these members will appreciate conservation here in the glen."

Some people called for measures that would go beyond raising awareness and that would be targeted at specific audiences to change their attitudes towards cat management:

"We need to educate people starting from primary school. Use the labels on cat food to get the messages across. Need to change the attitude of gamekeepers whose instincts are to shoot/kill predators including cats regardless of whether they are Wildcats, hybrids or ferals."

"This is a shooting estate and cats- of any sort - are at great risk of being shot. It is possible that with education and discussion that this risk might be minimised."

"Education for general public and farmers about the effects of un-neutered domestic/feral cats on Wildcat survival. Australia has laws that mean cats must be neutered?... Not sure how enforceable it is? "

7.3.7.10 Communication and co-operation

For many respondents, the issue of utmost importance was co-operation among all parties and individuals involved in decision-making around creating priority where "*communication is key"*.

"To me it seems that the greatest risk is from lack of co-ordination and co-operation between the different groups involved. If they could all get round the same table and come up with a sensible, practicable plan and then carry it out in a shared fashion, that would be an excellent way forward. At present each group is doing its own thing and either actions will be omitted or dislocated. The ones that will suffer most will be the Wildcats."

"Communication with all parties is vital. Particularly members of the public if a TNR programme is to be carried out and I would advocate a series of public meetings in any area chosen."

7.3.8 Attitudes to Trap-Neuter-Release (TNR)

7.3.8.1 Awareness of local Trap-Neuter-Release Programmes

Awareness of any existing local TNR programmes was quite low, with only one third (31%) of people saying they were aware of TNR programmes in their area (Figure 31). It is not known how closely this matches the actual prevalence of TNR programs in the study areas.

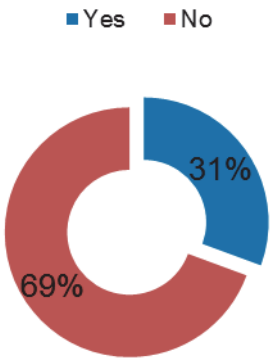


Figure 31. Are you aware of any Trap-Neuter-Release programmes in your area? n=98.

Cats Protection were the most commonly recognised provider of local TNR programmes and the involvement of veterinary clinics in TNR was mentioned twice.

7.3.8.2 Support and feasibility of Trap-Neuter-Release programmes

Two thirds (66%, n=99) of respondents would be supportive of a co-ordinated TNR programme (Figure 32).

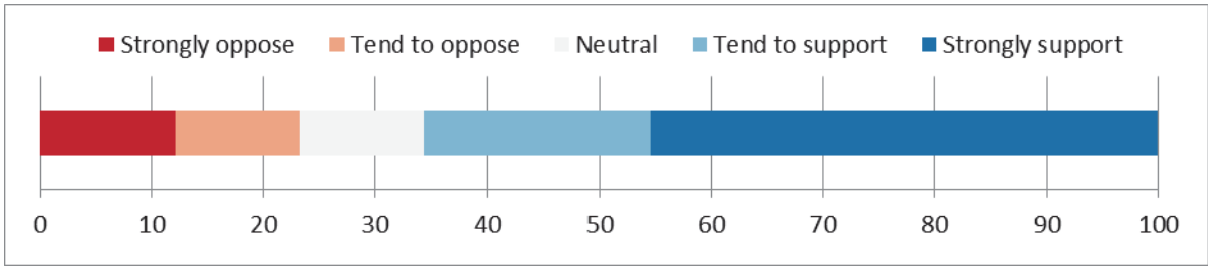


Figure 32. To what extent would you support a co-ordinated TNR programme? Total %. n=99.

Nearly two thirds (59%) of respondents think TNR is feasible in their area (Figure 33).

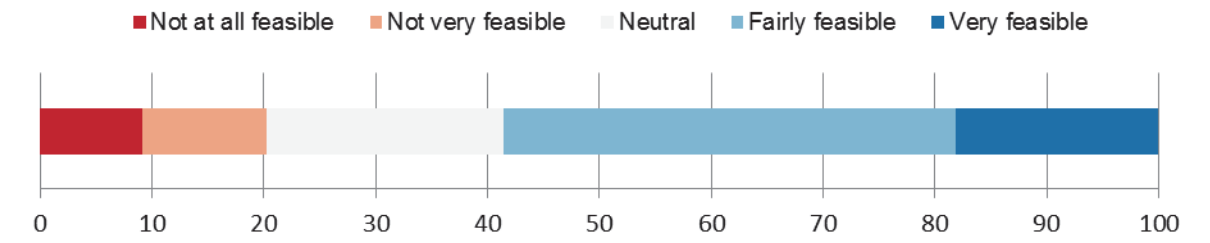


Figure 33. To what extent would a TNR programme be feasible for managing feral cat populations? Total %. n=99.

There is a highly significant correlation between perceptions of the feasibility of TNR and support for TNR (Fisher's test, n=97, $p<0.001$); 91% of those who consider TNR feasible would support a coordinated TNR programme, whilst just 9% would oppose.

Support for TNR was highest among Cats Protection volunteers (92%, n=12) and vets (91%, n=21) and these two groups were also most likely to consider TNR to be feasible (83% and 86% respectively). There were mixed reactions among estate managers and farmers, with the former split between support (50%, n=12) and opposition (50%) to TNR, some of whom opposed the subsequent release of trapped cats. Less than half (46%, n=33) of farmers were in favour of TNR and 30% were opposed. Estate managers were more likely than farmers to think TNR was feasible (58% and 42% respectively). Gamekeepers tended to oppose TNR (89%, n=9) and were more likely to consider it unfeasible (67%). Again, caution needs to be exercised when interpreting these results due to uneven distribution across respondent categories and multiple counts of responses for several individual respondents.

Suggesting TNR as an effective method for controlling populations of feral cats provoked some strongly negative reactions from those who favoured lethal predator control methods. Several respondents (13) consider re-releasing cats ineffective:

> *"I would kill them, not release them! The exception would be any feral cats that were close to Wildcats in appearance. I support* [trapping and neutering] *but I do not really favour releasing them at all, why would you?"*

> *"I'm unconvinced of the welfare of trap neuter release. It also doesn't eliminate disease spread, is trap and euthanize a better but controversial option?"*

Some respondents thought that one of the issues is that releasing feral cats back in the wild might have adverse impacts on Wildcat populations in terms of competition for territory and food:

> *"Releasing them only puts strain on wild cat populations competing for food, territory etc."*

> *"Would prefer to see the feral cats destroyed to prevent competition for food and territory to allow Wildcat numbers to possibly rise again."*

Concerns were also raised over the possibility that Wildcats and domestic cats might be caught in traps and questions were raised whether we can feral cats can always be differentiated from pet cats when carrying out TNR.

Several people thought TNR would not be feasible in reducing the numbers of feral cats as their population levels are too high and there are too many areas to cover, many of which are inaccessible.

> *"I don't think you could ever catch the last feral cat; there would be too many areas not in the scheme would harbour breeding populations".*

On the other hand, many of those involved in cat management praised TNR.

> *"We have been fairly successful and feel that more farmers realise how important it is to have a small, healthy feral colony on their property."*

7.3.8.3 Management of TNR

Although the question on who should lead on trapping within a TNR programme gave the option to tick only one answer that would best describe one's preference, many respondents chose multiple answers. Thus Figure 34 shows the frequency of answers to each option.

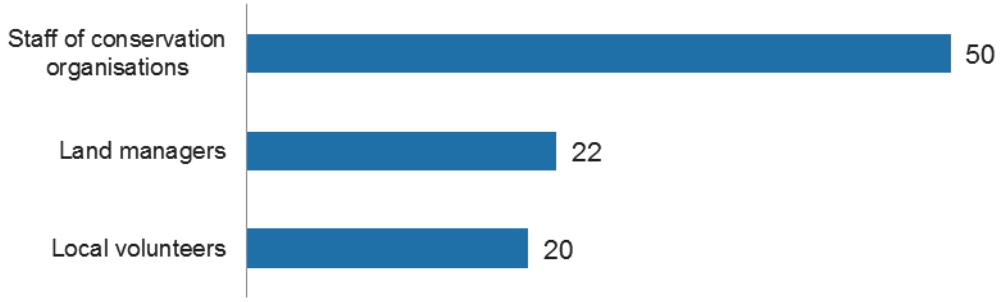


Figure 34. Who should carry out a co-ordinated Trap-Neuter-Release programme in your area? n=82.

More than half of the 82 respondents expressed preference for the TNR to be led by staff from conservation organisations. On the other hand, there was some support for the provision of funding for TNR to be conducted by local people and that this could be a welcome contribution to the local economy:

> *"Perhaps use the skill of gamekeeper or other local business and support local economy by giving funds to this business".*

> *"Local knowledge needs to be used and obviously if people are getting paid for their work in trapping or removing feral cats, then I think you will be likely to get a better uptake of and offers of assistance."*

Finally, cooperation between all the above parties in carrying out a TNR programme was seen as desirable.

7.3.9 Predator control

Twenty-four respondents indicated they are currently using predator control methods (Table 32), the majority being farmers or vets. Among these respondents are some involved in management of feral cats for purposes other than predator control, such as Trap-Neuter-Release for cat welfare purposes. Lamping and shooting and cage trapping and snaring were the most frequently reported control methods. The total reported number of feral cats killed or trapped by predator control methods was 252. Only six respondents reported using cage trapping and neutering as a combined control method though more than half the total number of cats reported as trapped were through this method. Indeed one respondent reporting having trapped 100 cats.

Table 32. Predator control methods used and approximate number of feral cats trapped or killed through each method in the last 12 months. n=24

Predator control methods	Currently used	Feral killed/trapped
Lamping & shooting	19	71
Snaring	3	0
Cage trapping & snaring	11	32
Cage trapping & neutering	6	146
Other	5	3
Total	44	252

The “other” category primarily contained comments on slight variations to these methods.

Thirty-three people answered the question relative to readiness to make changes to their predator control methods to reduce risks to Wildcats if their area was established a priority area for Wildcat conservation (Figure 35). This is more respondents than responded to the previous question on the current use of predator control methods. This suggests that there are people in our sample who are potentially involved in predator control but who are currently not actively using any control methods. Due to a small respondent count to this question, absolute numbers of responses are reported. Fifteen people would not consider making changes to their methods, nine would and the same number did not know.

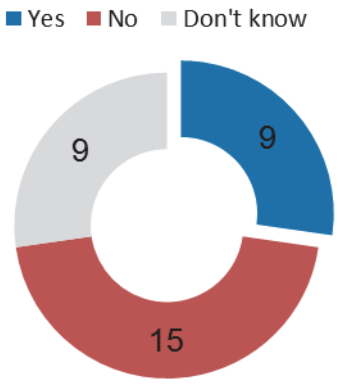


Figure 35. Would you make changes to your predator control methods to reduce risks to Wildcats? n=33.

It is apparent from other comments that this mixed response might be caused by uncertainty on the possible limitations imposed on some forms of predator control methods, namely shooting and snaring. Some expressed discontent with the current extent of lethal methods and called for stricter regulations and legislation that would favour TNR. Those who thought lethal methods were more effective than TNR at reducing feral cat populations might oppose any restrictions on lethal control activities.

7.3.10 Neutering and vaccination of domestic cats

Half of respondents (50%) were not sure whether neutering of domestic cats was a common practice in their area and 44% believed it was a common practice (Figure 36). There was even more uncertainty on whether vaccinating pet cats was common, with 59% saying they

did not know, and only one in three thought vaccinating was common (Figure 37). Some respondents explained they did not know the answers because they had little information on the issue or were not cat owners.

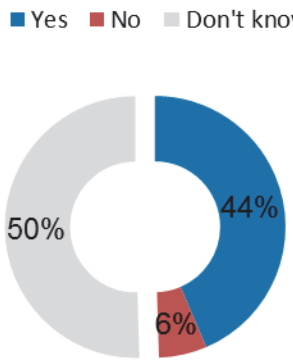


Figure 36. Is neutering of pet cats a common practice in your area? N=101.

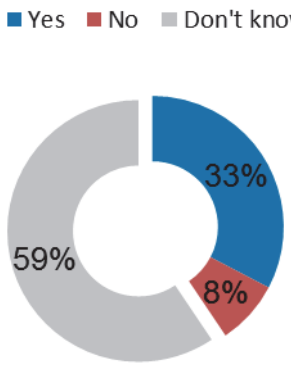


Figure 37. Is vaccinating pet cats a common practice in your area? n=101.

Many vets stated that the levels of neutering uptake were high among their clients, usually higher than levels of vaccinating pet cats. Two veterinary employees added their clients were provided with initial vaccinations, including primary courses of flu/enteritis/leukaemia vaccines, but many did not continue in on-going annual vaccination.

> *"Approximately 80% of cats registered in our practice are vaccinated and probably 90 plus % are neutered".*

Employees and volunteers of Cats Protection also thought that levels of neutering were high and added they provide first vaccinations for all the cats they rehomed.

In several areas, vouchers offering discounts or free neutering have led to an increase in the levels of neutering.

> *"I am involved in Cats Protection work and we have a good policy with vaccination and neutering. Providing vouchers to people wanting to neuter their cats but unable to do so because of costs".*

> *"We have run a free or assisted neutering system for many years - we paid for nearly 70 cats to be neutered in 2013. And cats homed by Cats Protection are vaccinated*."

There was some concern that feral cats that can be found in rural areas, and specifically feral cats living on farms, were often not neutered and vaccinated.

> *"Not all pet cats vaccinated. Those in rural locations are less likely to be vaccinated (even if neutered and well cared for) and yes these are most likely to contact wild or feral cats".*

> *"Almost 100%* [of cats are neutered and vaccinated] *except on farms and estates etc. where "semi-feral" cats are rarely neutered and vaccinated - these "semi-ferals" are the greatest risks to pure Wildcats".*

7.4 Discussion and Conclusions

The questionnaire survey revealed a high level of support for Wildcat conservation though with some concern over what priority areas might mean in terms of restrictions on current management practices. It was apparent that most respondents had not seen Wildcats themselves in the proposed priority areas. Some who had seen them reported that Wildcats were far less common than formerly. Against this background, support for conserving cats that most closely resembled Wildcats, even if they were not "pure" Wildcats, was generally high. Support for specific management actions was mixed; whilst there was broad recognition of the threats posed to Wildcats by interbreeding with feral cats, some respondents favoured lethal control measures of feral cats over TNR.

7.4.1 Survey sample

At least 221 respondents were contacted and 104 completed questionnaires were received. There were large variations in the number of questionnaires received between different study areas and different respondent types. It is important to consider the potential selection bias associated with this type of convenience sampling. Because the sample was mostly limited to the type of respondents involved in land and cat management, responses might not necessarily be representative of whole population. The wide range of activities these groups undertake in relation to cat management may drive differences in experiences and preference for different cat management measures. Therefore, any comparison of results between groups needs to be interpreted with caution as the views of some groups of respondents are underrepresented.

Another response bias is linked with people's motivations for completing the questionnaire. Motivation levels might be higher for those who have knowledge of cat management or an interest in Wildcat conservation. To increase people's willingness to participate, we asked general questions on issues of Wildcat conservation and included open-ended questions and "other" options where respondents could have provided their own honest responses.

A non-response bias occurs when some respondents included in the initial sample refuse to participate or cannot be reached (Dillman, 2007). To tackle the bias, we did not ask personal or sensitive information that might deter people from sharing their views openly and reassured that responses would not be individually attributed. Those who did not send back questionnaires after the first invitation to participate in the survey were sent additional questionnaires encouraging them to get involved and the cover letters explained the importance of their responses to the future decision-making on Wildcat conservation. Nonetheless, it is possible that people who are less supportive of Wildcat conservation may have been less likely to complete and return a questionnaire.

7.4.2 Public sightings of Wildcats and feral cats

Fewer respondents had seen evidence of Wildcats (n=29) than of feral cats (n=65) with the majority of evidence comprising sightings. We provided the same wildlife identification guide as Davies and Gray (2010) to give respondents guidance on how to distinguish Wildcats from feral cats. These sightings are unsupported by any further evidence, for example photos, and thus cannot be verified for accuracy. The difficulty of verifying public records of Wildcat sightings is reported in previous studies (Easterbee *et.al.*, 1991; Davies and Gray, 2010). The records do, however, give indication of local people's experiences and contact with Wildcats and feral cats, which might influence their attitudes towards measures linked with Wildcat conservation efforts.

7.4.3 Attitudes to Wildcat protection

In line with findings from Scottish omnibus survey that the Wildcat is among the top species associated with Scotland (Granville & Mulholland, 2013), many of our respondents considered the Wildcat to be an iconic species that is a key part of the Scottish natural heritage, of native biodiversity, important for healthy and balanced ecosystems. There was concern that Wildcats are becoming rare and are in need of saving from extinction. The majority of respondents thought protecting Wildcats was important and would like to see Wildcats protected in their local areas. Most people held positive views about the possibility of saving Wildcats in the wild although some questioned whether it was too late now and whether captive breeding would be a more effective solution. Most respondents believed that we should preserve those Wildcats that are not "pure" and there were some who questioned whether there are any "pure" Wildcats left. Overall, the presence of Wildcats was seen as an asset to Scotland, its natural heritage and valuable in bringing more tourism to the local area though some concerns were raised, linked to possible negative impact of Wildcat predation of livestock and game birds species on farms and sporting estates.

7.4.4 Priority areas and management actions

Our findings reveal that more than half of all respondents were in favour of setting up priority areas and only one in seven would not support them. Around one third of respondents were undecided about whether this was a good response to the risks to Wildcats locally. Much of this uncertainty could be attributed to uncertainty on behalf of the respondent as to how these areas would be established, how they would impact local communities and what restrictions might be put in place resulting from measures to protect Wildcats. In light of this, the most supported conservation action was making more information publicly available about Wildcat protection.

An area-based comparison of responses points to some differences in the level of support for priority areas. The number of respondents was limited and variable across study areas though and any interpretation of results needs to be exercised with caution. Respondents in six out of nine study areas tended to favour priority areas or were undecided but with low levels of opposition. Of the remaining three study areas, Dulnain was the one with least support whilst the small number of responses from Stratherrick and Drumtochty were equally split between support and being undecided. The reasons for the lower level of support for priority areas at Dulnain are unclear but further analysis of responses indicated opposition and uncertainty among respondents could be linked to concerns over wildcats killing lambs, lack of "pure" wildcat populations, the potential boundary of priority areas (one respondent thought the whole country should be designated) and over who would be involved in management (four respondents were opposed to involving local people in managing feral cats). Two respondents who did not support priority areas expressed concern about unnecessary interfering with wildcat populations and the possible negative impacts of bringing attention of the public to where wildcats can be found. There was uncertainty about whether accidental killing during predator control was a risk to wildcats and about the impacts of conservation measures on current predator control but two respondents expressed concern about unnecessary killing and disregard for the rights of feral cats as a result of conservation measures.

Vets, estate managers, and respondents in the "other" category were most likely to endorse priority areas. More than half of Cats Protection volunteers and gamekeepers were also in favour but the latter were more likely to oppose priority area establishment than the former. Farmers had the most mixed response from all respondent groups and were the least likely to support priority areas. These results indicate there is a lack of consensus about the merits of priority areas between different groups of local people involved in cat and land

management. To examine this further, we consider below the perceptions of risks to Wildcats and attitudes towards actions to manage feral and domestic cats.

7.4.4.1 Feral cat management

Respondents generally reported that there were no advantages of feral cats, except for pest control and that neutered feral cats may act as a buffer between Wildcats and domestic cats. Perceived disadvantages included interbreeding with Wildcats, spread of diseases to other cats and livestock, and predation of other species, especially birds. Such concerns over the potential risks of feral cats to wildlife (including Wildcats) and to agricultural animals need to be taken into account when evaluating individual preferences for managing feral colonies. In this context, other studies have found that beliefs held about feral cats predicted attitudes towards various measures for feral cat management (Wald & Jacobson, 2013; Wald *et al*., 2013).

Interbreeding with feral cats and spread of diseases from feral cats were considered to be the most serious threats to Wildcats. Those who thought these were serious risks were significantly more likely to support the creation of priority areas than to oppose them and to support measures that would encourage local people to be actively involved in managing feral cat populations and actions aimed at reducing feral cat populations. These were also the two most popular measures to control feral cats. Even though discouraging feeding of feral cats was the most opposed action, those who thought transmission of diseases was a threat to wildcats were significantly more likely to support this measure. The measure, alongside encouraging proper storage of foodstuffs to avoid creating food sources for feral cats, also received a mixed response, which might be explained by concerns for the well-being of feral cats if their food sources were removed.

Questions about how to reduce feral cat populations and who should be involved; generated polarized views. Trap-Neuter-Release (TNR) was strongly opposed by those in favour of lethal predator control methods. These respondents often stated that re-releasing feral cats into the wild was ineffective in preventing spread of disease and competition for food and territory with Wildcats. In contrast, TNR advocates recognised this as a more humane method of control to address the welfare, value and rights of feral cats and to prevent unnecessary culling. All in all, two thirds of respondents would support a co-ordinated TNR programme and slightly fewer thought it was feasible at controlling feral cat populations. The majority of those who considered TNR feasible were significantly more likely to support TNR than to oppose it.

People expressed preference for TNR to be carried out by staff of conservation organisations, followed by land managers and local volunteers, mostly Cats Protection. Cooperation between all the above parties was seen as key. Perceived barriers to the feasibility of TNR included large populations of feral cats and large areas to be covered by TNR, lack of standardized guidelines, insufficient funding and long-term commitment.

7.4.4.2 Domestic cat management

There was broad support for managing domestic cats by encouraging their neutering and vaccination. There was greater support for this than for actions aimed at managing feral cats. In comparison to the risks from Wildcats, which were considered to be serious by the majority of respondents, only half thought that risks associated with interbreeding with, and spread of diseases from, domestic cats were serious. Those who thought interbreeding with domestic cats was a serious threat to Wildcats were significantly more likely to support encouraging pet cat vaccination than to oppose it.

There was a low level of knowledge among most respondents about whether neutering and vaccinating pet cats was common in local areas. Vets and Cats Protection volunteers mostly reported that levels of neutering uptake were very high, usually higher than levels of vaccinating. There was some concern that feral cats that can be found in rural areas, and specifically feral cats living on farms, were often not neutered and vaccinated, similar to concerns reported during the Cairngorms Wildcat Project (Hetherington & Campbell, 2012). Several respondents would prefer legislation on compulsory neutering over voluntary uptake as part of measures advocating responsible domestic cat ownership. The additional costs of neutering and vaccinations imposed on cat owners were also of concern. Some respondents expressed concern that domestic cats may be inadvertently trapped in TNR and may be difficult to distinguish from feral cats.

7.4.4.3 Predator control

Inadvertent killing of Wildcats during legitimate feral cat control operations was identified as a potential threat to Wildcats (Hetherington & Campbell, 2012). There was a lack of clear consensus in response to survey questions about predator control. Whilst there were clear views about whether or not legitimate predator control was a threat to Wildcats, there were also a large number of respondents who were undecided on this matter. Almost half of those who carry out predator control would not consider making changes to their methods in order to minimise risks to Wildcats. In some cases this is because they did not think that their current activities posed a threat to Wildcats. Opposition to actions on predator control also appear for some respondents to be related to a fear of their activities being restricted, for example by legislation, as part of conservation efforts.

7.4.5 Recommendations

7.4.5.1 Wildcat protection

Even though most had limited experience of seeing Wildcats, questionnaire respondents believe Wildcats are a valuable part of Scotland's natural heritage and should be saved. To make it easy for people to shape and influence what will happen in Wildcat conservation, future public campaigns should provide clear messages on what people can do locally.

7.4.5.2 Predator control

There was considerable uncertainty about risks to Wildcats from accidental killing during predator control. It is important to understand the severity of these risks if those involved in predator control are to consider adopting more Wildcat-friendly methods where necessary. The challenge for Wildcat conservation is to build on previous work from the Cairngorms Wildcat Project, working in partnerships with the game keeping profession and farmers, sharing knowledge of predator control and improving confidence in wildcat identification. It is also advisable to actively engage in a dialogue with stakeholders involved in land management, including farming and sporting businesses to ensure conservation action contributes to, rather than harms, the local economy.

7.4.5.3 Priority areas and shared decision-making space

Our study shows that despite a lot of support for individual management actions, there is uncertainty on what would be involved in creating priority areas and what this would mean for local people. This is reflected in support for provision of more information on Wildcat protection in general, and on the impacts of individual conservation actions specifically.

Future engagement with different stakeholder groups should move beyond information giving to information building. To this end, we recommend running a series of public workshops targeted at identifying local positions with regard to Wildcat protection and

assessing the different interests in cat and land management. These workshops should involve representatives from all groups that have a stake in Wildcat conservation and focus on evaluating how positions and support differ between stakeholder groups and how common ground can be built on to maximise the likelihood of Wildcat conservation actions being successful.

8. GENERAL DISCUSSION

8.1 Limitations

The work presented in this report is based on research and monitoring carried out over a six month period from October 2013 to March 2014. Fieldwork was concentrated in the period November to February. A number of limitations of this approach should be borne in mind when interpreting the results.

For practical reasons, sites were not surveyed simultaneously, which would have been best for comparisons between sites. There is some evidence that Wildcat behaviour, and hence probability of being captured by a camera trap, may vary seasonally. For example, periods of snow may impede movements and so lower, sheltered, more wooded areas may be used in winter and higher, more exposed ground may be more used in summer (e.g. Mermod & Liberek, 2002), though the absence of prolonged cold weather during the survey period for the work presented here may have served to reduce the potential for seasonality to confound the results. Additionally, male Wildcats may roam more in the late winter, at mating time, in search of females (Wittmer 2001) and this may explain why previous live-trapping of Wildcats in Scotland has had a greater success rate in winter than in autumn (Daniels & Macdonald 2002). It is possible, therefore, that the lack of recaptures at different cameras at Strathbogie, despite the overall number of cats recorded there, may be because this site was camera-trapped mainly in November, when animals are more sedentary, before such wandering behaviour commences. Alternatively, it is also possible that, with the relatively high number of individual cats recorded compared to most of the other study sites (see Table 22), home ranges were smaller, which would also serve to reduce the chances of an animal being captured on multiple cameras.

Camera trapping and live-trapping (and collection of genetic material) are essentially sampling approaches. Cats detected by this work will represent a sub-sample of cats likely to be within the study areas. Although the chosen camera spacing follows protocols recommended by, for example, Kilshaw & Macdonald (2011), there is no guarantee that a cat present in the area will encounter a camera. Nor is there any guarantee that encounters will result in an image being recorded. Hetherington & Campbell (2012), using two camera traps per sample point, showed that a survey period of 21 days captured images of around 50% of the individual cats caught on camera over a longer, 60 day, survey. Given that an unknown number of cats are still likely to evade detection over this period, the 21 day sample period may result in images of fewer than half the cats present in the study area. Nonetheless Can *et al.,* (2011), Kilshaw & Macdonald (2011), Hetherington & Campbell (2012) and Kilshaw *et al.,* (2014) have shown such surveys to give results sufficiently robust for purposes of comparison between sites or between survey periods and, in the context of the current survey, such a sample period allowed deployment of more cameras over a larger area and larger number of sites than would otherwise have been the case.

8.2 Strength of evidence

This study's strength lies in the use of multiple evidence streams to asses which areas to take forward for targeting of conservation actions. Selection of sample areas followed a standardised protocol across sites and was based on preliminary analysis showing what area was required to, at least theoretically, support a viable Wildcat population. Subsequently, cats caught on camera, or live-trapped, were assessed for pelage scores by a team of experts and assessed using both strict and relaxed identification criteria.

A variety of metrics are presented for comparing cat numbers between sites. Spatially explicit capture-recapture analysis was only possible for a small sub-set of sites, but, for these sites, it provides information that can be used in conjunction with future surveys to assess population trends. Although subject to unknown degrees of statistical variability,

presentation of metrics on capture rates and on MNA (minimum number known to be alive) provide additional ways of carrying out crude comparisons of cat populations between sites for the sake of adding to information on which have the most merit for selection as priority areas.

Analysis of genetic material brought in calibration samples from a wider range of cats and included analysis of additional samples obtained recently, as well as those from the field survey described here. The finding that there is widespread introgression of domestic cat DNA into Wildcat populations is consistent with previous findings. Further work on the correspondence between pelage characteristics and newly established molecular markers would help to clarify the relationship between these indicators.

The questionnaire survey revealed broad support for Wildcat conservation actions. There was some variation among respondent type in support for particular actions and these findings should help to shape and inform implementation of conservation actions over the course of the Wildcat Conservation Action Plan.

8.3 Recommendations for future work

The work presented in this report provides the evidence base to support the recommended selection of six priority areas from the nine candidate areas investigated. The caveats presented above are typical of short studies that involve assessing populations of rare and elusive animals. The perilous status of the Wildcat as a Scottish animal, though, means that the caveats presented cannot be used as a justification for delaying action. Instead, an adaptive approach, as is reflected within the Scottish Wildcat Conservation Action Plan, should be taken, with adjustments made as appropriate as further evidence becomes available.

Ongoing monitoring alongside clearly defined objectives in priority areas is essential to determine the success or otherwise of conservation actions. The recommended priority areas are considerably larger than the study areas for this work and take account of continuous areas of habitat including areas that an expanding population would be likely to colonise. Although it has limitations which need to be taken into account, camera trapping is a highly efficient way to establish the presence of cats, to provide images for assessment of pelage characteristics and to form the basis of an objective sampling regime. Given the failure of the sampling design used here to generate sufficient data for estimating robust population estimates, though, fieldwork during the course of the Scottish Wildcat Conservation Action Plan will need to be carried out in a more substantial way than that presented here if trends in population sizes, as a measure of conservation success, are to be assessed over time. In particular such effort should be spread over a longer timescale to increase the number of detection histories. Such sampling regimes should be guided by simulation studies on data collected in this and other studies to determine that the sample design employed stands a good chance of producing reliable trend data. Such simulations were beyond the scope of the current project.

Genetic sampling provided the opportunity to assess the relative levels of hybridisation in each of the survey areas. The number of samples obtained that can be attributed to each of the priority areas is lower than would have been desirable, reflecting the nature of presumed low density cat populations. Furthermore the cats live-trapped did not include those that scored highest on pelage characteristics and it is not clear if this was by chance or if Wildcats are harder to catch than hybrid or feral domestic cats. The results suggest that in all populations sampled there is a degree of introgression. The most common assignment was to F2 hybrids, although as the analysis used only enables detection of up to two generations of hybridisation, these may represent much longer histories of introgression. However, there were contemporary samples of cats from museum sources and from the wild

that showed >70% of sampled DNA being indicative of Wildcat. There is no established threshold as to what proportion of sampled DNA should indicate Wildcat origin for a cat to be regarded as a Wildcat for conservation and management purposes. Recent live-trapping studies, though, show that most cats that meet that 70% level resemble Wildcats on pelage (Roo Campbell, unpublished data). A further study is recommended to clarify the relationships between genetic and pelage criteria.

Conservation of Wildcats is integrally linked to, and dependent on, actions of local residents and land managers. The questionnaire survey presented here provides some benchmarks for support of conservation actions. The opportunity should be taken through delivery of the Scottish Wildcat Conservation Action Plan to increase our understanding of stakeholder motivations and ways of delivering management actions that achieve the largest buy-in. Such findings will increase the chances of being able to successfully apply Wildcat conservation actions across a larger extent beyond the priority areas.

Ultimately, it is important that there is a carefully structured methodology for assessing the results of Wildcat conservation actions in the priority areas. The coordinated approach to selection and management of these areas provides a clear opportunity for developing and fine-tuning techniques for conserving Wildcats. If, in the longer term, there is a push to restore Wildcat populations across Scotland, it is essential that there is a good evidence base for applying actions across larger areas. This report provides a starting point for designing studies to generate such evidence. Whilst the data derived were insufficient for robust population estimates, they may be able to be used in conjunction with data from other studies in power analysis to inform the scale and duration of monitoring that needs to be carried out in order to improve on these in future monitoring programs.

9. PRIORITY AREA RECOMMENDATIONS

The main objective of this study was to identify six priority areas from an initial list of nine in which Wildcat conservation action is most likely to be effective. These areas are where it is planned that conservation resources will be directed during the lifetime of the Scottish Wildcat Conservation Action Plan. The Plan considers that focused action, such as encouraging responsible cat ownership, managing feral cats and reducing accidental killing during predator control activities, will have the greatest prospect of improving conditions for Wildcats. The areas were all selected initially as they have recent, verified Wildcat records. Six sites are presented here as being recommended for selection, along with a summary of the evidence justifying the selection. However, it is recognised that the evidence base is not as strong as would have been desirable. Sampling secretive species that exist at low densities over a limited time period can produce data with large degrees of inherent uncertainties. Repeat sampling along the same lines as presented here could generate a different hierarchy of sites in terms of existing Wildcat populations. Nonetheless, the evidence is the best currently available for prioritising conservation actions and the uncertainties do not justify delay in efforts to protect Wildcats.

There remains the potential to carry out actions in areas that are not selected as being among the six priority areas but resources will be focused on the priority areas that are ultimately agreed. Some of the actions in the Scottish Wildcat Conservation Action Plan are wider in their outreach in terms of education and awareness about Wildcats and feral and domestic cats and have the potential to benefit Wildcats across their range in Scotland.

The recommended priority areas are considerably larger than the study areas for the camera trapping surveys and take account of continuous areas of habitat including areas that an expanding Wildcat population would be likely to colonise (see Table 33). Although the overall extent of the recommended priority areas varies from 20,576 Ha to 48,697 Ha, the extent of high quality Wildcat habitat as defined in Section 3.2, ranges just from 7,500 Ha to 12,899 Ha. The recommended boundaries have been influenced by information on wildcats from other recent surveys and the practical considerations of management boundaries such as areas of land ownership. In some areas, recommended boundaries follow coastline or major rivers. In other situations they follow watersheds, reflecting the likely extent of areas of land that are managed as continuous units. Where initially selected boundaries follow woodland, a 2 km buffer is applied to recognise the importance of adjacent hill ground to hunting cats. In some such situations, woodland may be more favoured in winter (the time of the surveys described in this report) with hill ground being more utilised in summer (e.g. Mermod & Limberek, 2002). Towns and villages with more than 1,000 inhabitants were excluded. Whilst education and awareness-raising may be carried out in these communities, intensive actions, such as Trap-Neuter-Release, are likely to be more efficiently applied within or closer to areas more likely to be occupied by Wildcats.

Table 33. Area of land and area of good quality Wildcat habitat within each recommended priority area. Habitats above 650m, and habitat within the buffer areas around settlements (900 m) and habitation (200 m) were excluded from the estimate of available preferred habitat as per habitat selection description in Section 3.2. Land Cover Scotland 1988 (LCS88) data were used to remove freshwater areas from total available habitat.

	Priority area extent (Ha)	Priority area extent excluding freshwater (Ha)	High quality Wildcat habitat within priority area (Ha)
Angus Glens	37460	37215	11068
Dulnain	20576	20471	7520
Morvern	48697	48312	12899
Strathavon	34319	34319	9885
Strathbogie	34725	34721	11994
Strathpeffer	33626	32497	10904

9.1 Angus Glens

9.1.1 Evidence summary

The camera trap survey revealed 11 cats in the Angus Glens study area of which seven were classed as Wildcat (relaxed criteria), one as a hybrid and three as domestic. Genetic material from the single live-trapped cat confirmed the pelage assessment status as a domestic cat. Hair and faecal matter collected from four cats during this survey were of sufficient quality to permit an assessment of cat purity and all were classed F2 (or higher) hybrids (Annex 5).

Interestingly, the Cairngorms Wildcat Project did not reveal evidence of Wildcats in the National Park part of the Angus Glens or even of wild-living tabby-marked cats which were widely reported from all the other main wooded valleys in the National Park (Hetherington & Campbell, 2012). However the study area for this survey lies outside the National Park boundary and no intensive camera trapping was conducted in the Angus Glens during the Cairngorms Wildcat Project.

9.1.2 Merit as a Wildcat Priority Area

The Angus Glens are recommended as a priority area for Wildcat conservation. The number of Wildcats recorded in this study was greater than at any other site and indicate that the region is likely to be one of the most important in Scotland for Wildcats.

Two thirds of questionnaire respondents support the establishment of Angus Glens as a priority area for Wildcat conservation (section 7.3.6.2). Some areas within the proposed priority area boundary are owned by Forestry Commission Scotland and others are privately owned. Some surrounding land is actively managed for game shooting and cooperation of landowner and managers here should be sought to assist in delivering conservation actions.

9.1.3 Priority area boundary

The recommended priority area is shown in Figure 38. A large area comprising significant parts of Glenisla, Glen Clova and Glen Prosen is included in this area. These glens form a large area of contiguous habitat and Wildcats have been reported historically from across this area. The boundaries follow principally the watersheds to the east and west, large areas of high ground to the north and areas where land use becomes gradually more intensive to the south. The south-western boundary largely follows the B951 whilst other minor roads are used for convenience along the south-eastern boundary. The boundary comes to within

4 km of Kirriemuir, which might present challenges for management of feral cats. The closest Cats Protection branch is close by, in Forfar, and Trap-Neuter-Release has been carried out previously in this region. The presence of a veterinary practice in Kirriemuir will aid further such activity.

The recommended area extends across 37,460 Ha, of which 11,068 Ha is considered high quality Wildcat habitat (Table 33) as defined in Section 3.2. Most of this high quality habitat is located in lower parts of the glens. It is possible that Wildcats detected on camera traps in these areas in winter may make more use of higher ground in the summer. This justifies including higher areas between the glens within the priority area but there may be justification in further in extending the area northwards further into the Cairngorms National Park if future evidence points to significant use of this area as well.

9.2 Blair Atholl

9.2.1 Evidence summary

Just a single cat was recorded during this survey and this was classified by pelage as a hybrid. No cat genetic material was collected in this study area. There is previously evidence of a larger number of cats being present in this region, including six Wildcats recorded during an intensive camera trap survey in the region in 2010-12 (Hetherington & Campbell, 2012).

9.2.2 Merit as a Wildcat Priority Area

As no Wildcats were found by this survey, the area is not currently recommended as a priority area. Given recent evidence of cats, it was expected that more may have been found during this survey. As discussed in Section 4.4, the low number may have been connected to the time of year or survey or may indicate a significant population decline. This area should be reassessed for implementation of Wildcat conservation measures in the future.

9.3 Drumtochty

9.3.1 Evidence summary

There was just a single image obtained from this study area which shows what appears to be a black cat. No genetic material from cats was collected during this survey.

Two further free-living cats were logged during small scale camera trapping in autumn 2013, a ginger cat and a striped tabby with white feet, chest and front of face that may be a hybrid or a domestic cat (N. Littlewood, unpublished data). Images of Wildcats have been obtained at two points in the study area in the recent past (Kerry Kilshaw, unpublished data) and one of the recent museum specimens that was classed as a wildcat back-cross originated from this area. However, the evidence of the existence of defendable Wildcat populations from other sites is currently more compelling.

9.3.2 Merit as a Wildcat Priority Area

This region is not currently recommended as a priority area for Wildcat conservation. However, it is possible that future surveys may reveal more Wildcats or hybrids within the extensive commercial forestry plantations of Fetteresso or Drumtochty or further afield into Glen Dye or Durris forest. The area may become more important if the status of Wildcats in the Angus Glens can be secured as it may then provide some degree of connectivity with formerly important Wildcat areas in Deeside.

9.4 Dulnain

9.4.1 Evidence summary

Just two cats were recorded during this work, a Wildcat and a domestic cat. No genetic material from cats was collected during this survey.

Other surveys in recent years have revealed significantly more Wildcats and hybrids in this area. Four Wildcats and nine hybrids were recorded in part of the area during a study in 2010 (Kilshaw & Macdonald 2011) indicating that the area is capable of supporting a larger population of Wildcats than the single animal identified from this study.

9.4.2 Merit as a Wildcat Priority Area

It is proposed that this area is adopted as a conservation area. Although just one Wildcat was recorded, this nonetheless ranks the site above the three from which this work did not record any Wildcats (Blair Atholl, Drumtochty and Stratherrick). The low number of Wildcat records during this survey compared to previous work may be due to features of survey design or to an actual decrease in the population (see Section 4.4).

Questionnaire surveys suggested a relatively low level of support for the establishment of a Wildcat priority area at this site (Section 7.3.6.2). The reasons for this are unclear but if Dulnain is adopted as a priority area, this should be investigated to determine if this is representative of the wider community living in and managing this area or if there are particular concerns that can be addressed.

9.4.3 Priority area boundary

The recommended priority area is shown in Figure 39. The recommended boundary follows the Cairngorms National Park boundary to the west (which is largely along watersheds) and the river Spey to the east. To the north, the boundary has been set at a 2 km buffer onto hill ground from the woodland boundary but then excludes the town of Grantown-on-Spey. The boundary at the south excludes Aviemore running instead along the A9 to just south of Aviemore and then following a watershed up to the National Park boundary.

The recommended area extends across 20,576 Ha, of which 7,520 Ha is considered high quality Wildcat habitat (Table 33) as defined in Section 3.2. This makes it the smallest recommended priority area on both measures. There is little connectivity with high quality Wildcat habitat to the north and west whilst the river Spey provides a potential deterrent to regular movement on the eastern side. However, the area could be extended across the Spey, to encompass Abernethy Forest, if surveys can reveal the persistence of Wildcats there.

The presence of communities within (Carrbridge and Boat of Garten) and just outside (Aviemore and Grantown-on-Spey) the priority area presents challenges related to management of feral and domestic cats. Action may be aided by there being a veterinary practice in Grantown-on-Spey that previously supported the Cairngorm Wildcat project along with the Strathspey branch of Cats Protection that offers vouchers for free neutering.

9.5 Morvern

9.5.1 Evidence summary

Four Wildcats were identified during the field survey, as well as three domestic cats. One of two cats with a 7PS of 20 was recorded at this site. Genetic analysis of the two live-trapped showed that these were an F1 hybrid (which, on pelage, had been classed as Wildcat under

relaxed ID criteria and a hybrid under strict ID criteria) and a domestic cat (that had been classified as domestic on pelage).

Together with the adjacent Ardnamurchan peninsular, Morvern was identified as having a particular concentration of records of probably Wildcats by Davis & Gray (2010).

9.5.2 Merit as a Wildcat Priority Area

Morvern is recommended as a priority area for Wildcat conservation based on the results of the camera trapping survey. Previous records also show the area to be a potential Wildcat stronghold. Furthermore, the area's geography may facilitate conservation actions through limiting feral cat incursion. Additionally ongoing Wildcat conservation measures in the adjacent Ardnamurchan peninsula may facilitate a degree of metapopulation structure with Morvern Wildcats.

9.5.3 Priority area boundary

The recommended priority area is shown in Figure 40. It is recommended for the sake of defensibility, that the whole of the Morvern peninsular be incorporated into the priority area. This area extends to 48,697 Ha, the largest of the recommended priority areas (Table 33). Much of this is open hill ground on which the density of any Wildcats may be low though the extent of high quality Wildcat habitat, as defined in Section 3.2, nonetheless is also the highest of all sites at 12,899 Ha. There is a narrow neck at the base of the peninsula, between Loch Sunart and Loch Linnhe, of only around 11 km. This geography may aid defence of Wildcats by limiting incursion routes of feral cats.

The recommended area extends considerably beyond the study area for this work. Much of the peninsula is mountainous and may be unsuitable for regular use by Wildcats. However there are significant areas of scrubby woodland along the southern and eastern shores. These are remote sites that would be difficult to access for survey but certainly have at least the potential to be used by Wildcats.

Within the peninsular, there is just one village, Lochaline, with the small community otherwise being scattered and mostly located along the south-western coast. Hence any risk from domestic (as opposed to feral) cats should be easy to identify. The closest veterinary practice is in Fort William which might pose challenges for Trap-Neuter-Release operations. However, the strong support for Wildcat protection expressed by questionnaire respondents (Table 31) bodes well for such operations.

9.6 Strathavon

9.6.1 Evidence summary

This survey revealed one Wildcat (relaxed ID criteria) and two hybrids. No genetic material from cats was collected during this survey. Davis and Gray (2010) and Hetherington & Campbell (2012) both show recent evidence of Wildcats in this region.

9.6.2 Merit as a Wildcat Priority Area

The current status of the Wildcat population in this region is unclear and based on these sparse data, it is not possible to indicate whether conservation measures have the potential to be effective in securing a viable population in the long-term. However, as evidence was found of at least one Wildcat, it is recommended that the area be adopted as a Wildcat conservation priority area. This status should be reviewed if future surveys show alternative sites to hold more viable populations.

9.6.3 Priority area boundary

The recommended priority area is shown in Figure 41. The area broadly encompasses Strath Avon and Glenlivet. It is bordered by watershed to the west and by a 2 km buffer on the main forest extent to the north and east. To the north, the recommended boundary extends downriver to the confluence of the two glens, again with a 2 km buffer of hill ground.

The recommended area extends across 34,319 Ha, of which 9,885 Ha is considered high quality Wildcat habitat (Table 33) as defined in Section 3.2. In due course, a healthy Wildcat population may expand further down river and consideration may then be given to extending the priority area to Bridge of Avon or further north.

The main settlement in the area is at Tomintoul and responsible cat ownership will need to be encouraged here as well as in outlying dwellings. The closest veterinary practice to this town is at Grantown-on-Spey. There is a Moray branch of Cats Protection, which is active right within this area in Glenlivet and takes part in Trap-Neuter-Release activities.

9.7 Strathbogie

9.7.1 Evidence summary

Four Wildcats (relaxed ID) and three hybrids were caught by camera trapping during this study. One of these wildcats had a 7 TPS of 20. Two cats live-caught in the study area were classified as F2 hybrids based on genetic analysis; both had been classified as hybrid by pelage analysis. Of the five individuals live-caught in an adjacent area, two were classified as a Wildcat back-cross (both classified as domestic on pelage), and three as F2 hybrids (two classified as hybrid on pelage, one as Wildcat on relaxed ID criteria and hybrid on strict ID criteria). Genetic analysis of hair and faecal matter revealed one cat classified as Wildcat back-cross. The area, and especially the region to the east, at Gartley Moor, has previously yielded a number of Wildcat records (e.g. Silva *et al.,* 2013a).

9.7.2 Merit as a Wildcat Priority Area

The number of cats caught on camera justify recommendation of Strathbogie as a Wildcat priority area. However there appears to be very significant introgression between Wildcats and domestic cats at this site with three of the four Wildcats scoring as hybrids on strict ID criteria whilst the presence of at least three domestic cats in the study area indicates the potential for further introgression. Conservation action should concentrate initially on removing or neutering obvious domestic cats.

9.7.3 Priority area boundary

The recommended priority area is shown in Figure 42. The boundary encompasses a polygon around the outer edges of Clashindarroch Forest, Bin Forest and Gartley Moor together with a 2 km buffer of open ground around the forest boundary. The southern boundary includes more open rough ground away from the forest edge. These are all areas that have either recently produced verifiable records of Wildcats (principally through camera trapping) or are adjacent areas with historical records.

The recommended area extends across 34,725 Ha, of which 11,994 Ha is considered high quality Wildcat habitat (Table 33) as defined in Section 3.2. Areas beyond this boundary may already hold Wildcats but have not been subject to detailed survey. Other adjacent areas may be potentially suitable for an expanding Wildcat population to spread into. Forestry Commission Scotland is the major landowner which may aid implementation of conservation actions.

The largest town in the area in Huntly. This has been excluded from the priority area, as Trap-Neuter-Release operations would be better targeted in forest and other outlying areas. Huntly has a veterinary practice and a Cats Protection branch.

Further expansion of this priority area could be considered in the light of evidence from future surveys, in particular, the Coreen Hills, to the south-east, whilst expansion westwards to the woods around Dufftown may ultimately lead to enhanced connectivity with Wildcats at Strathavon.

9.8 Stratherrick

9.8.1 Evidence summary

Just a single cat was caught on camera trap at Stratherrick. Although images obtained were inconclusive, it was categorised as a hybrid. A road casualty collected in Dec 2013 between this site and Inverness was determined to be a hybrid. No genetic material from cats was collected during this survey.

A Wildcat was recorded in this region by Davis & Gray (2010) but there is little further evidence of a sizable population of Wildcats currently persisting in the area.

9.8.2 Merit as a Wildcat Priority Area

This region is not recommended here as a priority area for Wildcat conservation.

9.9 Strathpeffer

9.9.1 Evidence summary

No cats were recorded in the main Strathpeffer study area during the current survey. However, following reports from local people, reactive camera trapping resulted in three Wildcats (relaxed criteria; two under strict criteria), a further hybrid and a domestic cat being recorded. No genetic material from cats was collected during this survey. The camera-trapping of three Wildcats just outside the initial study area suggests that the study area may not have been the optimum area for Wildcats in this region. It is possible that seasonal movements may occur and that the study area, which is largely more upland and forested ground than where the cats were pictured, may be used in summer with the area where the cats were photographed, a lowland part of the study area, being a winter refuge. A road kill cat was also recovered from the A835 near the survey area during the survey period which was scored as a wildcat (relaxed ID) and subsequently genetically tested as a Wildcat back-cross.

9.9.2 Merit as a Wildcat Priority Area

On the basis of the evidence of Wildcats just outside the study area, the site is proposed as an area to take forward for Wildcat conservation action.

9.9.3 Priority area boundary

The recommended priority area is shown in Figure 43. In the southern, western and northern portions, the boundary follows the edge of the significant woodland area together with a 2 km buffer of hill ground. The eastern boundary follows the Cromarty Firth shore though with settlements of Strathpeffer, Dingwall excluded and the boundary skirting the edge of Evanton. Much of the woodland north and west of Dingwall and Strathpeffer has not yielded recent Wildcat records though the boundary extends to include an area where Wildcats were reported during the survey period.

The recommended area extends across 33,626 Ha, of which 10,904 Ha is considered high quality Wildcat habitat (Table 33) as defined in Section 3.2. Given that the main evidence of Wildcats came from reactive camera trapping, further surveys outside the study area for this report should be carried out. Such surveys are planned to the south of this area and the boundary should be reviewed if these reveal Wildcat presence.

The presence of several small towns adjoining the priority area will present challenges for Wildcat conservation. There are Cats Protection branches in Alness and Inverness and a veterinary practice in Dingwall which may be able to assist with Trap-Neuter-Release.

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10. PRIORITY AREA MAPS

Recommended boundaries for priority areas are shown on the following maps. It is anticipated that the adoption of these boundaries will aid the strategic planning of conservation actions and of monitoring to assess the success these. The boundaries may also have relevance for guiding suitability of applicants for agri-environment payments. Nonetheless, for implementation of some conservation actions, such as encouraging domestic cat neutering, or of carrying out Trap-Neuter-Release-Operations on feral cats, it is suggested that these boundaries are viewed more as guidelines. Decisions should be made in individual cases on the likely contribution of carrying out actions in specific locations to Wildcat conservation.

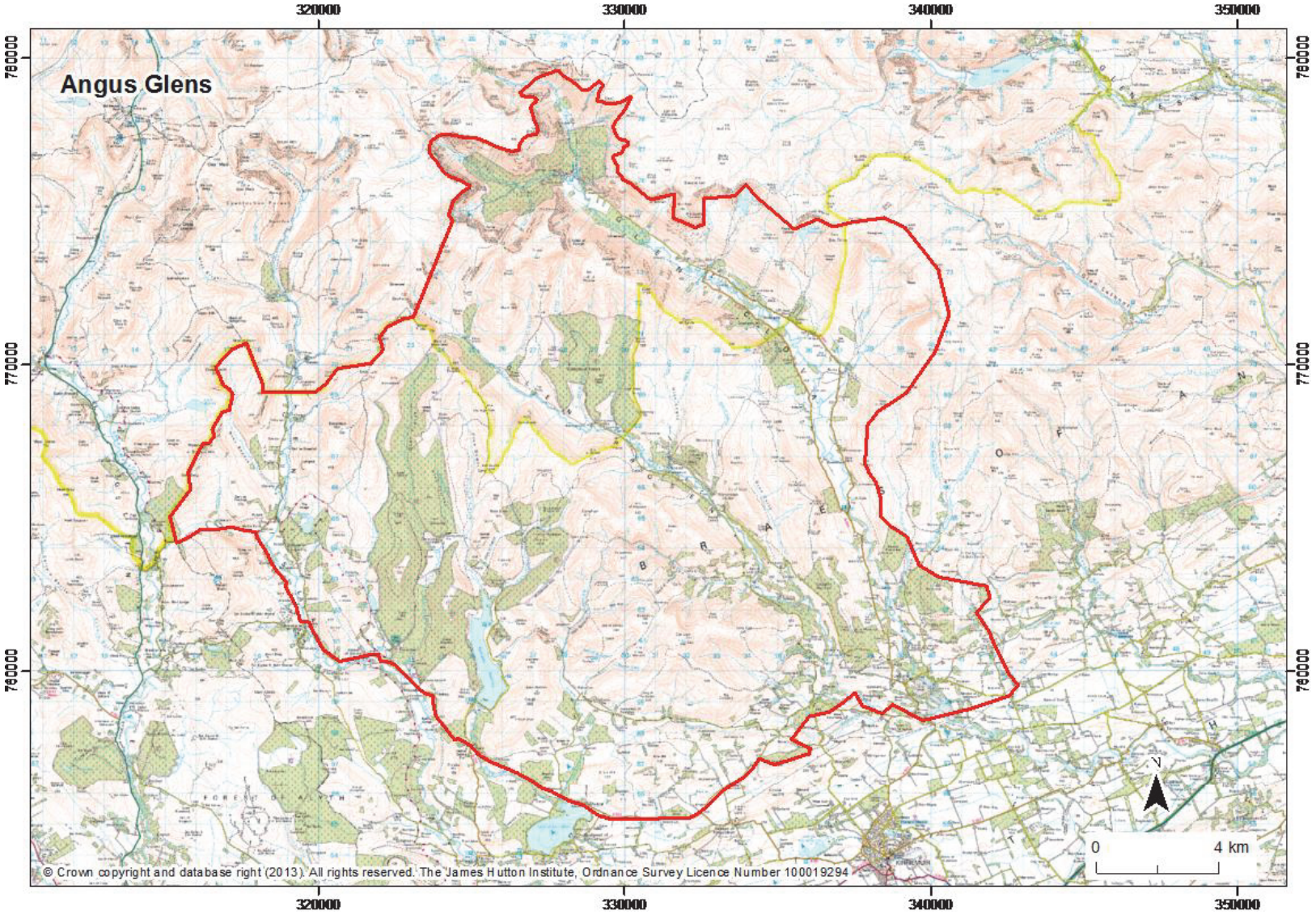

Figure 38. Angus Glens recommended Wildcat priority area.

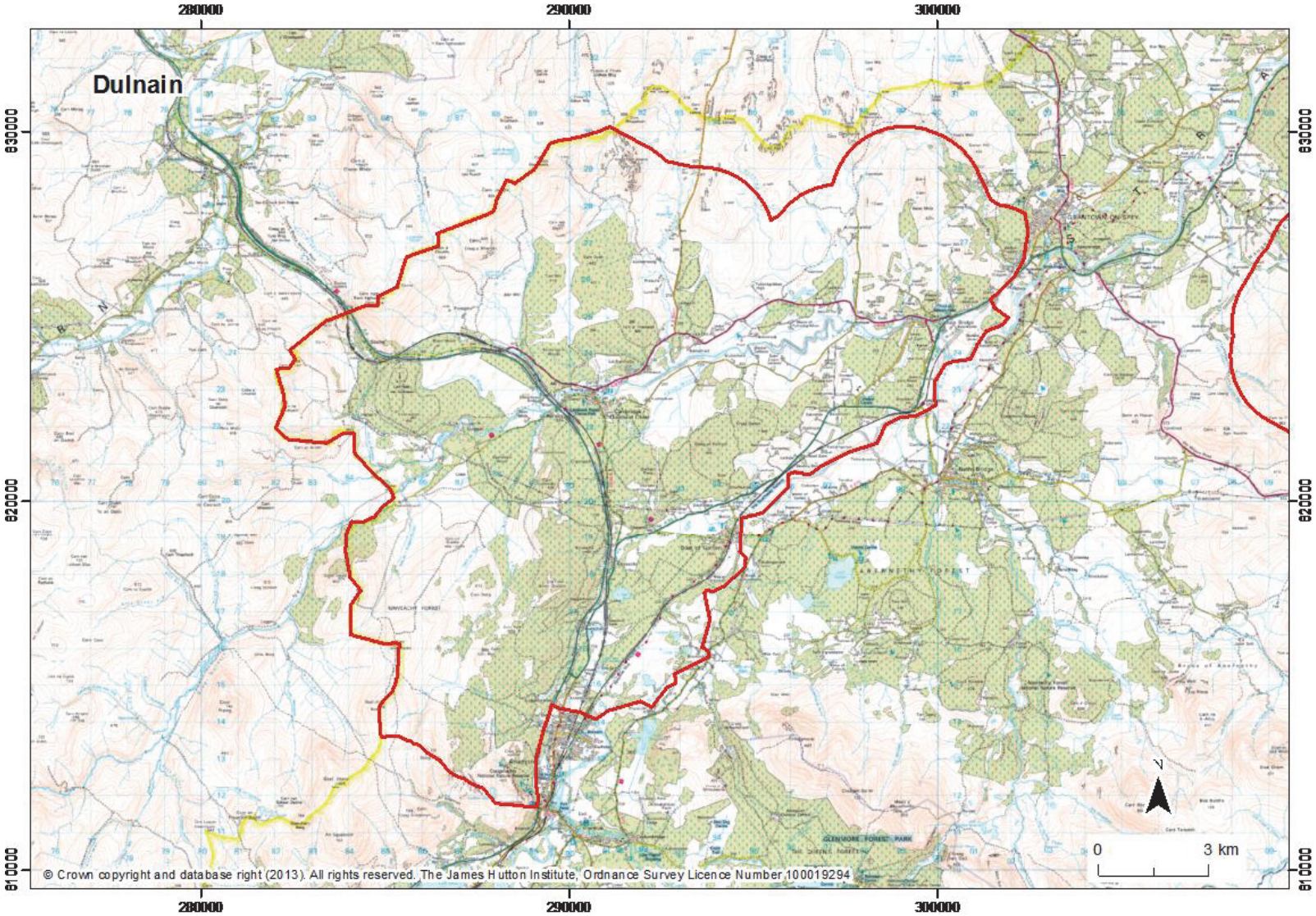

Figure 39. Dulnain recommended Wildcat priority area.

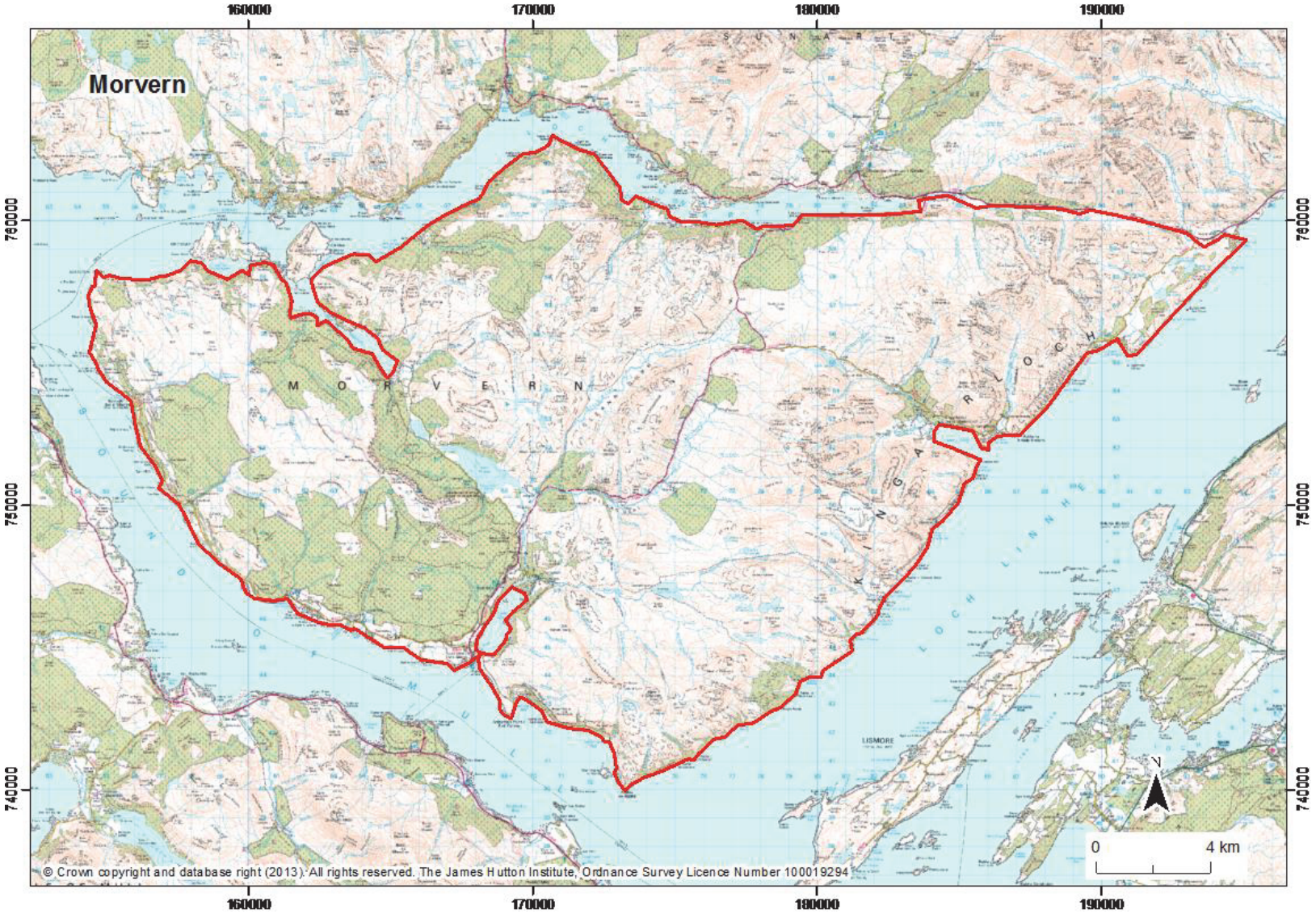

Figure 40. Morvern recommended Wildcat priority area.

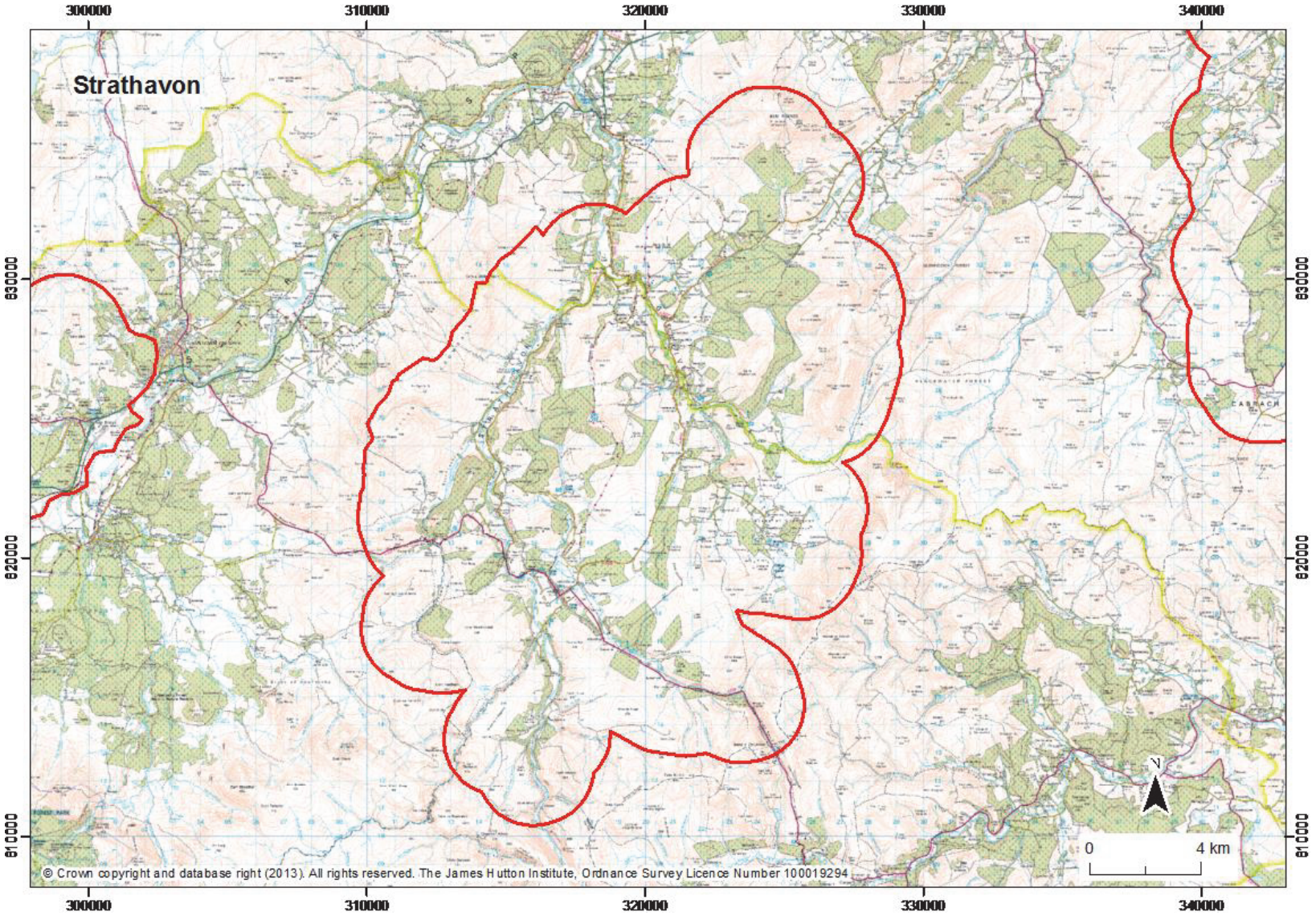

Figure 41. Strathavon recommended Wildcat priority area.

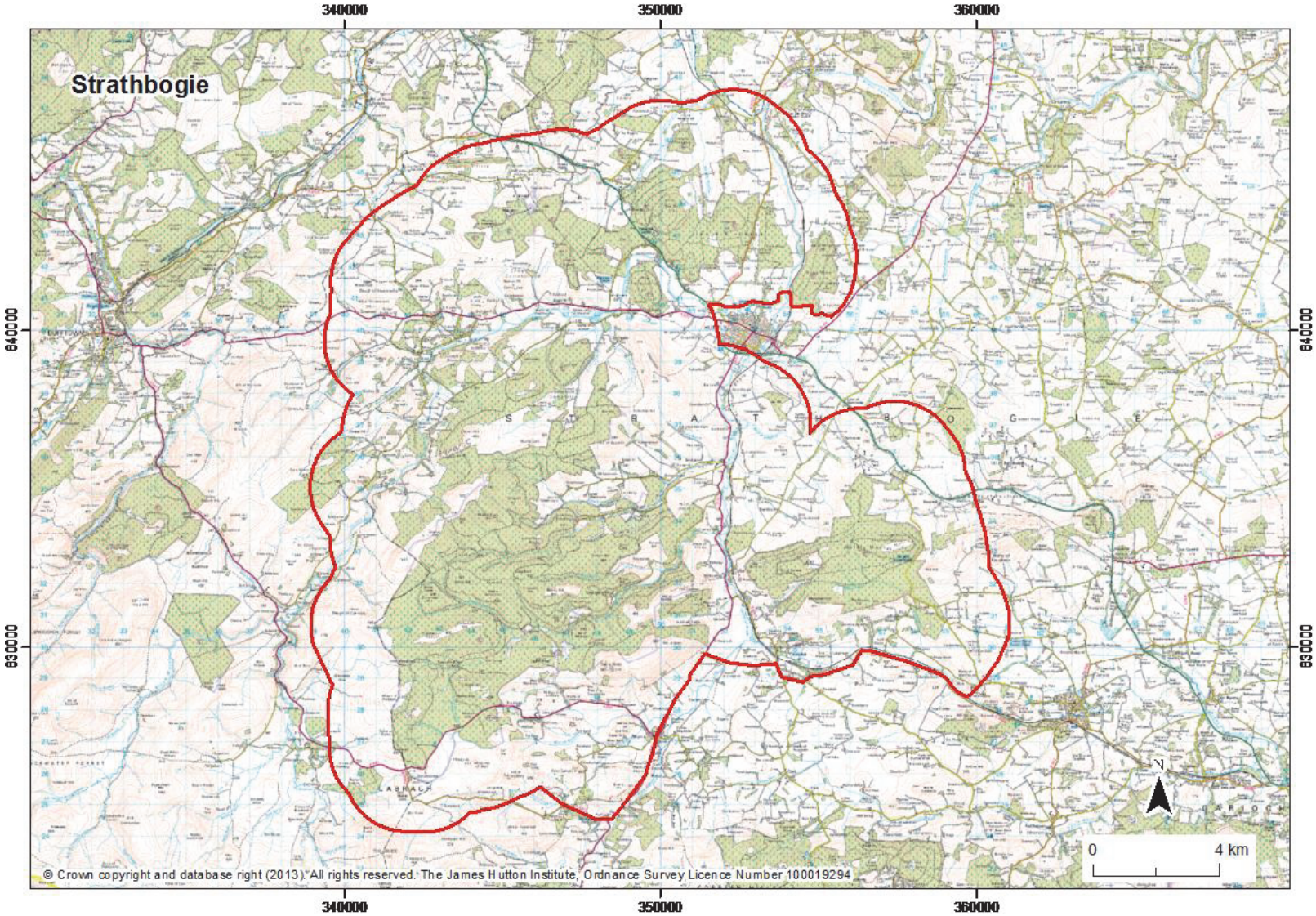

Figure 42. Strathbogie recommended Wildcat priority area.

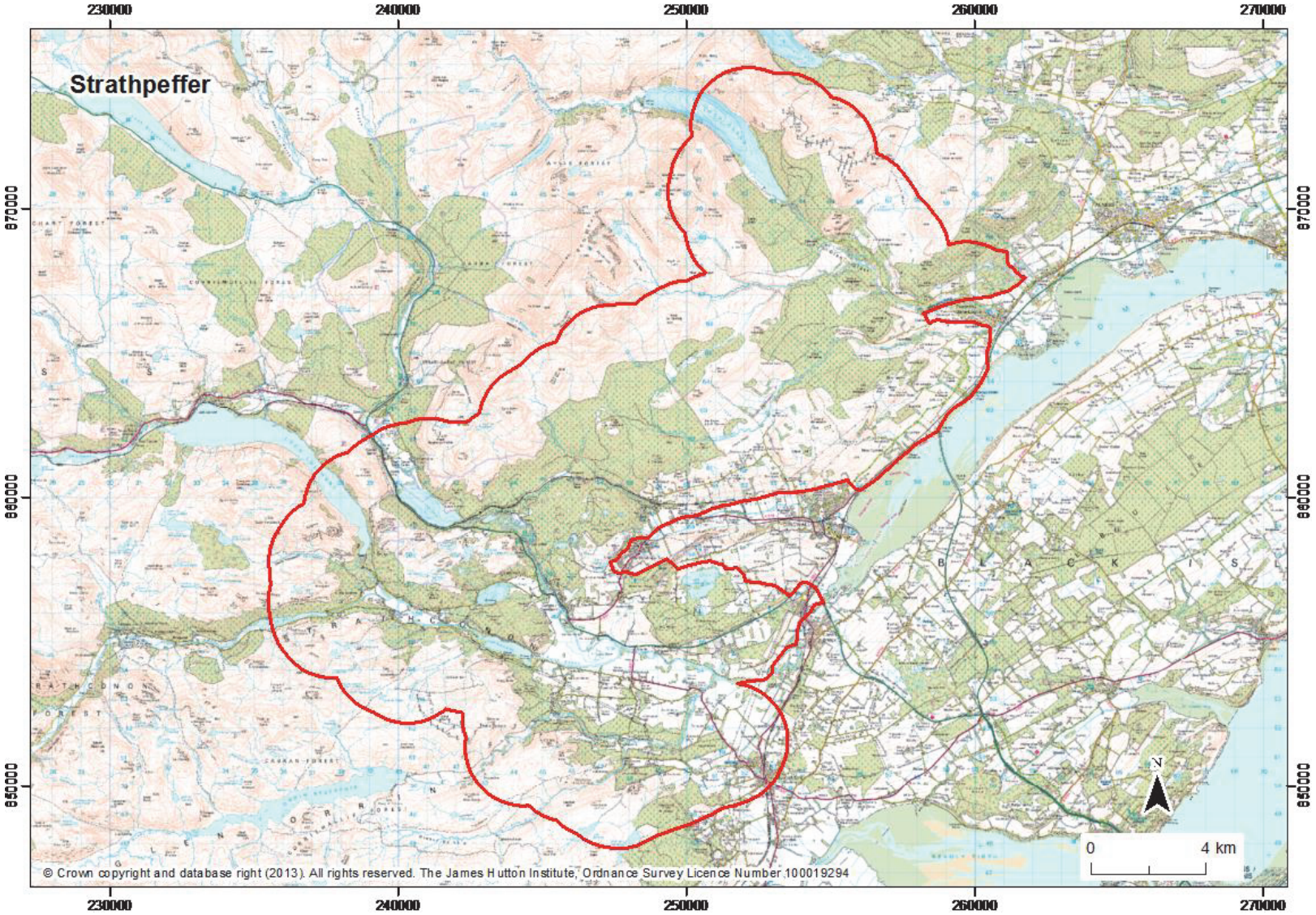

Figure 43. Strathpeffer recommended Wildcat priority area.

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ANNEX 1: CAPTURE DATA FOR ALL CATS PHOTOGRAPHED

Any captures of the same cat at the same camera within two hours are classed here as a single capture event. Camera locations are contained in Confidential Annex 1.

Site	Station ID	Cat ID	Date	Time	In 3 week survey
Angus Glens	ANG13	ANG-A	17/01/2014	11:42:00	Yes
Angus Glens	ANG19	ANG-A	31/01/2014	19:10:00	Yes
Angus Glens	ANG05	ANG-B	28/12/2013	22:21:00	Yes
Angus Glens	ANG02	ANG-B	19/12/2013	01:11:00	Yes
Angus Glens	ANG15	ANG-C	05/02/2014	17:33:00	Yes
Angus Glens	ANG15	ANG-C	11/02/2014	16:36:00	Yes
Angus Glens	ANG22	ANG-D	22/02/2014	03:58:30	No
Angus Glens	ANG22	ANG-D	11/12/2013	20:24:00	Yes
Angus Glens	ANG16	ANG-E	17/12/2013	05:41:00	Yes
Angus Glens	ANG17	ANG-E	02/12/2013	16:01:00	Yes
Angus Glens	ANG22	ANG-E	24/01/2014	05:45:00	No
Angus Glens	ANG193	ANG-F	09/03/2014	20:20:21	No
Angus Glens	ANG14	ANG-G	09/02/2014	02:38:55	Yes
Angus Glens	ANG16	ANG-H	05/01/2014	04:35:00	No
Angus Glens	ANG17b	ANG-H	16/12/2013	18:44:42	Yes
Angus Glens	ANG23	ANG-I	18/02/2014	10:00:00	No
Angus Glens	ANG17	ANG-I	10/12/2013	15:37:00	Yes
Angus Glens	ANG17b	ANG-I	25/12/2013	13:57:27	Yes
Angus Glens	ANG22	ANG-J	14/02/2014	09:40:44	No
Angus Glens	ANG22	ANG-J	19/02/2014	13:54:05	No
Angus Glens	ANG19	ANG-K	11/02/2014	01:29:00	Yes
Angus Glens	ANG35	ANG-L	07/03/2014	20:21:00	Yes
Angus Glens	ANG20	ANG-L	25/01/2014	02:21:00	Yes
Angus	ANG22	ANG-M	13/02/2014	04:05:50	No

Site	Station ID	Cat ID	Date	Time	In 3 week survey
Glens					
Angus Glens	ANG02	ANG-N	19/12/2013	23:51:00	Yes
Drumtochty	DRU31	DRU-A	25/02/2014	22:09:00	Yes
Dulnain	DUL39	DUL-A	07/12/2013	18:28:00	Yes
Dulnain	DUL39	DUL-A	07/12/2013	19:08:00	Yes
Dulnain	DUL39	DUL-A	08/12/2013	04:38:00	Yes
Dulnain	DUL12	DUL-B	08/11/2013	00:30:00	Yes
Morvern	MOR15	MOR-A	13/01/2014	03:06:00	Yes
Morvern	MOR38	MOR-A	18/01/2014	00:54:36	Yes
Morvern	MOR38	MOR-A	28/01/2014	18:22:58	Yes
Morvern	MOR38	MOR-A	03/02/2014	03:49:12	No
Morvern	MOR38	MOR-A	03/02/2014	04:12:23	No
Morvern	MOR22	MOR-B	08/01/2014	18:29:46	Yes
Morvern	MOR22	MOR-B	21/01/2014	04:10:27	Yes
Morvern	MOR22	MOR-B	07/02/2014	20:02:20	No
Morvern	MOR22	MOR-B	11/02/2014	03:35:16	No
Morvern	MOR222	MOR-B	08/02/2014	06:55:11	No
Morvern	MOR222	MOR-B	08/02/2014	18:09:02	No
Morvern	MOR222	MOR-B	09/02/2014	06:42:43	No
Morvern	MOR37	MOR-C	15/01/2014	23:04:49	Yes
Morvern	MOR38	MOR-C	09/01/2014	16:05:48	Yes
Morvern	MOR22	MOR-D	08/01/2014	14:34:17	Yes
Morvern	MOR22	MOR-D	09/01/2014	06:49:04	Yes
Morvern	MOR22	MOR-D	09/01/2014	18:09:40	Yes
Morvern	MOR22	MOR-D	11/01/2014	13:15:20	Yes
Morvern	MOR22	MOR-D	13/01/2014	14:20:43	Yes
Morvern	MOR22	MOR-D	30/01/2014	13:47:32	No
Morvern	MOR11	MOR-E	14/01/2014	23:02:30	Yes
Morvern	MOR11	MOR-E	21/01/2014	06:56:32	Yes
Morvern	MOR22	MOR-F	03/02/2014	11:55:47	No
Morvern	MOR36	MOR-G	16/01/2014	02:57:24	Yes
Morvern	MOR36	MOR-G	17/01/2014	20:40:54	Yes
Morvern	MOR36	MOR-G	27/01/2014	20:09:52	Yes
Strathavon	SAV19	SAV-A	26/12/2013	12:23:00	Yes
Strathavon	SAV19	SAV-A	26/12/2013	13:37:00	Yes
Strathavon	SAV19	SAV-B	09/01/2014	12:10:45	Yes
Strathavon	SAV19	SAV-B	09/01/2014	12:51:10	Yes
Strathavon	SAV19	SAV-B	09/01/2014	13:23:25	Yes
Strathavon	SAV19	SAV-B	09/01/2014	17:43:45	Yes
Strathavon	SAV19	SAV-B	11/01/2014	06:28:34	Yes
Strathavon	SAV19	SAV-B	12/01/2014	16:32:20	Yes
Strathavon	SAV39	SAV-C	29/12/2013	18:49:00	Yes

Site	Station ID	Cat ID	Date	Time	In 3 week survey
Strathavon	SAV39	SAV-D	08/01/2014	18:40:00	Yes
Strathbogie	SBO34	SBO-A	19/11/2013	15:17:31	Yes
Strathbogie	SBO34	SBO-A	19/11/2013	16:06:10	Yes
Strathbogie	SBO34	SBO-A	10/01/2014	21:41:08	No
Strathbogie	SBO34	SBO-A	10/01/2014	22:39:03	No
Strathbogie	SBO34	SBO-A	11/01/2014	05:06:50	No
Strathbogie	SBO20	SBO-A	21/01/2014	16:58:59	No
Strathbogie	SBO20	SBO-A	21/01/2014	18:18:14	No
Strathbogie	SBO20	SBO-A	22/01/2014	05:17:03	No
Strathbogie	SBO20	SBO-A	22/01/2014	12:18:54	No
Strathbogie	SBO36	SBO-B	11/11/2013	11:18:00	Yes
Strathbogie	SBO36	SBO-B	19/11/2013	14:03:00	Yes
Strathbogie	SBO36	SBO-B	22/11/2013	10:21:00	Yes
Strathbogie	SBO36	SBO-B	22/11/2013	11:40:00	Yes
Strathbogie	SBO36	SBO-B	27/11/2013	13:14:00	Yes
Strathbogie	SBO36	SBO-B	02/12/2013	12:55:00	No
Strathbogie	SBO36	SBO-B	03/12/2013	14:00:00	No
Strathbogie	SBO36	SBO-B	13/12/2013	14:35:54	No
Strathbogie	SBO36	SBO-B	27/12/2013	12:16:40	No
Strathbogie	SBO36	SBO-B	01/01/2014	11:30:18	No
Strathbogie	SBO36	SBO-B	20/01/2014	15:47:53	No
Strathbogie	SBO32	SBO-C	13/11/2013	19:48:12	Yes
Strathbogie	SBO32	SBO-C	13/11/2013	20:10:27	Yes
Strathbogie	SBO32	SBO-C	21/11/2013	23:47:03	Yes
Strathbogie	SBO32	SBO-C	22/11/2013	00:15:27	Yes
Strathbogie	SBO32	SBO-C	22/11/2013	00:31:58	Yes
Strathbogie	SBO32	SBO-C	27/11/2013	18:14:35	Yes
Strathbogie	SBO32	SBO-C	27/11/2013	23:24:37	Yes
Strathbogie	SBO36	SBO-C	18/12/2013	10:39:56	No
Strathbogie	SBO05	SBO-D	15/11/2013	04:31:02	Yes
Strathbogie	SBO20	SBO-E	15/11/2013	21:24:00	Yes
Strathbogie	SBO20	SBO-E	16/11/2013	01:49:31	Yes
Strathbogie	SBO20	SBO-E	16/11/2013	04:54:24	Yes
Strathbogie	SBO20	SBO-E	16/11/2013	05:16:49	Yes
Strathbogie	SBO20	SBO-E	16/11/2013	06:09:46	Yes
Strathbogie	SBO20	SBO-E	16/11/2013	15:15:26	Yes
Strathbogie	SBO20	SBO-E	16/11/2013	21:18:58	Yes
Strathbogie	SBO20	SBO-E	17/11/2013	03:21:30	Yes
Strathbogie	SBO11	SBO-E	21/11/2013	14:58:00	Yes
Strathbogie	SBO11	SBO-E	21/11/2013	15:23:00	Yes
Strathbogie	SBO04	SBO-G	10/11/2013	17:57:21	Yes
Strathbogie	SBO04	SBO-G	18/11/2013	06:28:12	Yes
Strathbogie	SBO39	SBO-H	15/11/2013	23:19:36	Yes

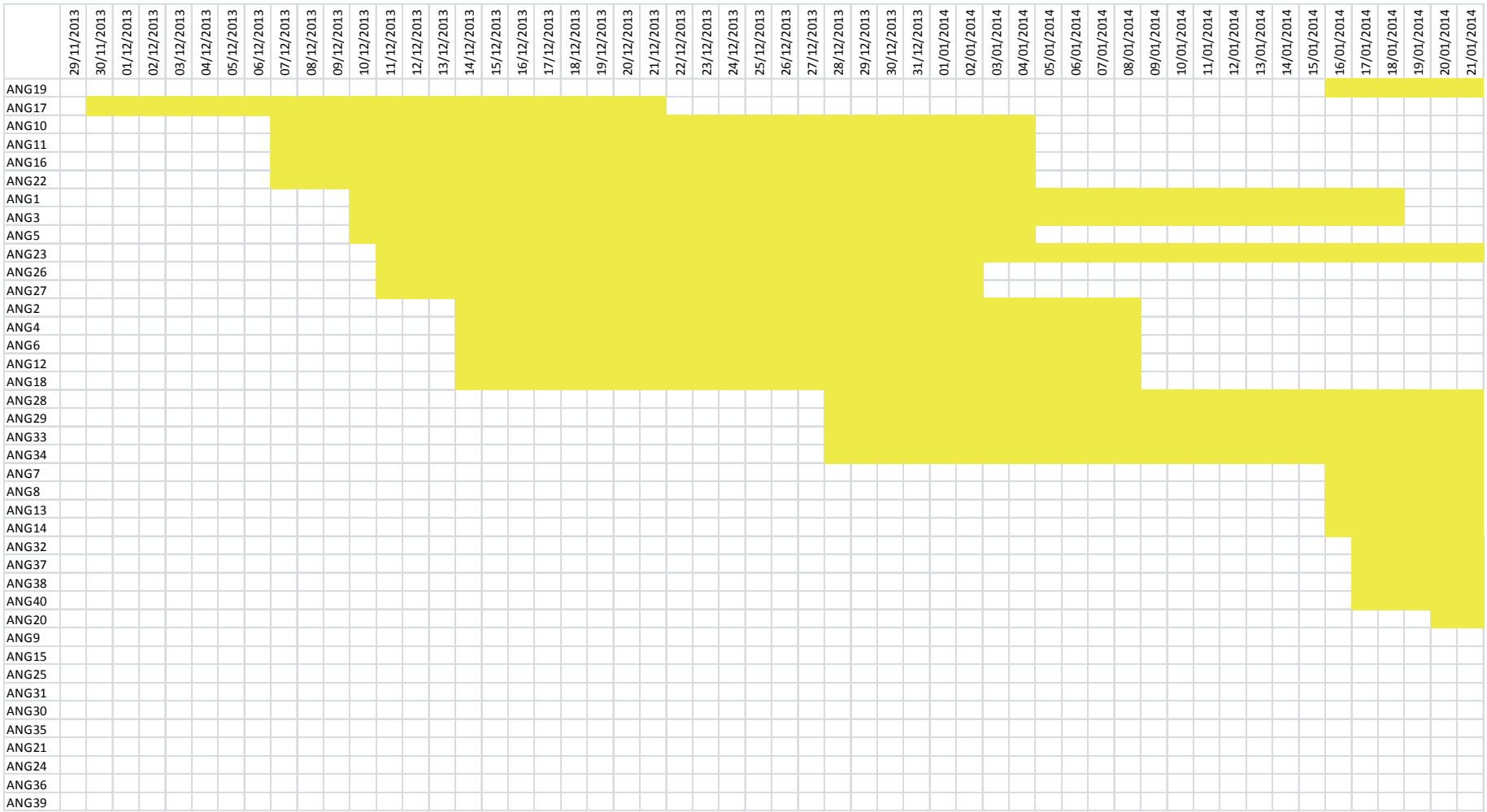
Site	Station ID	Cat ID	Date	Time	In 3 week survey
Strathbogie	SBO12	SBO-I	26/11/2013	08:39:00	Yes
Strathbogie	SBO12	SBO-I	26/11/2013	17:22:00	Yes
Strathbogie	SBO12	SBO-I	26/11/2013	18:17:00	Yes
Strathbogie	SBO12	SBO-I	27/11/2013	07:02:00	No
Strathbogie	SBO12	SBO-I	27/11/2013	07:32:00	No
Strathbogie	SBO12	SBO-I	27/11/2013	15:18:00	No
Strathbogie	SBO04	SBO-J	17/11/2013	13:05:42	Yes
Strathbogie	SBO04	SBO-J	17/11/2013	17:22:42	Yes
Strathbogie	SBO04	SBO-J	17/11/2013	17:55:52	Yes
Strathbogie	SBO04	SBO-J	17/11/2013	19:31:57	Yes
Strathbogie	SBO04	SBO-J	17/11/2013	21:06:42	Yes
Strathbogie	SBO04	SBO-J	18/11/2013	01:11:07	Yes
Strathbogie	SBO04	SBO-J	18/11/2013	02:05:33	Yes
Strathbogie	SBO04	SBO-J	18/11/2013	02:22:39	Yes
Strathbogie	SBO04	SBO-J	18/11/2013	09:53:38	Yes
Strathbogie	SBO04	SBO-J	18/11/2013	11:29:51	Yes
Strathbogie	SBO04	SBO-J	28/11/2013	10:34:59	Yes
Strathbogie	SBO04	SBO-J	28/11/2013	11:17:54	Yes
Strathbogie	SBO04	SBO-J	29/11/2013	00:27:29	Yes
Strathbogie	SBO04	SBO-J	29/11/2013	09:22:20	Yes
Strathbogie	SBO04	SBO-J	30/11/2013	22:15:42	No
Strathbogie	SBO04	SBO-J	03/12/2013	07:21:21	No
Strathbogie	SBO04	SBO-K	11/11/2013	11:27:06	Yes
Strathbogie	SBO04	SBO-K	22/11/2013	14:04:39	Yes
Strathbogie	SBO04	SBO-K	26/11/2013	14:21:34	Yes
Strathbogie	SBO36	Unidentified - prob SBO-B or SBO-C	17/12/2013	10:29:00	Yes
Strathbogie	SBO36	Unidentified - prob SBO-B or SBO-C	14/12/2013	14:59:54	Yes
Strathbogie	SBO36	Unidentified - prob SBO-C	19/12/2013	09:53:33	Yes
Stratherrick	SER40	SER-A	20/02/2014	23:58:22	Yes
Strathpeffer	SPE41	STR-A	22/01/2014	20:27:35	No
Strathpeffer	SPE41	STR-A	28/12/2013	22:49:19	Yes
Strathpeffer	SPE41	STR-A	03/01/2014	09:21:50	No
Strathpeffer	SPE42	STR-B	14/12/2013	18:59:21	Yes
Strathpeffer	SPE42	STR-B	15/12/2013	01:45:23	Yes
Strathpeffer	SPE42	STR-B	15/12/2013	07:24:33	Yes
Strathpeffer	SPE42	STR-B	16/12/2013	00:03:43	Yes
Strathpeffer	SPE42	STR-B	16/12/2013	00:26:27	Yes
Strathpeffer	SPE42	STR-B	16/12/2013	00:45:08	Yes
Strathpeffer	SPE42	STR-B	16/12/2013	03:32:35	Yes
Strathpeffer	SPE42	STR-C	24/01/2014	20:35:34	No
Strathpeffer	SPE42	STR-C	25/01/2014	05:48:40	No

Site	Station ID	Cat ID	Date	Time	In 3 week survey
Strathpeffer	SPE42	STR-C	25/01/2014	06:02:35	No
Strathpeffer	SPE42	STR-C	25/01/2014	06:17:01	No
Strathpeffer	SPE42	STR-C	03/02/2014	00:59:23	No
Strathpeffer	SPE42	STR-C	30/12/2013	20:47:47	Yes
Strathpeffer	SPE42	STR-C	02/01/2014	23:24:45	Yes
Strathpeffer	SPE42	STR-D	03/02/2014	18:28:46	No
Strathpeffer	SPE42	STR-E	23/12/2013	19:41:02	Yes

ANNEX 2: TIME LINES FOR CAMERA TRAPS

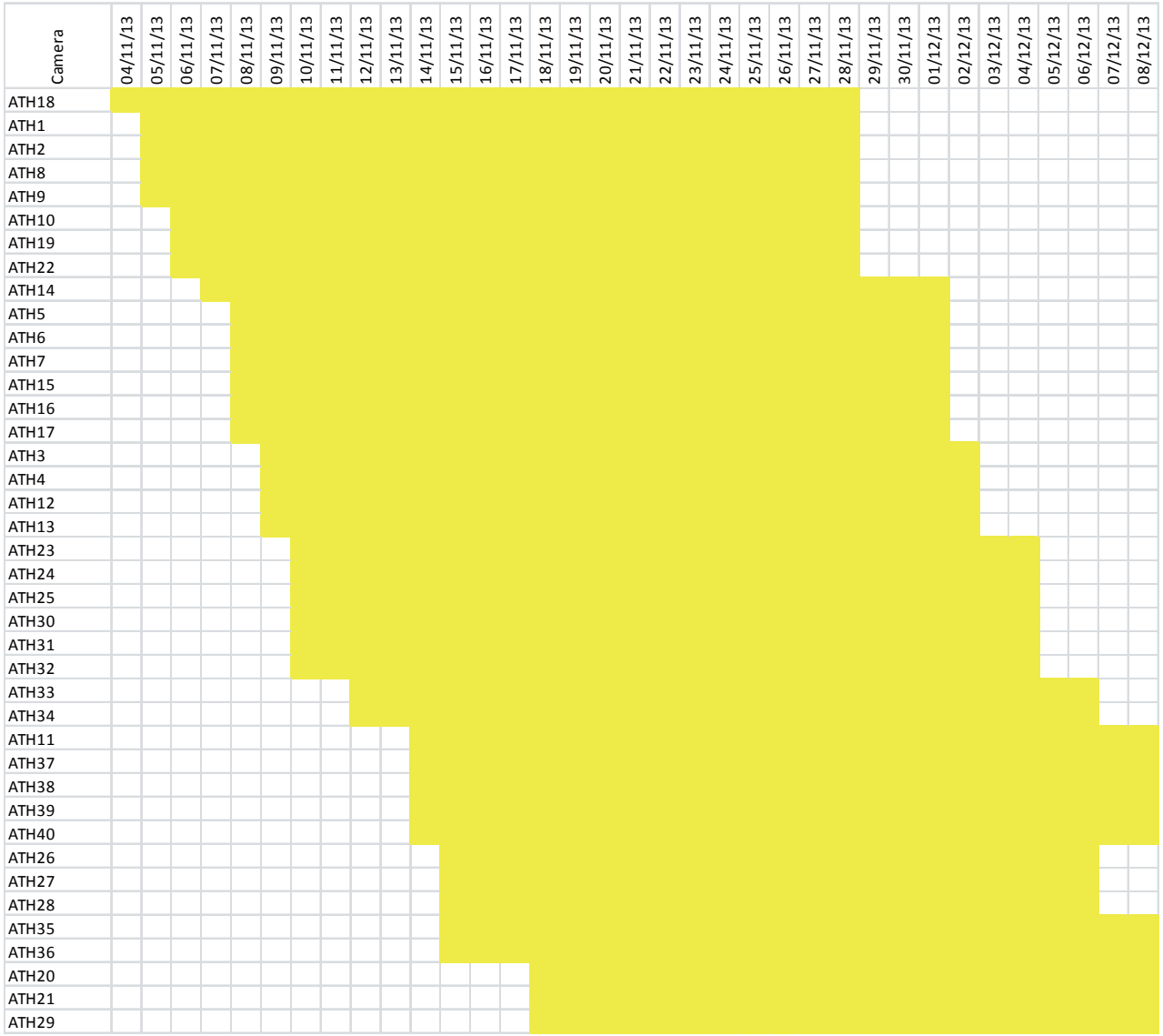
Dates when each camera was deployed and working are highlighted in yellow. Staggered deployment in most cases reflects the time to set up cameras at each location, but at Angus Glens and Stratherrick also reflects the timing of access permissions.

Angus Glens (a)



Angus Glens (b)

Atholl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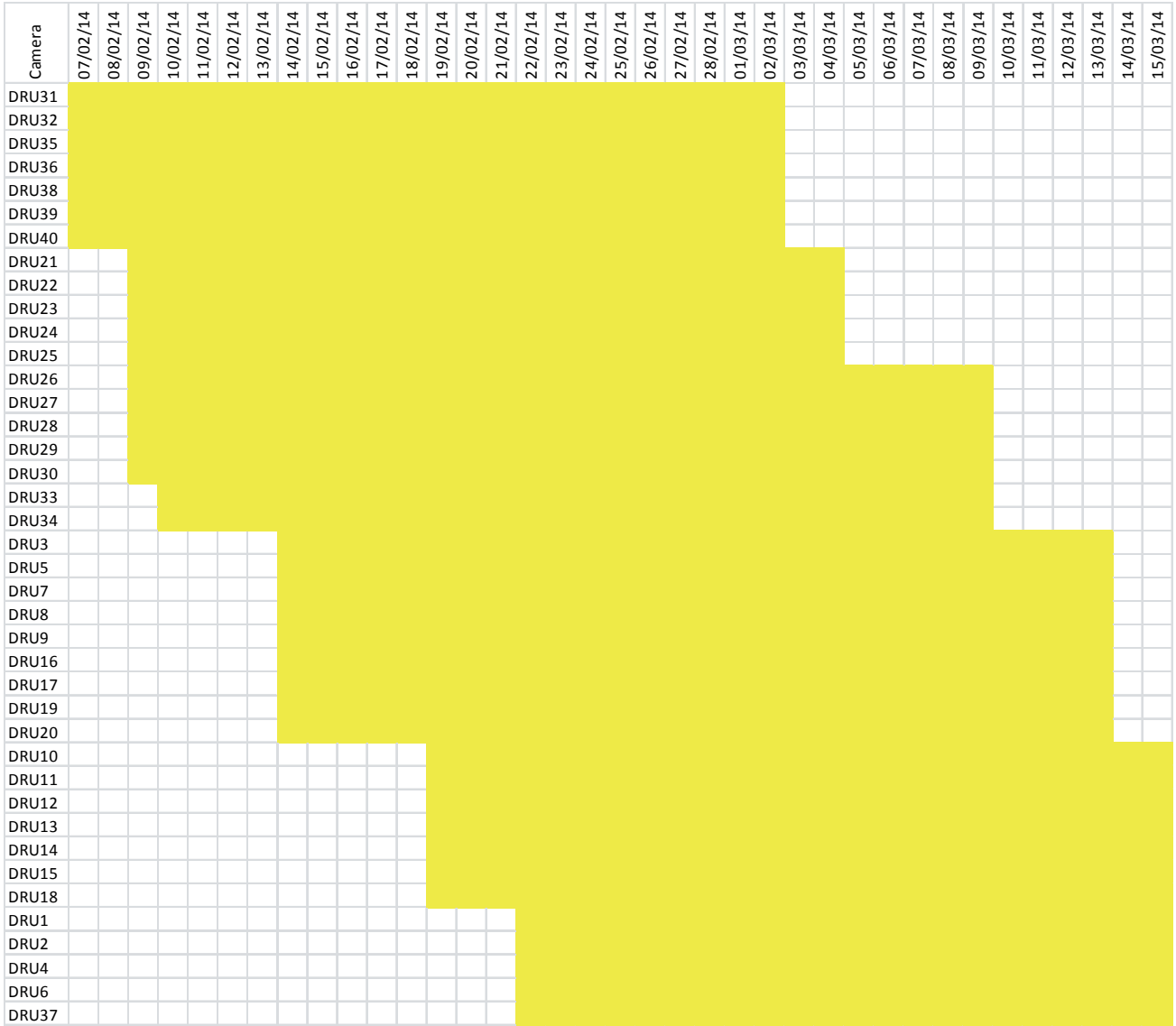
Drumtochty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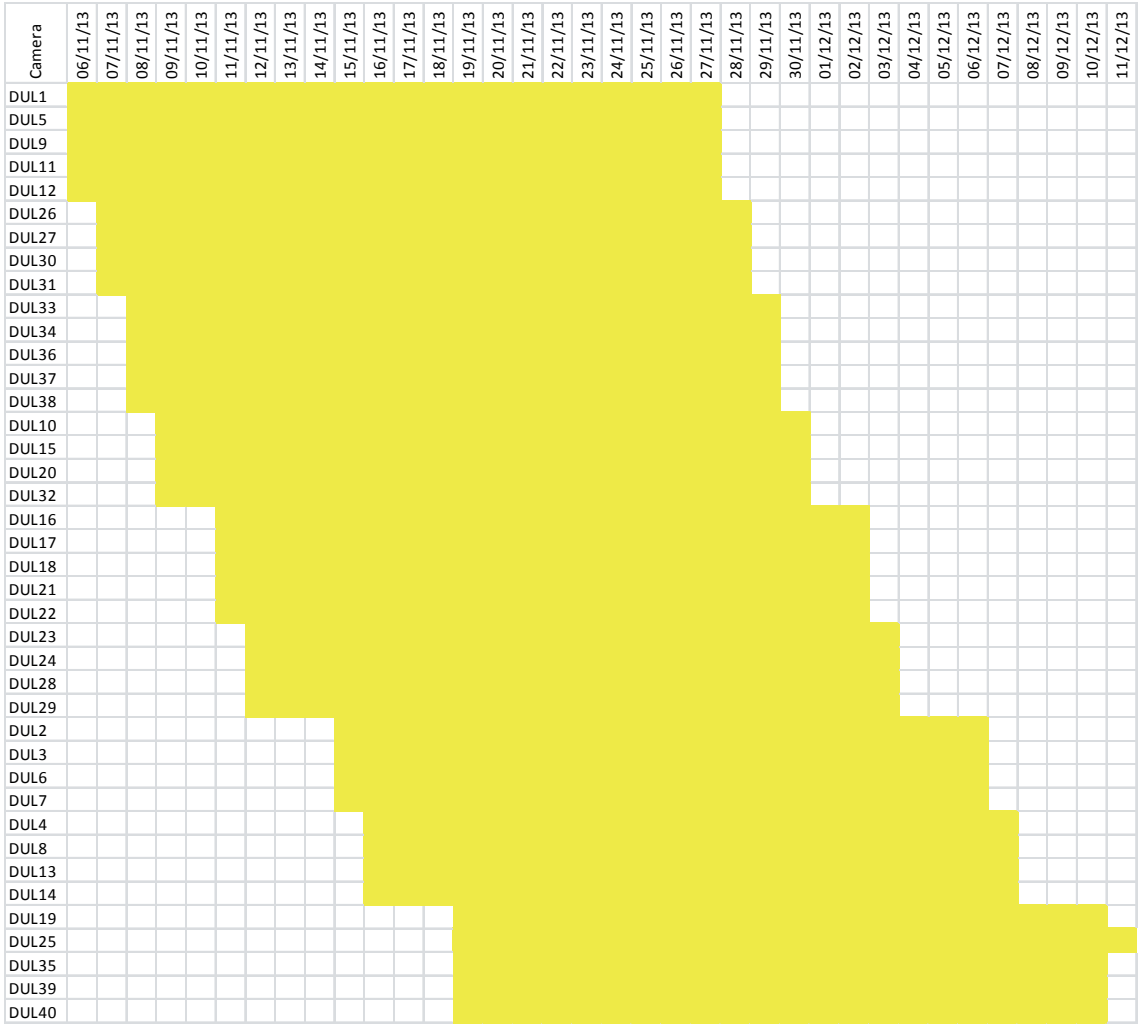
Dulnain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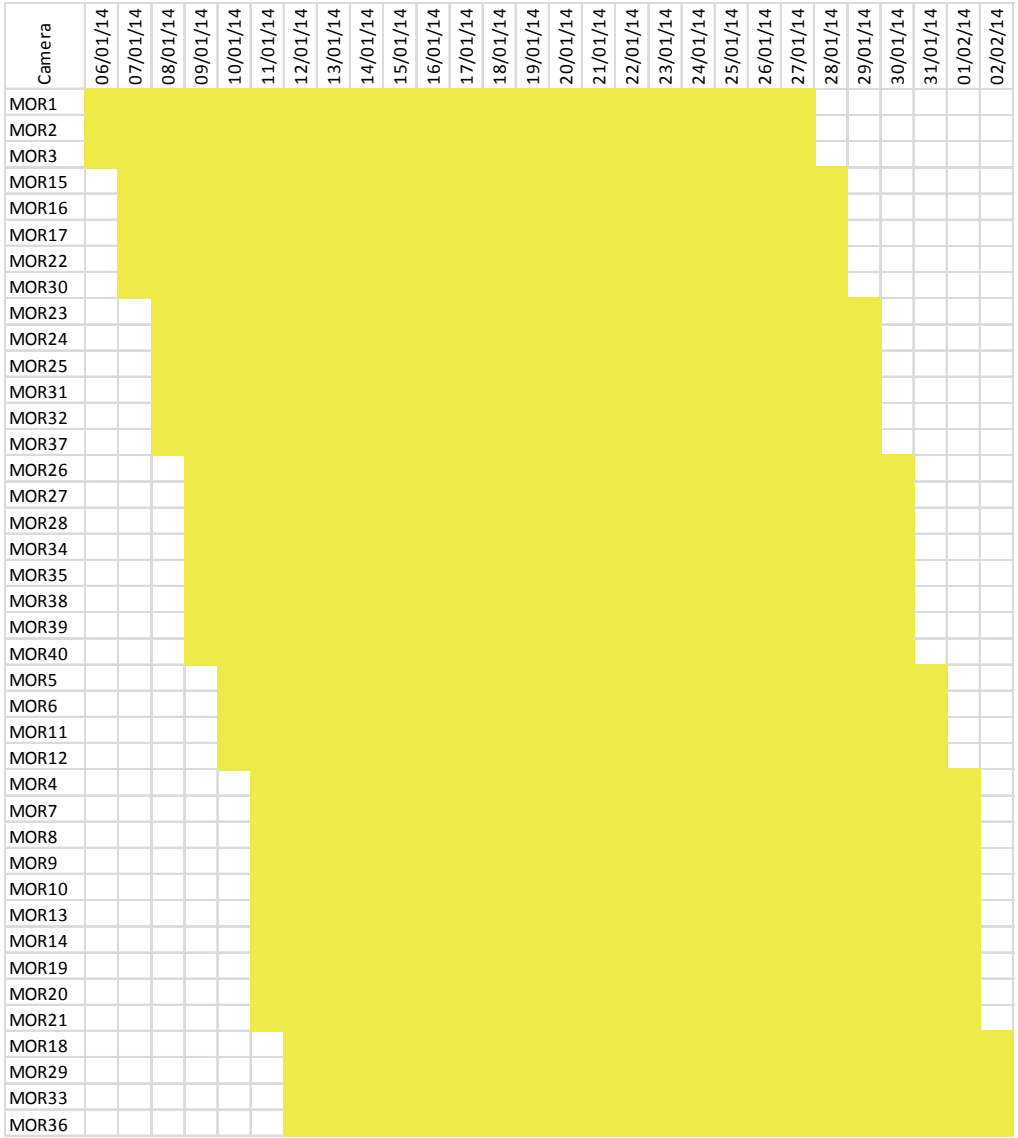
Morvern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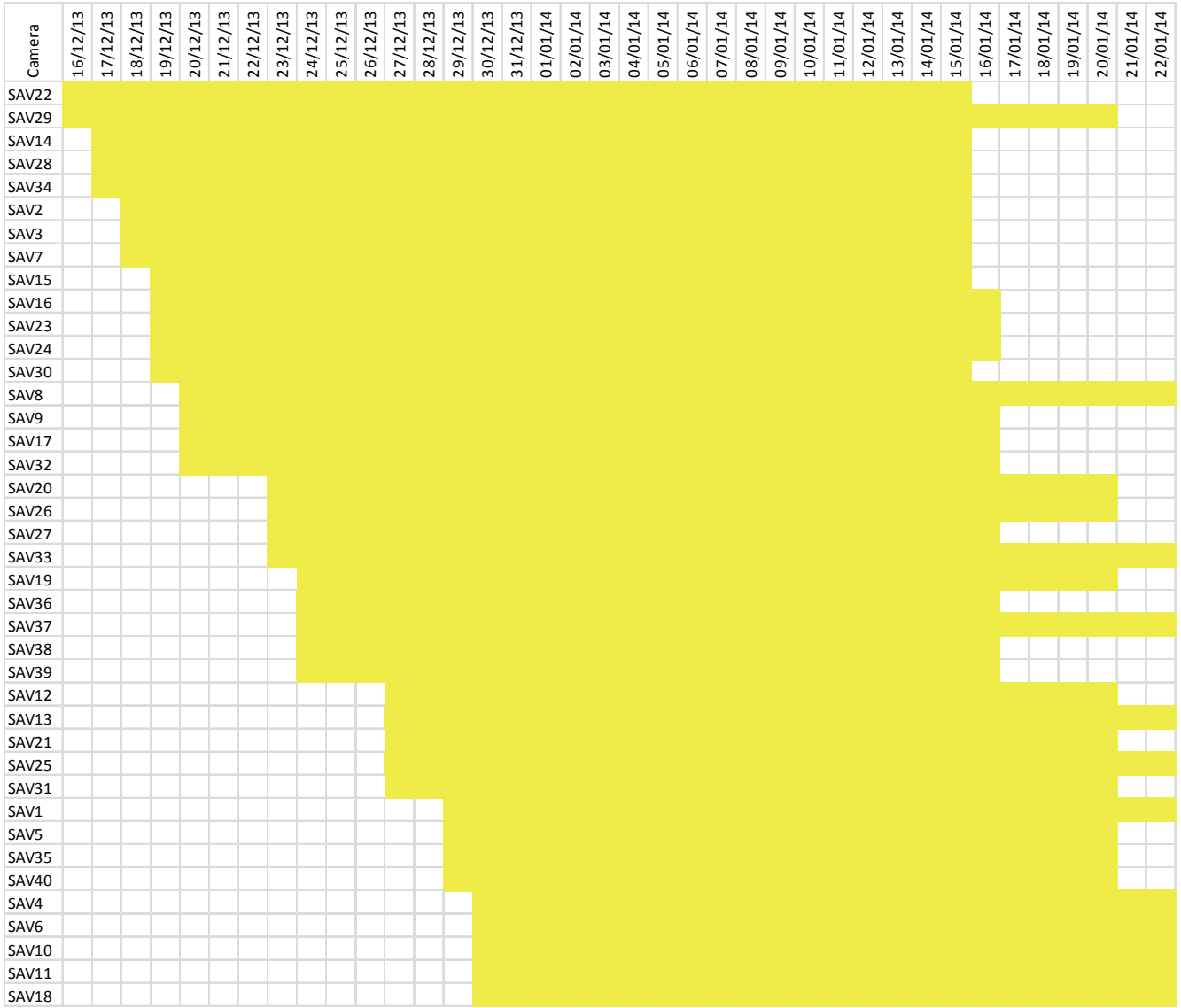
Strathavon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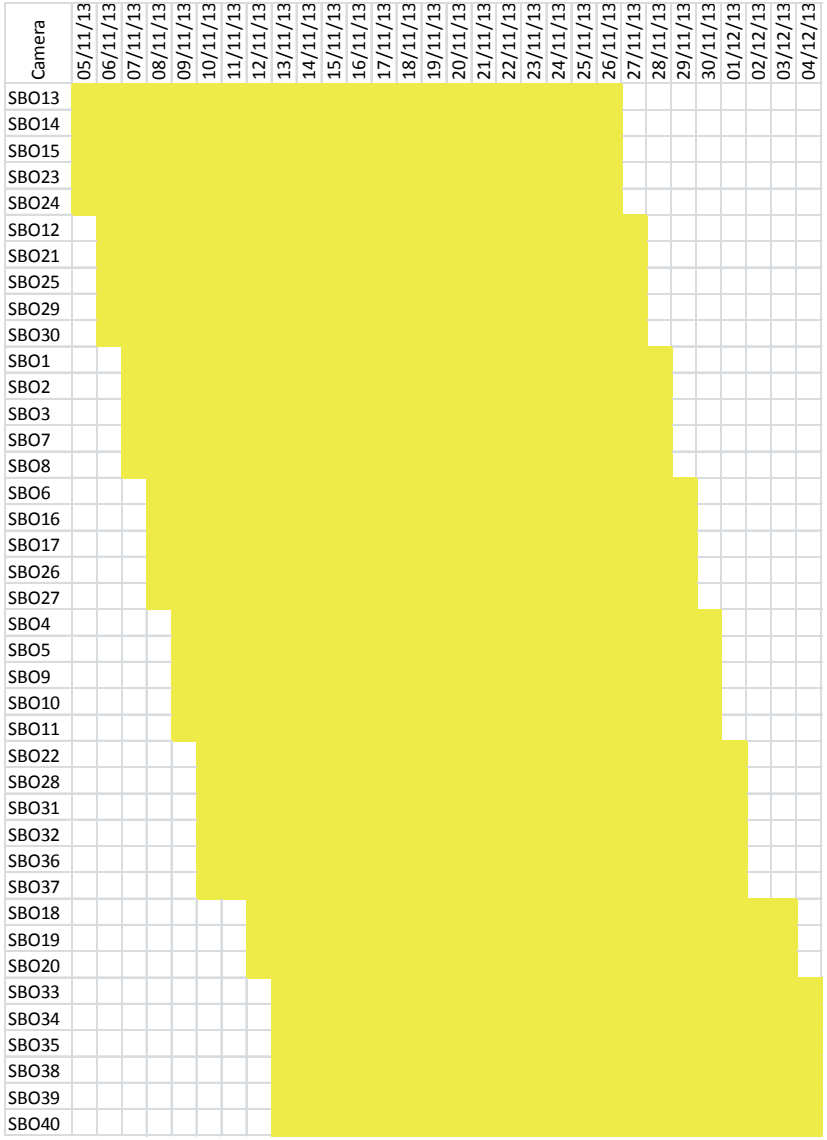
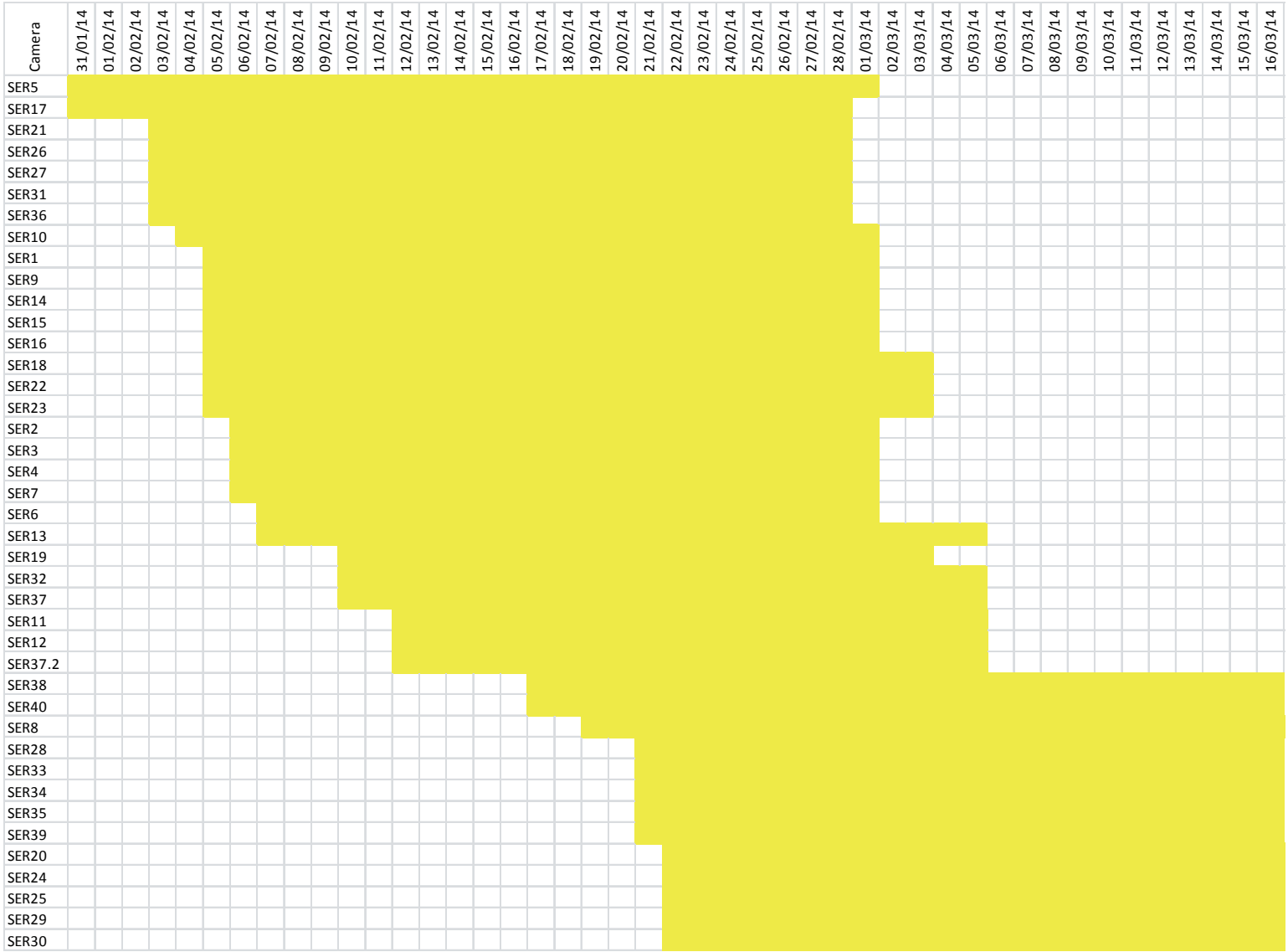
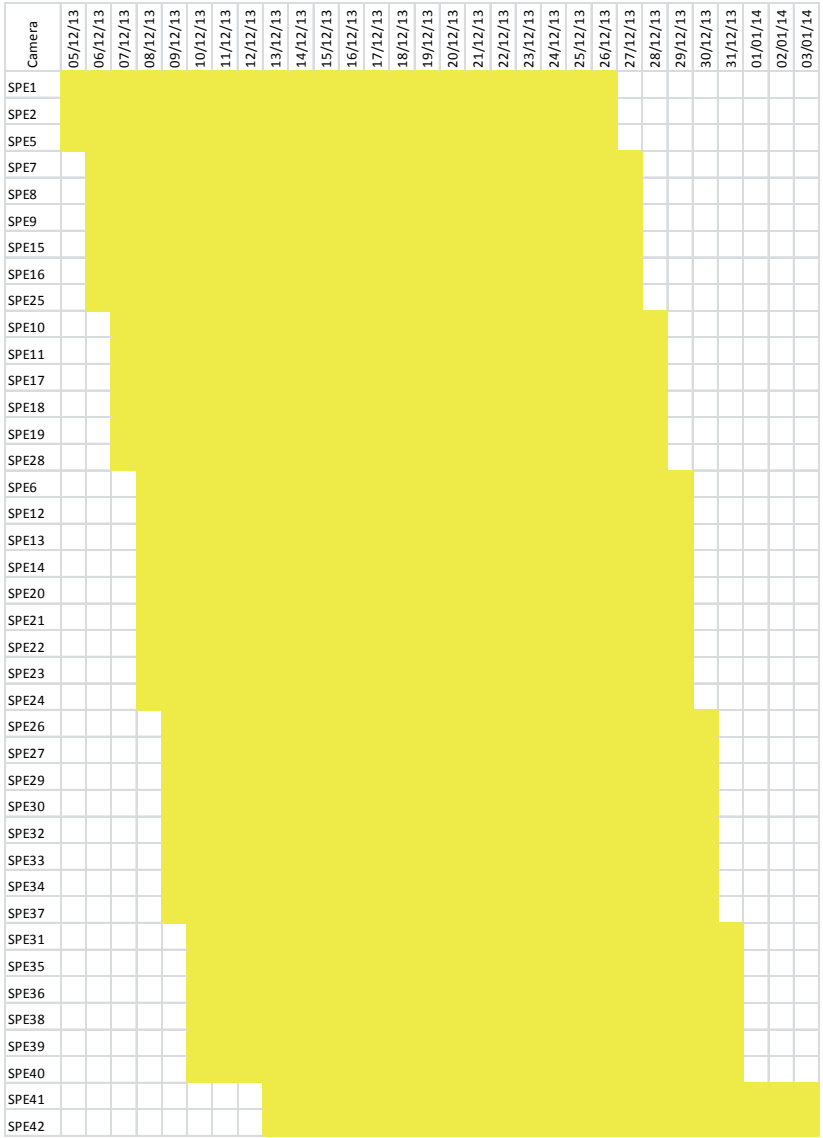
Strathbogie



Stratherrick



Strathpeffer



ANNEX 3: GENETIC SAMPLES ANALYSED UNDER PROJECT PP788

Key: D = domestic; W = wild; H = heterozygote (hybrid)
F = female; M = male; X = no sexing result
'W/H/D sex' refers to the wildcat / hybrid / domestic sex chromosome result
Initials of sample providers ('Origin') available from SNH.

Submitted ID	Date in lab	Origin	Area	Sample type	Cat/Negati	mtDNA	Nuclear DNA SNP markers													Sex	W/H/D SEX
							1	2	3	4	5	6	7	8	9	10	11	12	13	14		
ANG1	11/03/2014	RC	ANGUS	faeces	CAT	W					W					W	W				X	X
ANG10	11/03/2014	RC	ANGUS	faeces	CAT	W					W		W			W					X	X
ANG11	24/03/2014	AR	ANGUS	faeces	Negative																	
ANG11.A	24/03/2014	AR	ANGUS	faeces	Negative																	
ANG12	25/03/2014	RC	ANGUS	faeces	Negative																	
ANG14	25/03/2014	RC	ANGUS	faeces	Negative																	
ANG17	11/03/2014	RC	ANGUS	faeces	CAT	W			D	W	W	D	W		D	W	H		W	H	F	D
ANG17	11/03/2014	RC	ANGUS	faeces	Negative																	
ANG17	11/03/2014	RC	ANGUS	faeces	Negative																	
ANG17	11/03/2014	RC	ANGUS	faeces	Negative																	
ANG17B	11/03/2014	RC	ANGUS	faeces	Negative																	
ANG18	11/03/2014	RC	ANGUS	faeces	Negative																	
ANG19	25/03/2014	RC	ANGUS	hair	CAT	W	D	W	H	H	D		W	H	W	W	H	W	D	H	M	D
ANG20	24/03/2014	AR	ANGUS	faeces	Negative																	
ANG20.A	24/03/2014	AR	ANGUS	faeces	Negative																	
ANG22	25/03/2014	RC	ANGUS	hair	CAT	W			D	W	W	D	W	H	H	W	W			W	X	X
ANG22	25/03/2014	RC	ANGUS	hair	CAT	W						D				W					F	D
ANG22	25/03/2014	RC	ANGUS	hair	CAT	W					H			W		W					M	D
ANG26	01/04/2014	AR	ANGUS	hair	CAT	W	D	W	D	W	H		W	H	D	W	H	H	H	H	X	X
ANG3	11/03/2014	RC	ANGUS	faeces	CAT	D								W							X	X
ANG4	11/03/2014	RC	ANGUS	faeces	Negative																	
ANG4	11/03/2014	RC	ANGUS	faeces	Negative																	
ANG J	25/03/2014	RC	ANGUS	blood		W	D	H	H	H	H	H	W	H	D	W	W	H	W	W	F	H
ATH10	11/03/2014	RC	ATHOLL	faeces	Negative																	
ATH25	11/03/2014	RC	ATHOLL	faeces	Negative																	
ATH30	11/03/2014	RC	ATHOLL	faeces	Negative																	
ATH8	11/03/2014	RC	ATHOLL	faeces	Negative																	
Auchleven	24/03/2014	NP	NA	tissue		W	W	W	H	W	W	H	H	W	W	W	H	W	W	H	F	W
CV1	12/12/2013	JK	STRATHPEFFER	tissue	CAT	D	D	D	W	D	W	D	H	D	D	D	H	D	D	D	F	D
Kin- 1	11/03/2014	RC	DULNAIN	faeces	Negative																	
Kin - 2	11/03/2014	RC	DULNAIN	faeces	Negative																	
DRUM35	25/03/2014	RC	DRUMTOCHTY	faeces	Negative																	
DUL scat 01	11/03/2014	RC	DULNAIN	faeces	Negative																	
DUL scat 02	11/03/2014	RC	DULNAIN	faeces	Negative																	
DUL scat 03	11/03/2014	RC	DULNAIN	faeces	Negative																	
DUL scat 04	11/03/2014	RC	DULNAIN	faeces	Negative																	
Montreathmont	28/01/2014	ES	ANGUS	hair		D	D	D	D	W	D	D	D	W	W	D	D	D	D	D	H	X	X
GCA	15/01/2014	RCP	STRATHBOGIE	blood		D	H	H	H	H	W	D	W	W	W	H	H	W	H	H	M	H
GCB	15/01/2014	RCP	STRATHBOGIE	blood		W	W	W	W	W	H	W	H	W	H	H	D	H	W	H	F	W
GCC	21/01/2014	RCP	STRATHBOGIE	blood		W	H	W	H	D	W	W	W	D	W	D	W	W	W	W	F	W
GCD	21/01/2014	RCP	STRATHBOGIE	blood		W	H	W	D	D	H	H	W	D	H	H	H	W	H	H	M	H
GCE	24/01/2014	RCP	STRATHBOGIE	blood		W	H	W	W	W	H	W	W	H	H	D	W	W	W	W	F	H
GH10.12	14/11/2013	NMS	DULNAIN	tissue		W	W	W	W	W	W	D	H	H	D	W	H	W	H	H	M	D
GH16.10	14/11/2013	NMS	NA	tissue		W	W	W	H	W	W	H	W	W	W	W	W	W	W	W	F	H
GH17.10	14/11/2013	NMS	STRATHAVON	tissue		W	H	W	W	H	W	H	H	W	W	W	H	W	H	W	F	H
GH23.12	14/11/2013	NMS	STRATHBOGIE	tissue		W	D	D	H	H	D	H	H	W	H	H	H	D	H	H	M	H
GH24.12	14/11/2013	NMS	ANGUS	tissue		W	D	H	W	W	H	H	H	D	H	H	H	H	H	W	**M**	H
GH25.12	14/11/2013	NMS	NA	tissue		W	H	H	H	H	D	D	D	H	H	H	H	W	D	H	M	D
GH30.12	14/11/2013	NMS	ANGUS	tissue		D	D	H	H	H	D	D	H	H	H	H	H	W	H	H	M	D
GH31.12	14/11/2013	NMS	DRUMTOCHTY	tissue		W	W	W	W	W	W	H	H	W	W	H	W	W	H	W	M	H
GH34.12	14/11/2013	NMS	NA	tissue		D	D	D	H	D	D	D	D	D	D	H	D	D	H	H	M	D
GH36.12	14/11/2013	NMS	STRATHAVON	tissue		W	H	D	H	D	D	H	D	D	H	W	D	D	W	W	F	D
GH4.10	14/11/2013	NMS	DULNAIN	tissue		W	W	D	H	W	D	H	H	W	H	H	W	D	W	H	F	H
GH6.10	14/11/2013	NMS	STRATHBOGIE	tissue		W	W	W	W	W	W	H	W	W	W	H	W	W	W	W	F	W
GH60.10	14/11/2013	NMS	DULNAIN	tissue		W	H	D	D	D	D	D	D	H	D	H	D	D	D	D	M	H
GH8.12	14/11/2013	NMS	NA	tissue		W	W	D	D	H	H	D	D	H	H	H	H	D	W	D	F	D
Kitten	29/11/2013	DR	STRATHBOGIE	blood		D	H	W	H			H			H	W	W	W		H	F	D
MB_F10	13/01/2014	MB	NA	hair		D																
MB_F11	13/01/2014	MB	NA	hair		D																
MB_F12	13/01/2014	MB	NA	hair		D																
MB_F13	13/01/2014	MB	NA	hair		D																
MB_F14	13/01/2014	MB	NA	hair		D																
MB_F15	13/01/2014	MB	NA	hair		D																
MB_F16	13/01/2014	MB	NA	hair		D																
MB_F17	13/01/2014	MB	NA	hair		D																
MB_F18	13/01/2014	MB	NA	hair		D																
MB_F3	13/01/2014	MB	NA	hair		W																
MB_F4	13/01/2014	MB	NA	hair		D																

Submitted ID	Date in lab	Origin	Area	Sample type	Cat/Negati	mtDNA	Nuclear DNA SNP markers													Sex	W/H/D SEX
							1	2	3	4	5	6	7	8	9	10	11	12	13	14		
MB_F5	13/01/2014	MB	NA	hair		D																
MB_F6	13/01/2014	MB	NA	hair		D																
MB_F7	13/01/2014	MB	NA	hair		D																
MB_F8	13/01/2014	MB	NA	hair		D																
MB_F9	13/01/2014	MB	NA	hair		D																
MB_M1	13/01/2014	MB	NA	hair		D																
MB_M10	13/01/2014	MB	NA	hair		D																
MB_M11	13/01/2014	MB	NA	hair		D																
MB_M12	13/01/2014	MB	NA	hair		D																
MB_M13	13/01/2014	MB	NA	hair		D																
MB_M14	13/01/2014	MB	NA	hair		D																
MB_M2	13/01/2014	MB	NA	hair		D																
MB_M3	13/01/2014	MB	NA	hair		W																
MB_M4	13/01/2014	MB	NA	hair		D																
MB_M5	13/01/2014	MB	NA	hair		D																
MB_M6	13/01/2014	MB	NA	hair		D																
MB_M7	13/01/2014	MB	NA	hair		D																
MB_M8	13/01/2014	MB	NA	hair		D																
MM1	11/03/2014	MM	NA	faeces	Negative																	
MOR1	11/03/2014	RC	MORVERN	faeces	Negative																	
MOR2	11/03/2014	RC	MORVERN	faeces	Negative																	
MOR3	11/03/2014	RC	MORVERN	faeces	Negative																	
MOR4	11/03/2014	RC	MORVERN	faeces	Negative																	
MOR5	11/03/2014	RC	MORVERN	faeces	Negative																	
MOR-D	19/02/2014	RCP	MORVERN	blood		W	H	D	W	D	D	H	W	D	D	H	H	H	D	D	F	D
MOR-B	19/02/2014	RCP	MORVERN	blood		W	W	H	H	H	H	H	H	H	H	H	H	H	H	H	F	H
P1F1	17/01/2014	AC	NA	blood		D	W	D	W	W	W	D	W	W	H	D	W	D	W	W	F	W
P1M1	17/01/2014	AC	NA	blood		D	W	D	W	W	W	D	W	W	H	D	W	D	H	W	M	W
P2F1	17/01/2014	AC	NA	blood		D	W	D	W	W	H	D	W	W	W	D	W	W	W	W	F	W
P2M1	17/01/2014	AC	NA	blood		W	W	H	W	W	W	H	W	W	D	D	W	H	H	W	M	W
PH18.12	14/11/2013	NMS	NA	tissue	NA	W	W	W	W	D	H	H	W	W	W	W	W	W	W	W	M	W
PH27.12	14/11/2013	NMS	DRUMTOCHTY	tissue		W	H	D	W	D	D	D	H	W	H	H	H	D	D	H	M	H
PH31.12	14/11/2013	NMS	DRUMTOCHTY	tissue		W	H	H	D	H	D	H	H	H	H	W	D	H	W	D	F	H
RC1	21/01/2014	RCP	STRATHBOGIE	faeces	CAT	W	W	H	W	W	W	W	H	W	H	H	H			H	X	X
RC157	11/03/2014	RC	NA	faeces	Negative																	
SAV19	11/03/2014	RC	STRATHAVON	hair	CAT	D						D		H				D			F	D
SAV19	11/03/2014	RC	STRATHAVON	hair	Negative																	
SAV39	11/03/2014	RC	STRATHAVON	hair	Negative																	
SAV40	11/03/2014	RC	STRATHAVON	hair	Negative																	
SBO04	11/03/2014	RC	STRATHBOGIE	hair	CAT	D		D		D		D	H	H	H	H	H			H	M	D
SBO1	11/03/2014	RC	STRATHBOGIE	faeces	Negative																	
SBO-B	15/01/2014	RCP	STRATHBOGIE	blood		D	W	H	D	D	W	H	H	H	H	D	H	H	W	H	M	D
SBO-C	21/01/2014	RCP	STRATHBOGIE	blood		D	H	D	W	H	H	H	H	H	W	D	H	D	H	W	M	D
Scaniport	25/03/2014	RC	NA	tissue		D	H	D	W	D	D		H	H	W	H	H	D	D	W	M	D
Deeside	Feb-14	HS	NA	hair	CAT	W	W	W	W	H	D	D	W	D	D	W	D	W	H	D	M	D
SER12 (6)	11/03/2014	RC	STRATHERRICK	faeces	Negative																	
SER30	11/03/2014	RC	STRATHERRICK	faeces	Negative																	
SER31	11/03/2014	RC	STRATHERRICK	faeces	Negative																	
SER34 (4)	11/03/2014	RC	STRETHERRICK	faeces	Negative																	
SER38 (3)	11/03/2014	RC	STRATHERRICK	faeces	Negative																	
TUMM25	11/03/2014	RC	NA	faeces	Negative																	
U1	11/03/2014	RC	NA	faeces	Negative																	
U2 Glen Affric	11/03/2014	RC	NA	faeces	Negative																	
WCT-CPL	28/02/2014	Vet	NA	blood		D	W	H	H	D	H	W	W	H	W	H	H	H	H	H	M	W
WCT-T1	04/03/2014	JB	NA	tissue		W	W	W	W	D	D	D	W	D	W	D	D	W	H	D	M	D
WCT-T2	04/03/2014	JB	STRATHPEFFER	tissue		D	W	H	D	W	W	D	W	W	H	W	W	H	H	W	M	W

ANNEX 4: STRUCTURE RESULTS FOR ALL TEST SAMPLES WITH SUFFICIENT DNA PROFILE DATA

Columns 1 and 2 contain sample identifiers; columns 3-7 contain the (posterior) probability that sample belongs to the wildcat group in each of three runs, together with the mean and standard deviation (sd); columns 8-12 contain the same data for domestic cat assignment. Details of sample specific assignment variance (90% probability intervals) and posterior allele frequencies are available from the authors.

Sample type		Wildcat assignment (%)					Domestic cat assignment (%)				
		run 1	run 2	run 3	mean	sd	run 1	run 2	run 3	mean	sd
wildcat control		0.975	0.975	0.975	0.975	0.000	0.025	0.025	0.025	0.025	0.000
wildcat control		0.975	0.975	0.975	0.975	0.000	0.025	0.025	0.025	0.025	0.000
wildcat control		0.975	0.975	0.975	0.975	0.000	0.025	0.025	0.025	0.025	0.000
wildcat control		0.975	0.975	0.975	0.975	0.000	0.025	0.025	0.025	0.025	0.000
wildcat control		0.975	0.975	0.975	0.975	0.000	0.025	0.025	0.025	0.025	0.000
wildcat control		0.837	0.838	0.838	0.838	0.001	0.163	0.162	0.162	0.162	0.001
wildcat control		0.940	0.941	0.941	0.941	0.001	0.060	0.059	0.059	0.059	0.001
wildcat control		0.894	0.895	0.895	0.895	0.001	0.106	0.105	0.105	0.105	0.001
wildcat control		0.975	0.975	0.975	0.975	0.000	0.025	0.025	0.025	0.025	0.000
wildcat control		0.975	0.975	0.975	0.975	0.000	0.025	0.025	0.025	0.025	0.000
wildcat control		0.975	0.975	0.975	0.975	0.000	0.025	0.025	0.025	0.025	0.000
wildcat control		0.973	0.973	0.973	0.973	0.000	0.027	0.027	0.027	0.027	0.000
wildcat control		0.973	0.974	0.973	0.973	0.001	0.027	0.026	0.027	0.027	0.001
test sample	GH6.10	0.940	0.941	0.941	0.941	0.001	0.060	0.059	0.059	0.059	0.001
test sample	GH16.10	0.935	0.935	0.935	0.935	0.000	0.065	0.065	0.065	0.065	0.000
test sample	GH31.12	0.858	0.859	0.859	0.859	0.001	0.142	0.141	0.141	0.141	0.001
test sample	PH18.12	0.852	0.853	0.854	0.853	0.001	0.148	0.147	0.146	0.147	0.001
test sample	Auchleven	0.817	0.818	0.818	0.818	0.001	0.183	0.182	0.182	0.182	0.001
test sample	GH17.10	0.776	0.778	0.777	0.777	0.001	0.224	0.222	0.223	0.223	0.001
test sample	GCE	0.765	0.767	0.766	0.766	0.001	0.235	0.233	0.234	0.234	0.001
test sample	P2F1	0.760	0.762	0.762	0.761	0.001	0.240	0.238	0.238	0.239	0.001
test sample	RC1	0.722	0.724	0.724	0.723	0.001	0.278	0.276	0.276	0.277	0.001
test sample	WCT-T2	0.717	0.719	0.719	0.718	0.001	0.283	0.281	0.281	0.282	0.001
test sample	ANG22	0.709	0.711	0.711	0.710	0.001	0.291	0.289	0.289	0.290	0.001
test sample	P2M1	0.703	0.705	0.705	0.704	0.001	0.297	0.295	0.295	0.296	0.001
test sample	GCC	0.694	0.695	0.695	0.695	0.001	0.306	0.305	0.305	0.305	0.001
test sample	GCB	0.688	0.690	0.690	0.689	0.001	0.312	0.310	0.310	0.311	0.001
test sample	GH10.12	0.677	0.679	0.679	0.678	0.001	0.323	0.321	0.321	0.322	0.001
test sample	P1F1	0.676	0.679	0.679	0.678	0.002	0.324	0.321	0.321	0.322	0.002
test sample	GCA	0.638	0.640	0.640	0.639	0.001	0.362	0.360	0.360	0.361	0.001
test sample	P1M1	0.635	0.637	0.638	0.637	0.002	0.365	0.363	0.362	0.363	0.002
test sample	ANG17	0.598	0.600	0.601	0.600	0.002	0.402	0.400	0.399	0.400	0.002
test sample	ANG J	0.586	0.588	0.588	0.587	0.001	0.414	0.412	0.412	0.413	0.001
test sample	WCT-CPL	0.577	0.580	0.579	0.579	0.002	0.423	0.420	0.421	0.421	0.002
test sample	GH4.10	0.550	0.552	0.552	0.551	0.001	0.450	0.448	0.448	0.449	0.001
test sample	ANG19	0.545	0.547	0.547	0.546	0.001	0.455	0.453	0.453	0.454	0.001
test sample	GH24.12	0.517	0.519	0.519	0.518	0.001	0.483	0.481	0.481	0.482	0.001
test sample	MOR-B	0.516	0.518	0.518	0.517	0.001	0.484	0.482	0.482	0.483	0.001
test sample	ANG26	0.509	0.512	0.512	0.511	0.002	0.491	0.488	0.488	0.489	0.002
test sample	SBO-B	0.486	0.488	0.488	0.487	0.001	0.514	0.512	0.512	0.513	0.001
test sample	GCD	0.483	0.485	0.485	0.484	0.001	0.517	0.515	0.515	0.516	0.001
test sample	Deeside	0.475	0.478	0.478	0.477	0.002	0.525	0.522	0.522	0.523	0.002
test sample	SBO-C	0.475	0.477	0.477	0.476	0.001	0.525	0.523	0.523	0.524	0.001
test sample	WCT-T1	0.443	0.445	0.446	0.445	0.002	0.557	0.555	0.554	0.555	0.002
test sample	GH30.12	0.412	0.415	0.415	0.414	0.002	0.588	0.585	0.585	0.586	0.002
test sample	PH31.12	0.408	0.410	0.410	0.409	0.001	0.592	0.590	0.590	0.591	0.001
test sample	GH25.12	0.379	0.382	0.382	0.381	0.002	0.621	0.618	0.618	0.619	0.002
test sample	Scaniport	0.374	0.379	0.379	0.377	0.003	0.626	0.621	0.621	0.623	0.003
test sample	GH23.12	0.360	0.364	0.364	0.363	0.002	0.640	0.636	0.636	0.637	0.002
test sample	GH8.12	0.343	0.346	0.347	0.345	0.002	0.657	0.654	0.653	0.655	0.002
test sample	GH36.12	0.327	0.331	0.331	0.330	0.002	0.673	0.669	0.669	0.670	0.002
test sample	PH27.12	0.308	0.313	0.314	0.312	0.003	0.692	0.687	0.686	0.688	0.003
test sample	MOR-D	0.272	0.276	0.276	0.275	0.002	0.728	0.724	0.724	0.725	0.002
test sample	CV1	0.180	0.183	0.184	0.182	0.002	0.820	0.817	0.816	0.818	0.002
test sample	Montreathmont	0.165	0.173	0.173	0.170	0.005	0.835	0.827	0.827	0.830	0.005
test sample	GH34.12	0.111	0.115	0.115	0.114	0.002	0.889	0.885	0.885	0.886	0.002
test sample	GH60.10	0.082	0.085	0.086	0.084	0.002	0.918	0.915	0.914	0.916	0.002
domestic control		0.024	0.024	0.024	0.024	0.000	0.976	0.976	0.976	0.976	0.000
domestic control		0.024	0.024	0.024	0.024	0.000	0.976	0.976	0.976	0.976	0.000
domestic control		0.024	0.024	0.024	0.024	0.000	0.976	0.976	0.976	0.976	0.000
domestic control		0.024	0.024	0.024	0.024	0.000	0.976	0.976	0.976	0.976	0.000
known introgression		0.505	0.508	0.507	0.507	0.002	0.495	0.492	0.493	0.493	0.002
known introgression		0.736	0.738	0.738	0.737	0.001	0.264	0.262	0.262	0.263	0.001
known introgression		0.855	0.856	0.856	0.856	0.001	0.145	0.144	0.144	0.144	0.001
known introgression		0.736	0.738	0.738	0.737	0.001	0.264	0.262	0.262	0.263	0.001
known introgression		0.737	0.738	0.738	0.738	0.001	0.263	0.262	0.262	0.262	0.001
known introgression		0.775	0.776	0.776	0.776	0.001	0.225	0.224	0.224	0.224	0.001

ANNEX 5: NEW HYBRID CATEGORY ASSIGNMENT DATA FOR INDIVIDUAL CATS

Column 1 contains original sample identifiers; columns 2-7 contain the (posterior) probability that the sample belongs to each hybrid class. Due to the nature of the analysis, the addition of further samples or DNA markers may affect class assignment in some cases.

Note: All cats under this analysis are assigned to one of six categories. Cats subject to more ancient introgression will appear as F2 hybrids under this analysis.

Sample ID	Wildcat	Wild Back-X	F1 hybrid	F2 hybrid	Dom Back-X	Domestic
GH6.10	0.994	0.006	0.000	0.000	0.000	0.000
GH16.10	0.993	0.007	0.000	0.000	0.000	0.000
PH18.12	0.559	0.366	0.000	0.075	0.000	0.000
GH17.10	0.001	0.957	0.000	0.042	0.000	0.000
Auchleven	0.080	0.902	0.000	0.018	0.000	0.000
GCE	0.007	0.883	0.000	0.111	0.000	0.000
RC1	0.001	0.870	0.000	0.130	0.000	0.000
GH31.12	0.242	0.750	0.000	0.008	0.000	0.000
WCT-T2	0.002	0.635	0.000	0.363	0.000	0.000
GCA	0.000	0.586	0.001	0.413	0.000	0.000
MOR-B	0.000	0.099	0.600	0.281	0.020	0.000
P2F1	0.094	0.232	0.000	0.674	0.000	0.000
ANG22	0.029	0.394	0.000	0.577	0.000	0.000
P1F1	0.003	0.021	0.000	0.976	0.000	0.000
P2M1	0.001	0.345	0.000	0.654	0.000	0.000
GCC	0.001	0.064	0.000	0.935	0.000	0.000
ANG17	0.000	0.050	0.000	0.949	0.000	0.000
P1M1	0.000	0.012	0.000	0.988	0.000	0.000
GCB	0.000	0.438	0.000	0.562	0.000	0.000
GH10.12	0.000	0.300	0.000	0.700	0.000	0.000
WCT-CPL	0.000	0.144	0.002	0.854	0.000	0.000
ANG J	0.000	0.014	0.000	0.984	0.002	0.000
SBO-B	0.000	0.007	0.002	0.977	0.014	0.000
GH24.12	0.000	0.002	0.001	0.988	0.009	0.000
GCD	0.000	0.002	0.000	0.996	0.001	0.000
GH4.10	0.000	0.002	0.000	0.997	0.001	0.000
ANG26	0.000	0.002	0.000	0.998	0.001	0.000
SBO-C	0.000	0.001	0.000	0.977	0.021	0.000
ANG19	0.000	0.000	0.000	1.000	0.000	0.000
GH30.12	0.000	0.000	0.002	0.914	0.084	0.000
PH31.12	0.000	0.000	0.000	0.872	0.128	0.000
GH25.12	0.000	0.000	0.000	0.881	0.119	0.000
Deeside	0.000	0.000	0.000	0.999	0.000	0.000
WCT-T1	0.000	0.000	0.000	1.000	0.000	0.000
Scaniport	0.000	0.000	0.000	0.918	0.068	0.013
GH36.12	0.000	0.000	0.000	0.785	0.197	0.018
GH8.12	0.000	0.000	0.000	0.756	0.241	0.004
GH23.12	0.000	0.000	0.000	0.628	0.371	0.001
PH27.12	0.000	0.000	0.000	0.492	0.403	0.105
MOR-D	0.000	0.000	0.000	0.425	0.499	0.076
CV1	0.000	0.000	0.000	0.030	0.053	0.917
Montreathmont	0.000	0.000	0.000	0.008	0.018	0.974
GH34.12	0.000	0.000	0.000	0.000	0.012	0.988
GH60.10	0.000	0.000	0.000	0.000	0.003	0.997

ANNEX 6: SURVEY QUESTIONNAIRE AND COVER LETTERS

Survey of views on wildcat conservation in your area

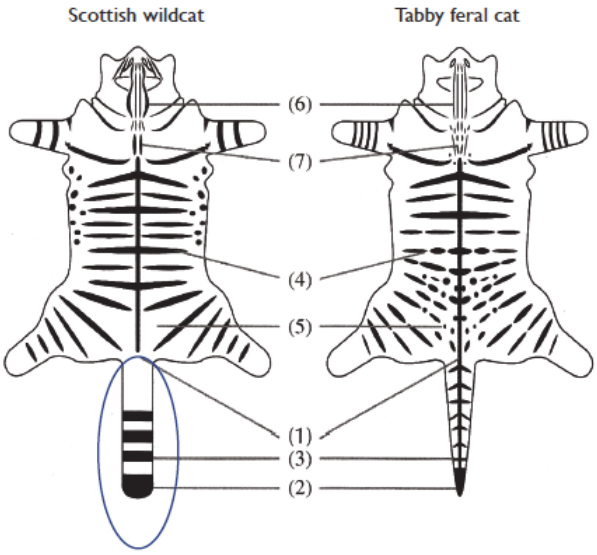
What to do:

Using a pen please tick (✓) the appropriate boxes to indicate your answer to each question. If you would like to write additional comments on the questionnaire you are welcome to do so in Part D.

Before completing the survey, please take a moment to look at the map on page 2 to see where we have in mind when we ask questions about **your area**.

Part A The Scottish wildcat

The following questions ask about your experience of wildcats in your area and your opinions on wildcat conservation.
Scottish wildcats are a native species with a tabby coat and thick tail with black bands.
See the wildcat identification guide below.



Wildcat Field Identification

If a cat has **all** of the following, assume it is a wildcat:

1 Dorsal stripe on lower back always stops at the root of the tail
2 Tip of tail blunt and black
3 Distinct aligned tail bands
4 Unbroken flank stripes
5 No spots on rump; stripes may be broken, but distinct
6 Four nape stripes broad, wavy and unfused
7 Two shoulder stripes

1 ***Have you seen evidence of wildcats in your area in the last 12 months?***

☐ Yes ☐ No ☐ Don't know

If you answered No or Don't know, please go to question 4.

2 ***What evidence of wildcats have you seen?***

Please tick any answers that apply:

☐ Wildcat sighting ☐ Faeces ☐ In trap ☐ Paw prints ☐ Road kill carcass

☐ Other (Please specify):.....


TUMMEL FOREST
Loch Tummel
TAY FOREST PARK
Blair Atholl
Killiecrankie
Tummel Bridge
Glen Garry
Glen Errochty
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3 ***Please indicate on the map any places where you have seen evidence of wildcats by writing a 'W'.***

4 ***What do you think are the advantages of having wildcats in your area?***
Please write them here:

5 ***What do you think are the disadvantages of having wildcats in your area?***
Please write them here:

6 ***To what extent do you agree, or disagree, with the following statements?***
There is no right or wrong answer, it is your personal opinion we are interested in.
Please tick the appropriate boxes.

Statement	Strongly agree	Tend to agree	Neither agree nor disagree	Tend to disagree	Strongly disagree
a. It is important to protect the Scottish wildcat from extinction					
b. I think it is possible to protect Scottish wildcats in the wild					
c. If the wildcats we have left are not 'pure', it is still important to preserve those that are closest to the native form in appearance and behaviour					
d. Wildcats living in my area should be protected					

Part B Feral cat

The following questions ask about your experience with feral cats in your area and will be used to inform management actions to reduce the threats to wildcats from feral cats.

Feral or "stray" cats live mostly in the wild and are not owned by people. Feral cats can be tame or completely afraid of people. Sometimes they are fed by people. In this section, when we refer to feral cats we are also referring to hybrids between feral cats and wildcats.

7 ***Have you seen evidence of feral cats in your area in the last 12 months?***

☐ Yes ☐ No ☐ Don't know

If you answered No or Don't know, please go to question 10.

8 ***What evidence of feral cats have you seen?***

Please tick any answers that apply:

☐ Feral cat sighting ☐ Faeces ☐ In trap ☐ Paw prints ☐ Road kill carcass

☐ Other (Please specify):.....

9 ***Please indicate on the map any places where you have seen evidence of feral cats by writing an 'F'. If you know about any feral cat colonies (3 or more cats living wild together in one place) indicate their location on the map by writing a 'C'.***

10 ***What do you think are the advantages of having feral cats in your area?***
Please write them here:

11 ***What do you think are the disadvantages of having feral cats in your area?***
Please write them here:

Part C Priority areas for wildcat conservation

One of the possibilities for protecting wildcats is setting up priority wildcat areas where risks to wildcat populations could be minimised. Priority wildcat areas will not be formally designated and the uptake of management actions that would minimise risks to wildcats would be voluntary.

Thinking about your area please answer questions 12–16.

12 ***How serious a problem do you think the following potential risks to wildcats are in your area, or do you think they are not a problem at all?*** Please tick the appropriate boxes.

Potential risk to wildcats	Very serious	Fairly serious	Neutral	Not very serious	Not at all serious
a. Interbreeding **with feral cats**					
b. Transmission of diseases **from feral cats**					
c. Accidental killing (by e.g. shooting and/or snaring) as part of legitimate predator control					
d. Interbreeding **with domestic cats**					
e. Transmission of diseases **from domestic cats**					

13 ***Listed below are a number of management actions that could be applied in a priority wildcat area to minimize risks to wildcats. To what extent would you oppose or support each management action if your area was selected to become a priority area for wildcat conservation?*** Please tick the appropriate boxes.

Management Action	Strongly oppose	Tend to oppose	Neutral	Tend to support	Strongly support
a. Reduce populations of feral cats in my area to minimise interbreeding with wildcats					
b. Encourage local people to be actively involved in managing populations of feral cats in my area					
c. Encourage cat owners to have their pet cats neutered in order to reduce the chances of interbreeding with wildcats					
d. Make more information publicly available about wildcat protection					
e Encourage cat owners to have their pet cats vaccinated (against e.g. cat flu and/or feline leukaemia virus) to help reduce the risks from the spread of diseases to wildcats					
f. Discourage feeding of feral cats					
g. Encourage wildcat friendly predator control methods (e.g. cage trapping)					
h. Promote proper storage of foodstuffs to avoid creating food sources for feral cats					

14 ***Do you think setting up a priority area for wildcat conservation is a good response to the risks to wildcats in your area?***

☐ Yes ☐ No ☐ Don't know

15 ***Please give reasons for your answer to question 14 here even if you answered 'Don't know':***

16 ***Would you have any concerns about your area becoming a wildcat priority area?***

Trap-Neuter-Release programme

To reduce threats to wildcats from feral cats in wildcat priority areas, the Scottish Wildcat Conservation Action Plan proposes to co-ordinate a programme that would involve trapping, neutering, vaccinating and releasing feral cats back in the wild. This management approach is often called Trap-Neuter-Release (TNR).

17 ***Are you aware of any Trap-Neuter-Release programmes in your area?***

☐ Yes ☐ No

If yes, please give details here:

18 ***To what extent would you oppose or support a co-ordinated Trap-Neuter-Release programme to manage populations of feral cats in your area?*** Please tick the appropriate box.

☐ Strongly oppose ☐ Tend to oppose ☐ Neutral ☐ Tend to support ☐ Strongly support

19 ***To what extent would a Trap-Neuter-Release programme be feasible for managing feral cat populations in your area?*** Please tick the appropriate box.

☐ Not at all feasible ☐ Not very feasible ☐ Neutral ☐ Fairly feasible ☐ Very feasible

20 ***Who should carry out a Trap-Neuter-Release programme in your area?***

Please tick one answer that best describes your preference.

☐ Local volunteers ☐ Land managers ☐ Staff of conservation organisations

☐ Other (Please specify): .....

21 ***Do you have any comments about Trap-Neuter-Release programme in your area?*** Please write them here:

Predator control

The following questions are for people involved in predator control. If you do not currently use any methods of predator control, please go to question 24.

22 ***Please tell us what methods you, or anyone you work with, currently use for predator control by ticking the appropriate boxes. If you have approximate numbers of feral cats that you have caught and/or killed using each method of control in the last 12 months, please write them in the table.***

Predator control method	Currently using	Approximate number of feral cats trapped or killed through each method in the last 12 months
Lamping and shooting		
Snaring		
Cage trapping and shooting		
Cage trapping and neutering		
Other (Please specify):		

23 ***If your area was selected to become a priority wildcat area would you consider making changes to your predator control methods to reduce risks to wildcats?***

☐ Yes ☐ No ☐ Don't know

Domestic cat

Another aim for priority wildcat areas will be to promote responsible domestic cat ownership, which will involve encouraging neutering and vaccination of domestic cats.

24 ***Is neutering of pet cats a common practice in your area?***

☐ Yes ☐ No ☐ Don't know

25 ***Is vaccinating pet cats (e.g. against cat flu and/or feline leukaemia virus) a common practice in your area?***

☐ Yes ☐ No ☐ Don't know

26 ***What, if any, information do you have on the uptake of vaccination and neutering in your area?***

Part D Further comments

27 *Do you have any comments on issues facing wildcat conservation and/or the management of priority areas?*
Please write them here:

Part E About you

Please tell us a little bit about yourself to help us better understand who are the respondents in each area.

28 *Which of the following best describes you?*

- ☐ a. Farmer
- ☐ b. Crofter
- ☐ c. Estate Manager
- ☐ d. Gamekeeper
- ☐ e. Vet
- ☐ f. Cats Protection volunteer
- ☐ g. Other (Please specify): .....

Thank you for your time!

Scottish Natural Heritage
All of nature for all of Scotland

The James Hutton Institute

WILDCRU
Wildlife Conservation Research Unit

THE ROYAL ZOOLOGICAL SOCIETY OF SCOTLAND

07/01/2014

Dear Sir, Dear Madam,

A Conservation Action Plan for the Scottish wildcat was recently published by a partnership of organisations. As part of this, the James Hutton Institute and the Wildlife Conservation Research Unit are working with Scottish National Heritage (SNH) to determine where conservation action for Scottish wildcats should be prioritised. We are seeking the views of a small sample of key interest groups in your area, including local Cats Protection volunteers, on whether your area should become a priority area for wildcat conservation.

We would like you **to complete and return the enclosed question booklet in the pre-paid envelope by the 21th of January** to tell us what you think about protecting wildcats in your area. We are interested in your response even if you do not have specific knowledge of wildcats in the area defined on page 2 of the question booklet. Your responses will be invaluable in helping prioritise action for protecting wildcats in the near future.

The booklet should take no more than 10 minutes to complete. Participation in this survey is completely voluntary. If there are any questions you prefer not to answer, you may omit them, but please try to answer as many questions as you can.

The findings of this survey will be published in summary form as an SNH report and will not attribute responses to individuals. All information you give will be kept **strictly confidential**. The booklet has an identification number for mailing purposes only so we can record a response against your name when the booklet is returned to us. Your name will never be placed on the booklet and will not be linked to any answers you give.

If you have any questions about the study, or would like additional information to assist you in completing the booklet, you are welcome to contact Nick Littlewood at the address/phone number/e-mail given below.

On behalf of the project team, thank you for taking the time to help us with this important study.

Yours sincerely,

N. Littlewood

Nick Littlewood
Telephone: 01224 395 209
E-mail: nick.littlewood@hutton.ac.uk

For more information on the wider background to the study, see the Scottish Wildcat Conservation Action Plan, downloadable at: www.snh.org.uk/pdfs/publications/wildlife/wildcatconservationactionplan.pdf

If you would like to get involved in wildcat conservation in your area please send an e-mail to Fiona.Strachan@snh.gov.uk

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Scottish Natural Heritage
All of nature for all of Scotland

The James Hutton Institute

WILDCRU
Wildlife Conservation Research Unit

THE ROYAL ZOOLOGICAL SOCIETY OF SCOTLAND

14/02/2014

Dear Sir, Dear Madam,

Several weeks ago you would have received a question booklet asking about your views on protecting Scottish wildcats in your area. To the best of our knowledge, it has not yet been returned.

We are writing again because your responses are important in helping the Scottish National Heritage and local organisations to decide what actions need to be taken to protect wildcats in the near future. We are interested in your response even if you do not have specific knowledge of wildcats in the area defined on page 2 of the question booklet.

People who have already responded told us about the advantages and disadvantages of setting up priority areas for wildcat conservation and about their experiences with the management of feral and domestic cats. We sent the booklet only to a small group of local people in several areas around Scotland so hearing from everyone helps assure that we make the best possible decisions about wildcat conservation.

The study is drawing to a close and we would be very grateful if you could take just 10 minutes of your time to **complete the question booklet and return it to us by the 28th of February** in the enclosed postage-paid envelope.

We want to assure you that everything you tell us is confidential. Each booklet has an identification number on the last page so that we can check your name off of the mailing list when the booklet is returned. The list of names is then destroyed and your name is never linked to any answers you give. The findings of this survey will be published in summary form as an SNH report.

If you have any questions or comments about the study, please contact Nick Littlewood at the address/phone number/e-mail given below.

Thank you very much for helping with this important study.

Yours faithfully,

N. Littlewood

Nick Littlewood
Telephone: 01224 395 209
E-mail: nick.littlewood@hutton.ac.uk

For more information on the wider background to the study, see the Scottish Wildcat Conservation Action Plan, downloadable at: www.snh.org.uk/pdfs/publications/wildlife/wildcatconservationactionplan.pdf

If you would like to get involved in wildcat conservation in your area please send an e-mail to Fiona.Strachan@snh.gov.uk

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