



Cairngorms
NATIONAL PARK

The Cairngorms Wildcat Project

Final Report



HIGHLAND
TIGER
THE SCOTTISH WILDCAT

THE CAIRNGORMS WILDCAT PROJECT

Final Report

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EXECUTIVE SUMMARY

Background

The Cairngorms Wildcat Project was a practical trial of targeted conservation actions for the Scottish wildcat. The Project was a partnership between the Cairngorms National Park Authority (CNPA), Scottish Natural Heritage (SNH), The Royal Zoological Society of Scotland (RZSS), the Scottish Gamekeepers Association (SGA) and Forestry Commission Scotland (FCS). The project was informed by a stakeholder conference in 2008, was officially launched in May 2009, and ran until March 2012. It was largely funded by SNH under the Species Action Framework and by additional funds generated through the Highland Tiger appeal.

The actions of the Project fall into 4 main headings. These are:

1. Raising awareness of wildcats and their conservation
2. Neutering domestic cats
3. Working with estates
4. Researching and monitoring wildcats

Raising awareness of wildcats and their conservation - A key feature of the Project was the use of the 'Highland Tiger' awareness-raising brand to communicate to a wide audience the species' rarity and the actions they could take to help conserve it. The project established a website (www.highlandtiger.com), as well as other internet resources and promotional materials, and stimulated much coverage in the print and broadcast media. Many educational talks were delivered at a local level and included targeted presentations to key audiences such as farmers and gamekeepers.

Neutering domestic cats - The Project sought to develop a close working relationship with the cat welfare charity Cats Protection in order to co-ordinate the promotion and delivery of neutering and vaccination of domestic and feral cats within the CNP. This element of the Project relied on volunteer effort and collaboration with local veterinary practices, who collated available data on the number of animals treated locally. The Project also sought to raise awareness of responsible domestic cat ownership in the Park, by delivering talks and through the production of a leaflet which was made widely available.

Working with estates - The Project worked with the gamekeeping community to establish a practical protocol for their feral cat control activities that minimised the risks of harming wildcats. The protocol included:

- A practical, but precautionary, set of criteria which helps identify a wildcat in the field, i.e. a tabby-marked cat with a thick, ringed, blunt tail; a dorsal stripe which does not extend onto the tail; and no white feet;
- Promoting methods of control which endeavour to avoid harm to wildcats, i.e. cage-trapping;
- Advice on what action to take if a wildcat is accidentally caught;
- Guidance on the humane treatment of feral or domestic cats.

Five estates participated in the Project by adopting the protocol and reporting on their feral cat control activities and any wildcat sightings.

Research and monitoring wildcats – Intensive camera trap monitoring was adopted by the Project to obtain baseline and trend data on wildcat and feral cat presence on the five participating estates. In addition, the Project collated the results of opportunistic camera trapping, sightings records by the public, and the recovery of wild-living cat carcasses for analysis.

Key findings and outcomes

The Project has successfully engaged the public about wildcats which is reflected in: the species' greater prominence in the most recent Scottish Nature Omnibus survey; by increased participation in voluntary feral cat neutering work; by attendance at local talks on the subject; by the volume of public sightings records submitted; and by donations to the Highland Tiger Fund.

Feral cat management by a network of trained Cats Protection volunteers has been substantially stepped up within the CNP with the help of the Project. Feral cat neutering is dependent on enthusiastic individuals as well as intelligence from local communities. The efficacy and sustainability of this mechanism, without continuing staff resources to co-ordinate it, remains to be demonstrated as a tool for wildcat conservation. To be an effective tool for wildcat conservation, Trap Neuter Release needs to be co-ordinated, based on intelligence of wildcat and feral cat distributions. Over the course of the project there was no increase in uptake of pet cat neutering via local veterinary practices. The reasons for this are not fully understood, but could be various.

A major success of the Project was the effective partnership between conservation and land management interests. The Project's engagement with estates was very positive and raised awareness of wildcats and the need for their conservation amongst gamekeepers, and appears to have directly benefitted their conservation. The estate protocols developed by the Project could be adopted by the gamekeeping sector in their own training and guidance and applied more widely in other stronghold areas. The proactive management by land managers of feral cat populations for wildcat conservation could potentially be supported by public funding mechanisms e.g. SRDP.

Research has focused on establishing the status of cats currently living wild in the CNP. This has included the assessment of distributions based on submitted public records as well as assessing the extent of hybridisation from analysis of camera trap images and roadkill carcasses (genetic results to follow). Consequently our knowledge of wild-living cats in the CNP has been much enhanced. The findings suggest wildcats are very rare, but are present in low numbers in the western half of the National Park, i.e. Badenoch & Strathspey, Highland Perthshire and possibly Glenlivet. No records substantiated with photos or carcasses were obtained from the eastern side of the Park, i.e. Deeside, Donside and the Angus Glens. Camera trap images and recovered cat carcasses indicate that feral cats and hybrids are more numerous and widespread and occupy the same areas as wildcats, hence the risks from hybridisation appear to be real and continuing.

A programme of practical measures has therefore been successfully trialled in the CNP with the involvement of a wide range of interest groups. The package of measures required a large input of dedicated staff time over the three years of the

Project. Elements of the Project will continue where they can be integrated with standard practice and some could be replicated elsewhere where the local infrastructure permits (access to volunteers, veterinary services etc.). The efficacy for wildcat conservation of some actions, such as volunteer co-ordinated Trap Neuter Release (TNR) remain to be fully demonstrated and may require longer-term monitoring to fully evaluate.

There is now the opportunity to build on the work of the Cairngorms Wildcat Project in developing a new national Action Plan for the Scottish Wildcat. The project has reinforced the parlous state of the Scottish Wildcat, but offers some practical actions that could continue to be applied in the Cairngorms National Park and in other areas identified as strongholds for wildcats.

I. Introduction

In 2007, Scottish Natural Heritage (SNH) included the Scottish Wildcat on a list of 32 species for priority conservation action, which would mean that effort and resources would be focused on its conservation. The first steps to create a wildcat conservation project in the Cairngorms National Park (CNP), an area previously identified as being a stronghold for wildcats, were also taken in 2007, when the Cairngorms National Park Authority (CNPA) added the wildcat as a key priority species to the Cairngorms Local Biodiversity Action Plan. Following on from this, a meeting of potential project partners was called at the CNPA offices in Grantown in September 2007 in order to discuss how best to take forward a conservation project in the CNP. This was attended by representatives of the CNPA, SNH, Scottish Gamekeepers' Association (SGA), and Royal Zoological Society of Scotland (RZSS). Forestry Commission Scotland (FCS) would later join this steering group as would the Wild Media Foundation (WMF) although the WMF's direct involvement was temporary and concluded prior to the official launch of the Project.

In order to identify a way forward for a Cairngorms-based wildcat conservation project, it was decided to hold a conference. The conference, entitled "Practical wildcat conservation in the Cairngorms National Park" was held in Aviemore in April 2008. This event was well attended by around 100 delegates from a wide variety of sectors and, through several workshops, served to identify options for progressing a conservation project, as well as helping to raise awareness of wildcats and their plight, both locally through discussions amongst those in attendance, and nationally by way of resultant press coverage.

The steering group of partner organisations designed a Project which would be funded largely by SNH's Species Action Framework, but also with significant funding contributions from CNPA and RZSS. A Memorandum of Understanding (MoU) was signed by all Project partners with stated aims:

- To secure the future of the Scottish wildcat within the Cairngorms National Park (CNP), leading to further action across a wider area of Scotland
- To raise awareness of the plight of the Scottish wildcat
- To promote public support for wildcat conservation measures

Furthermore, the Project's objectives were:

- To work with land managers in the CNP to ensure that the population of Scottish wildcats benefits from existing feral cat control activities;
- To set in place sustainable feral cat management, with the support and co-operation of landowners, such that this will become self-sustaining beyond the life of the project;
- To carry out research and monitoring to develop a greater understanding of Scottish wildcat conservation status, ecology, genetics and epidemiology within the context of the project;
- To engage the support of the local community for responsible domestic cat ownership, including participation in voluntary neutering and vaccination schemes

- To provide an efficient and effective programme of activities which could be applied for the benefit of Scottish wildcat across a wider geographic area of Scotland
- To capitalise on the charismatic nature of the Scottish wildcat in the CNP to nurture an ethos of collaboration and ownership in the Project across a wide spectrum of interest groups and individuals.

A full-time Project Manager was employed in February 2009. The Cairngorms Wildcat Project was officially launched by Environment Minister Roseanna Cunningham at the Highland Wildlife Park on May 5th 2009. The Project ended on March 31st 2012.

This reports sets out the various activities of the Project and reports on their outcomes. It is divided into 7 chapters:

1. Introduction
2. Raising awareness of wildcats and their conservation
3. Neutering domestic cats
4. Working with estates
5. Researching and monitoring wildcats
6. Project closing conference
7. Conclusions



2. Raising awareness of wildcats and their conservation

The Project MoU had two stated aims relating specifically to awareness-raising:

- To raise awareness of the plight of the Scottish wildcat
- To promote public support for wildcat conservation measures

Furthermore, one of the objectives of the Project was:

- To capitalise on the charismatic nature of the Scottish wildcat in the CNP to nurture an ethos of collaboration and ownership in the Project across a wide spectrum of interest groups and individuals.

2.1 The importance of public awareness-raising

The Scottish wildcat is a rare, elusive and largely nocturnal species confined to the most thinly populated parts of the UK. Its conservation is complex, for a range of reasons. Firstly, the species is a predator, and can therefore be perceived as a threat to some land management interests, such as gamebird conservation. Furthermore, the species can be superficially similar to a tabby-marked domestic cat, which presents difficulties in accurate identification during species surveying and monitoring, during feral cat control activities practised by estates, and feral cat neutering work conducted by cat welfare groups and vets. This is further confused by hybridisation, which results in the occurrence of wild-living cats with shared features of both wildcats and domestic cats. This had also led over the years to scientific disagreement on defining the Scottish wildcat and how the species should be conserved.

From the outset of the Project, it was agreed that raising awareness of the wildcat and its plight, both at a wide public level and at a more specific and local level, was critical to the success of any wildcat conservation project. Two key groups which the Project aimed to reach in order to influence behaviours which could directly benefit wildcats were domestic cat owners and gamekeepers. Given how widespread in society cat ownership is, messages about responsible cat ownership can only be delivered widely, rather than in a more targeted fashion that is achievable for a professional community such as gamekeepers. Consequently, the Project engaged with the gamekeeping community in a more appropriate, targeted manner (see Chapter 4).

In order to catch the public's imagination and inspire them about wildcat conservation efforts in line with the aims and objectives of the MoU, the Project chose a strong awareness-raising brand, 'Highland Tiger' (HT). A number of awareness raising materials utilising this brand, including a website, social media, postcards and DVD, were developed to raise the profile of the wildcat and communicate conservation issues and actions. Furthermore, the brand would be used wherever possible in dealings with the media.

Benefits to wildcat conservation of the Project's broader public awareness-raising activities would be:

- Greater awareness of the need for neutering and vaccination of domestic cats to conserve wildcats

- Public involvement in recording of wild-living cats across the National Park and beyond
- Donations of money and time from inspired members of the public which could be usefully directed at Project objectives

2.2 Web presence

The Project website, www.highlandtiger.com, was designed to be the public focal point for up-to-date information about wildcats and their ecology, which would also detail the objectives and activities of the Project in a visually attractive, user-friendly way. The site provided specific guidance on responsible cat ownership and wildcat identification. A news section and Project Manager’s blog regularly update visitors on Project developments, advertise talks and other events, and make pleas for voluntary assistance e.g. with feral cat trapping. The public are also encouraged to contribute to wildcat conservation by reporting wildcat sightings via an online form. There is also an opportunity to donate money to the Highland Tiger Fund, a wildcat conservation fund administered by the RZSS, the proceeds of which are used to further wildcat conservation and research in the Cairngorms National Park.

Table 2.1 Web traffic for www.highlandtiger.com for the three years of the Project.

Year	Total visits	Monthly average	Daily average
May 09 – Mar 10	94265	8570	286
Apr 10 – Mar 11	216940	18078	603
Apr 11 – Mar 12	161705	13475	449

Access to Matrixstats for the Highland Tiger website allows statistical analysis of how the site is used by visitors. This shows that the number of visitors to the site grew steadily over the first year following its launch and remained consistently high over the second and third years, with an average of 449 daily visits for the year 2011/12. The year running from April 2011 to March 2012 saw fewer total visits to the website than the previous. However, April 2010 had seen a very large volume of visitors (almost 70,000) because of a prominent story about the Project on the BBC News site, which linked to the HT site. Excepting April, the average monthly figure for the 2010/11 year would have been 13371, rather than 18078. The 2011/12 year, with an average of 13475 visits per month, therefore largely represents a year of consolidation on visitor numbers to the website, which remained fairly constant over the course of the year. Beyond the homepage, the Project Manager’s regularly-updated blog typically attracted the most visits to the website. The total visits to the site for each quarter from April 2009 to March 2012 are displayed in Fig. 2.1.

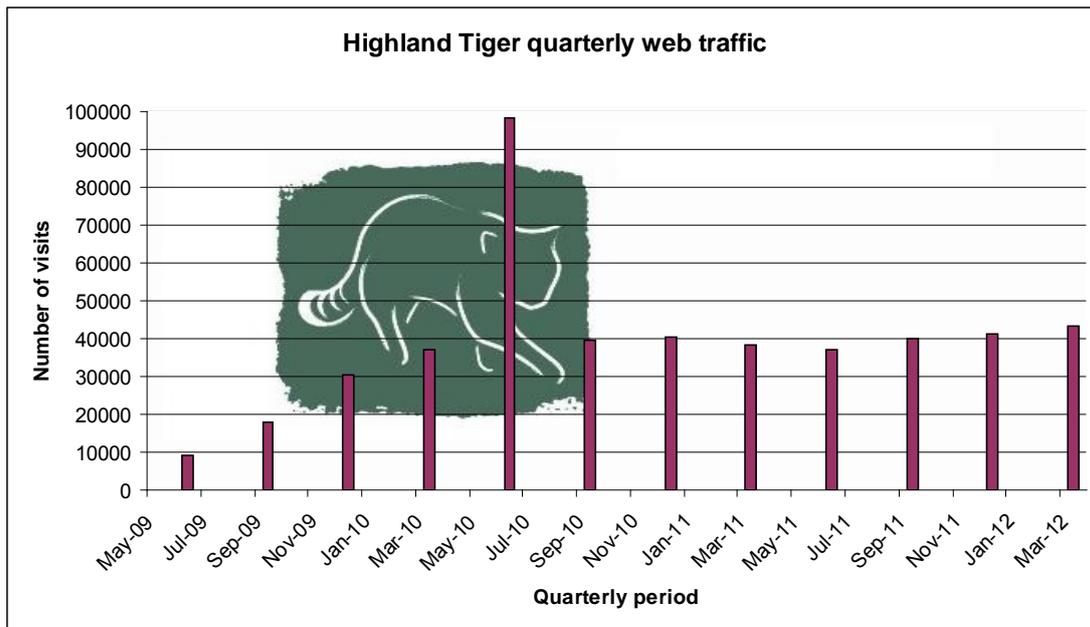


Fig. 2.1 Total web traffic visiting *highlandtiger.com* during each quarter from April 2009 to March 2012

The Highland Tiger Facebook page was created in May 2009 with the aim of quickly delivering specific messages, such as advertising an event or making a plea for assistance, to a community of interested individuals. In June 2010, the Facebook page had 1404 followers. By June 2011 that had grown to 2560, and by the end of March 2012 numbers had risen further to 3125. The page continues to be managed by staff from the RZSS Education Department.

A Highland Tiger Youtube channel, www.youtube.com/user/HighlandTigers, was created in October 2010 and is administered by RZSS staff. By the end of March 2012 the channel had uploaded 13 different videos, including the Project’s introductory DVD material, a BBC Landward feature on the Project, camera trap video footage, as well as wildcat footage taken by members of the public in the wild and captivity. By the end of March 2012, the total number of channel views stood at 13,253. The Project’s introductory DVD material, which explains the plight of the wildcat and how people can help, had been viewed 2826 times.

2.3 Awareness-raising materials

The Project funded the production of both Highland Tiger postcards and an introductory DVD. The rationale behind the postcards was to provide a quality, but low-cost product free of charge to the public, which would celebrate the wildcat, help to raise its profile but, by including the Highland Tiger website URL in large letters on the reverse, would help to spread the word about the Project, particularly as postcards are designed to be sent to others. 250,000 postcards were produced, and were handed out in mixed packs of five or singly.

As well as being distributed to members of the public at Project talks and events, postcards have been handed out to Highland Wildlife Park visitors during the wildcat feeding time talk delivered by the keepers, often resulting in donations to the RZSS wildcat conservation fund. Large quantities of postcards were also passed to National Park rangers and organisations such as Wild Scotland and Cats Protection to hand out at public events. Some local visitor centres and hotels made postcards

available next to a charity collection can for the Highland Tiger Fund administered by the RZSS. Approximately 50,000 postcards remain with the RZSS and will be used for continued awareness-raising, e.g. at educational events and keepers' feeding-time talks.

The Project commissioned a 7-minute introductory DVD which combined images, text, narration and music to explain the need for wildcat conservation. It is more costly to produce a copy of the Highland Tiger DVD than a pack of postcards and so DVDs were distributed to people who were in a position to show it to a wider audience, e.g. at society meetings, school classes etc. Around 120 DVDs were distributed before the feature was made available via the Highland Tiger YouTube channel.

2.4 Media coverage and articles

To date, the project has enjoyed positive and widespread coverage in all media – print, broadcast and web - locally, nationally and globally (Appendix 1). Much of this coverage has been achieved through proactive approaches from journalists who have heard about the Project, and coverage has a ripple effect encouraging more coverage in other titles. A press release was issued to coincide with the Project's ministerial launch in May 2009, resulting in widespread media coverage including on BBC Reporting Scotland and on STV News as well as on local radio and in Scottish newspapers. Since then the Project has enjoyed frequent and significant media coverage. In line with the Project's Communications Strategy, there was media coverage of the Project in every 3-month period of the year. Following an approach from the BBC, the Project featured on the 'One Show' a month after launching, attracting a prime-time TV audience of 4.5 million.

Very significant media coverage, including articles in a wide variety of national and local press, in several magazines, on many websites, and on local and national radio, resulted from BBC Scotland's TV and web coverage of the Project on April 29th 2010 (mentioned above). Much of this coverage included the URL of the HT website, with the consequence that there were over 46,000 visits to the Project website on a day which would otherwise have received something in the region of 400. The equivalent advertising cost of the coverage stemming from, and including, the BBC coverage was calculated by media consultants at over £637,000. Furthermore the Highland Tiger fund received over £1300 worth of donations via the website in the week following the BBC web coverage. This represented 24% of 2010's web donations occurring in less than 2% of the available time.

Further coverage in the broadcast media included features across the UK on the BBC's Countryfile, Autumnwatch, and Newsround programmes, in Scotland on their Landward and Out of Doors programmes, and several repeated one-minute shorts broadcast on STV in the commercial breaks between prime-time evening programmes.

The Project stimulated front cover stories in several magazines. The *BBC Wildlife* magazine, the UK's biggest-selling wildlife periodical, carried a six-page feature focusing on the Project in September 2010. A double-page spread in the Spring/Summer edition of the SGA's membership magazine *Scottish Gamekeeper* saw a front cover with the very positive title 'Highland Tiger: keepers' key role in conservation'. A one-page article appeared in the October 2010 edition of *National Geographic* magazine resulting in worldwide coverage in different languages reaching

an estimated 40 million readers. The Project was featured in a 4-page article in the *Shooting Times* in September 2011. SNH produced a six-page article for the Winter 2010 edition of their magazine, *The Nature of Scotland*, while articles have also appeared in the national press in a wide variety of titles including the Scotsman, Herald, Sun, Daily Mail, Telegraph, Times and Observer newspapers. More locally to the Cairngorms National Park, the Project has been covered in local titles such as the Strathspey & Badenoch Herald, Donside Piper and Press & Journal while articles written by the Project Manager about the need for the intensification and expansion of feral cat neutering have appeared in several village newsletters across the National Park.

A press release was sent out to mark the end of the Project the day before the closing conference on 23rd April 2012. This was given as an exclusive initially to BBC Scotland, who recorded interviews for Scottish TV and radio news, as well as for UK-wide children's TV news programme Newsround. The following day the press release was sent to other media outlets, such as national press.

2.5 Talks and public events

The Project Manager (PM) responded to invitations to speak about the Project at society meetings in and around the National Park. Priority was given to groups based on audience composition and size, and also geographical location. To date the Project Manager has delivered 52 presentations, with a total audience size of over 2000 people (Appendix 2). This included several local audiences with a general interest in wildlife, as well as more specific audiences comprised of local farmers, national park rangers, gamekeepers, mountain guides, or schoolchildren. The National Park rangers are now all aware of the Project and distribute Project materials, such as postcards, leaflets and DVDs, to a wide public audience. Some also assist with camera trapping around the National Park. Any donations or speaker's fees are passed to the Highland Tiger fund administered by the RZSS.

In summer 2009, the Project formed the main focus of a staffed presence within the CNPA marquee at two large public events: the Grantown Show and Braemar Gathering. At both events Project partnership personnel interacted with the public, handing out large numbers of postcards to help kick-start conversations with passers-by about wildcats and the Project. The Project has also been represented at both the Moy (2010 and 2011) and Scone (2010) Game Fairs (see chapter 3) with a staffed stand.

2.6 Education work

The Education team of the RZSS has, since 2010, worked wildcat conservation messages into its work both at the Highland Wildlife Park, and as a specific Scottish wildcat lesson offered by way of an outreach programme to schools around Scotland, including in the Highlands (Appendix 3). Total audience size reached almost 900 adults and children from across Scotland, including many from northern Scotland. The CNPA also organised two educational events in Strathspey and Deeside in May and June 2010, entitled 'Celebrating Nature'. These had a woodland theme and were aimed largely at schoolchildren. RZSS staff were in attendance to talk about wildcats and their conservation at both events.

2.7 Awareness-raising amongst specific sectors

In addition to the broad public awareness-raising work, the Project also targeted specific conservation messages at key sectors, e.g. local cat welfare groups, vets,

farmers, and gamekeepers through the use of print media or face-to-face presentations. The outcomes of awareness-raising on responsible cat ownership and wildcat-friendly predator control are dealt with in chapters 2 and 3 respectively.

2.8 Outcomes of the public awareness-raising element of the Project

2.8.1 Greater awareness of Scottish wildcats

In order to evaluate the effectiveness of its communications, SNH commissioned market-research consultants to produce The Scottish Nature Omnibus. The Autumn 2011 omnibus report compared results from September 2011 to those of a comparable report in September 2010. A total of 1,055 interviews took place in the autumn 2011 omnibus survey and quotas were set to ensure that the results were representative of the Scottish population. A total of 1158 interviews had taken place in September 2010. In both reports awareness of Scotland's nature and landscapes was assessed.

A specific question was asked in both years what wildlife the interviewee associated with Scotland. In September 2010, 8% of respondents replied with 'Scottish wildcat'. However, by September 2011 the wildcat's share of the audience had almost doubled to 15%. In September 2010, when asked what species they were concerned about, 13% of interviewees responded with Scottish wildcat, making the species the 5th most significant in terms of public concern. However, by September 2011 the share of the audience had risen to 17% and the species had become the 3rd most significant in terms of public concern.

These results provide evidence for both an increased level of public awareness in Scotland of Scottish wildcats and the need to conserve them. Given the considerable media attention that the Project has enjoyed and the reach of its awareness-raising activities, it is very probable that the recent increase in public awareness and sympathy of wildcats in Scotland is due, at least in part, to the Project and the activities of its partner organisations. However, it is also likely that the awareness-raising activities and media coverage of the Scottish Wildcat Association, which was also publicly launched in spring 2009, may also have contributed to this.

2.8.2 Public involvement in recording

In total, the Project collated 470 potential wildcat records from within and outwith the Cairngorms National Park. 80% of these, some accompanied by photographs, came from members of the public unconnected to the Project and 60% of records were submitted via the Project website. In total, 56 carcasses of tabby-marked cats were uplifted from in and around the National Park and taken to the National Museums of Scotland for detailed analysis of pelage characteristics and other morphological features. Project staff were notified about the whereabouts of 75% of these carcasses by members of the public unconnected to the Project. Raised public awareness of wildcats and the Project has facilitated the furthering of scientific understanding of the distribution of wild-living cats and the extent of hybridisation. The subject of recording is explored in more detail in chapter 4.

2.8.3 Donations to wildcat conservation

Donations to the Highland Tiger Fund administered by the RZSS came from a variety of avenues but can be largely grouped into:

- Website
- Highland Wildlife Park Keeper For A Day
- Highland Wildlife Park keepers' feeding time talks
- Collection cans at local venues and events
- Corporate donations and trusts

Improved awareness generated by the Project is likely to have facilitated donations via all avenues with the exception of the Highland Wildlife Park's Keeper for a Day programme. More specifically, the Project's website clearly has a very significant role to play in web-based donations, while Project postcards were instrumental in leveraging donations via the web (they had been originally offered in return for donations); during the Highland Wildlife Park's feeding time talks (keepers give cards to those making donations); and in conjunction with collection cans at talks, public events and in rangers stations and visitor centres around the National Park.

From May 2009 to March 2012, the Highland Tiger Fund received a total of around £48,000. The donations can be broken down into the five main categories thus:

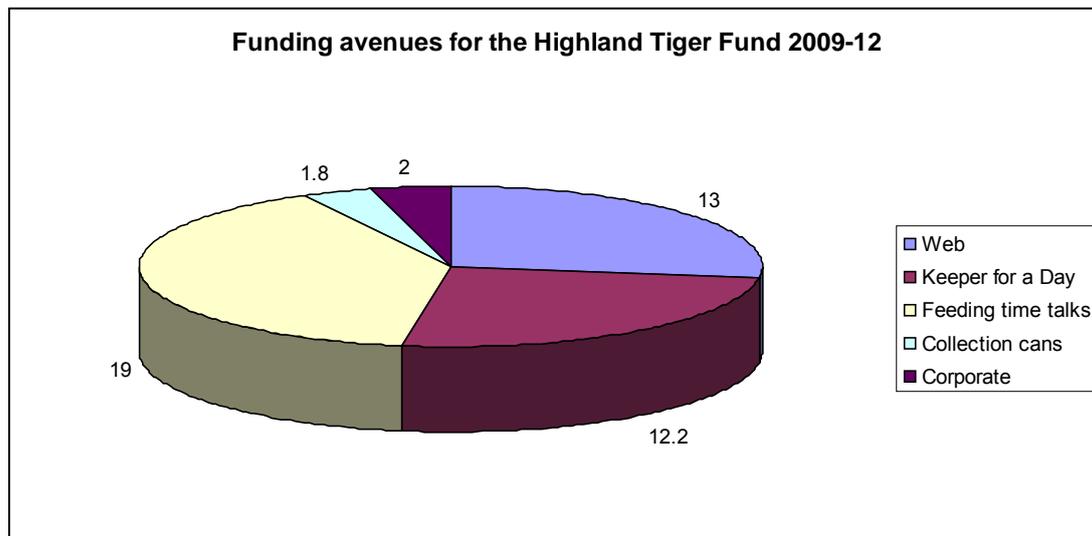


Fig 2.2 Funding avenues for the Highland Tiger Fund 2009-12. Amounts shown are thousands of pounds.

The cost to wildcat conservation of the Project's awareness-raising materials such as the website and postcards has been more than compensated for. The website had cost £9200 to design and generate but web donations amounted to £13,000. The Project's postcards cost £8050 to design and produce but donations levered by postcards (e.g. keepers' talks - £19,000, collection cans - £1800) amounted to £20,800. Approximately 50,000 postcards remain to be used for further awareness raising and potentially for fund-raising.

In total, donations to the Highland Tiger Fund have, to date, generated around £48,000 for wildcat conservation in the Cairngorms National Park, and have been directed mainly at the employment and equipment costs of Dr Roo Campbell of the RZSS, who has been conducting field monitoring on behalf of the Project (see Chapter 5 for further detail).

2.8.4 Inspiring others to help

Public support for the wildcat and the Project was harnessed in other ways which benefited the Project. Several local people volunteered to become Cats Protection volunteers so that they assist with feral cat trapping to benefit wildcat conservation in their area. Others wrote articles for local newsletters and approached companies for corporate sponsorship for the Highland Tiger Fund. One individual raised money for the Fund by running a 10km road race dressed as a tiger, while a professional photographer donated a percentage of sales of wildcat calendars he'd designed and produced. An event was organised by a Cats Protection volunteer in Donside to raise funds for and awareness of wildcat conservation. The 'Highland Tiger Fling' took place in Tullynessle in September 2010 and attracted over a hundred local people to a social evening where Project staff were on hand to talk about wildcats. The event raised £1200 for the Highland Tiger fund. Another similar event is planned for the same venue in June 2012.

3. Neutering domestic cats

The Project MoU had two objectives relating specifically to the management of domestic cats:

- To set in place sustainable feral cat management, with the support and co-operation of landowners, such that this will become self-sustaining beyond the life of the project;
- To engage the support of the local community for responsible domestic cat ownership, including participation in voluntary neutering and vaccination schemes

3.1 Background

Domestic cats are likely to be relatively numerous and widespread in the Cairngorms National Park, especially at the more settled and farmed elevations. The National Park supports a resident human population of around 17,000, which is scattered across the region in various towns, villages and isolated farms and houses.

Domestic cats were probably brought to Britain from the continent during the Iron Age having been domesticated from the Middle Eastern subspecies of the wildcat *Felis sylvestris lybica* (Kitchener & O'Connor, 2010). It is not known exactly how long domestic cats have existed in the area that is now the Cairngorms National Park but it is likely to be many centuries. The original motives for domestication of the cat very likely relate to its ability to hunt and kill rodent pests such as mice and rats, and latterly its ability to live closely alongside humans in their homes as a pet. Both these qualities are still important for people in the Cairngorms and the relative importance of these two qualities dictate how the domestic cat interacts with both people and landscape today.

Pet domestic cats are generally looked after by owners who value them as a companion animal. They are routinely fed and in many cases, though not all, receive regular veterinary treatment which often includes being neutered and receiving annual booster injections to combat several feline diseases. Some pet cats live only indoors but many spend at least part of the day and/or night outdoors where they are free to roam.

Feral domestic cats live more independently of humans. They do not differ from pet cats in their genes or coat markings but are much less likely to receive veterinary care or to be fed regularly and may therefore be in poorer condition. Unusually for a felid, feral domestic cats can live colonially at locations where they exploit clustered food resources, such as where they are fed directly by sympathetic non-owners, or where there is an unnatural concentration of food brought about by human activities, such as at rubbish dumps or on farms with high concentrations of commensal rodents such as rats and mice. Some cats living on farms may have a lifestyle somewhere in between that of a pet and a feral, with varying levels of feeding and veterinary care. Furthermore some feral cats may adopt a lifestyle independent of humans altogether, and live as a solitary animal with a home range in the wider countryside (as opposed to within a colony in a human environment). These cats live similarly to wildcats and hunt their own wild food and receive no veterinary care.

It is considered that domestic cats pose a serious conservation threat to Scottish wildcats through introgressive hybridisation and potentially through disease transmission (Macdonald *et al.*, 2004). They may in some circumstances also compete with wildcats for resources such as territory, food and mates.

Scientific opinion on the effectiveness of TNR versus lethal control of feral cats is divided (e.g. Longcore *et al.* 2009). Some of the differences relate to the objectives of different TNR programmes; which may be welfare or conservation driven. Some models estimate that >70% of the feral cat population needs to be neutered to be effective in reducing the population. Although in the case of wildcats the immediate threat is from hybridisation rather than competition or predation, the ultimate aim must still be to reduce the number of (un-neutered) cats entering the population. However, TNR in the UK is principally carried out from a cat welfare perspective and is regarded as more socially palatable than lethal control amongst town residents and for example, where farmers may wish to keep some cats to control mice and rats (although as noted this is becoming less common due to the threat of toxoplasmosis). The Project did not set out to compare the relative benefits of TNR and the lethal control routinely carried out by estates, but viewed these approaches as complementary in reducing the number of un-neutered feral cats.

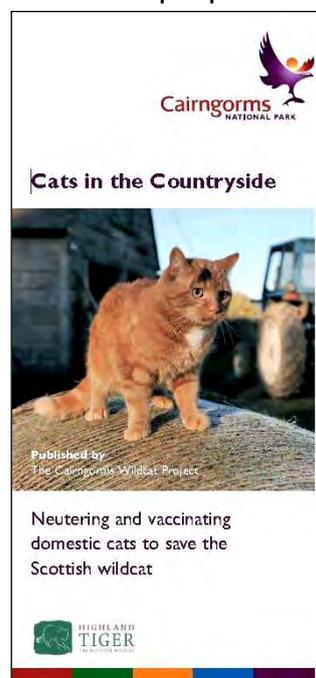
The Project sought to reduce the threats posed to wildcats by encouraging increased neutering and vaccination of domestic cats. Neutering would remove a domestic cat's capacity to interbreed with wildcats, and should also limit the growth of the domestic cat population, thus reducing further the risk of interbreeding, competition and disease transmission. Vaccination of pet cats and disease screening of ferals should also reduce the likelihood of fatal diseases being spread to wildcats.

It was clear that engagement with the local veterinary community was important as it would be they who would carry out neutering procedures and vaccinations. Furthermore, Cats Protection (CP), the UK's largest cat welfare organisation, which has a network of volunteer branches across Scotland, was identified as a body whose expertise, policies and resources could be harnessed to help achieve Project objectives.

3.2 Encouraging responsible cat ownership

Pet cat ownership is common and widespread enough in Scottish society that it justifies the use of broad public awareness-raising means. The need for people to be responsible cat owners, i.e. have their pets vaccinated and especially neutered was a message which was frequently included within articles or features in national and local media. However a need was identified for a more targeted approach providing more detailed information and advice on how and where to get pet cats neutered.

The Project produced a leaflet promoting the need for responsible cat ownership in the National Park. Entitled "Cats in the Countryside" and endorsed by all local veterinary practices and TV vet Joe Inglis, the leaflet outlines the reasons why neutering domestic cats is important for both cat welfare and wildcat conservation. It provides contact details of local vets and explains both CP's voucher scheme, where financial help is available to



meet the costs of neutering pet cats, as well as their TNR service. The leaflet has been made widely available across the National Park to vets, CP volunteers, and National Park rangers, as well as at various local events, visitor centres and local shops and supermarkets selling cat food. Estate A (see chapter 4) took 50 to distribute to tenants on the estate, while a keeper from Estate C took several to pass to the local village store. 5000 copies were produced and fewer than 500 remain. The leaflet can be downloaded from the Highland Tiger website at: www.highlandtiger.com/pdf/cats%20in%20the%20countryside.pdf

3.3 Expanding and intensifying TNR

Early on in the Project, a dialogue developed with Cats Protection with the aim of intensifying and expanding the neutering of pet and feral cats across the Cairngorms National Park. This followed a presentation on wildcat conservation by the Project Manager and Douglas Richardson of the RZSS at the CP's Scottish conference in Aviemore in June 2009. CP is largely dependent on a network of local volunteer branches which are coordinated by paid national staff and part of their remit is the Trapping, Neutering and Return (TNR) of feral cats. TNR involves the use of baited cage-traps to catch feral cats and bring them to the local vets. There they are usually screened for potentially fatal diseases such as FeLV and FIV. Those testing positive are euthanized, thus helping to reduce the prevalence of fatal feline diseases in the countryside. Those which test negative are neutered (provided they are more than 3 months old) and then released where they were trapped. The CP branch pays the vet for the neutering procedure.

At the time of the start of the Project, CP branch coverage of the National Park was patchy. Only one branch, Strathspey, was substantially located within the Park's boundaries. A series of other branches covered peripheral parts of the Park in theory, but their main activities were located far outside its boundaries (Fig 2.1) and so their activities inside the Park were intermittent at best. Furthermore, the Deeside area was not covered at all by a local branch.



Fig. 3.1. The distribution of Cats Protection branches at the start of the Project. Solid blue lines indicate a branch with core activities within the National Park. Dotted lines indicate the approximate coverage of branches largely based and active outside the National Park.

Following productive discussions, CP expressed an interest in employing a volunteer coordinator whose job it would be to ensure that all CP volunteers in and around the Cairngorms National Park were trained in wildcat identification, were aware of wildcat conservation issues, and operated in a coordinated, strategic manner across the region, especially with regard to feral cat TNR. They would also recruit and train new volunteers. The Project had agreed to contribute one third of the annual costs of employing that CP staff member and it was hoped that the coordinator would be in place by the end of summer 2010. However, as a result of the unfavourable economic climate, CP ultimately decided they could not afford to employ an extra staff member. It was agreed that the coordination of volunteer branches in the Cairngorms region should be carried out with existing human resources.

The Project Manager organised a meeting in January 2010 between representatives from most of the seven veterinary practices which cover parts of the National Park, as well as CP staff. Vets agreed to provide neutering and vaccination data so as to help identify trends and patterns over time. It was felt that the majority of unneutered and unvaccinated cats in the National Park are likely to be farm cats. Vets agreed they would be unofficial ambassadors for the Project in dealings with their farming clients and make enquiries about any unneutered cats on farms and advocate neutering.

In spring 2010, CP took the decision to open a new branch in Deeside, an area that had been lacking a branch for several years. Volunteers were trained in feral cat TNR. Its geographical coverage stretches from Banchory up the Dee valley to

Braemar, thus covering a significant proportion of the eastern side of the National Park.

CP admitted that they had traditionally found it difficult to engage with farmers in northern Scotland on the issue of farm cat neutering. However, CP decided to run a free, farm cat neutering scheme for farmers in the Cairngorms National Park in August 2010, which was advertised in the local press and launched at the Black Isle Show. Take-up, however, was low with only three Strathspey-based farmers applying. In October, the Project Manager gave a presentation to 50 farmers at the Cairngorms Farmers' Forum about the need for farm cat neutering to protect the Scottish wildcat. The audience was made aware of the CP's TNR service and that the costs of neutering could be covered by CP while funds allowed. As far as is known, however, no applications to CP for TNR assistance were made as a result of this event. Whether this reflects apathy or just a lack of unneutered cats on the farms in question is not known.

3.3.1 Volunteer training and involvement

In light of the limited human resources available for TNR in most areas, as well as the muted response of the public to TNR services offered by CP, it was decided that a more proactive approach to TNR, involving more volunteers, should be tested.

Via alerts on the Highland Tiger blog, Facebook page and via a series of e-mails, the Project Manager put out a call for more prospective Cats Protection volunteers to get involved with TNR to benefit wildcat conservation in and around the Cairngorms National Park. The response was good with over 20 new volunteers recruited from across and around the National Park, most of whom are attracted by the wildcat conservation angle. Two CP training days took place in October 2010 in Stonehaven and Aviemore for newly recruited as well as pre-existing volunteers from the CP branches covering the National Park. As well as presentations from CP staff, the Project Manager gave presentations which aimed to ensure a strong understanding of wildcat conservation issues and ID, as well as identification of targeted areas for TNR, i.e. regions around the five estates with which the Project was working (see Chapter 3).

The nine new volunteers recruited for the Strathspey branch become the branch's new TNR team and received new trapping equipment. Each volunteer was assigned a geographical area and was encouraged to follow up any tip-offs and to contact householders and land managers in rural areas proactively about any unneutered cats in the area. It was hoped that a more coordinated, 'sweep' approach to TNR across an area, making use of new volunteers' contacts in the local countryside, would result in increased feral neutering in Strathspey in the future.

In late 2011, CP decided that several potential volunteers from the Tomintoul & Glenlivet area, who expressed an interest in becoming involved in TNR, would form a separate TNR branch for the area. The new branch is separate from the pre-existing Moray branch which is largely based around lowland towns some distance away to the north, and which had only sporadic involvement in TNR in the Glenlivet area in recent years (see Fig. 2.2)

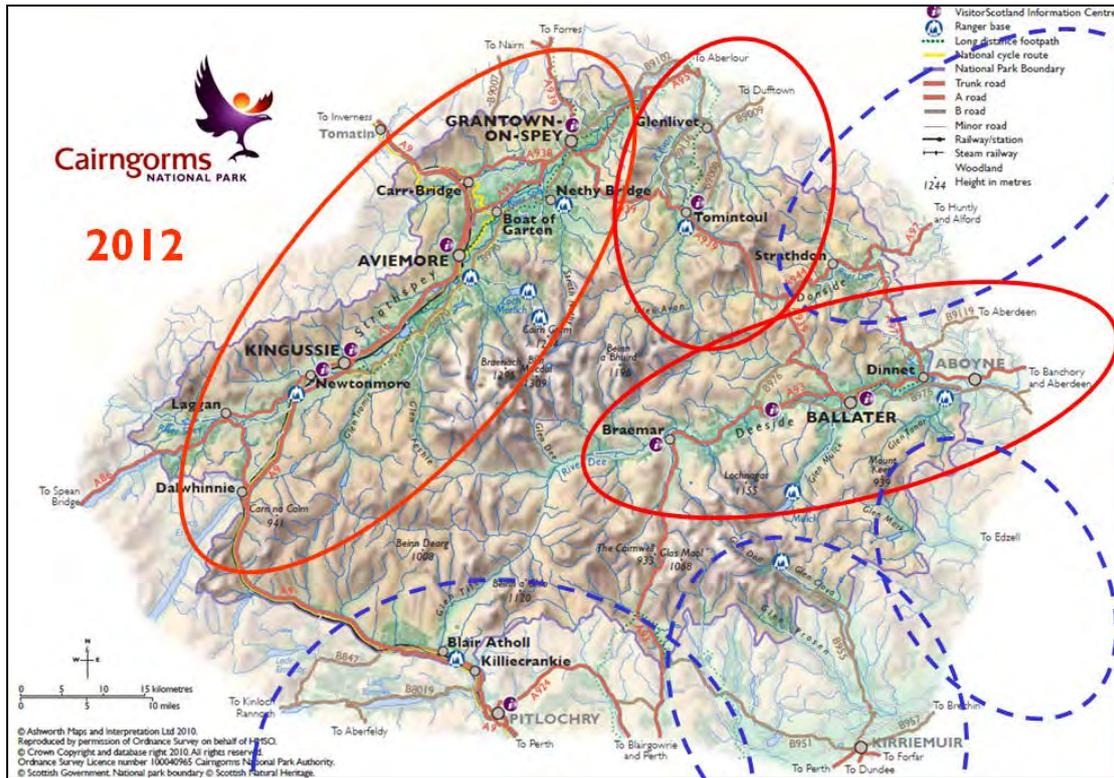


Fig. 3.2. The distribution of Cats Protection branches at the end of the Project. Solid red lines indicate a branch with core activities within the National Park. Dotted blue lines indicate the approximate coverage of peripheral branches largely based and active outside the National Park.

3.4 Outcomes

Cat vaccination and neutering data was collated from seven veterinary practices whose client base derives from in and around the Cairngorms National Park: Aberlour Veterinary Centre; The Crofts Veterinary Centre, Brechin; Harbit & Ryder, Pitlochry & Aberfeldy; Morven Veterinary Practice, Alford & Ballater; Strathspey Veterinary Centre, Granttown & Kingussie, Thrums Veterinary Group, Kirriemuir; and Woodside Veterinary Group, Aboyne & Torphins.

3.4.1 Vaccinations

Of the seven Cairngorms veterinary branches, one (Aberlour) was unable to collate data on cat vaccinations. Granttown could supply vaccination data only for 2010 and 2011 and was not confident that data retrieval from their computing system was consistent between those two years. Total vaccinations, which included initial courses as well as boosters, are shown for six practices from 2005 to 2011 in Table 2.1 and Fig. 2.3.

Table 2.1. Total cat vaccinations (initials and boosters) at 6 Cairngorms veterinary practices 2005-11

	Total vaccination						
	Aberlour	Aboyne	Alford	Brechin	Granttown	Kirriemuir	Pitlochry
2005		423	411	207		752	380
2006		444	395	193		775	387
2007		440	441	190		1003	373
2008		466	467	252		956	232
2009		477	444	274		890	313

2010		460	431	185	288	948	247
2011		499		159	130	1009	190
Total	0	3209	2589	1460	418	6333	2122

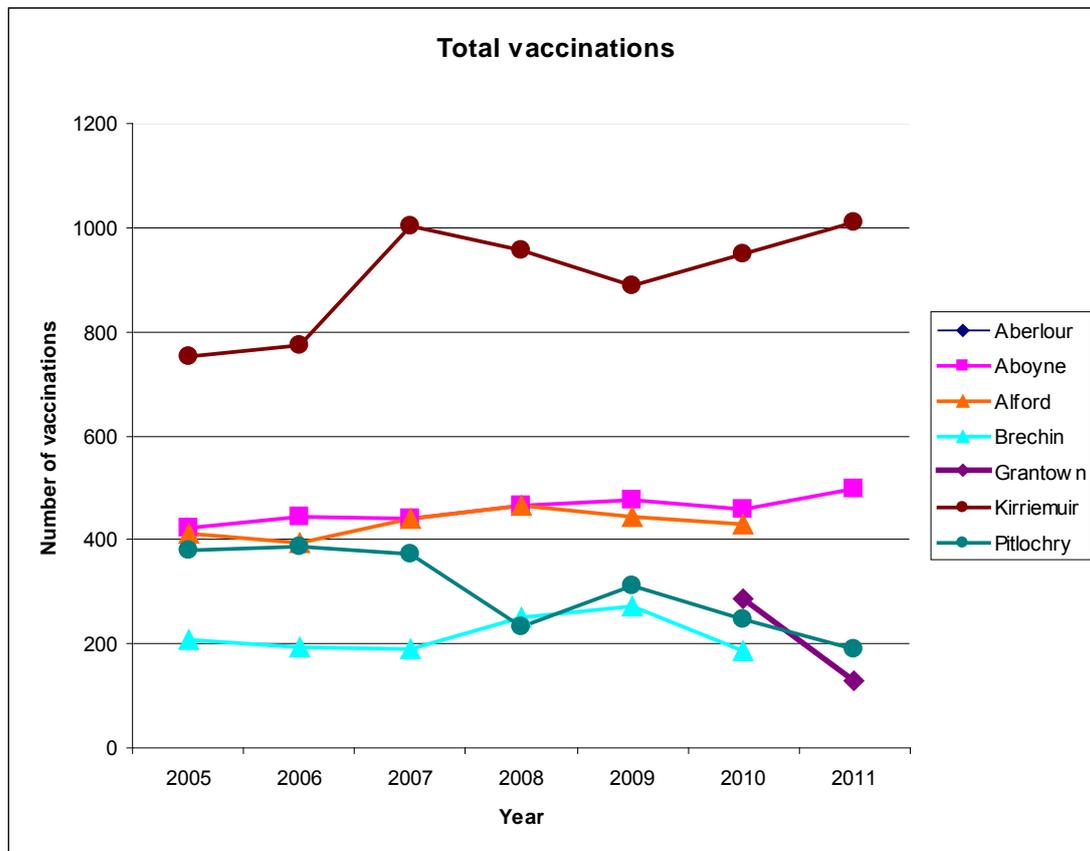


Fig. 2.3. Total cat vaccinations (initials and boosters) at 6 Cairngorms veterinary practices 2005-11

The picture is mixed, with Grantown showing a steep decline over 2 years which could be due to data error. Pitlochry showed a decline over the period, while Brechin and Alford were relatively stable. Aboyne showed a gradual rise over the period while Kirriemuir fluctuated a little but overall showed a rise at a high volume of vaccinations.

3.4.2 Neutering

Data for the total number of neutered cats was collated from each of the seven practices (Table 2.2 and Fig. 2.4) Aberlour could not provide data for 2005 and 2006 while Grantown could provide data only for 2010 and 2011. Again there were reservations by the vets there over the reliability of their electronic record retrieval system. Kirriemuir again showed a high volume of cat veterinary work which had increased steadily from 2005 to 2009 before dropping significantly in 2010 then slightly again in 2011. Grantown again showed a significant drop between 2010 and 2011 which was put down to either data error or the economic downturn (J. Harley, Strathspey Vets, *pers. comm.*). Aberlour showed a gradual decline in cat neutering work while Aboyne reported a gradual increase over the period. The remaining three practices were, on the whole, rather stable in their volume of cat neutering work.

Table 3.2. *Total number of cats neutered at the seven Cairngorms veterinary practices 2005-2011*

	Total neutering						
	Aberlour	Aboyne	Alford	Brechin	Grantown	Kirriemuir	Pitlochry
2005		132	149	90		444	86
2006		99	114	107		503	97
2007	136	144	172	122		521	100
2008	143	170	146	123		569	84
2009	91	130	141	122		606	90
2010	113	147	158	113	153	437	69
2011	91	169		115	77	414	76
Total	574	991	880	792	230	3494	602

Figures for the amount of Cats Protection-sponsored neutering at each practice were also collated (Table 2.3; Fig. 2.5). Cats Protection-sponsored neutering generally relates to feral cats subject to local TNR and also to local pet cats where the owners have been given a voucher by the local CP branch to help meet the costs of the veterinary procedure. For four branches, figures from 2005 onwards were available. Aberlour and Aboyne had figures from 2007 onwards, while Grantown had figures from 2008.

Table 3.3. *Cats Protection-funded neutering at the seven Cairngorms veterinary practices 2005-2011*

	Cats Protection Neutering						
	Aberlour	Aboyne	Alford	Brechin	Grantown	Kirriemuir	Pitlochry
2005			0	45		304	4
2006			14	86		296	7
2007	21	24	40	88		242	17
2008	38	26	13	68	35	329	19
2009	13	20	33	92	87	406	14
2010	35	29	34	78	56	192	7
2011	16	38		88	50	175	6
Total	123	137	134	545	228	1944	74

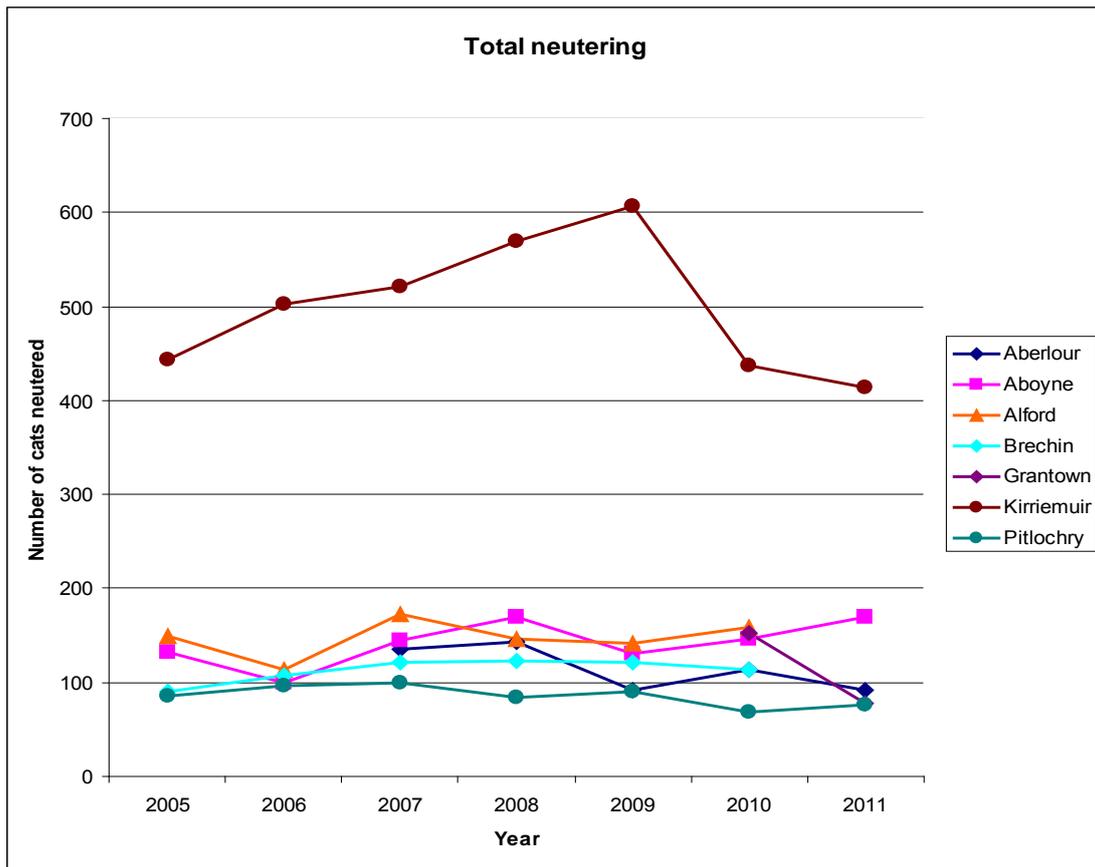


Fig 3.4. Total number of cats neutered at the seven Cairngorms veterinary practices 2005-2011

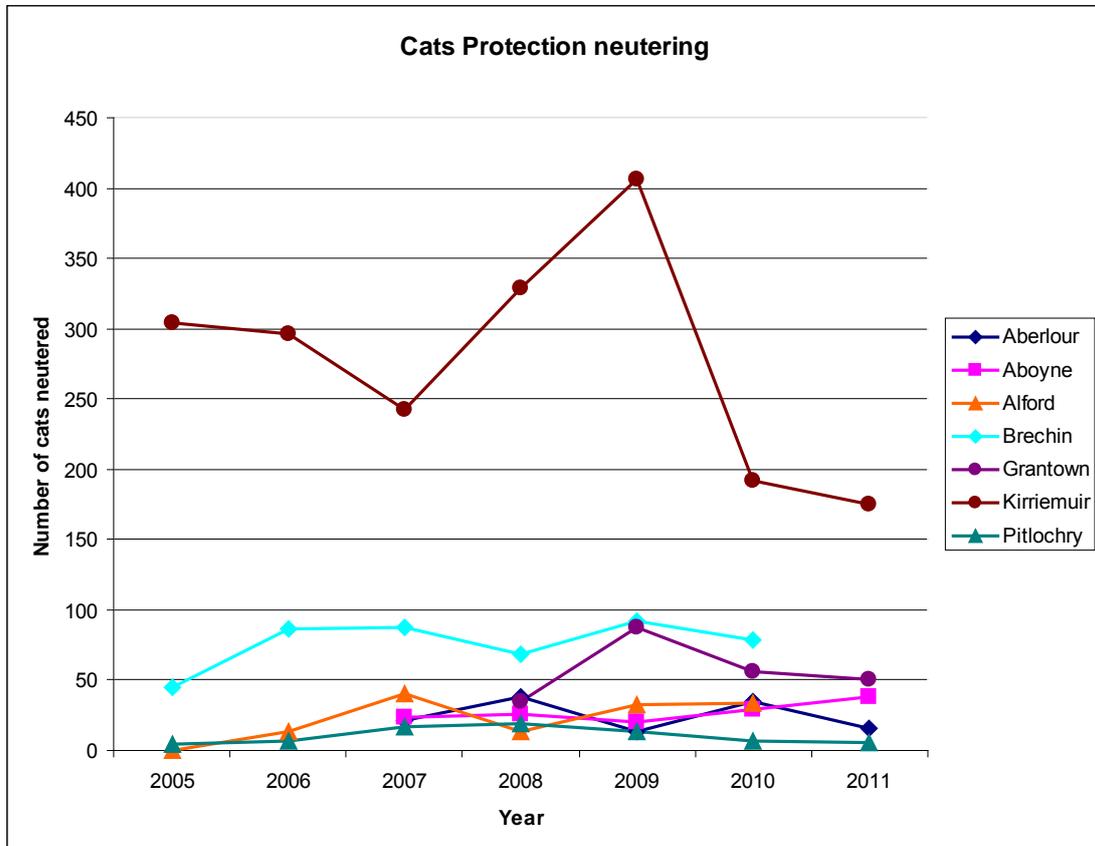


Fig 3.5. Cats Protection-funded neutering at the seven Cairngorms veterinary practices 2005-2011

Cats Protection-sponsored neutering was most prevalent in Angus, where the Kirriemuir- and Brechin-based practices had the two highest figures over a 7-year period. Both these practices had a considerable proportion of their total cat neutering work sponsored by the Cats Protection – 56% for Kirriemuir and 68% for Brechin. The limited amount of available data also suggest that a significant proportion of the neutering work undertaken in Grantown is sponsored by CP. Kirriemuir saw a steep increase in CP-sponsored neutering to a peak in 2009 of over 400 cases followed by a steep decrease. Pitlochry also showed a steady increase followed by a steady decrease, albeit on a smaller scale. Aboyne has shown a modest but steady increase while for the other practices there is no clear pattern.

Feral cat neutering data for the three years 2009 to 2011 were also supplied by Cats Protection for the branches that operate within and just outside the National Park boundaries. These were grouped into branches which were regarded as core to the National Park (Strathspey, Deeside, and Glenlivet & Tomintoul) and peripheral (Forfar & District; Inverurie & Alford; Montrose & Brechin; Moray; and Perthshire) as suggested by the map in Fig. 2.2.

The peripheral branches cover large rural areas as well as some relatively large settlements e.g. Perth, Elgin, Inverurie and Montrose. Consequently, they can typically call on more volunteers than the core branches based in the National Park where the rural population density is significantly lower. However, the level of TNR work they carry out in the National Park is low volume and sporadic. The total number of feral cats neutered by the peripheral branches across their areas during 2009-2011 amounted to 727. Over half of these were sponsored by the Forfar & District branch, which saw a very significant decline from 2009 to 2010, but especially from 2010 to 2011. Because of this, total feral neutering in the peripheral branches declined considerably year on year. However not including the Forfar & District data in the peripheral branch figures gives a much more stable picture, with a slight increase across the three-year period.

Table 3.4. *Feral cats trapped by five peripheral CP branches 2009-11.*

Branch	2009	2010	2011	Total
Forfar & District	195	152	28	375
Inverurie & Alford	39	36	32	107
Montrose & Brechin	24	12	23	59
Moray	12	6	20	38
Perthshire	40	61	47	148
Total	310	267	150	727

Of the three core branches, only one, Strathspey, has been operational throughout the period 2009 to 2011. Deeside became operational in spring 2010, while Glenlivet & Tomintoul only became operational in December 2011. In order to give a fuller picture of the level of TNR activity in these branches, Table 2.5 also shows the total for the first quarter of 2012, which represents the final few months of the Project. Deeside showed an increase in feral TNR work from 2010 to 2011 while the first quarter of 2012 suggests a continuation of that trend. Glenlivet & Tomintoul has started only very recently but has begun to demonstrate encouraging figures for the first quarter of 2012. Strathspey showed a marked increase from 2010, when TNR levels were very low, to 2011. Between the three branches there has been a significant increase across the 3 years, and the first quarter of 2012 already

represents over two thirds of the total for the previous full year. By July 2012, the Glenlivet & Tomintoul branch had trapped and neutered over 50 cats.

Table 3.5. *Feral cats trapped by three core CP branches Jan 2009 to March 2012 inclusive.*

Branch	2009	2010	2011	< Apr 12	Total
Deeside	-	23	39	17	79
Glenlivet & Tomintoul	-	-	1	17	18
Strathspey	6	3	11	1	21
Total	6	26	51	35	118

3.5 Discussion

Rates of vaccination since 2005 over 5 veterinary practices have been stable and indicate no obvious increase over the period. Total cat neutering from 2007 over 6 practices actually declined over the period, but the total decline was exacerbated by a considerable reduction in neutering at one practice in Kirriemuir. Cats Protection-sponsored neutering across 7 practices from 2008 also declined but this is due largely to a significant decline at one practice, again in Kirriemuir. The other practices, minus Kirriemuir, have a more stable picture with regards to CP-sponsored neutering over the time period. In terms, specifically, of total feral cat neutering in CP branches peripheral to the National Park, there has been a steep decline over the past 3 years. However, a decline in just one branch, Forfar & District, skews the picture. Trends in the other four branches are stable and in fact show a slight increase. The Forfar & District branch primarily uses the Thrums Veterinary Group in Kirriemuir for neutering the cats it catches during TNR activities. The reduction from 2009 to 2011 of 167 neutered ferals in the Forfar & District branch explains much of the decline in both CP-sponsored neutering and total cat neutering in Kirriemuir over that time period.

Much of Forfar & District's TNR work was carried out by one individual who invests a lot of time and effort in TNR, with the result that she had trapped many hundreds in the past few years. However, a change in her personal circumstances meant she had less spare time to devote to TNR following 2009 and consequently the level of trapping in the Forfar and Kirriemuir areas was significantly reduced, something which has resonated throughout both the veterinary and CP neutering data in the Cairngorms region.

The difference that one committed individual can make to levels of TNR is apparent elsewhere. For example, the TNR work of the Deeside branch, which has continued to increase since the branch's inception in 2010, is largely as a result of one motivated volunteer. Likewise the encouraging start to the TNR work of the Glenlivet & Tomintoul branch has been dependent on one or two motivated volunteers.

The situation in the Strathspey branch is more complex. A relatively large number of new volunteers were recruited to the branch late in 2010 to augment the existing but small number of volunteers. They responded to a plea from the Project for volunteers to get involved in TNR work to help save the Scottish wildcat. Many of those who responded were experienced in the animal handling or wildlife conservation sectors and lived locally within the community. They were trained in

the use of TNR equipment and given advice on how best to approach the public, especially land managers, about feral cat TNR. Nearly all the new volunteers worked full-time and several of them, who worked at the Highland Wildlife Park, expressed concerns about how to fit in morning visits first to traps baited overnight in the countryside, then to the vets in Grantown with any trapped cats, all before they started work at 8am, which is also the same time the veterinary surgery opened. The Wildlife Park animal collection manager, who sits on the Project Steering Group, advised his staff that they could arrive late to work provided they phoned in advance. However, other volunteers not employed at the Wildlife Park, remained concerned that the timing of trap-checking and veterinary visits could not be worked into their working week.

Another potential barrier to effective TNR work which was identified by some of the new volunteers was that they did not know of the existence of feral cat colonies and were uncomfortable cold-calling on people in the countryside, e.g. farmers, they did not know. The Project Manager then sent out a plea via several e-mails to people based in the Badenoch & Strathspey area, as well as via the blog and Facebook, for information on the whereabouts of any unneutered feral cats or rural locations where proprietors would allow cage-trapping. This resulted in several permissions for cage-trapping, including locations where ferals were known or suspected. Contact details of proprietors, grid references of locations, and the likelihood of ferals occurring at the locations, were then tabulated and passed to all volunteers. They were then encouraged to make contact with proprietors in order to lay traps, in late Autumn/early winter 2011. Winter has been recommended as the ideal time to practise TNR as not only as the cat population typically in a pre-breeding stage, but also ferals are more likely to be frequenting rural buildings for shelter and are more likely to take bait in traps, as wild food sources will be less abundant.

Shortly after, however, the pre-existing branch committee decided that winter TNR was inappropriate for welfare reasons and should not therefore go ahead. Their concerns lay around trapped cats being kept in cold, drafty conditions in farm buildings before being uplifted to the vets. They also had concerns about the cats' post-operative well-being in cold conditions, particularly if surgery resulted in the localised shaving of fur, as is the case for female cats.

Cats Protection policy does not forbid winter TNR, provided there is due consideration to volunteers' Health & Safety and that cat welfare is not significantly compromised. CP staff and experienced volunteers from other areas advised on methods of reducing any potential cat welfare impacts of cold weather, which included covering trapping cages with blankets and insulating them from the ground with sheets of polystyrene. It was also recommended that traps should be checked more frequently in very low temperatures so as to reduce the amount of time a cat would spend in a cage. This information was passed to the branch committee who were asked to reconsider, particularly as the winter in question, 2011/12, had turned out to be much milder than in previous years.

The outcome for TNR in 2011, helped partly by having a larger number of trained volunteers, was an increase in the number of neutered ferals on the previous two years. The new volunteers were responsible for catching three of the eleven neutered ferals, and one of them was a pregnant female. However, compared to the other core branches, the number of potential TNR volunteers was considerably greater and should have resulted in a greater number of trapped cats than it did.

Possible reasons as to why the potential for substantially increased TNR in Strathspey remained unfulfilled are:

- Lack of time available for TNR amongst new volunteers, many of whom worked full-time
- Lack of motivation or confidence to get out trapping
- A conflict of objectives between pre-existing volunteers, who are largely motivated by cat welfare, and new volunteers who are motivated by wildcat conservation
- Relatively low numbers of ferals in the area because of previous years of TNR

This last point may or may not be relevant but the Strathspey branch does contrast with the other two core branches in having been in operation for several years.

Despite being few in number, volunteers in Deeside and Glenlivet & Tomintoul have been more effective to date. However, they have spare time in which to carry out TNR and are motivated enough to get out, speak to land managers using existing contacts, and in some cases, make door to door enquiries. The wildcat conservation angle has been a significant motivator for these volunteers and is used heavily by them when communicating the need for TNR to the public. Indeed, they find the Project's 'Cats in the Countryside' leaflet a very useful tool when engaging with people for the first time.

4. Working with Estates

The Project MoU had two objectives relating specifically to gamekeeping:

- To work with land managers in the CNP to ensure that the population of Scottish wildcats benefits from existing feral cat control activities;
- To set in place sustainable feral cat management, with the support and co-operation of landowners, such that this will become self-sustaining beyond the life of the project;

4.1 Background

In the Cairngorms National Park and wider eastern Highlands, the management of gamebirds such as red grouse, pheasants and red-legged partridges, is an important part of the rural economy. Many of the estates in the National Park have gamebird management as a focus of their objectives. Part of this management includes the control of several mammalian and avian predators seen as a threat to gamebird populations. Predators which are routinely controlled throughout the region through a variety of legal means judged to be humane are corvids (except ravens), foxes, weasels, stoats, mink, and feral cats. A range of other avian and mammalian predators are legally protected and can only be killed under licence. This includes the Scottish wildcat.

Feral cats are typically controlled on sporting estates by night-time shooting with a spotlight, when foxes are very often the main target. Baited cage-traps, which capture the animal alive, are also widely used and, by law, must be checked at least every 24 hours. For maximum cost-benefit, cage traps tend to be deployed in numbers around an area of particular sensitivity, e.g. a pheasant release pen. Snares, which are typically set for rabbits or foxes, can, on occasion, also catch feral cats. If set correctly and legally, they should hold the animal alive until the gamekeeper checks it at least once every 24 hours. Both cage traps and snares should allow non-target species to be released unharmed.

Spotlights typically produce eye-shine from nocturnal animals and gamekeepers can judge species from the colour and size of the eye-shine. However, if feral cats are shot on the basis of a cat body shape or cat eye-shine there is then considerable scope for wildcats to be shot inadvertently. The combination of darkness, distance, and obscuring vegetation makes accurate identification of cats, particular tabby-marked ones, potentially challenging and there is significant scope for errors of judgement. Cage-trapping reduces the scope for error considerably as a much clearer view of the animal can be ascertained. However, in both a spotlighting and cage-trapping scenario, the safety of an endangered and legally protected species is heavily dependent on the attitudes and judgement of the gamekeeper. In order to keep wildcats safe in the eastern Highlands then, it is crucial for the gamekeeping community to be both sympathetic towards wildcat conservation and confident in wildcat identification.

Given the parlous conservation status of the Scottish wildcat, brought about by introgressive hybridisation, positive engagement with the gamekeeping profession is very important. A significant proportion of the National Park is kept, and gamekeepers are active in a wide variety of terrain, at all times of year and at all

times of day, often with a spotlight. Productive relationships may therefore yield much-needed information on wildcat status, ecology and conservation threats.

4.2 Communicating wildcat-friendly predator control

A fundamental step to engaging with the gamekeeping profession was to have a gamekeeping organisation represented in the Project partnership. The Scottish Gamekeepers Association (SGA) was approached by the Project Manager and asked if they would contribute to wildcat conservation by joining the Project. Their management committee agreed, with the result that a SGA representative has sat on the Project steering group throughout the Project. The Project Manager was then asked to give a presentation at the SGA's 2008 AGM and talked to 120 gamekeepers from across Scotland about wildcat identification and the need for wildcat conservation.

Three articles about the Project have appeared in the SGA's membership magazine 'Scottish Gamekeeper' to date, resulting in a front cover photo of a wildcat on two occasions. One in the Spring/Summer 2010 edition was drafted by the Project Manager and set out in detail the potential value of the gamekeeping profession's contribution to wildcat conservation by adopting wildcat friendly predator control and monitoring. That edition of the magazine carried the front page headline 'Highland tiger: keepers' key role in conservation'.

The Project Manager gave presentations about wildcat-friendly predator control at two training workshops organised by the Cairngorms National Park Authority aimed at local land managers. One took place in Grantown on Spey and one at Mar Lodge near Braemar, and both were attended by local gamekeepers.

The Project had a staffed presence at stands at the Scone Game Fair in 2010 and the Highland Field Sports Fair at Moy in 2010 and 2011. At Scone the Project stand was located within the marquee of the event organisers, the Game & Wildlife Conservation Trust, while at Moy the Project was hosted within the marquee of the Scottish Gamekeepers Association. This ensured good engagement with those living and working in rural Scotland, and resulted in discussion about wildcats and their conservation with several hundred people, particularly gamekeepers, from across Scotland. Taxidermic specimens of a wildcat and tabby domestic, on loan from Inverness Museum and the National Museums of Scotland, were also very useful at attracting people over to the stand, and also for illustrating the differences in coat markings between the two types of cat. Furthermore, a range of Project materials was provided to visitors, including laminated wildcat ID cards.

The SGA, one of three snaring accreditation bodies, requested several hundred ID cards to distribute them to keepers attending their legally-required snaring courses. In March 2012, the Project Manager gave a presentation to 100 gamekeepers from across Scotland at the annual Keeper's Day of the British Association for Shooting and Conservation (BASC) and gave wildcat ID cards to each delegate.

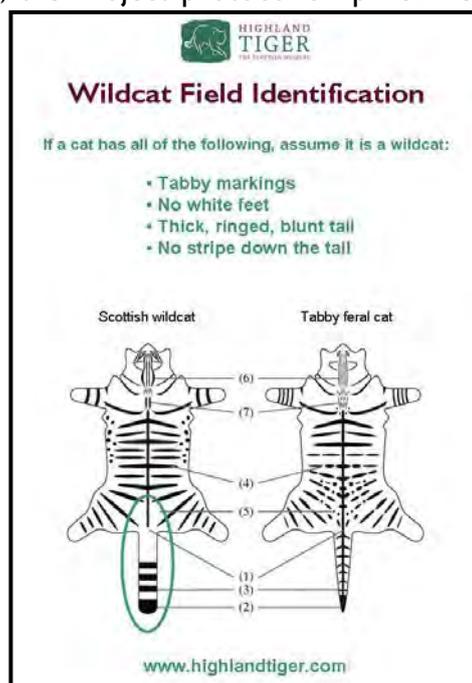
4.3 Developing a protocol for wildcat-friendly predator control

The Project Steering Group designed a draft protocol to help ensure predator control activities by gamekeepers on estates were wildcat-friendly. In order to ensure the protocol would be as relevant and practicable as possible a workshop titled 'Predator control and the Scottish Wildcat' was organised by the Project and held at the Lecht Ski Centre in December 2009. Despite the first heavy snowfall of the winter, the workshop attracted 41 delegates, the majority of whom were gamekeepers from in and around the National Park. Almost 20 estates were represented, covering around 60% of the Park.

Discussions and exercises were both productive and constructive and informal feedback suggested the event was well received, with several keepers saying they found it more interesting, informative and relevant than expected. Delegates were asked to comment on the draft estates protocol, and in doing so, helped to make this document more relevant for wildcat conservation and more practical for gamekeepers to use. All in attendance subsequently received a comprehensive workshop report (Cairngorms Wildcat Project, 2010) which summarised the presentations given, as well as the discussions that took place and the results of the interactive exercises. Several other interested estates couldn't make the workshop but received copies of the workshop report, while several others were sent a report with a covering letter introducing the Project to them. Estates whose gamekeeping staff were thus aware of the need for a precautionary, wildcat-friendly approach to predator control, as well as for monitoring the wildcat population, amounted to around 85% of the area of the Cairngorms National Park. The workshop report can be downloaded from the Highland Tiger website.

4.4 The Estates protocol

The protocol (see Appendix 5 for detail) encouraged gamekeepers, when engaged in their routine feral cat control work, not to shoot if there was any doubt about a cat's identity. To improve confidence in wildcat identification, the Project presented a practical definition of a wildcat based on its physical appearance. In order to ensure that it is both field-practical and precautionary, the Project protocol simplified key wildcat pelage criteria identified from research by Kitchener *et al.* (2005). The Project's working definition of a wildcat largely focuses attention on the animal's tail shape and markings as the tail is considered to be a feature readily noticed in the field. Relaxing the strict definition in this way is likely to reduce the margin for error in the field and probably also conserves better quality hybrids, which are likely to possess a great deal of valuable wildcat genetic material. The protocol therefore encourages gamekeepers not to shoot any tabby-marked cat with a thick, ringed, blunt tail and which has neither white feet nor a stripe running down the tail. Responding to a request from gamekeepers, the Project also produced laminated ID cards carrying a schematic coat markings diagram. These were intended to be small and durable enough to be carried in a trouser pocket or glove compartment and were



distributed widely to gamekeepers on the five estates and beyond, as well as to Cats Protection TNR volunteers.

Wherever possible, gamekeepers were encouraged to use live cage traps for feral cat control, rather than rely solely on night-time shooting, with the aim of considerably reducing the risk of wildcats being accidentally shot. Wildcats caught in cage traps, following inspection of coat markings, can be released unharmed. The Project's protocol encourages the estate to re-home via the Cats Protection any errant pets caught in cage traps, while feral cats are neutered via the Cats Protection or humanely dispatched by estate staff.

The Project then rolled out this protocol in two ways. Firstly the ethos of the protocol was disseminated to the wider gamekeeping community in Scotland through a variety of means as already outlined. Secondly, a more detailed and measurable implementation was concentrated on five estates in the Cairngorms National Park.

4.5 Testing the protocol in the Cairngorms National Park

The Steering Group decided to trial new methods of wildcat monitoring and promote wildcat-friendly predator control by testing the protocol on a limited number of keepered estates in the Cairngorms National Park. The idea was to decrease the risk of the estates' feral cat control activities to wildcats and then measure whether any change in approach, combined with a local expansion of TNR activities in the wider landscape, resulted in an increase on the estate of cats matching the Project's definition of a wildcat.

The Project approached five estates (A-E) where tabby-marked, wild-living cats were thought to occur, and which were well spread out across the National Park. Estate A was considered to have wildcats but also some ferals thought to originate from nearby villages. Estate B reported that wildcats had become scarcer there in recent years but that ferals had become more common. Estate C felt that they did have some wildcat activity but that feral activity was also rather low, but that sources existed nearby. Estate D felt they had both wildcats and ferals and also had a tenancy agreement in place whereby pet cats should be neutered. Estate E felt there were some ferals but that wildcats had not been reported on the estate for several years. By March 2010 all had consented to work with the Project. The Project Manager met with gamekeeping staff from each of the estates to explain the protocol and provide both training in wildcat identification and the pocket-sized laminated ID cards. The occurrence of cats on the estate over time would be measured by the use of intensive camera trapping on each estate during two periods approximately one year apart.

The protocol also encouraged gamekeepers to report any cat activity on the estate to the Project Manager during his regular liaison visits. This included any cats matching the Project's definition of a wildcat as well as any potential hybrids or feral domestics. Information from estate gamekeepers about any colonies of unneutered ferals, e.g. on local farms, was passed to local vets and Cats Protection branches with a view to encouraging farmers to allow TNR.

Initially the Project deployed two Cuddeback Capture camera traps on each estate. This make had been recommended by lynx and wildcat researchers in Switzerland and Germany as being effective, simple to use, and relatively inexpensive.

Gamekeeping staff provided advice on good locations on the estate for cameras and also supplied bait in the form of venison or dead gamebirds. Some also checked batteries and downloaded the contents of the memory cards.

It soon became clear, however, that more intensive camera trapping was required in order to gain a more thorough and objective understanding of the wild-living cat situation on each estate. Coincidentally, Kerry Kilshaw, a researcher at the University of Oxford's WildCRU, was looking into the potential use of camera trapping for monitoring the Scottish wildcat. SNH funded her to carry out a pilot study (Kilshaw & Macdonald, 2011) and the Project Manager introduced her to staff from two of the five estates in order for her to choose a site. Estate A was chosen and she deployed 40 baited and paired-up Cuddeback Captures at 20 locations there during the months of the 2009/10 winter. At this time, the RZSS decided to employ a field researcher to study the ecology and conservation of wildcats in the Cairngorms National Park with a view to the research being complementary to the work of the Project. Dr Roo Campbell began work in spring 2010 and was initially supplied with 40 camera traps by RZSS to carry out intensive camera trap monitoring on the five Project estates. A further 40 were purchased by the Project in the autumn so that two estates could be monitored at the same time.

4.6 The five estates

The Project Manager met regularly with staff from the five estates to gather information on feral cat control activities and any records of cats on the estates. A record was taken of the number of gamekeeping staff employed, the amount of effort invested in cage-trapping and night shooting, and the number of feral cats caught or shot. The total number of cage-trapping nights on each estate was calculated by multiplying the number of deployed cages by the approximate number of nights they were deployed. The total number of nights of spotlighting activity on each estate was calculated by multiplying the number of vehicles engaged in spotlighting by the approximate number of nights they were engaged. The figures for feral cat control effort are collated in Table 3.1.

The Project Manager also collated as many cat records as possible from the estate, including sightings by estate staff and members of the public, any photos, including from opportunistic camera trapping, as well as any roadkill carcasses from around the estate.

4.6.1 Feral cat management

Estate A

The landscape of the estate is mixed, with areas of open hill ground managed as deer forest and grouse moor, but with large areas of woodland on low and high ground, as well as enclosed farmland on the lower ground. There are tenanted farms and cottages on the estate as well as villages near its periphery. Pheasant rearing is no longer practised. Rabbits occur on the estate but experienced a sharp decline over the course of the Project probably due to two severe winters and possibly disease.

The estate's year starts on February 1st. Cages were typically laid in response to sightings of ferals. A suspected male wildcat, weighing 5.5 kg, was caught in a cage trap on 16/10/09 and released unharmed *in situ*. Photographs show the cat matched the Project's definition as it had a thick, ringed, blunt tail but spotting on the flanks suggest it was probably a hybrid near the wildcat end of the spectrum. The majority

of ferals shot on the estate are done so with a spotlight and these tend to occur on the lower ground. Estate staff consider that ferals originate in neighbouring villages.

A longer term dataset since 2005 shows a considerable reduction in the number of feral cats shot after 2007, when numbers fell from 33 to 5 (Fig. 3.1). As can be seen from Table 3.1, the estate expended a moderate amount of effort in both cage trapping and spotlighting and culled a low number of ferals. There was a slightly increasing trend in the total number of ferals shot over the three years, with spotlighting having played a more significant role in the last year. Cats generally occur on the lower ground away from much of the grouse moor interest and the estate no longer has a pheasant interest, therefore predator control activities are not intensive. Effort was similar in levels to Estates C and E but yielded fewer ferals than on those two estates. This could be attributable to several factors. For example, a significant proportion of the wild-living cat population on the estate, as indicated by camera trapping and sightings records, matches the Project's definition of a wildcat. These cats are not therefore subject to control so only a relatively small proportion of the estate's wild-living cat population would be shot. Furthermore, this population may suppress incursions and densities of feral domestics, either through territorial aggression or through food competition, thus helping to ensure that the general abundance of ferals is relatively low. The existence of a Cats Protection branch locally for several years may also have contributed to a greater proportion of feral, farm and pet cats in the surrounding area having being neutered by way of TNR activities and a voucher scheme for pets.

Estate B

This estate is a mosaic of woodland, farmland and hill ground managed for grouse and deer. There are villages on the periphery of the estate as well as a significant number of rural houses and tenanted farms. The gamekeeping staff was increased by two in 2006 and intensive pheasant rearing occurs on some areas of lower ground. Rabbits occur across the estate.

The estate's year starts in March. Mar 09 to Feb 11: 12 traps around pheasant pens for 30 nights from late July – late August. Normally 17 traps widely deployed for 6 Months Oct-Apr but severely curtailed due to snowfall during the winter. Consequently used only Mar-Apr then Oct-Dec. Mar 11 to Feb 12: 12 traps around pheasant pens for 30 nights from late July – late August. 25 traps widely deployed for 6 months Mar-Apr then Oct-Feb. The increase in gamebirds in recent years was suggested by keepers as a reason for why the feral cat population has increased over the same time scale. Pheasant pens act as a 'honey-pot' for ferals and cage-trapped cats are caught mainly around pheasant pens, e.g. 29 of the 36 cage-trapped cats in 2009/10 were caught in a pheasant-rearing area and 17 of those were caught around just one pheasant pen. Many of the cats were considered to be subadult. Each pheasant pen has 2-3 cages baited and set around it. Cats shot during spotlighting are more evenly spread across the estate on lower beats. Upper beats have few ferals. Most of the ferals shot by spotlight in the last year, which experienced a significant upsurge, were in an area of the estate where large numbers of unneutered farm cats are considered to occur.

Table 4.I. Feral cat control effort at five estates in the Cairngorms National Park during 2009-2011. Separate figures for feral cats killed during cage-trapping and spotlighting were not available from Estate A in 2009 or from Estate E in 2009 and 2010.

Estate	Staff	Approximate trapping nights			Number of cats trapped			Trapped wildcats	Approximate spotlighting nights			Number of cats shot			Feral cats shot or neutered			
		2009	2010	2011	2009	2010	2011		2009	2010	2011	2009	2010	2011	2009	2010	2011	Total
A	2.5	186	186	250	?	3	2	1	150	150	150	?	1	4	4	4	6	14
B	7	1890	1890	4860	36	26	22	0	1170	1170	1170	31	22	65	67	48	87	202
C	4	200	200	200	3	4	5	0	260	260	260	10	15	14	13	19	19	51
D	3	20	30	30	2	3	0	0	50	50	50	7	0	0	9	3	0	12
E	10	240	240	240	?	?	0	0	130	130	130	?	?	16	15	17	16	48

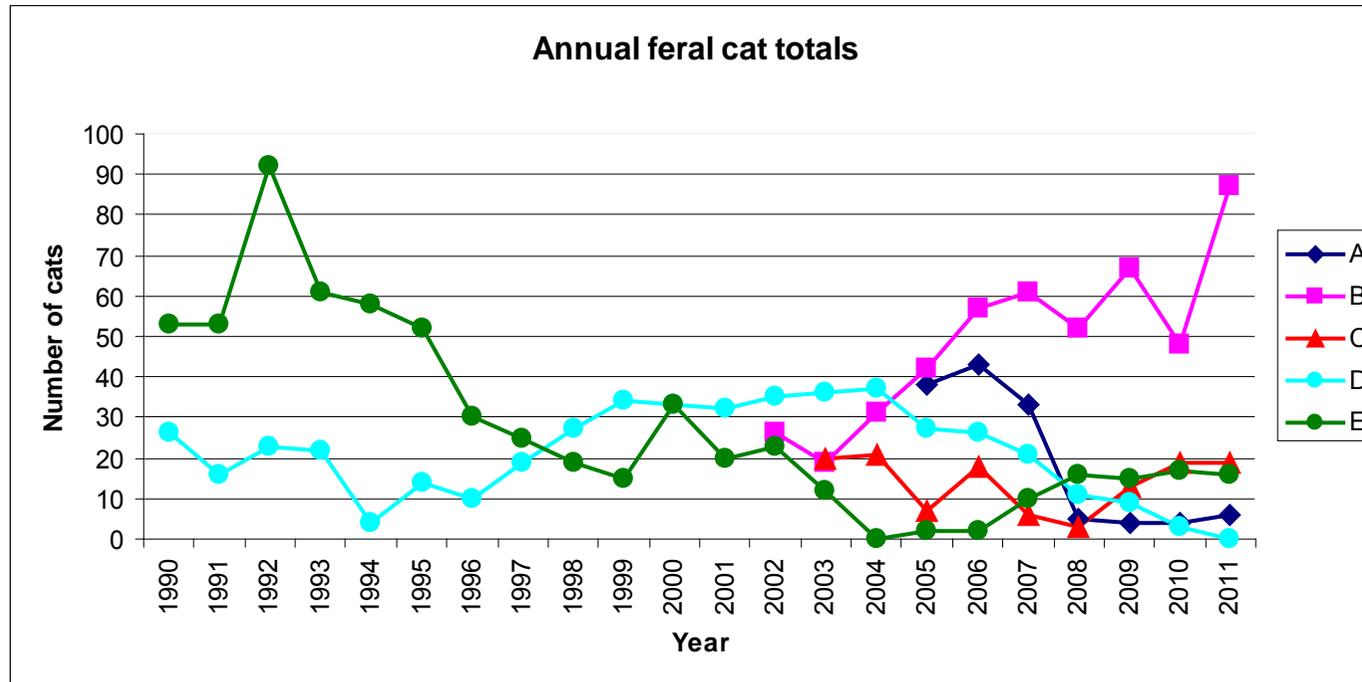


Fig. 4.I. The total number of feral cats shot on 5 estates for years between 1990 and 2011. Note the 2010 figure for Estate D includes two cats which were neutered, rather than shot.

The number of ferals controlled on Estate B has risen steadily since 2003 (Fig. 3.1). The estate has recently invested considerable effort in predator control which is reflected in the number of staff engaged in predator control and the high number of both cage-trapping and spotlighting nights (Table 3.1). This effort is driven largely by gamebird management objectives, especially for pheasants, and resulted in a large number of ferals being shot. The apparent abundance of ferals on the estate, which reportedly increased in the past few years, could be attributed to several potential factors. The intensification of pheasant rearing on the estate may have created a new and rich food resource which has contributed to the increase in the feral population. The 'honeypot' effect of pheasant pens may pull farm cats away from colonies in local farm buildings where they may have been less observable by keeping staff in previous years. The attractiveness of the pheasant pens to cats and the apparent effectiveness of cages in this scenario mean that the use of clustered cage traps is more cost-effective in terms of the gamekeepers' time (as cages must be checked at least once every 24 hours).

Camera trapping indicates that wildcats are scarce or absent on the estate and are therefore unlikely to represent a significant proportion of the local, wild-living cat population or to exert any territorial or competitive pressure on feral cats. Indications from both gamekeeping staff and local veterinarians are that there are considerable numbers of unneutered cats on farms in parts of the estate and that these are likely to be serving as sources for feral populations in the wider countryside.

Estate C

The majority of the estate is upland in character and is managed for grouse. However on the lower sections of the estate the landscape is mixed largely between woodland and farmland. Pheasant rearing is not practised. The estate itself is thinly populated with houses inhabited mainly by estate staff. However, villages and a higher density of farms occur close to the estate marches. Rabbits occur.

The estate's year starts in January. The increase in ferals killed from 2009 to 2010 was considered by the head keeper to reflect a rise in the local feral cat population. Ferals occur in several beats but mostly in the lower ground. Cage traps are deployed usually in response to known feral occurrences. One juvenile tabby-marked cat was caught in a cage trap on 17th March 2010 and, due to uncertainty of identification at its young age, was transferred to the HWP where, after a period of time and a mtDNA test, it was judged not to be a wildcat. Another tabby-marked feral was caught in a snare and dispatched. The majority of feral cats occur on the lower, wooded ground in a 500 m wide strip.

Over a longer timescale, the number of ferals controlled on the estate has fluctuated but remained stable overall (Fig. 3.1). The estate invested a moderate amount of time in feral cat control activities in the last three years and shot a moderate number of ferals as a result (Table 3.1). Most of these were shot during spotlighting. Wildcats were not camera-trapped on the estate, although cats with either a black or silver tabby colouration were photographed on several occasions. Unsubstantiated sightings of cats matching the description of a wildcat have been reported from both the core and periphery of the estate. Two roadkill carcasses from the public road on the edge of the estate were sent to the National Museum of Scotland for analysis, and while one has yet to be assessed, one was found to be a hybrid.

Estate D

This estate is well-wooded, with tenanted farms and houses on the lower ground in the river valleys and higher, more open elevations managed for deer and grouse. Pheasant rearing is no longer practised and snaring has not been practised for several years. Villages lie close to its periphery and rabbits are now much less abundant than they were in previous decades.

The estate's year starts in April. Cage trapping is used for specific issues, e.g. there were 30 trapping nights at a hen house experiencing unidentified predation until a pine marten was caught and released. 2 trapped at a farm, in November 2009. Between 1st April 2010 and 31st March 2011 three feral cats were caught. Two were given to Cats Protection, and were neutered and vaccinated. One of these was released on an estate farm and one was re-homed elsewhere. One was humanely dispatched. The 7 ferals shot in 09/10, were all in or very near farmland. No ferals were shot with a spotlight in 2010/11 and no cats were trapped or shot at all in the last year.

Compared to the other estates, Estate D invested the least time in both cage-trapping and spotlighting. Correspondingly, the number of cats controlled was the lowest. In the final year, no cats were cage-trapped or shot at all. This estate was the only one which passed cage-trapped feral cats to the local Cats Protection for neutering. The low number of ferals shot can be explained in part by the estate's objectives – it does not have a economic gamebird interest on the low ground of the estate where cats occur most. Furthermore, the abundance of feral cats appears to be low and more concentrated at one end of the estate, where much of the farmland occurs. Wildcats were not recorded on camera traps or by any other substantiated means. However, there were nocturnal sightings records by keepers of cats matching the description of a wildcat, as well as photographs of cat footprints in mud. Both of these were reported from remote areas of the estate near the interface of open hill and pinewood not subject to camera trapping, and could mean that wildcats do occur but at low densities in an environment lacking rabbits and where they could be difficult to observe because of the terrain and thick cover.

The last three years, when compared to a longer term dataset (Fig 3.1) show a steady decline in the number of cats shot on the estate. An increase between 2000 and 2005 was attributed to increased effort from one keeper, who pursued feral cat control intensively but who has since left the estate. This implies less effort since then in feral cat control. Whether this means that the feral cat population on the estate is now higher as a result is not possible to confirm. However, the increase in feral and farm cat neutering in the area in recent years may mean that there are fewer cats in the local countryside to fill the niches made vacant through shooting.

Estate E

The majority of the estate is open ground given over to deer management and some walked-up grouse shooting. However the lower ground is well wooded with some farmland. Some pheasant rearing occurs on the low ground as do rabbits in some areas. Several estate houses and some tenant farms also occur on the low ground and a village lies at the periphery of the estate.

The estate's year runs from March to February. Very few cats are caught in cage traps, and none were trapped in 2011/12. They are deployed around pheasant pens but feral cats are not considered to be significant problem for pheasants on the estate. Spotlighting occurs using 5 vehicles from September to April for approximately one night per week for 6 months. 1 tabby feral was shot in June 2010 at a farm on the estate. Two tabby-marked cats were shot in March 2011. One had been observed on a previous occasion in poor light but no shot was taken for fear it was a wildcat. In better light more recently it was judged not to be a wildcat, having a white chest and thin tapering tail. The other cat was a probable hybrid, which had white feet but otherwise looked a good cat as it had a thick, ringed tail with no continuing dorsal stripe. This is probably the same white-footed cat which was camera trapped by the gamekeeper 2.5 km away on 25th December 2010 and 1st January 2011. According to the keeper, ferals basically occupy the strip of lower ground running along the valley. Two of the carcasses mentioned above were frozen and transferred to the Highland Wildlife Park then the National Museums of Scotland. Results of pelage analysis have still to be confirmed.

Estate E has seen a general decline in the number of ferals controlled over the past 20 years, although the trend increased from 2006 to 2008, before stabilising at levels considerably lower than in the early 1990s (Fig. 3.1). Over the past 3 years, the estate invested a moderate amount of time in both cage-trapping and night-time shooting. The number of ferals shot was moderate but was skewed towards spotlighting. Cage-trapping was employed mainly around a small number of pheasant pens. However, unlike Estate B, pheasant pens did not appear to be an obvious attractant for feral cats. Camera trapping did show that wildcats were present, despite having been undetected by keepers in the years previous to the Project. The keepers are now aware of their presence, having been instrumental in detecting them through opportunistic camera trapping. Spotlighting now appears to be precautionary with some feral cats or hybrids at the domestic end of the spectrum only being shot on the second or third occasion of being spotlighted when more confident identification could be gained.

4.6.2 Monitoring

Detailed monitoring data from each of the estates are available in Appendix 6, and are summarised in Table 4.2, where they are compared with the intensive camera trapping results detailed in Chapter 5. Estate A had a relatively high volume of potential wildcat monitoring data, which tallied with a relatively high volume of intensive camera trapping data. Estates B and D had high volumes of sightings data of potential wildcats but either no or very low volumes of photographic data, including intensive camera trap data. Estate C generated moderate levels of sightings data but no photographic data, while Estate E had low levels of sightings data, but high levels of photographic data.

Table 4.2. Summary monitoring data from each of the five estates. Figures relate to the number of potential wildcats observed.

Observation method	Estate A	Estate B	Estate C	Estate D	Estate E
Staff sightings	6	6	3	4	1
Other sightings	5	5	2	6	0
Roadkill carcasses	2	0	1	0	0
Opportunistic camera traps	5	1	0	0	1
Other photo	7	1	0	0	2

Intensive camera traps	6	1	0	0	6
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4.7 Outcomes: gamekeeping methods

In order to assess any impact the Project may have had on gamekeeping methods relating to the management of wild-living cats, 43 questionnaires were sent out in July 2011 to gamekeepers in the Cairngorms National Park who either:

- attended the “Practical Wildcat Conservation in the Cairngorms National Park” conference in Aviemore in April 2008; or
- attended the “Predator control and the Scottish wildcat” workshop at the Lecht in December 2009; or
- attended the “Wildlife and the Law” training course at Mar Lodge in May 2009; or
- is employed on one of the estates that the Cairngorms Wildcat Project works closely with.

The accompanying covering letter asked recipients to complete the questionnaire and send it back in the pre-paid, self addressed envelope by July 31st. The questionnaire could be completed anonymously. Seventeen responses were received, representing a 40% return rate.

All who replied chose to be anonymous and the responses to each question were as follows:

1. Since your contact with the Project, do you feel more confident or less confident in your ability to identify a wildcat in the field?

MORE	14
LESS	0
THE SAME	3

2. Since your contact with the Project, have you modified your predator control activities to reduce the likelihood of killing wildcats? E.g. have you changed the relative use of lamping, snaring or cage trapping; have you made changes to the timing, location or effort invested in predator control?

YES	8
NO	9

Of those who said ‘yes’ and elaborated:

1 said he was shooting fewer stripy cats

2 said they were doing more live-trapping

1 said he was more aware of cats when lamping

1 said he was using cage traps more often and not snaring at all

1 said he was taking time to identify cats

Of those who said ‘no’ and elaborated:

- I said he was confident he wouldn't catch a wildcat
- 2 said they had always been careful
- 3 said they had never seen a wildcat on the estate
- I said that snares and cages were not put where wildcats had been seen
- I said that they didn't snare or cage trap and that wildcats had not been seen
- I said they could not see any practical way of modifying that would benefit wildcats

3. Since your contact with the Project, have you avoided shooting a cat because of the risk it might be a wildcat?

YES	9
NO	8

Of those saying yes, and who elaborated:

- 3 said on 1 occasion
- 2 said on 2 occasions
- 1 said on 3-5 occasions
- 1 said on 5 occasions

Of those saying no and elaborating:

- 1 said they haven't seen a cat while lamping
- 4 said they had never seen a wildcat on the estate
- 1 said it had always been estate policy to avoid shooting if any doubt
- 1 said it was important to control ferals which threaten wildcats
- 1 said he had always been careful

4. If you answered 'yes' to Question 3, do you think you would have avoided shooting the cat(s) before you had any contact with the Project?

YES	5
NO	4

1 other respondent who had answered 'no' to Q3, answered 'yes' to Q4 and expanded by saying that staff on his estate would avoid shooting a cat looking like a wildcat, if they ever saw one.

5. Since your contact with the Project, do you think you have seen a potential wildcat?

YES	12
NO	5

Of those responding 'yes':

- 5 saw wildcats on 1 occasion
- 2 saw wildcats on 2 occasions
- 1 saw wildcats on 2 or 3 occasions
- 3 saw wildcats on 3 occasions
- 1 saw wildcats on 12 occasions

Of those responding 'yes':

5 reported their sightings to the Project (total of 22-23 cats)

6 did not report their sightings (total of 7 cats)

1 did not respond (total of 3 cats)

5 respondents provided further comments:

- "Well done. Keep up the neutering/removal of farm type ferals"
- "Keep up the good work"
- "My sighting of the cat was near XXXX on XXXX and I knew that people had already reported sightings there"
- "All we seem to see here are feral cats that have been dumped by the public"
- "I would just like to say that in the area I work in, the amount of feral cats and domestic cats has increased significantly in the past ten years and would doubt very much if there were any pure bred wildcats left"

4.8 Discussion

The extent and intensity of feral cat control on estates varies according to their objectives. Those with a significant gamebird interest are likely to invest more staff and time in controlling cats. On the whole, the number of cats caught or shot on estates reflected the amount of effort put into cat control. Cage-trapping was used to address acute issues e.g. predation around pheasant pens or hen houses or in areas where feral cats had recently been sighted. Feral cats were controlled more widely on estates through night-time shooting, usually when foxes were the main target species.

The benefits to estates of engaging with the Project varied according to circumstances. By attempting to lower the feral cat population through encouraging more neutering of pets and ferals the Project was seen by many estate staff as being broadly consistent with their own objectives and they were thus willing to support it. For example both Estate A and Estate D found that wildcat conservation was a new and useful angle to help motivate tenants to have pet cats neutered, which would in turn benefit not only wildcats but also broader estate management. At least one of the estates was also keen to be perceived as a habitat for wildcats as they feel this would help to promote tourism on the estate.

The questionnaire, which was sent to gamekeepers who had come into contact both with the Project and its message about the need to conserve wildcats and more specifically the wildcat friendly estates' protocol, was answered by respondents anonymously. Although only a small sample, the results suggest that the Project has considerably improved confidence in wildcat identification amongst gamekeepers with whom it has come into direct contact. Almost half of respondents said they had modified their predator control activities so as to reduce the risks to wildcats, e.g. by taking greater care in cat identification during shooting or by using cage-trapping more often. Of those who said they hadn't modified their activities, several indicated that was because they felt that wildcats did not occur on their ground or because they had always been careful to avoid harming wildcats. More than half (9) of respondents said they had avoided shooting a cat because of the risk it could be a wildcat since their contact with the Project, while several of those that said they hadn't, said it was due to there being few cats or wildcats around. Just under half of those who said that they

had avoided shooting a cat since their contact with the Project (4), admitted they would have shot the cat before their contact with the Project. Care must be taken when extrapolating from such a small sample size, but it does imply that several potential wildcats owe their continued existence in the Cairngorms National Park to the positive response of gamekeepers to the Project and its message about wildcat-friendly predator control.

Given the Project invested time in engaging with the wider keeping profession through specialist magazine articles, attendance at national game fairs, and by addressing well-attended gamekeeping meetings, it is reasonable to assume that greater confidence in wildcat identification and modifications to predator control activities to safeguard wildcats have occurred beyond those gamekeepers sent questionnaires, or even those working within the Cairngorms National Park. Indeed, the Project Manager was made aware anecdotally of a gamekeeper outside the National Park deciding not to shoot a potential wildcat which he had in his sights, and which he judged to have been predated his pheasants, because he had read an article in the *Scottish Gamekeeper* magazine about the need for gamekeepers to help conserve wildcats.

There is also considerable potential for gamekeepers to be involved in the monitoring of wildcat populations. Most keepers are in the field very frequently, in a wide range of terrain, at a variety of times of day, and at all times of year, very often with a spotlight. They are therefore in an excellent position to report on trends in populations, as well as on details of wildcat activity and landscape-use. The majority of potential wildcats seen by gamekeepers responding to the questionnaire were reported to the Project, thus helping to improve our understanding of the status of wildcats in the Cairngorms National Park. This information is particularly useful when substantiated with photographs and several keepers have been invaluable in assisting with the deployment and running of camera traps. The experiences of Estate E, where wildcats had not been thought by estate staff to occur, yet the opportunistic deployment of Project camera traps by one of the gamekeepers, proved that the wildcats were indeed present in numbers, do illustrate several points: wildcats can be difficult to detect purely through human observation; gamekeeping staff have a valuable role to play in wildcat monitoring; and camera traps are an invaluable tool for gathering hard evidence of wildcat occurrence and the extent of hybridisation. Chapter 4 describes in detail the use of camera trapping, as well as other methods for monitoring wild-living cat populations.

5. Researching and monitoring wildcats

The Project MoU had an objective relating specifically to research and monitoring:

- To carry out research and monitoring to develop a greater understanding of Scottish wildcat conservation status, ecology, genetics and epidemiology within the context of the project;

5.1. Intensive camera trap monitoring

A repeated intensive camera-trap based monitoring study was initiated in the five target estates. The aim of this study was three-fold:

1. To assess cat populations in terms of the numbers of wildcat, hybrid cat and domestic cat
2. To assess changes in the numbers of cats during the project
3. To investigate the ecology of wildcats, hybrid cats and domestic cats with the intention of informing future management of cats for wildcat conservation

5.1.1. Photography

In the five target estates, 20 pairs of camera-traps (Cuddeback Capture® or Capture® IRs) were set out in a grid of 4 × 5 pairs, with a spacing of 0.5-1.5 km (mean 1km) between nearest neighbours, following Kilshaw and Macdonald (2011). This was achieved by placing on a map points 1km apart in 4 × 5 km grid, visiting each point and investigating suitable locations near the point. Cameras were not set at random with respect to habitat characteristics and instead were, where possible, preferentially (but not exclusively) placed at locations showing one or more of the following features based on previous studies on wildcat habitat use (Scott et al. 1993; Daniels et al. 2001; Lozano et al. 2003; Ballesteros-Duperón 2005; Poto

čnik et al. 2005; Theil 2005; Klar et al. 20

- In cover habitat near open habitat
- On or near paths or game-trails
- Along linear features such as drystone dykes, stock fences and riparian belts
- At bottlenecks for animal movement such as holes in otherwise animal-proof fencing (i.e. a 6ft deer fence with narrow-gauge mesh)

Field signs of cats were not used in deciding camera locations in preference to the features listed above because future random changes in the movement of wildcats away from areas that they were using during the first survey could lead to a reduction in population estimates during future surveys (a process known as ‘regression to the mean’). Conversely, cat field signs were not avoided if the location fulfilled other criteria.

Cameras were set in pairs in order to minimise data loss from camera failure and to maximise the likelihood of photographing both sides of visiting cats to aid identification during recaptures. These camera pairs (referred to as ‘stations’ hereon in) were baited using a combination of lures including feathers, scent (Hawbakkers Wildcat Lures # 1 and #2) and meat (chicken leg, pheasant or deer offal). In Estates A (but see below) and B, no meat bait was used. Scent and meat lures were refreshed at the beginning of weeks 3, 5 and 7. Surveys lasted up to 84 days. The survey is to be repeated each year at the same camera trap

locations with lures matching that of prior surveys on the estate. Time of year was also matched closely.

In estate A, a survey was conducted by Kerry Kilshaw (WildCRU) beginning in Feb 2010. This survey matched the CWP surveys in methodology except that pheasant carcasses were used as bait. This could be regarded as a baseline survey for estate A. Beginning Dec 2010, Kerry Kilshaw revisited Estate A but used scent and feather lures and also adjusted the location of some of the cameras. In order to ensure that future surveys could be linked to these two surveys, we resurveyed Estate A beginning May 2011 using the same camera locations and bait as used the first survey. The remaining four estates were all surveyed through autumn-spring 2010-2011 (year 1) and again autumn-spring 2011-2012 (year 2). In Estate B, while bait protocols were tested, an additional three months data was collected prior in summer 2010.

Cameras recorded the date and time of each photograph taken. Individual cats were identifiable based on pelage markings. We thus know the location, date, time and identity of cats photographed (or captured).

5.1.2. Habitat mapping

At each camera station, habitat characteristics were visually assessed and recorded. These include: canopy cover (%); shrub layer mean cover (%); herb layer mean height; herb layer mean cover (%). Maps were digitised from 1:25,000 OS maps in Quantum GIS (v. 1.5.0), checked against satellite images available from Google™ Maps and ground-truthed during camera placement and rebaiting. Habitats are defined in Table 5.1.

Table 5.1. Habitat class descriptions

Habitat	Definition
Coniferous	Any habitat dominated by coniferous trees including Caledonian pine forest and pine / spruce plantations
Deciduous	Any habitat dominated by deciduous trees and shrubs including birch wood and juniper scrub
Felled	Recently felled plantations dominated by early successional herbs and grasses. This class was incorporated into Grass during analysis
Grass	Pasture and unimproved grassland
Habitation	Houses and proximate gardens
Moor	Moorland
Open wood (Coniferous or Deciduous)	Habitat with sparse trees and/or shrubs so that the habitat was dominated by the underlying vegetation. These classes were incorporated into the class describing their underlying vegetation (Grass or Moor) during analysis

The habitat surrounding each station may play a role in the likelihood that a cat will be captured there. A buffer of 100m was placed over each station point and the proportion of the buffer consisting of each habitat class was calculated. Buffer areas that crossed rivers

>3m width where there were no suitable crossing points within the buffer area were truncated at the riverbank because habitat across such rivers would be inaccessible to a cat visiting the station without travelling >100m (Figures 5.4 – 5.8).

5.1.3. Statistical analyses

For all analyses, we defined a wildcat as a striped (tabby-marked) cat with a thick, blunt-tipped tail, a dorsal-stripe that ends at the base of the tail and no white feet (see Kitchener *et al.* 2005). This is the project working definition of a wildcat that is applied by gamekeepers in the field when making management decisions. All statistical analyses were conducted within the R programming environment (R v. 2.14.0, R Development Core Team 2011)

5.1.3.1. Population change and density

Following Kilshaw and Macdonald (2011), only the first 60 days of each survey were used to assess population change and density. The low numbers of wildcats captured (see results) combined with only two years data precluded the use of complex capture-mark-recapture (CMR) models in most cases. To assess changes in cat populations between year 1 and year 2 we applied a t-test, paired by estate, on the number of cats of each group captured, i.e. the minimum number alive (MNA).

Enough cats were captured in estate E to apply CMR models to estimate density, though the numbers were low and therefore results should be interpreted with caution. For this analysis, we applied a spatially-explicit CMR model using the package *SPACECAP* (Singh *et al.* 2010) in R. Following Kilshaw and Macdonald (2011), potential home-range centres were spaced at 0.5km intervals in areas within 3km of outlying stations. Points falling in unsuitable or inaccessible habitat were excluded. These were areas of habitation, roads and rail-tracks, moorland (see results) and areas falling on the opposite side of a large river that had no crossing points within the 3km buffer zone. The models used included the following: Trap response present, Spatial Capture-Recapture, Half-normal detection function, Bernoulli detection process. The Markov Chain Monte Carlo (MCMC) simulation used 50,000 iterations with a 1,000 iteration burn-in and no thinning.

5.1.3.2. Turnover of cats and site fidelity

Survival and recruitment of cats from year 1 to year 2 was calculated based on the number of cats captured in year 1 that were also captured in year 2 (survival) and the number of cats captured in year 2 that had not been captured previously.

The site fidelity of cats was calculated based on the number of cats surviving from year 1 to year 2 that were captured at the same stations in both years and the number of surviving cats that were captured at a station where they had not been captured previously. A cat could be counted as both using the same stations in the two years and different stations in each year if it was captured at >1 station, at one of which it had not been captured in year 1.



Figure 5.1. Photo of a probable wildcat taken during intensive camera-trapping of Estate E.

5.1.3.3. Temporal activity patterns

We examined the timing of activity by cats from each of the three groups (*g*) (wildcat, hybrid and domestic cat) using the times recorded by the cameras for each visit by a cat. To minimise issues associated with changes in the times of sunset and sunrise across the survey periods, we combined visit times into three hour blocks (*t*), beginning at midday (thus 1200 – 1459, 1500 – 1759..... 0900 – 1159). We used the package *lme4* (v. 0.999375-42, Bates and Maechler 2011) in R to construct GLMMs describing the effect of *t* on the number of visits (*v*) by each individual cat. A Poisson model was used with a log link function. Random intercepts were specified for Estate and individual cat ID. We expected a polynomial (non-linear) relationship between *t* and *v* due to the circularity of daily rhythms and data exploration indicated that a quadratic relationship would sufficiently explain *v* when *t* began at midday. We therefore included *t* and its quadratic component (t^2). We also included *g* and interactions between these variables and ($t \times g$, $t^2 \times g$) to assess whether activity patterns were different between wildcats, hybrids and domestic cats. After finding significant interactive effects, we then ran the same models as pair-wise comparisons between each group (three possible pairs: wildcat-hybrid, hybrid-domestic, wildcat-domestic) to assess which groups differed in temporal activity.

We estimated the effects of these variables by model-averaging using the package *MuMIn* (v.1.7.2, Bartoń 2012) in R for small sample sizes). Estimates within 4 AICc of the top model were averaged for parameter estimates.

5.1.3.4. Habitat association

While camera placement was not at random with respect to habitat, a diversity of habitat characteristics was evident at and around stations allowing an examination of the habitat association of cats. Cat populations and time-of-year varied between estates and therefore any analysis of habitat association must control for estate. We used cat abundance (within each cat group and combined) as our response variable. Cat abundance a at each station was the sum of the number of individual cats n_i captured at station j in year k .

We used the package *lme4* (v. 0.999375-42, Bates and Maechler 2011) in R to construct GLMMs describing the influence of habitat within 100m of each station (see above) on cat abundance. A Poisson model was used with a log link function. Estate was set as a blocking variable by specifying random intercepts for estate: thus we assume that the slope of the relationship between a and habitat is the same for all estates but (in accordance with differences in cat abundance between estates), the intercept of the relationship may be different.

We examined habitat association at two levels: First at a broad scale (within 100m of a station) and then at the small scale in wooded habitat (habitat at the station). We kept these analyses separate since there was evidence of intercorrelations between levels.

Broad scale: Our measure of habitat within 100m of each station is in the form of proportions, summing to 1, and therefore the proportion of one habitat type will correlate with the proportion of other habitat types across stations. Intercorrelations in predictors present a problem for linear models and can lead to over-fitting of the data (see Freckleton 2011). To negate this issue, we extracted orthogonal (non-correlating) principle components from the habitat data using the function *princomp* in R, leading to three habitat variables ($C1 - C3$, see results). We used these variables as predictors in the model together with a binary variable describing the presence or absence of rabbit at the station (based on whether cameras photographed rabbit in either year) and whether the station was next to an animal-proof fence that would channel cats past the cameras, increasing our perception of cat abundance. We might expect that cats prefer edges between cover and open habitat (e.g. Klar 2008) and so habitat that was mostly open or mostly closed would be less preferred than habitat that was a mix of open and closed. Since variable $C3$ describes habitat openness (see results) we included a quadratic component of $C3$ in the model ($C3 + C3^2$). We thus have six variables describing habitat: $C1$, $C2$, $C3$, $C3^2$, *rabbit* and *fence*.

Fine scale: At this scale, we only used stations there were in or at the edge of wooded habitat (N = 86 of 100) since the distinctiveness of non-wooded from wooded habitat would mask variability between different wooded habitats. The height and cover of the herb layer and the cover of the shrub layer will partially depend on the cover of the layers above, leading to intercorrelations between these variables. As above, we therefore extracted orthogonal principle components, leading to four habitat variables ($C4 - C7$, see results). We used these in conjunction with variables on the presence of rabbits and of a fence (see above) together with a binary variable describing whether the station was within 10m of a watercourse ('riparian').

We estimated the effects of these variables by model-averaging using the package *MuMIn* (v.1.7.2, Barto

ń 2012) in R.

for small sample sizes). Estimates within 4 AICc of the top model were averaged for parameter estimates.

To examine whether habitat association of cats were different between groups (*g*) (wildcat, hybrid and domestic), we constructed the same model but with three rows per station describing the abundance of each cat group separately. We allowed random intercepts for cat group (*g*). We then compared this model with the same model that kept intercepts constant across cat groups using AICc.

5.1.3.5. Assessing survey efficiency

In order to examine the effectiveness of the survey methodology, we graphed the cumulative proportion of all cats caught (during each of the 10 surveys and then as a mean of all surveys) over the whole period that cameras were deployed (max 84 days). We also calculated the cumulative proportion of cats caught over time from the mean of subsamples of every other camera station to assess whether the distance between cameras could be increased without impacting population estimates.

5.1.4 Results

Maps of each area surveyed, showing the location of cameras and habitat types at the broad-scale are shown in Figures 5.4 – 5.8.

5.1.4.1. Population change and density

In year 1 and year 2 a total of 13 wildcats, 11 hybrid cats and 15 domestic cats were detected. Wildcats were detected on only three of the five estates, with a mean of 1.4 wildcats/estate in year 1 increasing to 2 wildcats/estate in year two (Table 5.2). The increase in wildcats was not significant however ($t = -0.885$, $df = 4$, $P = 0.426$). Fewer hybrid cats were detected than wildcats and the change in numbers between years was not significant ($t = 0.535$, $df = 4$, $P = 0.621$). Domestic cats were detected on all estates in at least one of the years and the mean number per estate and change in number were the same as for wildcats, with the change again not significant ($t = -0.812$, $df = 4$, $P = 0.468$). Only estates A and E showed an increase in wildcats and a decline in hybrids and/or domestic cats. The remaining estates all showed an increase in the numbers of domestic cats.

The population density for cats in estate E in year 1, as estimated in *SPACECAP* 12.14 cats 100km⁻¹, rising to 25.57 cats 100km⁻¹ in year 2 (Table 5.3). The year 1 data included one hybrid and one domestic cat and therefore the estimate for wildcat in that year is 8.09 wildcats 100km⁻¹. Year 2 contained only wildcats. The estimates for sigma (a measure of mobility) varied widely between years being very large in year 1 and very small in year 2, reflecting shorter mean distance between captures in year 2. It is therefore likely that the population estimate in year 2 is inflated in relation to year 1, possibly also due to the smaller sample size and therefore these results should be interpreted with great caution.

Table 5.2. Cat population estimates (minimum number alive) and change in the population

site	year	Minimum number alive			Change		
		Wildcat	Hybrid	Domestic	Wildcat	Hybrid	Domestic
A	1	2	0	1			
B	1	1	1	2			
C	1	0	2	0			
D	1	0	2	3			
E	1	4	1	1			
Mean		1.4	1.2	1.4			
A	2	5	0	0	+3	0	-1
B	2	0	0	3	-1	-1	+1
C	2	0	3	3	0	1	+3
D	2	0	2	4	0	0	+1
E	2	5	0	0	+1	-1	-1
Mean		2.0	1.0	2.0	+0.6	-0.2	+0.6

Table 5. 3. Population size and density estimates for estate E. Sigma is a measure of the mobility of the animals. Lam0 is the expected encounter frequency (probability per camera-day) if the cat's home-range was centred on that camera. Beta is the regression coefficient that measures the behavioural response to the cameras. A larger value indicates that once captured, the cat is more likely to be captured again. Year 1 was estimated from six cats of which four were wildcats and therefore results should be adjusted accordingly. Year two was estimated from wildcats only.

Parameter	Year	Mean	95% CI	
			Lower	Upper
sigma	1	1.09E+11	0.0599	1.43E+11
lam0	1	0.0017	5.00E-04	0.0041
beta	1	2.74	1.67	3.85
N	1	9.28	6	16
Density	1	12.14	7.84	20.92
sigma	2	0.050	0.011	0.13
lam0	2	0.0084	0.0023	0.016
beta	2	2.51	1.52	3.48
N	2	19.56	10	30
Density	2	25.57	13.07	39.22

5.1.2.2. Turnover of cats and site fidelity

Overall, there was a trend of increasing turnover moving from wildcats to hybrids to domestic cats (Table 5.4 and 5.5). This trend involved a reduction in survival between years combined with a greater likelihood of detecting new animals in year 2.

Table 5. 4. Detection or otherwise of individual cats in each estate, and the station numbers at which they were captured in each year. Note that cat 1 and cat 3 from estate A were also detected in the baseline survey in year 0 (2009-2010). Some cats here were only detected outwith the main 60 days survey and so were not used in analyses of population change.

Estate	Cat	Classification	Year 1	Station(s)	Year 2	Station(s)
A	1	Wild	1	1	0	
A	2	Wild	1	1, 2	1	1, 2, 9
A	3	Wild	0		1	3
A	4	Wild	0		1	3
A	5	Wild	0		1	3
A	6	Wild	0		1	3
A	7	Domestic	1	10	0	
B	1	Wild	1	16	0	
B	2	Hybrid	1	1, 2	0	
B	3	Hybrid	1	11	0	
B	4	Domestic	1	1	1	1
B	5	Domestic	1	13	0	
B	6	Domestic	0		1	1
B	7	Domestic	0		1	3
B	8	Domestic	1	10	0	
C	1	Hybrid	1	7	0	
C	2	Hybrid	1	4	1	4
C	3	Hybrid	0		1	8, 11
C	4	Hybrid	0		1	11
C	5	Domestic	0		1	8
C	6	Domestic	0		1	11
C	7	Domestic	0		1	8
D	1	Hybrid	1	19	0	
D	2	Hybrid	1	16	1	16
D	3	Hybrid	0		1	19
D	4	Hybrid	0		1	19
D	5	Domestic	1	16, 19	0	
D	6	Domestic	1	16, 19	0	
D	7	Domestic	1	19	1	19
D	8	Domestic	0		1	16
D	9	Domestic	0		1	17
E	1	Wild	1	1, 5, 8, 14	1	8, 11
E	2	Wild	1	8, 12	1	12
E	3	Wild	1	1	0	
E	4	Wild	1	9, 13	1	9, 13
E	5	Wild	0		1	10
E	6	Wild	0		1	3
E	7	Hybrid	1	2, 3, 8, 12	0	
E	8	Domestic	1	8	0	

Table 5.5. Turnover of cats on each estate. Survived is defined as cats captured in year 1 (and year 0 for estate A) that were also captured in year 2. New cats are those that were not captured in year 1 (or year 0 for estate A).

		Estate					
Cat group		A	B	C	D	E	Mean
Survived	Domestic	0	0.33		0.33	0	0.25
	Hybrid		0	0.5	0.5	0	0.29
	Wild	0.5	0			0.75	0.57
	Mean	0.33	0.17	0.5	0.4	0.5	0.36
New	Domestic		0.67	1	0.67		0.78
	Hybrid			0.67	0.67		0.67
	Wild	0.80				0.40	0.60
	Mean	0.80	0.67	0.83	0.67	0.40	0.68

All cats showed high site fidelity (Table 5.4). Of the eight cats (four wildcats, two hybrids and two domestic cats) captured in both year 1 and year 2, all were detected at the same station in both years while only two (both wildcats) were also detected at different stations from the previous year.

5.1.4.3. Temporal activity patterns

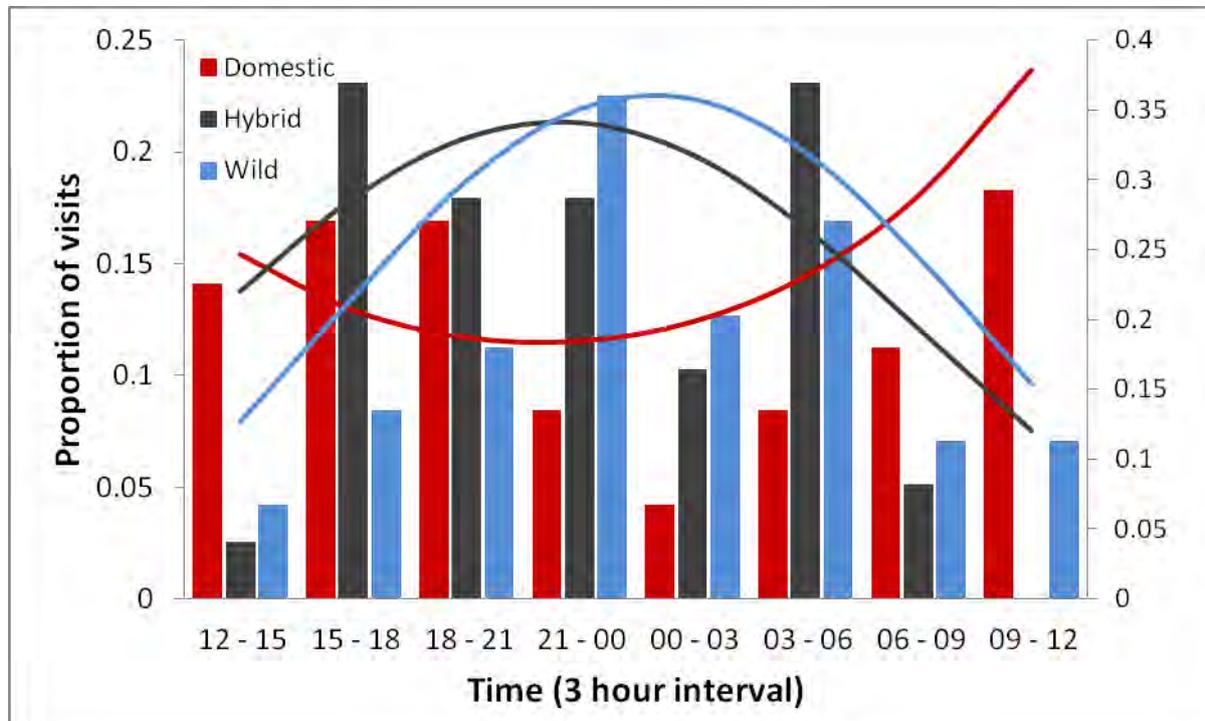


Figure 5.2. Temporal activity of cats (proportion of visits to a camera station) for each group, beginning at midday. Columns are the proportions for all individuals combined. Lines are model-averaged estimates from individual-level data. Wildcats and hybrid cats showed a nocturnal-crepuscular activity pattern that was significantly different from the diurnal activity of domestic cats.

The global model describing temporal activity patterns had a lower AICc (=401.7) than the next best model (AICc = 409.0) and therefore contained 97.1% of the Akaike weight. The global model indicated that there were significant interactions between cat group and time (Table 5.6) indicating that there were differences in activity patterns between two or all of the groups. Pairwise comparisons showed that activity patterns in domestic cats were different from both wildcats and hybrid cats (significant $t \times g$ and $t^2 \times g$ interactions) but that wildcat and hybrid activity patterns were not different (Table 5.6). Overall, both wildcats and hybrid cats exhibited a nocturnal-crepuscular activity pattern with visits peaking around dusk and dawn at very few occurring in the middle of the day (Figure 5.2). Domestic cats in contrast exhibited a diurnal activity pattern with fewer visits in the middle of the night (Figure 5.2).

Table 5.6. Model estimates of the influence of time on cat activity (number of visits by each individual). Estimates with 95% confidence intervals not crossing zero indicate significant effects and are marked with asterisks. The model containing cats from all groups indicated significant differences between groups (as indicated by significant interaction terms). Pairwise comparison between groups showed that wildcats and hybrid cats were not different but domestic cats were different from both wildcats and hybrid cats.

Variable	All cats 95% CI			Wildcat vs Hybrid 95% CI		
	Estimate	Lower	Upper	Estimate	Lower	Upper
Intercept	-0.317	-1.254	0.619	-2.407*	-3.398	-1.416
t	-0.503*	-0.953	-0.052	0.764*	0.352	1.177
t ²	0.053*	0.003	0.102	-0.087*	-0.131	-0.042
g (Hybrid)	-1.828*	-3.287	-0.370			
g (Wild)	-2.632*	-4.289	-0.975	-0.252	-1.318	0.813
g × t (Hybrid)	1.139*	0.437	1.841			
g × t ² (Hybrid)	-0.129*	-0.207	-0.052			
g × t (Wild)	1.454*	0.700	2.210	0.156	-0.341	0.653
g × t ² (Wild)	-0.154*	-0.235	-0.073	-0.025	-0.112	0.063
Variable	Hybrid vs Domestic 95% CI			Wildcat vs Domestic 95% CI		
	Estimate	Lower	Upper	Estimate	Lower	Upper
Intercept	-0.663	-1.805	0.478	-0.403	-1.474	0.669
t	-0.438	-0.984	0.107	-0.493*	-0.964	-0.022
t ²	0.047	-0.013	0.106	0.052*	0.001	0.103
g (Hybrid)	-1.456	-3.410	0.498			
g (Wild)				-2.444*	-4.393	-0.496
g × t (Hybrid)	1.098*	0.292	1.904			
g × t ² (Hybrid)	-0.129*	-0.207	-0.052			
g × t (Wild)				1.447*	0.670	2.225
g × t ² (Wild)				-0.154*	-0.235	-0.073

5.1.4.4. Habitat association

Principle Component Analysis of Habitat

Broad scale: The first three components extracted accounted for >99.99% of the variance in habitat data (Table 5.7). Component *C1* can be thought of as describing increasing nutrient-poor upland conifer habitat, associated with a decline in deciduous woodland and grass habitat and a small increase in proximity to moorland. *C2* describes increasing moorland habitat which is associated with a decline in grass and coniferous habitat and not associated with deciduous woodland habitat. *C3* describes increasing openness from deciduous woodland habitat to grassland habitat.

Table 5.7. Principle components extracted from proportional habitat data.

	C1	C2	C3
Proportion of variance	0.407	0.345	0.246
Coniferous	0.639	-0.485	
Deciduous	-0.456		-0.817
Grass	-0.598	-0.282	0.558
Moor	0.158	0.828	0.114

Fine scale: At the station level, four components were extracted from the habitat characteristics, accounting for all variance in the data (Table 5.8). *C4* can be thought off as indicating canopy closure; *C5* as dense scrub and shrub layer habitat with a low herb layer; *C6* as woodland with denser shrub layer and a taller more sparse herb layer; and *C7* as describing general openness of the station.

Table 5.8. Principle components extracted from habitat at stations

	C4	C5	C6	C7
Proportion of variance	0.479	0.308	0.137	0.075
Canopy cover	0.646	-0.160		-0.742
Shrub cover	-0.469	0.548	0.508	-0.471
Herb cover	-0.559	-0.342	-0.587	-0.475
Herb height	-0.227	-0.746	0.625	

Habitat effects on number of cats captured

Broad scale: While differences in the significance of effects on cat abundance were detected in the different cat groups when analysed separately (Table 5.9), the best model incorporating a random effect of cat group was a poorer description of cat abundance than the best model without (AICc = 232.8 with random effect of cat group versus AICc = 226.4 without). We were then justified in grouping together all cats for analysis (Table 5.8). Two models accounted for >93% of the Aikaike weights while all other models were >4 AICc from the best model. We therefore used these top two models to average parameter estimates. These top models contained all variables except *rabbit*, while the next top model was the global model containing all variables. The model averaged results from these two models indicate a decline in cat abundance with increasing upland conifer (*C1*), increasing

moorland (C2) and increasing habitat openness (C3). The negative effect of the quadratic component of habitat openness indicates an increasing rate in the decline in habitat suitability with increasing openness. The presence of rabbit showed a positive effect on cat abundance, but this effect was not significant. The presence of an animal-proof fence had a positive influence on cat abundance, indicating that these structures channel the movements of cats.

Table 5.9. Coefficient estimates for the influence of different habitat types within 100m, presence of rabbit and animal-proof fencing on the number of individual cats detected at each station across years. Statistically significant effects are found where 95% CI do not cross zero and are highlighted with an asterisk.

Variable	All cats			Wildcat		
	Estimate	Lower	Upper	Estimate	Lower	Upper
Intercept	-1.2*	-1.81	-0.58	-3.76*	-6.23	-1.28
C1	-0.72*	-1.01	-0.44	-0.32	-0.75	0.11
C2	-1.12*	-1.8	-0.44	-1.03	-2.09	0.03
C3	-0.35*	-0.67	-0.03	-0.05	-0.45	0.35
C3 ²	-0.3*	-0.51	-0.09	0.06	-0.21	0.34
Rabbit	0.39	-0.26	1.03	1.57*	0.15	2.99
Fence	1.34*	0.77	1.92	0.66	-0.26	1.58

Variable	Hybrid			Domestic		
	Estimate	Lower	Upper	Estimate	Lower	Upper
Intercept	-2.8*	-4.42	-1.18	-2.93*	-4.35	-1.52
C1	-0.88*	-1.41	-0.34	-0.85*	-1.48	-0.22
C2	-1.75	-3.6	0.1	-0.66	-1.68	0.36
C3	-0.89*	-1.68	-0.11	0.06	-0.66	0.78
C3 ²	-0.89*	-1.66	-0.12	-0.55	-1.25	0.15
Rabbit	0.73	-0.61	2.07	1.25	-0.15	2.64
Fence	1.98*	0.82	3.14	1.81*	0.62	2.99

Fine scale: With all cat groups combined, no single model was clearly better than any other, with 11 other models showing an AICc value within 4 AICc of the top model. Model averaging over these 12 models indicated that of the four habitat principle components, only C5 (denser scrub and shrub layer habitat with a lower herb layer) had a significant influence on the number of cats visiting, with this effect being positive (Table 5.10). As before, the presence of rabbit and animal-proof fencing also had a positive influence on number of cats, but whether the station was in riparian habitat did not have an influence.

Comparing the top two models (holding in total 32.1% of the Akaike weights) with two models that were identical but for the inclusion of random intercepts for group indicated that there was some limited support for the habitat association of the groups differing: For the top model the AICc was only 2.11 AICc greater for a model with random effects for group (Akaike weight 74.7% without and 25.3% with random intercepts for group). Similarly, for the second top model the AICc was 2.1 AICc greater for a model with random effects for group (Akaike weight 74.0% without and 26.0% with random intercepts for group).

Examining the parameter estimates for each group separately (Table 5.10) showed that C5 was only important for wildcats and hybrid cats whereas for domestic cats, C4 (canopy closure) had a significant negative influence on number of visiting cats. In direct contrast to the broad scale habitat association, rabbit presence was not important for wildcats but was (positively) for hybrids and domestic cats. Note however that only stations in or at the edge of wooded habitat were used in this analysis. Riparian habitat was a significant negative predictor of the number of visiting domestic cats.

Table 5.10. Coefficient estimates for the influence of habitat characteristics at each station, presence of rabbit and animal-proof fencing and whether the habitat is riparian on the number of individual cats detected at each station across years. Statistically significant effects are found where 95% CI do not cross zero and are highlighted with an asterisk.

Variable	All cats			Wildcat		
	Estimate	95% CI		Estimate	95% CI	
		Lower	Upper		Lower	Upper
Intercept	-1.414*	-2.014	-0.814	-3.393*	-5.352	-1.438
C4	-0.016	-0.229	0.198	0.275	-0.165	0.715
C5	0.571*	0.268	0.874	1.155*	0.054	2.257
C6	-0.109	-0.527	0.309	-0.887	-1.961	0.186
C7	-0.381	-0.957	0.195	-0.909	-2.075	0.257
Rabbit	1.357*	0.722	1.991	0.942	-0.568	2.453
Fence	1.280*	0.537	2.024	1.458*	0.206	2.709
Riparian	-0.574	-1.325	0.177	-0.803	-2.453	0.847

Variable	Hybrid			Domestic		
	Estimate	95% CI		Estimate	95% CI	
		Lower	Upper		Lower	Upper
Intercept	-2.863*	-3.920	-1.806	-2.873*	-4.122	-1.624
C4	-0.120	-0.461	0.22	-0.608*	-0.997	-0.218
C5	0.570*	0.077	1.064	0.227	-0.338	0.792
C6	0.282	-0.405	0.97	-0.317	-1.035	0.401
C7	-0.423	-1.370	0.523	-0.133	-1.184	0.919
Rabbit	1.704*	0.651	2.757	1.994*	0.875	3.113
Fence	1.822*	0.601	3.042	1.455*	0.176	2.734
Riparian	0.061	-1.097	1.219	-1.369*	-2.713	-0.026

5.1.4.5. Assessing survey efficiency

In the five estates over both years, an average of 94% of individual cats captured were discovered within the 60 day period covering the baited survey (Figure 5.3). Baiting with meat at the start of week four and six was associated with a slight jump in cat captures. Nevertheless, 55% of the cats were captured within the first four weeks, prior to use of meat bait. Indeed there was a rapid accumulation of cat captures within the first two weeks of the survey with, on average, 45% of the total cats captured in this period. Using half the number of stations at half the density would have resulted in the capture of only 58% of the

cats discovered over the whole survey, indicating that more widely spaced cameras miss some individuals.

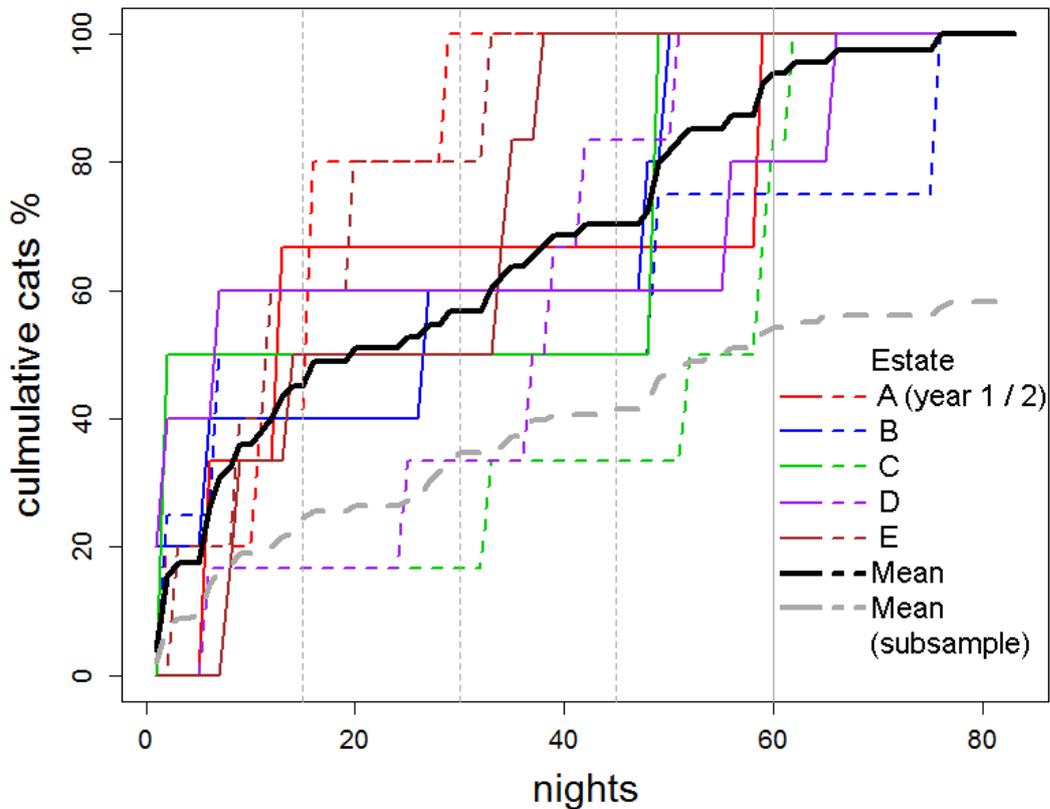


Figure 5.3. Cumulative percentage of cats (out of the total caught) over time in each estate. Solid coloured lines indicate the survey in year 1 and dashed coloured lines in year 2. The black line is the mean for all estates while the grey dashed cumulative line is the mean when only every second station is used (i.e. half the density of stations). Vertical grey dashed lines indicate approximate point of bait refreshment. In three of the estates, the last two bait refresh points also include the addition of meat bait. The solid grey vertical line marks the end of the main 60 day survey period used to compare population estimates.

Table 5.11. Time taken (survey-nights and camera-nights) to capture the first, second and third wildcats at estates where wildcats were detected.

Number of nights to capture wildcats N					
Estate	Survey	1st wildcat	2nd wildcat	3rd wildcat	Total number of wildcats
A	1	6	13		2
A	2	2	11	15	5
B	1	6			1
E	1	8	9	35	4
E	2	3	9	12	5
Mean		5.0	10.5	20.7	
Camera nights		100	210	413	

Examining the time taken to capture the first, second and third wildcats in estates where wildcats were detected using an array of 20 camera stations (Table 5.11) showed that the presence of wildcats was established on average five days from the start of the survey, and in all cases within eight days. Within two weeks, the presence of a second wildcat was also established in all cases. Time taken to detect the presence of a third wildcat was longer and overall we see an approximate doubling of time taken to detect each additional wildcat.

5.1.5. Discussion

Few wildcats were found across the study, highlighting the rarity of this species. The short duration of this study and the low numbers of wildcats make it challenging to detect any response to the conservation efforts of the CWP. With a small breeding population limiting recruitment rate, without further monitoring we may not see detectable differences in wildcat numbers. The CWP specifically targeted five estates dotted around the CNP, though lower-level conservation efforts were implemented elsewhere. It is possible that effects of improved management for wildcats on these five estates are hampered by management on neighbouring estates. To be more effective in the future, wildcat conservation may need to operate at a broader landscape level encompassing several connected estates that allow unimpeded wildcat movement between breeding populations.

Data from estate A indicate that we fail to detect some wildcats in some years: two wildcats on this estate were captured in 2009-10 and again in 2011-12, but only one of these was detected in 2010-11. Wildcats can show strong site fidelity, with all individuals detected in both 2010-11 and 2011-12 being captured at the same stations in both years. It is possible however that some wildcats move in and out of the study area as prey populations fluctuate.

Our measure of cat turnover (survival and recruitment) was necessarily simple. Nevertheless, there was a trend of increasing turnover (lower survival and greater recruitment) moving from wildcats, through hybrids to domestic cats. This trend may in part reflect predator-control practices, where domestic cats are more likely to be culled. Alternatively, this trend may arise because wildcats (and to a lesser extent hybrids) are better adapted to survival in the wild in the CNP. The higher recruitment of domestic cats illustrates the need to manage breeding feral cat populations at the source.

The similarity in broad-scale habitat association of the different cat groups (wildcat, hybrid and domestic cat) shows the importance of managing domestic cats and hybrids for wildcat conservation. Indeed, the location records presented in Table 5.4 show considerable spatial overlap between wildcats and hybrids and/or domestics on those estates where they co-occur. Daniels *et al.* (2001) also found no difference in habitat preference between two tabby cat groups that he distinguished as closest to and furthest from wildcat based on limb and gut morphology. We did however find some indication of a difference in finer-scale habitat association between domestic cats and hybrids or wildcats: domestic cats appear to show preference against dense forest exhibiting canopy-closure. Wildcats and hybrids did not show this preference and appeared to prefer habitat with a denser shrub layer and shorter herb layer. A denser shrub layer will provide greater cover while a shorter herb layer may make movement easier. Weber (2007) also found evidence that domestic cats avoid using deep forest areas away from habitat edges, whereas wildcats do not.

We also detected differences in the temporal activity patterns of cats, with domestic cats showing diurnal activity and wildcats and hybrid cats showing crepuscular-nocturnal activity patterns. Corbett (1979) also noted that wildcats were largely nocturnal. Our results may arise from some of the domestic cats on the estates being house cats that were shut in at night, or because domestic cats are less fearful of human activity. Langham (1992) noted for free-living domestic cats in New Zealand (where there are no wildcats) that, with the exception of some males, cats were chiefly nocturnal in autumn-winter-spring. It is possible that the diurnal activity of domestic cats found here also arises from temporal partitioning between domestic cats and other cats. While this difference in temporal activity may reduce the probability of contact between domestic cats and the other cat groups, domestic cats were not exclusively diurnal and wildcats and hybrid cats were not exclusively nocturnal. Therefore opportunities for domestic cats encountering other cats remain. The similarity in the temporal activity patterns and habitat association between wildcats and hybrid cats indicates that introgression between these groups is a continuing threat.

Our data is relatively coarse compared with that gained from radio-tracking of individuals and further radio-telemetry analysis may reveal more differences. Indeed, other studies in Europe have found indications of differences in habitat use by the different cats (e.g. Biro 2004; Weber 2007; Germain *et al.* 2009). Identifying such differences would aid wildcat conservation by improving wildcat-specific habitat management. Our results of the broad-scale habitat association of all cats combined, where cover habitat in non-upland areas is preferred, generally agrees with the findings of other studies on both wildcats (e.g. Klar 2005; 2008; Potočnik 2005; Saramento *et al.* 2006) and domestic cats (e.g. Hall *et al.* 2000; Edwards *et al.* 2002). In contrast to Daniels *et al.* (2001) and Klar *et al.* (2008) we did not find evidence of positive selection by cats for riparian wooded habitat.

While we were not able to assess the effect of increasing the survey effort by surveying much beyond 80 days or increasing the density of camera stations, decreasing effort in terms of time and station density did result in a decrease in the detection of cats. In particular, decreasing station density resulted in a roughly proportional decrease in detection. These results suggest that the station density and survey period set out by Kilshaw and Macdonald (2011) is about right for assessing cat populations. If we wanted to simply establish the presence of wildcats however, much less effort is required. From our analysis, a two week survey using 20 camera stations would be sufficient to establish the presence of otherwise of wildcats in a survey area. Such rapid surveys could then be employed to quickly map wildcat presence over large areas. Based on wildcat habitat association, these rapid surveys could be further streamlined by not employing the grid layout used in this study but instead setting out cameras 1km apart solely in prey-rich wooded habitat.

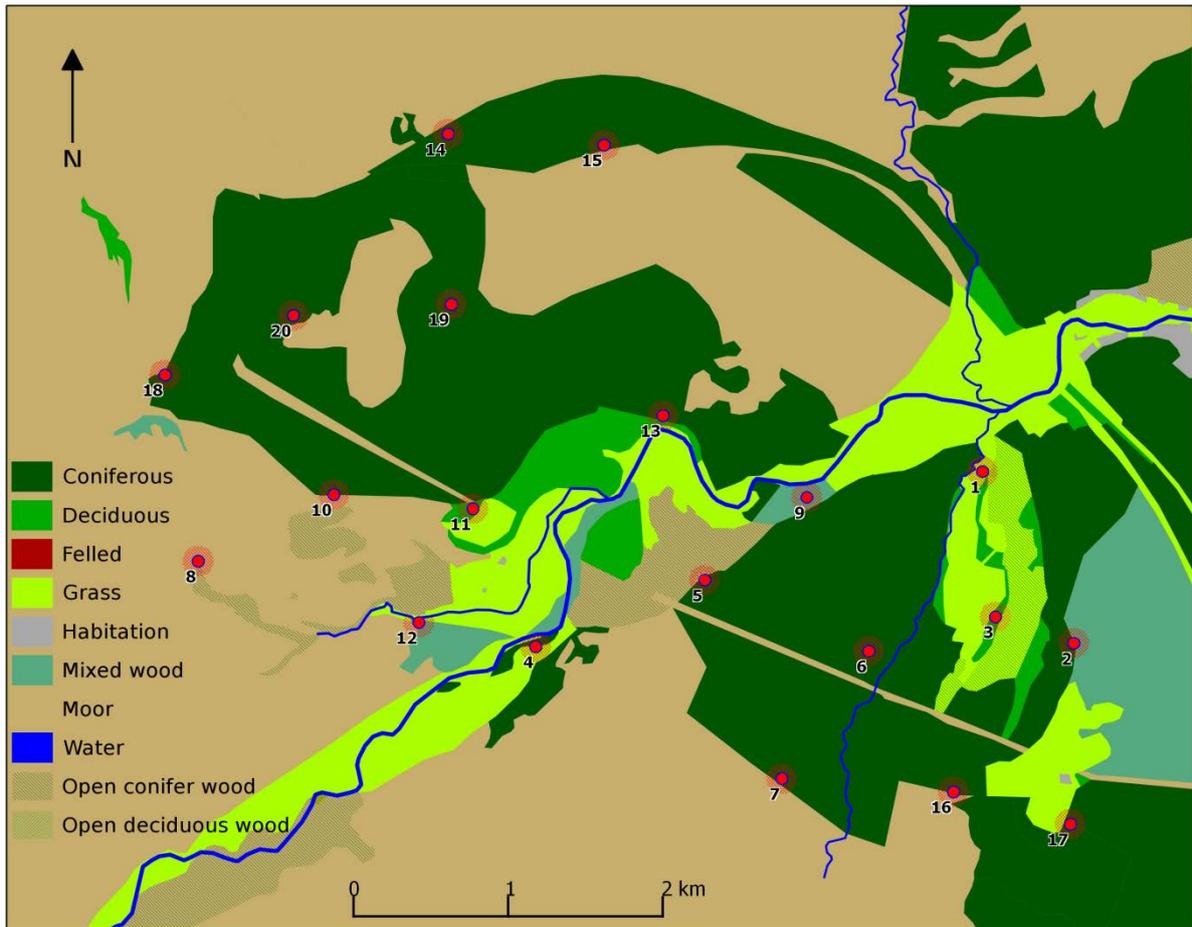


Figure 5.4. Map of Estate A. Red points represent the location of each of the 20 camera trap locations, with the 100m buffer around each camera trap location shown in red cross-hatch.

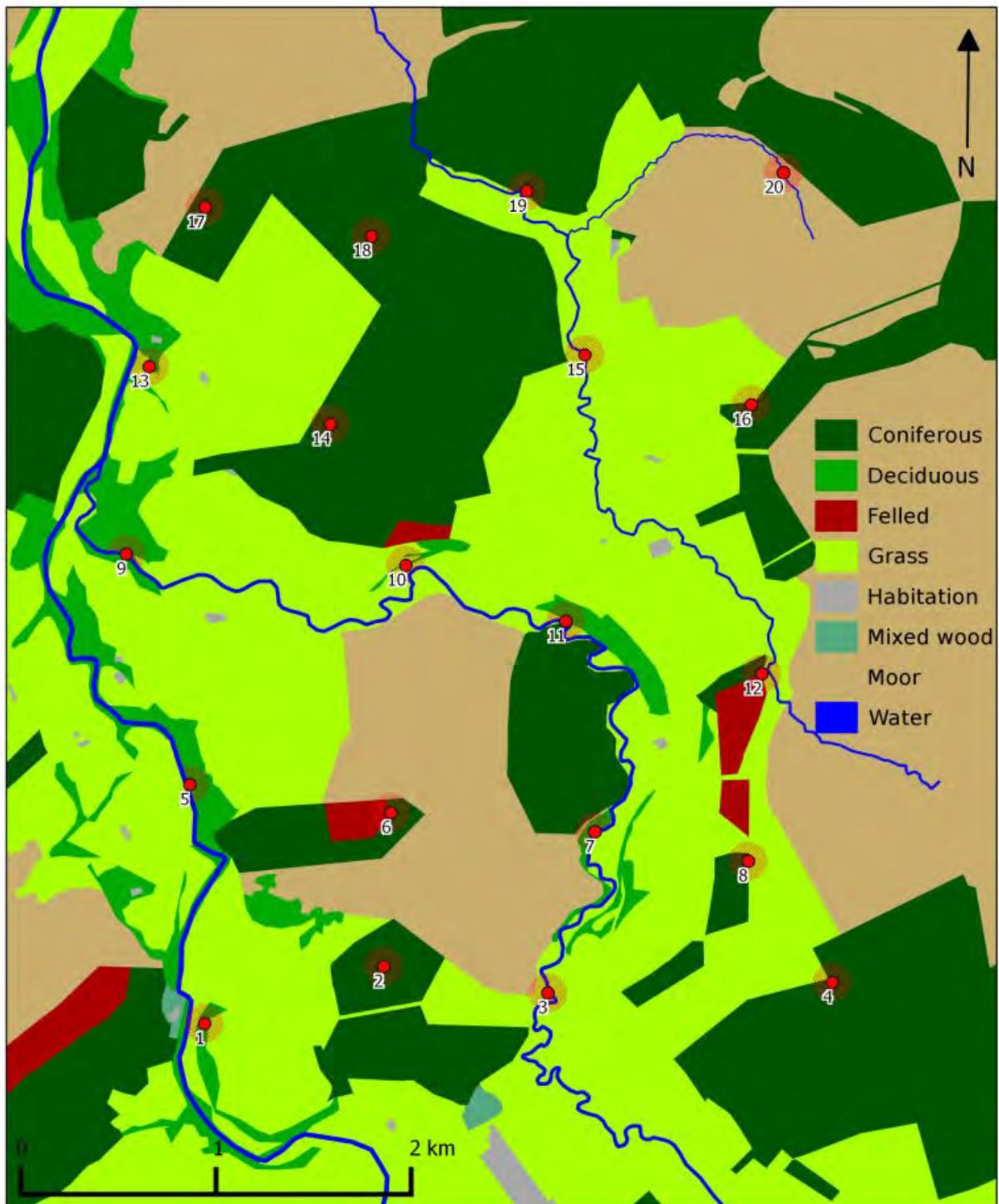


Figure 5.5. Map of Estate B. Red points represent the location of each of the 20 camera trap locations, with the 100m buffer around each camera trap location shown in red cross-hatch.

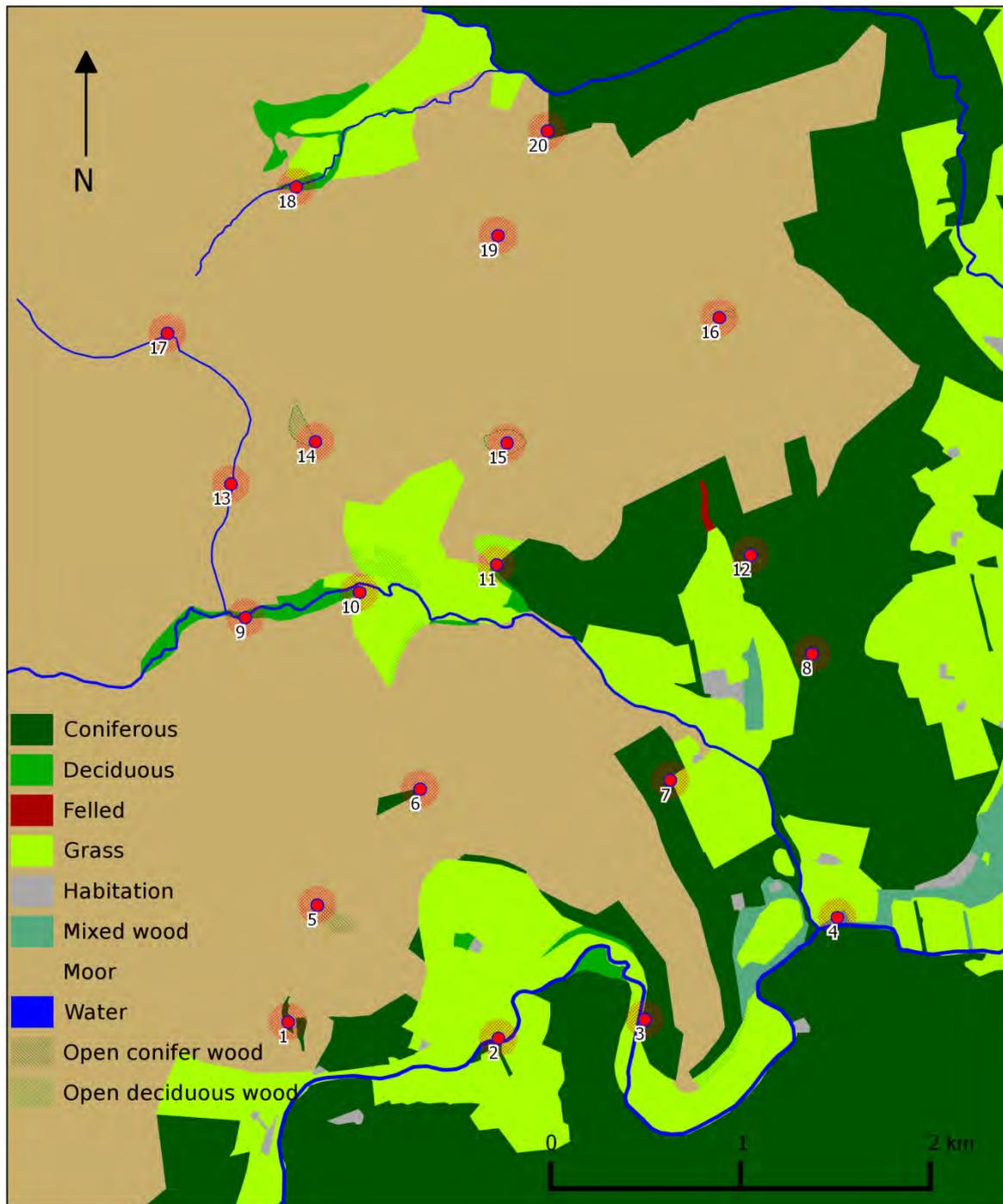


Figure 5.6. Map of Estate C. Red points represent the location of each of the 20 camera trap locations, with the 100m buffer around each camera trap location shown in red cross-hatch.

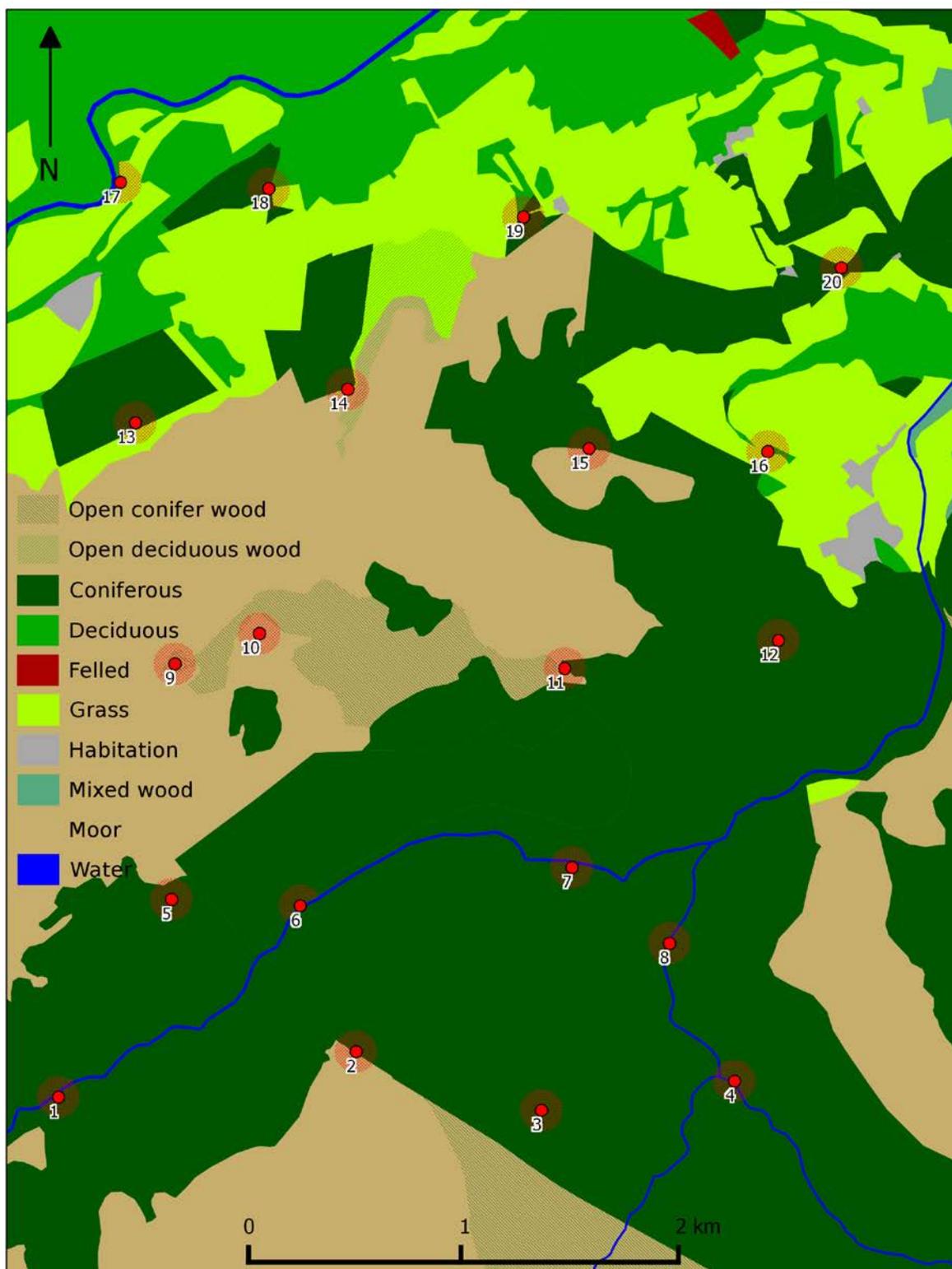


Figure 5.7. Map of Estate D. Red points represent the location of each of the 20 camera trap locations, with the 100m buffer around each camera trap location shown in red cross-hatch.

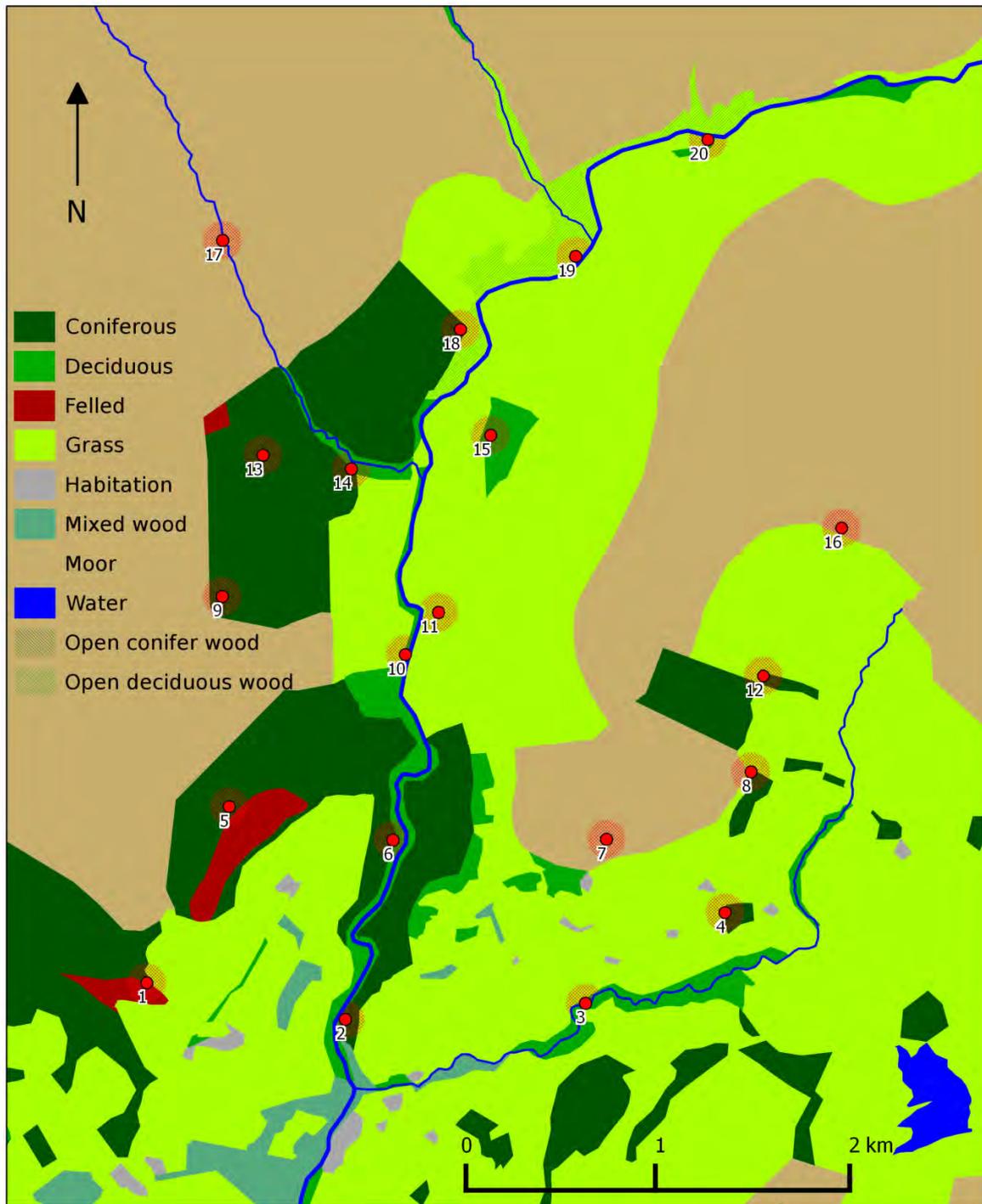


Figure 5.8. Map of Estate E. Red points represent the location of each of the 20 camera trap locations, with the 100m buffer around each camera trap location shown in red cross-hatch.

5.2 Opportunistic camera trapping

5.2.1 The Five Estates

Outside of the intensive camera trapping periods, estate staff assisted with opportunistic camera trapping, i.e. the use of one or two camera traps to monitor areas of the estate which appear to be suitable for wildcats or have had recent observations. This involved them setting up cameras, supplying bait, checking batteries, and downloading photos. This type of monitoring resulted in photographs of: a wildcat on Estate A; two domestic cats on Estate C; a domestic cat on Estate D; and a wildcat, a hybrid and three domestics on Estate E.



Fig. 5.7 Photo of a wildcat taken on a camera trap set up by a gamekeeper on Estate E.



Fig. 5.8 Photo of a presumed domestic cat taken on a camera trap on Estate D following a tip-off from a gamekeeper of cat field signs

5.2.2 Elsewhere in the Cairngorms National Park

Aside from the intensive and opportunistic camera trapping practised on the five participating estates, the Project also loaned out cameras to key individuals and organisations for smaller-scale opportunistic camera trapping around the National Park (Fig. 5.9). Cameras were typically looked after by National Park rangers or by staff from partner organisations and local conservation groups and wildlife enthusiasts who were given best practice information developed during the intensive camera trapping sessions on the estates. Several cat photos were taken at different sites across the National Park, including several wildcat shots in Badenoch & Strathspey, thus adding to our understanding of wildcat distribution and behaviour. The cameras also captured other local wildlife, including the first confirmed pine marten record for Glen Clova in the Angus Glens. A growing number of organisations and individuals in the National Park now have their own camera traps and these were encouraged to submit any photos of potential wildcats to the Project, resulting in several interesting records.

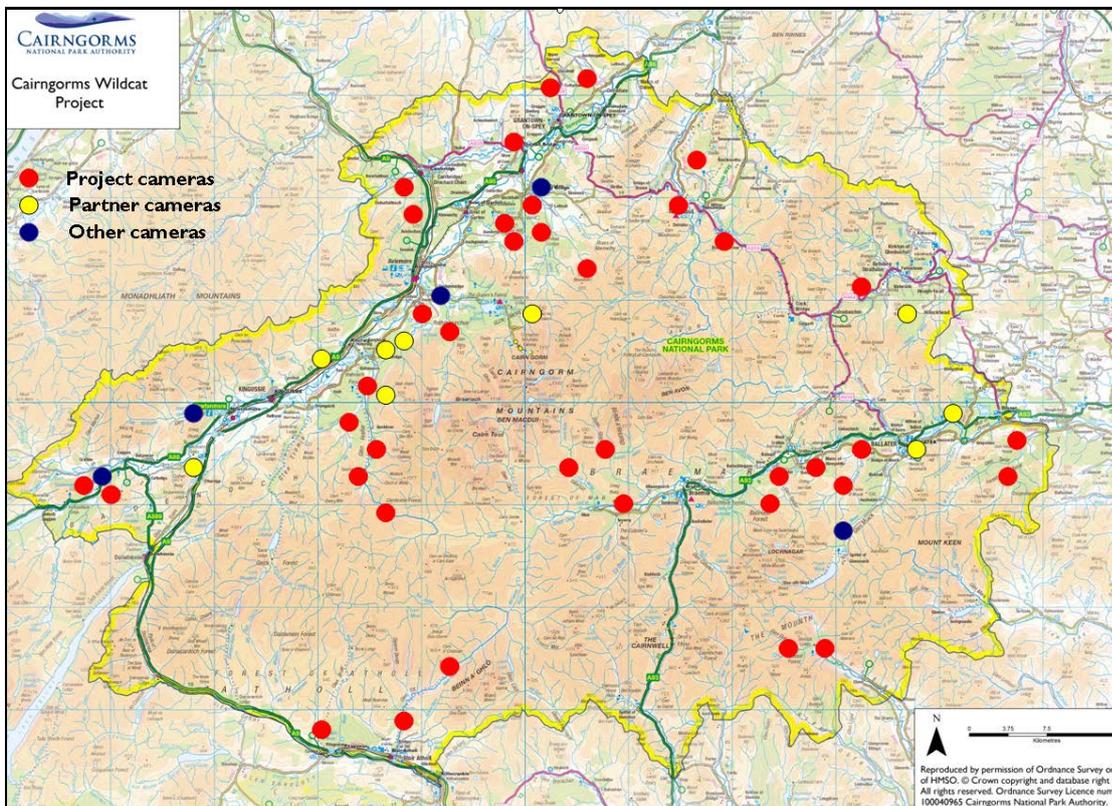


Fig. 5. 9. Map of Cairngorms National Park showing indicative locations of opportunistic camera trapping



Fig. 5.10. Photo taken in January on a Project camera trap set up by a member of the public at their remote house in Strathspey



Fig. 5.11. Photo taken on a camera trap belonging to a Project partner in the Badenoch area of the Cairngorms National Park

5.3 Sightings records

Records of sightings and roadkill carcasses are very useful sources of data about the potential distribution of wildcats in and around the Cairngorms National Park. The importance of reporting sightings to the Project is stressed during talks and at events, as is the reporting and collection of roadkill carcasses.

Since its launch, the Project collated records of potential wildcats and hybrids from across the National Park and beyond. The records were a mixture of unsubstantiated sightings, sightings with photos, camera trap images, and carcasses. Members of the public could report sightings via a form on www.highlandtiger.com, while there was also a considerable amount of word of mouth contact via associates of the Project. Often the Project received a flurry of records after media coverage, especially a newspaper or magazine article which encouraged readers to report sightings via the website. Records were also often forthcoming from visitors at public events such as countryside fairs. Surprisingly, many records to date have been accompanied by photographs or video footage taken by observers on their digital cameras or mobile phones, and this is very useful for substantiating sightings.

A total of 273 records were collated from across the Cairngorms National Park area, with the majority of these being unsubstantiated sightings records. 45% of records were supported with photographic evidence, while 10% related to carcasses. Given the Project's long awareness-raising reach, records were not confined to the National Park and a total of 197 further records were collated from other parts of Scotland. Records of wild-living, tabby-marked cats came from every part of the Cairngorms National Park where wooded landscapes occur, with the exception of the Angus Glens (Fig. 5. 12).

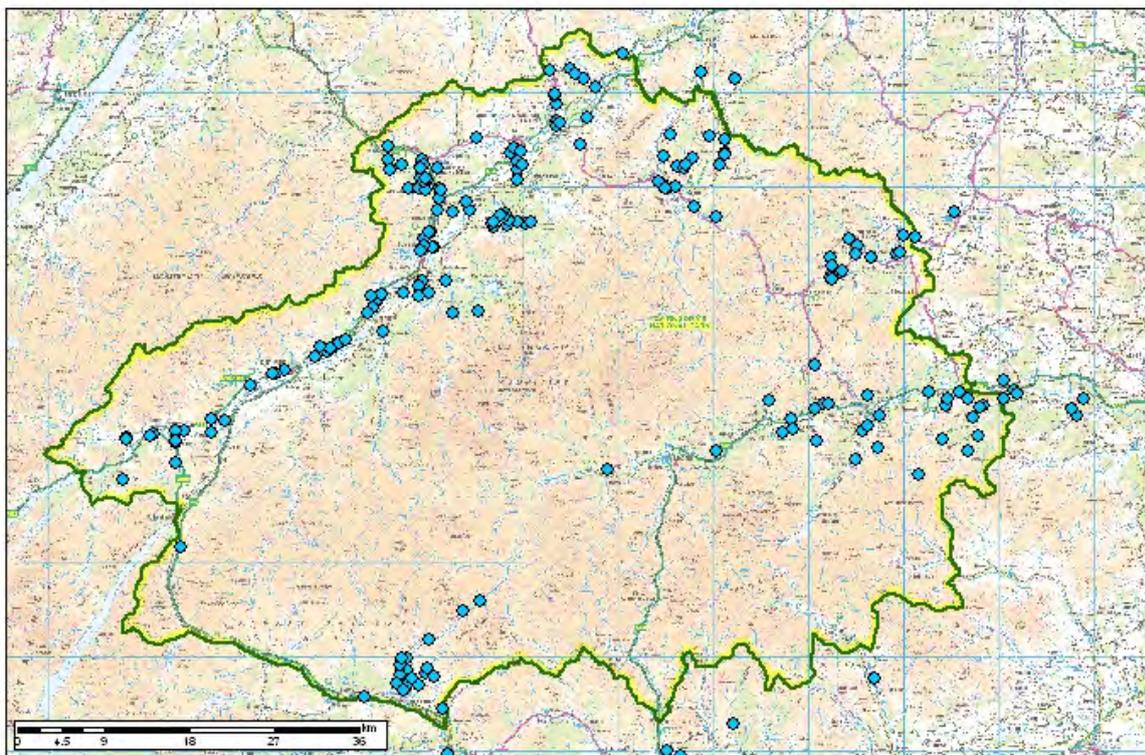


Fig 5. 12. Map of the Cairngorms National Park showing location of all records, both substantiated and unsubstantiated, of wild-living, tabby-marked cats collated by the Project.

However, experiences with other felid species elsewhere in Europe shows the merits of treating different kinds of records differently in terms of their reliability. The national monitoring system for Eurasian lynx in Switzerland acknowledges the varying reliability

between substantiated records such as photographs and carcasses on one hand, and unsubstantiated sightings on the other (Breitenmoser *et al.*, 2006). Sightings data from members of the public typically implies a geographical distribution for lynx considerably in excess of that implied by substantiated means such as camera trap photos, roadkill carcasses, and field signs as identified by trained experts. Many of the unsubstantiated records are likely to be correct but they are prone to biases and are handled with care. This is probably an even more acute issue for wildcats than for lynx as wildcats can be very similar in appearance, especially to the untrained eye, to other felids in the same landscape such as hybrids and tabby-marked domestic cats.

Consequently a categorisation system was developed for the various records which takes into account both the verifiability of the record, as well as the likely type of cat. Each record is assigned a letter A or B, based on the level of substantiation – A records were supported with photographic evidence or a carcass, while B records were unsubstantiated sightings records. The record then receives a number 1, 2, or 3 based on whether the described coat markings correspond with a probable wildcat (1); a probable hybrid (2); or a possible wildcat (3). An unsubstantiated sightings record of a cat matching the description of a wildcat (i.e. tabby-marked cat with no white feet, but which has a thick, ringed, blunt tail) is categorised as B1. Records where there is insufficient detail to ascertain from coat markings whether a tabby-marked cat is a wildcat or not are awarded a 3. So for example, a camera trap photo depicting a stripy cat but where the tail was not visible would be ascribed a category of A3. Records were logged on a Geographic Information System (GIS) and passed to the North East Scotland Biological Records Centre (NESBReC) before they will be made publicly available with an appropriate level of spatial detail via the NBN Gateway.

Figure 5. 13 shows the distribution of categorised records. Unsubstantiated records are represented by blue triangles and are more widespread. Substantiated records are represented by circles and those with the strongest likelihood of describing wildcats (category A1) are red. A1 records have a westerly distribution within the National Park being found only in Badenoch, Strathspey, Perthshire and a sole record in Glenlivet. There were no A1 records from the Aberdeenshire portion of the CNP, although other tabby-marked cats judged to be domestics and hybrids were recorded there photographically or as carcasses. Hybrids were confirmed from across the National Park with the exception of the Angus Glens, where recording effort was probably lower than in other areas.

5.4 Carcasses

Carcasses can provide much-needed information on distribution and hybridisation, as well as on diet, disease etc.

During the period 1992-1995 a sample of 192 wild-living cat carcasses had been collected mainly in eastern Scotland by Balharry and Daniels (1998). Using the strict 7PS pelage score, none of these cats were identified as wildcats at the time (Kitchener, 2012) and only eight of a slightly larger sample of wild-living cats were considered to be wildcats based on both their genetics (microsatellites) and pelage (Kilshaw *et al.* 2010).

As part of the Cairngorms Wildcat Project the public were encouraged to report roadkill carcasses to the Project and where possible transport them to freezers at the Highland Wildlife Park, SNH office in Aviemore, the Glen Tanar estate or local veterinary practices.

Some of the carcasses of tabby-marked cats which were shot on some of the five estates were also retained in freezers for analysis.

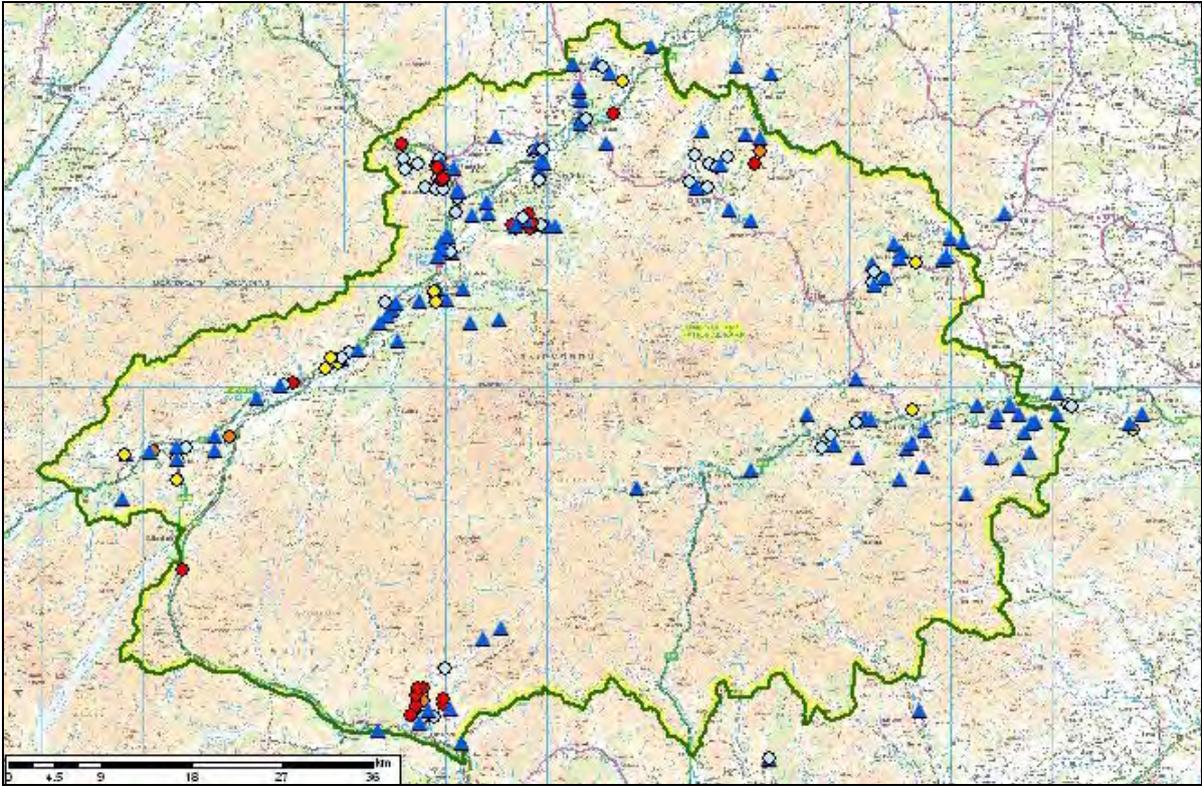


Fig 5. 13. Map of the Cairngorms National Park showing locations of all categorised records of wild-living, tabby-marked cats collated by the Project.

- A1 - Substantiated probable wildcat
- A2 - Substantiated probable hybrid
- A2/A3 - Substantiated hybrid/possible wildcat
- A3 - Substantiated possible wildcat
- ▲ B1/B2/B3 - Unsubstantiated records
- ▭ Cairngorm NP Boundary

In total, 56 carcasses of tabby-marked cats from within and outwith the CNP were retrieved via the Project and sent to the National Museums of Scotland (NMS) in Edinburgh for analysis of pelage and skull morphometrics to determine their taxonomic status.

In 2011 SNH commissioned the NMS to analyse 19 cat carcasses recovered from 1999 to early 2010, the collation of most of which was coordinated by the Project (see Appendix 6). The Project takes a precautionary approach to carcasses and so any roadkill tabby-marked cats from rural areas were collected for analysis. 15 of these came from the Cairngorms National Park, 3 were from Aberdeenshire and 1 was from NW Sutherland. On the basis of skull and/or pelage characteristics, two of the cats from Aberdeenshire and Sutherland were judged to be hybrids, while one Aberdeenshire cat was unidentifiable. Of the 15 from the Cairngorms, 3 from Strathspey were judged to be potential wildcats by the relaxed criteria (none were classed as wildcats by strict criteria); 2 were hybrids (1 Strathspey; 1 Perthshire); 5 were domestics (all Strathspey); and 3 were either hybrids or domestics (2 Strathspey; 1 Donside). Two were unidentifiable.

More recently a further round of tabby-marked cat carcasses collated by the Project was sent for pelage analysis to the NMS. Final results are awaited but provisional results indicate that most carcasses correspond to hybrids or tabby domestics. There was, however, one cat provisionally judged to be a wildcat. It was found dead in January 2012 at the side of the A9 near Dalwhinnie in the Badenoch part of the Cairngorms National Park.

Camera-trapping does suggest that wildcats still occur more widely in the CNP, especially in the western half. However, most of the cat carcasses submitted were roadkills and it has been hypothesised that roadkill carcasses may not be representative of the wild-living cat population as a whole, and in particular may be under-represented by wildcats, either for ecological or behavioural reasons (A. Kitchener, *pers. comm.*). This may explain the relative paucity of cats in the carcase sample that were judged to be wildcats. All assessed carcasses of tabby-marked cats shot on any of the five estates have been provisionally judged to be hybrids or tabby domestics.

A test of cat mitochondrial DNA was developed a few years ago and while undoubtedly a significant breakthrough, provides an incomplete picture about a cat's genetic background. Mitochondrial DNA is inherited through the mother's side only, and so a test result showing wildcat ancestry could still nevertheless mean that the animal is a hybrid, as it tells us nothing about the father's side. Other DNA analyses to date have been based on 9-13 microsatellite markers (see Kilshaw *et al* 2010). In conjunction with the RZSS, the University of Chester is seeking to develop a test based on markers derived from screening the entire wildcat genome. It is hoped that this may lead to a more definitive assessment of a cat's genetic make-up, i.e. what proportion of the markers are from a wild or domestic lineage. This has obvious applications for testing the purity of captive wildcats listed on the stud book, but also for testing roadkill carcasses or cat's temporarily caught under licence prior to their release. It is anticipated that a protocol for testing mitochondrial DNA of cat faeces could also be developed, which could have a useful application in field surveys.

SNH has commissioned the University of Chester to genetically test a sample of the contemporary cat carcasses from the Cairngorms National Park to assess hybridisation. The results of these assays will not be available until after the end of the Project, but will be incorporated with the Project findings to inform future conservation actions for wildcats in the Cairngorms National Park.

6. Conclusions

The Project MoU had a stated aim relating to the identification of successful, tested conservation measures, and the assessment of the potential for their wider application in other relevant areas:

- To secure the future of the Scottish wildcat within the Cairngorms National Park (CNP), leading to further action across a wider area of Scotland

Furthermore, one of the objectives of the Project was:

- To provide an efficient and effective programme of activities which could be applied for the benefit of Scottish wildcat across a wider geographic area of Scotland

6.1 Raising awareness of wildcats and their conservation

It is clear that the public are interested in wildcats and motivated by wildcat conservation. Harnessing that enthusiasm has helped help meet Project objectives and management, including drawing in significant financial donations which can then be used to fund Project activities. The media reach of the Project and its messages, e.g. the need for domestic cats to be neutered, has been prolific and extensive. Increased public awareness of the issues has brought a flow of information and intelligence in to the Project on the occurrences of unneutered farm or feral cat colonies. Furthermore, the wider public has helped to monitor populations of potential wildcats by reporting sightings and carcasses, as well as submitting photographs. Collating these data and plotting them on a GIS helps to detect spatial patterns in wild-living cat populations in and around the Cairngorms National Park.

To date the Project Manager has coordinated responses to media requests to feature the Project and has given presentations on the Project to over 2000 people. Furthermore, he has acted as a conduit for the collation and plotting records of potential wildcats and feral cats. The latter in particular highlights the need for a person or persons to act as a point of contact beyond the life-time of the Project. The website is proposed to remain as the main vehicle for reporting records with some ongoing site management from RZSS and others.

6.2 Neutering domestic cats

The Project has invested considerable effort into raising awareness generally and to specific audiences within the park. Yet no obvious trends in feline veterinary care were detected over past 3 years in and around the CNP. The reasons for this are not fully understood, but may reflect that levels of care were already good (J. Harley, Strathspey Veterinary Centre, *pers. comm.*); that individuals are not motivated to get cats neutered as they don't feel responsible for them; or the economic downturn has resulted in less disposable income available for pet cats (J. Harley, *pers. comm.*). It might be expected that neutering rates would plateau or even decline once a large proportion of the population has been neutered, so no clear increase in neutering after 3 years might reflect success.

The Project sought to work with established Cats Protection volunteer TNR teams to make best use of existing expertise and resources and to promote the sustainability of feral cat population control beyond the life-time of Project. The Project helped to recruit and train

new TNR volunteers, collate information from the public on occurrences of unneutered farm and feral cats, and raise awareness amongst a key target audience - the farming community. Over the course of the Project, the Trapping, Neutering and Return of feral cats in the Cairngorms National Park was expanded and in part intensified. The number of Cats Protection branches active within the National Park has risen from one to three and the annual number of neutered ferals has risen correspondingly from 6 in 2009 to 51 in 2011, and had surpassed that annual figure during the first half of 2012. These figures do suggest that, in at least some areas of the National Park, large populations of unneutered, free-ranging domestic cats remain. The rise in neutering within the National Park has not been mirrored in areas surrounding the Park, where there has been a marked decrease in the number of ferals being trapped over the same time period.

It is currently not possible to evaluate the benefits of the TNR programme to wildcats as the abundance of unneutered cats is unknown. The extent of the interaction between feral domestic cats and wildcats, and therefore the level of threat posed to wildcats, has not been quantified. It stands to reason, however, that a large population of unvaccinated, unneutered domestic cats in the same landscape as a relatively small wildcat population will lead to: competition for food resources and territory; more cat control by gamekeepers which, if not precautionary, could put wildcats at risk; increased risk of disease transmission; and an increased risk of interbreeding and hybridisation. The TNR process, which includes euthanizing cats with potentially fatal diseases, should result in a lower, more stable, domestic cat population which poses no risk to wildcats through interbreeding.

Gamekeeping staff from one of the participating estates had passed information to the Project about local farms where colonies of unneutered cats were thought to occur and which were thought to be acting as sources for the comparatively high numbers of feral cats encountered by keepers in the wider area. This situation was communicated to Cats Protection and a volunteer TNR branch was consequently established. TNR activity subsequently confirmed that unneutered colonies did occur on several local farms and that feral cats were widespread across the local landscape, often in habitats where wildcats could occur, something which was also confirmed by camera trapping. While it is not possible to state explicitly the effect of feral cat TNR on wildcats, the experiences in this particular area imply that a landscape supporting unneutered colonies at farms or other settlements will have a correspondingly high number of feral cats in the wider countryside, which could pose a significant conservation threat to wildcats. The high volume of ongoing TNR now occurring there (around 50 cats been trapped and neutered between January and July 2012), should therefore reduce the numbers of unneutered cats in the wider landscape, where they are subject to lethal control by gamekeepers, and thus reduce the scope for inter-breeding with wildcats. There is a need, therefore, to continue to collect neutering, camera trap, and gamekeeping data from estates with which the Project has worked, so that the effects of TNR can be better understood.

There is potential for TNR to continue to be more targeted and contribute more to wildcat conservation as more intelligence is forthcoming and greater understanding of wildcat populations develops. There is also a continuing need for collaboration between estates, farmers and Cats Protection TNR branches, with vets continuing to perform a key advocacy role both with pet cat owners and farmers. The CNPA will continue to produce and

distribute the 'Cats in the Countryside' leaflet, and in particular make it available to Cats Protection volunteers and local vets as an aid for their advocacy work.

The new volunteers that the Project has helped to attract to TNR will hopefully continue to be actively involved. However, much of the decrease in the total TNR figures for the branches peripheral to the National Park can be attributed to the reduced activity of a single volunteer in one particular branch who had less time available for TNR. Similarly, effective TNR in the Cairngorms is highly dependent on a small number of highly motivated volunteers. The rise of TNR activity within the National Park, which can at least be partly attributable to the Project, is therefore fragile and could be difficult to sustain if there is not a concerted effort to ensure that volunteer branches are sufficiently motivated, coordinated, trained and resourced.

6.3 Working with estates

The Project has achieved positive engagement with the gamekeeping profession through partnership and targeted awareness-raising. This appears to have improved the ability of gamekeepers to identify wildcats in the field and has encouraged them to be more wildcat-friendly in their activities. There is also some evidence of changes in attitudes to wildcats in the land management sector that can be attributed to the Project. Survey responses and interviews with estate staff have indicated that gamekeepers that have come into contact with the Project's messages do take precautionary approaches to the control of feral cats where there is a chance it could be a wildcat. Furthermore, evidence, both anecdotal and from the anonymous gamekeepers' questionnaire suggests there have been several instances of potential wildcats surviving situations unscathed where prior to the Project they would have been shot. The Project, through its use of camera traps, has flagged up that wildcats can be present on estates even where they have not been observed and identified by gamekeeping staff. There has been a small increase on participating estates in the use of cage traps, but spot lighting is still the most common method for controlling feral cats, although it is largely undertaken with fox control in mind. Cage-trapping should continue to be a component of feral cat control particularly where there is an acute predation issue or where there is any doubt about the identify of a particular cat or cats. However, it should be noted that a licence is required from SNH where it is judged that there is a significant likelihood of deliberately or recklessly catching a wildcat.

The Project looked in detail at 5 estates only and it could be that those estates are more open and transparent with their management activities than other estates. However the results from these estates would appear to demonstrate an interest in wildcat conservation; good awareness of the issues; and that reasonable steps have been taken to protect wildcats and avoid offences. Some have also recognised the kudos and/or wildlife tourism value of having wildcats on their land.

Over the course of the 3 years of the Project, staff at the five estates have removed 327 feral cats and poor hybrids as potential hybridisation threats to wildcats. The vast majority of these were shot, while a very small number were neutered. There is evidence that the approach in the field is precautionary and, that as well as preserving wildcats, will also preserve good hybrids. However, until further field-practical, discriminatory techniques are available and we have a better understanding of hybridisation within the wild-living cat population, the Project's approach is likely to have been appropriate. The precautionary

approach to feral cat control is also likely to make a positive contribution to wildcat conservation, particularly if it is carried out in tandem with increased local neutering of pet and feral domestic cats.

In order for the estates protocol for wildcat conservation to be self-sustaining and therefore established practice more widely, there is a need to engage with owners and estate staff in a structured manner across a wider area. Aspects of the protocol, such as wildcat ID, could therefore be incorporated into gamekeeper training courses on predator control run by organisations such as the CNPA, SGA, BASC, and GWCT.

6.4 Research & monitoring

There were some apparent disparities between the various monitoring methods employed. While one estate reported unsubstantiated potential wildcat sightings by staff and public roughly in line with the frequency of detection by intensive camera trapping, three of the five estates reported several unsubstantiated sightings of potential wildcats which were not confirmed by intensive camera trapping. Some of this disparity could be explained by the often fleeting and distant nature of wild-living cat sightings, which could make misidentification more likely than with camera trap photos. Alternatively, on Estate B all unsubstantiated sightings by estate staff took place on parts of the estate not subject to intensive camera trapping, thus raising the possibility that some cats in the wider landscape were missed by the camera traps, which were deployed on a roughly 20km² grid pattern. Many estates in the Cairngorms National Park, including all five monitored for the Project, are substantially larger than 20km².

One of the estates (E) experienced the converse, as camera trapping detected the presence of wildcats, which had not been picked up by the observations of gamekeeping staff, despite the use of lamps at night by several gamekeepers in a wide range of terrain there.

Camera traps proved to be a reasonably reliable means of detecting key pelage characteristics. Camera trapping therefore can be a useful and effective method for monitoring wild-living cats and, when used intensively over several years, could help detect trends in populations. It is also a useful tool for engaging the media, the general public, and estate staff.

The numbers of wildcats observed during the intensive monitoring were too low to make any general observations about populations or densities, particularly given the relatively short duration of the Project. Estimates were derived for one estate, but it is not known how representative this estate is of the wider area, especially given the variation in results between estates. Intensive monitoring on 5 estates between two years showed no statistically significant change in wildcat numbers (or of any cat), though there is a suggestion of a small increase in wildcats. There was a trend of increasing turnover (more losses and more new cats appearing between years) moving through a spectrum from wildcats through hybrid cats to domestic cats. This may be due to wildcat friendly predator control methods or perhaps because wildcats are better adapted to living in the surveyed environments. However, with more data it would be possible to build up a picture of population densities and changes over time, which could be linked to land management practices. Furthermore, intensive camera trapping could be rolled out to previously unsurveyed areas in order to build up a more comprehensive picture of where wildcats occur.

Evidence from pelage and morphological analyses of roadkill carcasses and/or camera trap photos indicate a high proportion of domestics and hybrids living in the Park. Nearly all wildcats were recorded in close proximity to areas where hybrids were also recorded so hybrids continue to pose a real threat to wildcats in the Cairngorms National Park through hybridisation and potentially competition.

Although there were unsubstantiated sightings, the lack of substantiated evidence from photographs and carcasses suggests that wildcats are very scarce on the eastern side of the National Park (Donside, Deeside & Angus Glens). The east-west split may highlight a difference in historical land management practice, as estates in the east are typically more intensively managed for red grouse shooting, with large areas of open moorland and greater historic predator control. Wildcat populations have recently been detected by intensive camera trapping on lower ground in parts of Aberdeenshire further to the east of the National Park (K. Kilshaw, *pers. comm.*). These populations, and indeed those in the west of the National Park, could potentially be sources for natural repopulation of the eastern Cairngorms National Park in a climate of improved wildcat management, but movement could be impeded by habitat fragmentation and/or predator control activities detrimental to wildcats.

6.5 Synthesis

What is the outlook for wildcat conservation in Cairngorms National Park?

The phenotypic wildcat does occur in the Cairngorms National Park but appears to be rare and restricted in its distribution. The risk of hybridisation persists as a result of the presence of hybrids and domestic ferals in areas where wildcats occur.

There are several parties interested in contributing to wildcat conservation and much improved levels of public awareness and support, including among influential groups such as gamekeepers and other wildlife managers. The network of Cats Protection TNR volunteers has been expanded and strengthened within the National Park, resulting in a steep increase in the numbers of farm and feral cats neutered.

In the absence of a dedicated Project Manager what aspects of the Project will continue in the Cairngorms National Park?

- A network of trained TNR volunteers resourced by Cats Protection
- Gamekeeping staff on estates continuing with wildcat-friendly predator control
- The promotion of wildcat field identification by gamekeeping organisations to their members
- Vets acting as advocates for responsible cat ownership and TNR
- Awareness-raising and education work by RZSS using Highland Tiger brand, including website, Facebook and YouTube, as well as feeding time talks at the Highland Wildlife Park
- SNH, CNPA and FCS ensuring that wildcats are well considered during the development management process

- The continuation of intensive camera trapping by RZSS to expand the existing dataset and thus better analyse trends in wild-living cat populations.
- Highland Wildlife Park and SNH Aviemore office to continue to take roadkill carcasses locally for freezing before transfer to, and assessment at, NMS.
- Collation of public sightings and photographic data by SNH, CNPA and RZSS, including via Highland Tiger website

Can we make recommendations for a package of conservation measures that could be applied elsewhere?

- Broad, public awareness-raising about wildcats and their conservation should continue. This lends itself to national campaigns utilising vehicles such as SNH publications and the Highland Tiger brand managed by RZSS. Other, more specific audiences may need a different, more targeted approach via key media, such as organisational membership magazines and websites.
- Cats Protection could perhaps have a targeted awareness-raising campaign in tandem with local vets aimed at the agricultural sector, but this is likely to need some proactive engagement from wildcat interest groups.
- The more active, targeted TNR of cats in rural areas, facilitated by public sympathy for wildcats, could be replicated beyond the National Park where there are active volunteer networks e.g. Cats Protection or conservation volunteers. Given that the intensification of TNR in the National Park is very recent it is currently difficult to evaluate its impacts on wildcat populations. There are relatively low levels of TNR activity in some key areas, but it has increased markedly in others. This may reflect spatial differences in the abundance of free-ranging domestic cats, which may themselves have been shaped by historical levels of TNR. However, just as likely is that it is governed by both the current availability and motivation of volunteers. A reduction in availability of just one active volunteer can have significant implications for levels of TNR. Furthermore, strategic TNR may be difficult to implement in more remote areas, where there might be increased distances and travel times between field sites, volunteers' homes, and veterinary services. Other species interests operate a network of volunteer co-ordinators, e.g. the British Trust for Ornithology, but this requires dedicated staff to support the network. Having staff specifically dedicated to the coordination of TNR activities across wider landscapes was explored by the Cairngorms Wildcat Project in partnership with Cats Protection but resourcing issues during an economic downturn ultimately prevented CP from recruiting for such a post. Project staff co-ordinating TNR has nevertheless been proposed for the Wildcat Haven project in Ardnamurchan. A key action would be to identify other stronghold areas which support wildcat populations in need of protection and to consider what contribution TNR could make and how it could best be supported and co-ordinated in those areas.
- Closer liaison with the agricultural sector, including groups such as Quality Meat Scotland, may help to identify incentives for farmers to ensure responsible cat ownership. For example, this could ascertain if there are, or could be, required standards of animal husbandry connected to the occurrence of cats, such as minimising

the spread of toxoplasmosis to livestock, which should be met for participation in assurance schemes.

- Wildcat-friendly predator control should be encouraged more widely. The Scottish Gamekeepers Association's representation on the Project partnership, the Project's close collaboration with local estates, and its liaison with the wider gamekeeping profession, have all helped to improve communication and engagement between agencies and the gamekeeping community about the conservation of a threatened predator. Traditionally, consensus between such groups on issues of predator conservation has been hard to reach, often resulting in conflicts around other species. The indications are that the Project's positive engagement has increased awareness among gamekeepers of wildcat conservation issues and improved field identification skills, both of which should directly benefit wildcat populations by reducing the likelihood of wildcats being shot during predator control activities. The wildcat-friendly estates protocol could be adopted in other areas, ideally taken on by the gamekeeping community through their own in-house training and awareness raising materials. To date, adoption of the protocol has been integrated into the estates' ongoing game management objectives and activities. However, there may be scope for it to be more proactively promoted and supported by publicly-funded land management support mechanisms such as SRDP. A wildcat conservation option could also include a requirement for camera trap monitoring and responsible cat ownership and/or TNR, something which has already been investigated for the SRDP's existing point system by the Scottish Agricultural College (R. Marwick, *pers. comm.*) However, this requires further consideration by the relevant agencies.
- Intensive camera trap monitoring, perhaps combined with some genetic sampling, could be rolled out to other areas. This is time- and resource-intensive and it may not be realistic to target everywhere at public expense. Therefore there is a need to target survey to key areas based on intelligence. There is scope to incorporate the growing amateur interest in camera trapping and assessable camera technologies, e.g. mobile phone cameras and videos. Best practice advice on camera trapping for wildcats, including baiting methods, should be made more widely available so as to maximise the effectiveness of such camera trapping. Wildcat data should be collated and subject to quality control before submission ultimately to a central point such as NBN.

What happens next?

- Having taken stock of the Project's findings and discussions at the closing conference, develop future actions by way of an updated Action Plan. SNH has offered to co-ordinate this process involving interested parties.
- The collation of various cat data and records needs to continue. This should include: veterinary data from local vets and Cats Protection branches; sightings of potential wildcats and hybrids by the public and estate staff; collection and assessment of roadkill carcasses; feral cat data from the five estates; and the number, type and density of cats caught on camera traps. Amongst other things, this will help to further assess the effectiveness of measures trialled by the Cairngorms Wildcat Project. These activities

will have to continue on a more informal basis than during the Project but it is hoped that they will continue.

- An informal Steering Group consisting largely of the Project's partners will continue to meet for the time being to help secure the legacy of the Project and contribute to the development of further actions for wildcat conservation.

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Image credits: Front cover – Laurie Campbell; P31 – source: Kitchener, A.C., Yamaguchi, N., Ward, J.M. and Macdonald, D.W. (2005). A diagnosis for the Scottish wildcat: a tool for conservation action for a critically-endangered felid. *Animal Conservation* 8: 223-237.

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Appendices

Appendix I. Media coverage of the Cairngorms Wildcat Project 2009-12.

Titles are colour-coded according to media type. Print media; Web; Radio; TV

Period	Title	Local	Scottish	UK	Intern'l
pre-May 09	Scottish Gamekeeper				
	Strathspey & Badenoch Herald				
	BBC News website				
May-Jun 09	North Magazine				
	Scots				
	Scotsman				
	Herald				
	Thistle-down - Glenlivet news				
	BBC News website				
	Moray Firth Radio				
	Reporting Scotland				
	STV News				
	One Show				
	Jul-Sep 09	Outdoor Photography			
Oct-Dec 09	Cairngorms LBAP news				
	Scotland in Trust				
	Flybe inflight magazine				
Apr-Jun 10	Daily Telegraph				
	Dundee Courier				
	Observer				
	Press & Journal				
	Daily Mail (Scotland)				
	Metro				
	Scotsman				
	Birmingham Mail				
	The Sun (Scotland)				
	Strathspey & Badenoch Herald				
	Press & Journal				
	Scottish Countryside Alliance news				
	The Times				
	Outdoor Photography				
	BBC News website				
	BBC News Website				
	Press Association				
	Belfast Telegraph				
	Guardian				
	Herald				
Daily Latest News					
Birmingham Mail					
Care2					

	Press & Journal				
	Scotsman				
	Telegraph				
	Times				
	Topix				
	Sun				
	Virgin Media				
	STV website				
	BBC Radio Scotland News				
	Moray Firth Radio				
	BBC Radio 4 News				
	Reporting Scotland				
	BBC Scotland News				
Jul-Sep 10	BBC Wildlife				
	Daily Mail				
	Mammal News				
	Scottish Gamekeeper				
	Donside Piper				
	Sunday Mail				
	Strathspey & Badenoch Herald				
	Alford Pages				
	Mountain Views				
	Encyclopedia of Life				
	PBS radio				
Oct-Dec 10	The Nature of Scotland				
	National Geographic				
	Scotsman				
	Scotland in Trust				
	Landward				
	Countryfile				
	Autumnwatch				
Jan-Mar 11	Inverurie & Alford CP news				
	Out of Doors				
	Newsround				
Apr-Jun 11	The Nethy				
	The People				
	Outer Aberdeen CP News				
	Shooting Times				
Jul-Sep 11	Daily Mail				
	Banffshire Journal				
	Shooting Times				
	STV 'shorts'				
Oct-Dec 11	Farm Woodland News				

	Scottish Gamekeeper				
	STV Highland News				
	360° Geo-Reportage Documentary				
Jan-Apr 12	Radio Scotland				
	Reporting Scotland				
	Newsround				
	BBC News website				
	Farming Today Radio 4				
	Scotsman				
	Herald				
	STV Website				
	Strathspey & Badenoch Herald				

Appendix 2. Presentations on wildcat conservation given by the Project Manager 2008-12.

Date	Interest	Location	Audience
07/03/2008	Gamekeeping	Perth	120
15/04/2008	Public	Aviemore	100
20/06/2008	Public	Edinburgh	10
04/11/2008	Wildlife	Fochabers	30
05/02/2009	Land management	Grantown	20
17/02/2009	Agency	Aviemore	15
26/03/2009	Agency	Battleby	40
14/05/2009	Land management	Mar Lodge	20
13/06/2009	Cat welfare	Aviemore	100
29/09/2009	Wildlife	Grantown	20
19/10/2009	Public	Boat of Garten	20
04/11/2009	Wildlife	Nethy Bridge	20
14/12/2009	Land management	Glen Tanar	15
17/12/2009	Gamekeeping	The Lecht	40
08/01/2010	Veterinary	Wildlife Park	10
28/01/2010	Outdoor	Stonehaven	30
03/02/2010	Public	Kincraig	30
06/03/2010	Wildlife	Aberdeen	90
26/03/2010	Gamekeeping	Blair Atholl	10
15/04/2010	Wildlife	Aberdeen	65
17/04/2010	Wildlife	Boat of Garten	70
22/05/2010	Public	Ballater	12
29/05/2010	Outdoor	Nethy Bridge	100
05/06/2010	Cat welfare	Wildlife Park	10
12/06/2010	Public	Newtonmore	20
09/07/2010	Rangers	Grantown	10
02/09/2010	Public	Tomintoul	20
19/08/2010	Outdoor	Glenmore	20
20/09/2010	Public	Aboyne	50
28/09/2010	School	Grantown	30
29/09/2010	Public	Alford	150
27/10/2010	Farming	The Lecht	50
30/10/2010	Cat welfare	Stonehaven	20
31/10/2010	Cat welfare	Aviemore	20
03/03/2011	Academic	Aberdeen	60
08/03/2011	Wildlife	Montrose	50

16/03/2011	Wildlife	Inverness	100
15/03/2011	Rangers	Aigas	10
03/05/2011	Academic	Wildlife Park	15
12/05/2011	Public	Glen Rinnes	30
16/05/2011	School	Blair Atholl	24
19/05/2011	Public	Grantown	60
19/09/2011	Academic	Grantown	30
05/10/2011	Academic	Wildlife Park	15
18/10/2011	Public	Grantown	60
20/10/2011	Wildlife	North Kessock	40
29/11/2011	Wildlife	Carrbridge	20
01/03/2012	Academic	Aberdeen	20
07/03/2012	Gamekeeping	Perth	100
15/03/2012	Forestry	Inverness	20
04/04/2012	Academic	Wildlife Park	20
05/04/2012	Public	Pitlochry	80

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Appendix 3. Events at which the Project was represented by a staffed presence

Date	Event	Location	Audience
13/08/2009	Grantown Show	Grantown	Public/Land management
05/09/2009	Braemar Gathering	Braemar	Public
22/05/2010	Biobuzz	Ballater	Public
2-4/7/10	Scottish Game Fair	Scone	Public/Land management
6-7/8/10	Highland Field Sports Fair	Moy	Public/Land management
29/09/2010	Highland Tiger Fling	Tullynessle	Public
21/05/2011	Celebrating Nature	Aviemore	Public
03/06/2011	Celebrating Nature	Balmoral	Schools
5-6/8/11	Highland Field Sports Fair	Moy	Public/Land management
11/08/2011	Grantown Show	Grantown	Public/Land management
28/08/2011	Creag Meagaidh NNR	Creag Meagaidh	Public
03/09/2011	Braemar Gathering	Braemar	Public

Appendix 4. Educational events hosted by the RZSS where wildcat conservation was a central theme. Green listings were visits by schools to the Highland Wildlife Park. Yellow listings were outreach activities at the schools in question. The pink listing was an adult visit to Edinburgh Zoo.

Date	Education Groups	Location	Pupils	Adults	Total
Jul-10	Fortrose Academy	Highland	17	2	19
Aug-10	Forres Academy	Moray	98	10	108
Oct-10	Askham Bryan College	Harrogate	0	14	14
Mar-11	SWRI Aviemore	Highland	0	18	18
May-11	Oatridge College	West Lothian	0	18	18
May-11	University of Central Lancashire	Lancashire	0	16	16
May-11	Nordens Ark	Sweden	0	16	16
Jun-11	Inverness Royal Academy	Highland	16	2	18
Jun-11	UHI Moray College	Moray	0	7	7
Sep-11	Forres Academy	Moray	170	16	186
Nov-11	Inverness Royal Academy	Highland	14	2	16
Nov-11	Angus College	Angus	0	9	9
Nov-11	Inverness Royal Academy	Highland	14	2	16
Dec-11	Barvas Primary school	Western Isles	16	4	20
Mar-12	Inverness Royal Academy	Highland	34	3	37
Mar-12	Pitlochry SWT	Perthshire	0	40	40
Oct-10	Lathallan School	Angus	100	10	110
Oct-10	Kirkhill Primary School	Highland	25	2	27
Oct-10	Resolis Primary School	Highland	30	2	32
Oct-10	Linlithgow Bridge	West Lothian	32	3	35
Nov-10	Ballachullish Primary School	Highland	24	1	25
Nov-10	Craigmount High School	Edinburgh	7	1	8
Nov-10	Uddingston Grammar	S. Lanarkshire	7	1	8
Jan-11	Donaldson's School	West Lothian	23	6	29
Feb-11	St. David's School	Edinburgh	72	4	76
Jun-11	Lothians U3A	Edinburgh	0	14	14
Totals			699	223	922

Appendix 5. The Estates Protocol which was given to each of the 5 estates the Project worked closely with.

The Cairngorms Wildcat Project

Estates' Protocol

Working with estates for wildcat conservation

This paper outlines the basis for the Cairngorms Wildcat Project working with estates in the Cairngorms National Park to conserve the endangered Scottish wildcat. Many Estates in the National Park control feral cats, predominantly to protect game birds. Whilst they are legally entitled to do this, it is illegal to kill a wildcat. The difficulty in separating a wildcat from a non-protected feral cat or hybrid poses a serious problem for all keepers who need to protect game and also operate within the law.

The Cairngorms Wildcat Project wishes to work with estates to help them solve this problem. We aim to help estates conduct cat control methods that help to ensure the wildcat remains protected.

Wildcats are threatened by hybridisation with feral domestic cats, which then results in confusion in identifying wildcats, tabby feral cats and hybrids during predator control activities. The project promotes a precautionary approach to feral cat control i.e. if in doubt: let it go and do not shoot. For the purposes of field identification it may be assumed that any cat which is **tabby with a thick ringed tail with a blunt black tip** can be assumed to be a wildcat. They should **not** have white feet, nor should the dorsal stripe extend down the tail.

We recognise that there are arguments that suggest that in some cases 'wild living cats' which both do and do not resemble wildcats can be genetically indistinct from an apparently true wildcat. Because separation between hybrids and 'true' wildcats in the field is extremely difficult, the project has assumed the need to conserve those cats that most closely resemble the archetypal wildcat.

Alongside precautionary feral cat management the project is promoting responsible cat ownership as well as the intensification and expansion of neutering of feral cat colonies around farms and settlements with a view to reducing the flow of domestic and feral cats into the countryside.

The Project wishes to develop, with the participation of estates, the following protocol for wildcat conservation:

WILDCAT FRIENDLY FERAL CAT CONTROL:

- All methods of feral cat control (trapping and shooting) on the estates will endeavour to prevent harm to wildcats (as defined by the project)
- All feral cat control carried out humanely and in line with the law
- No cat matching the Project's definition of a wildcat will be killed
- Any trapped wildcats will be released unharmed where they were trapped
- Should a wildcat be found injured in a trap, then the local vet should be informed immediately
- Any legally trapped feral cats are humanely killed or passed to Cats Protection for neutering
- Any legally trapped pet cats returned to owner if known, or Cats Protection if unknown.
- Any carcasses to be frozen ASAP and retained for collection by Project staff, along with details of where and when the specimen was collected.

RECORDING:

- Prior to release, photos are taken of any trapped wildcats as a record of their pelage markings. These should show lateral and dorsal views, including tail and head.
- Prior to release, hairs, complete with follicles, are plucked from any trapped wildcats for genetic testing.
- Project informed of all known records of wildcats on the estate
- Project informed of any new sightings of wildcats on the estate
- Project informed of any known feral colonies on or off the estate which could be targeted for neutering.
- Project informed of any sightings of ferals which were not subject to control

In return...

The Project can provide participating estates with the following:

- Advice on wildcat identification
- Camera traps to help detect and identify wildcats
- A freezer for storing feral cat carcasses
- A digital camera
- GPS
- Envelopes for hair
- Cage traps to replace night-time shooting as method of feral cat control
- Promotion of the estate as “wildcat friendly” if the estate wishes it.

If the estate would prefer to have no publicity, we respect this and would not reveal the estate’s identity via any media outlets. If, however, you wish to publicise your involvement, this may be done via some or all of the following: the Project website www.highlandtiger.com; in newspaper and magazine articles; in oral presentations on the Project delivered by the Project Manager; in radio and TV interviews; and of course through the estate’s own promotional material. It should be noted that three of the five Project partners are public bodies that can be subject to official Freedom of Information requests from the public. They are then duty-bound to provide any enquiring members of the public with information on the Project.

We would be happy to assist estates meet their objectives towards any existing domestic cat ownership policy they may have for tenanted homes on the estates by providing pet owners with information on both the plight of the Scottish wildcat, and the welfare of domestic cats (i.e. the need for neutering and vaccination), and the impacts that domestic cats can have on wildlife. Through our association with the Cats Protection it may also be possible to arrange discounted neutering of pet cats. Quick-release reflective collars for pet cats on the estate are something else we could provide if it was deemed desirable by the estate. Furthermore, in conjunction with Cats Protection, the Project can arrange for colonies of feral cats inhabiting any nearby towns and villages to be neutered, thus potentially reducing the number of feral cats likely to move on to the estate in the longer term.

NOTE

This protocol was developed after a workshop organised by the Cairngorms Wildcat Project entitled ‘Predator Control & the Scottish wildcat’ took place in December 2009. This was attended by over forty delegates, most of whom were local gamekeepers.

Appendix 6. Monitoring outputs from the five estates.

Estate A

Wildcat sightings by estate staff - In 2010, potential wildcats were seen in the spotlight on 4 occasions and no shots taken. In 2011 a large cat with wildcat colouration ran across a public road on 18/8/11 at around 2045. In 2012, one was seen in amongst juniper in February and one on rocky high ground in March.

Opportunistic camera trapping - Since July 2009 a single camera trap operated by a local enthusiast, sometimes baited, has been deployed at several different locations on the estate. Several images of two cats with thick, ringed, blunt tails were captured using bait, one on 7th December 2009 and another 19th March 2010. A cat matching the Project's definition of a wildcat was photographed on August 29th 2010 carrying a rabbit in its mouth. Video footage of another good cat attracted to chicken bait was captured on his camera trap in February 2011. Since September 2010 three more Project camera traps have been deployed on the estate on an *ad hoc* basis – one operated by estate staff (this has yet to photograph a cat) and two by the local enthusiast. This same person photographed a cat with a Project camera in January 2011 on three occasions (15th, 24th, and 25th) at the same location. It was a striped and had a ringed tail without a continuing dorsal strip but the end did taper. In October 2010, a BBC film crew set up camera traps for a few days around properties on the estate where sightings had previously been made. These photographed only hybrid cats.

Other photographic evidence - In July 2009, a female cat and four young kittens were observed and photographed. The mother was tabby-marked, and showed no spottiness on the body. The tail was rather thick, had distinct rings and had no stripe running down the tail, suggestive of a wildcat, although her behaviour, which showed little wariness of nearby humans, dogs and trains, was more typical of a domestic cat. All the kittens were tabby-marked but one had white feet and a white chest, suggesting at least one parent possessed domestic genes.

In December 2009 another cat was photographed. It was observed catching a vole and washing itself. The cat was reported to have unbroken stripes on its flanks, four broad lines running along its nape, a robust looking body and a ringed tail with a black, blunt end. There was no white on the animal. Neither the photographs showed, nor the observer recalled, whether there was a stripe running down the tail.

BBC footage from October 2010 showed two kittens near a den-site – one was tabby marked but its sibling was black. Subsequent mtDNA analysis of cat faeces at that den showed wildcat ancestry.

Roadkill carcasses - In October 2009, the carcass of a young, male tabby-marked cat from a nearby public road was sent to the NMS for assessment. It was judged to be a domestic or hybrid. It is conceivable this cat could be one of the litter photographed just over 1 km further north in July. In April 2011 the carcass of a tabby-marked cat was taken from a nearby public road to the freezer and sent to the NMS but was too badly damaged to be properly assessed.

Sightings on estate by non-staff - There were two sightings by different motorists on the verge of a nearby public road on one day in April 2010. The first was seen at 2150 while the other was seen 2km further north at 2230. The former animal was described as being tabby-marked with thick fur, while the latter was described as being large and stocky with striped markings and a thick tail. It is possible that both sightings relate to the same cat. In July 2010 a cat described by an ecologist as a 'Scottish wildcat' passed by his property. He had good views of the animal and was confident in his ID. A cat matching the Project's definition of a wildcat was seen in torchlight in January 2011. A large, stripy cat with a thick, ringed, tail was seen in February 2011. In January 2012 a tabby-marked cat with a thick, ringed tail was treed by a dog walker.

Details of sightings of feral cats evading control - Two black cats were seen by the headkeeper on bales in fields in 2011 but it was not clear if they were pets or not, and so no shot was taken. In summer 2011 one tabby-marked cat with a thin tail, and a tabby and white cat were seen near the houses of sporting staff but neither were shot. In January 2012 a black feral was seen in a field but was not seen again. A pet cat belonging to newly arrived tenants was cage-trapped in November 2011. The gamekeeper encouraged the tenants to agree to get this and another pet cat neutered for the sake of the local wildcat population. This was done at the local vets with the assistance of Project staff and Cats Protection.

Estate B

Wildcat sightings by estate staff - A large wildcat was seen on higher ground on the eastern march in January 2010. A potential wildcat (robust build, thick tail, shy nature) was seen by the head keeper at 11pm on 24th August 2010 crossing the drive of the lodge. The following morning at 6am the housekeeper reported seeing a wildcat crossing the track which runs behind the lodge. There were two sightings by estate staff from early December 2010 of a potential wildcat hanging around the estate buildings and thought to be scavenging deer off-cuts near the bins. There were no sightings in 2011. A tabby-marked cat ran across the bottom of the track to the lodge on 22nd March 2012, but the sighting was very brief and no markings were noted.

Opportunistic camera trapping - A single camera trap owned by the production team filming a story on the Project for the BBC's 'One Show', and baited with valerian, was deployed at a site with high rabbit numbers on higher ground from 9th April - 11th May 2009. On the 6th May a black, unneutered domestic tom was captured sniffing the valerian while on the 9th May a smaller, presumed female, tabby-marked cat was photographed interacting with the valerian lure. This cat was not wholly within the frame of the camera and it was not possible to discern if the cat was a domestic or wildcat.

2-3 Project camera traps were deployed in 2010 around the estate in areas of recent sightings or where estate staff felt would be good areas for wildcat. One camera was deployed at the same location on the higher ground and baited with valerian from 11th Feb – 28th Mar. Another camera baited with valerian was deployed at the scene of where a keeper had seen a potential wildcat on the eastern march from 11th Feb – 8th April. An unbaited camera was deployed on lower ground 8th April – 1st May. Between 22nd Mar and 28th May, two to three cameras were deployed at four sites around conifer plantations and were

initially baited with valerian. None of the camera traps captured photos of cats of any kind, although other predators such as pine marten, fox, stoat and badger were photographed. Unintensive camera trapping was not carried out on the estate during and following the intensive camera trapping period Jun-Dec 10, until Feb 12 when two cameras were deployed in the eastern portion of the estate but no cats were recorded.

Other photographic evidence - There have been several inconclusive photographs of adult and juvenile tabby-marked cats from one area of the estate. A cat was observed and photographed on 3rd June 2010 after it had crossed a public road. The cat was described as being large with tabby markings, a thick, ringed, blunt tail. The photograph seems to bear out this description and would correspond well to the appearance of a wildcat. The observer had seen what she thought may have been a wildcat kitten very close to this spot the previous year. Remotely taken video footage from around 1920 on 4th June 2011 in a cottage garden shows what appears to be a reasonably large, long haired tabby-marked cat with features suggesting a hybrid.

Sightings on estate by non-staff - A tabby-marked cat was sighted in a ruined farm building, where prey remains were found, having picked up its trail in snow on 18th February 2010. A kitten was seen at the cat flap of a cottage on the 4th May 2010 at around 11pm. The cat was described as being around 14 inches in body length, with a stripy torso, and with a rather bushy, ringed blunt tail. A cat was observed crossing a public road at 11am on 30th July 2010 by a motorist employed in the conservation sector. It was described as being a medium - large sized, thick-set cat with stripy markings and a broad banded tail with a noticeable terminal band. No white was noticed. The observer thought that the photo of the cat seen crossing the same road less than 3 km to the south on the 3rd June could have been the same cat. A cat was observed in mid October 2010 at the north east corner of the estate. It was described as tabby-marked with a blunt, bushy tail. On the 8th May 2011, a tabby-marked cat with a blunt, ringed tail was seen at the side of a public road.

Details of sightings of feral cats evading control - In 2010 a black feral was seen near the lodge but not shot because it was in front of a gas tank. Two black ferals were seen on the same night in early August 2010 from a minor public road but were not shot as the keeper did not have his rifle. Three tabby kittens were seen going down a rabbit hole on the river bank by a fisherman in an area where several ferals were known to breed, and were considered to be ferals. The head gamekeeper saw a black and white feral in undergrowth at on 23rd August 2010.

Information on sources of feral cats - One agricultural area of the estate is seen by estate staff as being a likely source area for feral cats. Several farms were reported to have many unneutered cats around the farm buildings. Cats Protection was informed and TNR resulted in several cats being neutered where access was gained. Feeding of ferals by several individuals was suspected by keepers in a nearby village. Few ferals are observed in the eastern beat of the estate which consists largely of high ground. There have been two sightings of potential wildcats by gamekeepers in this area however.

Estate C

Wildcat sightings by estate staff - There have been repeated sightings of a stocky, tabby-marked cat with a thick, ringed, blunt tail. This was seen on several occasions before mid December 2009 and then not seen again until 17th June 2010 when it was observed for an hour during the night hunting rabbits. Probably the same cat had been seen taking a rabbit into a nearby plantation in 2008 and returning a few minutes later without it, suggesting it was a female feeding kittens. A tabby-marked adult cat was observed in the same area in November 2011. A few days later a trio of kittens was seen close by – however, one was tabby, one black and one ginger.

Opportunistic camera trapping - Two Project camera traps were deployed in 2010 around the lower ground of the estate in areas of recent sightings or cat field signs. One camera was initially baited with valerian and deployed from 18th Feb - 23rd May at a location where a black cat and a tabby-marked cat had been seen together on 15th February during spotlighting and where cat field signs were evident. The black cat slipped away before it could be shot. The tabby-marked cat, which had not been shot for fear of it being a wildcat, was captured on the camera trap on several occasions from 20th March – 22nd May. The cat had a rather spotty coat, with a thin tapering tail and a dorsal stripe running down its length indicative of a feral domestic cat. A larger black cat was photographed at the same location between the 4th and 18th April. One to two cameras have been deployed at three different spots around the area of the repeated wildcat sightings from 18th Feb until the present (27th August). These were initially baited with valerian but did not photograph the potential wildcat which had been observed by estate staff. However, a large black cat was photographed on 3rd May and may have been the same animal previously snapped in April on the camera located 1.5 km away. However a large black cat, likely to have been the camera-trapped animal, was shot on 4th May. The running of two Project camera traps ceased when intensive trapping began.

Other photographic evidence - There is no other photographic evidence.

Roadkill carcasses - A carcass of a large striped cat, which had been picked up from the side of a nearby public road was analysed at the National Museums of Scotland. It was judged to have been a domestic or poor hybrid on the basis of its pelage and skull. Another carcass of what is thought to be a wildcat was removed from the public road by estate staff on 14th August 2010. The carcass was transferred to the HWP then NMS for analysis and results are awaited.

Sightings on estate by non-staff - A motorist nearly hit a cat on the public road on the early evening of 19th October 2010. The observer, a Cats Protection volunteer, described the cat as being a young adult wildcat and described it as being small in stature, having very pronounced dark grey and black stripes along the side with a thick, ringed, blunt tail, and with no spotting on the flanks. The Wildcat Project Manager saw a tabby-marked cat run across the public road on 17th September 2011 at around 2330. There was no obvious white on the cat, and the tail was rather thick, and although not a large animal, may have been a wildcat.

Details of sightings of feral cats evading control - The tabby-marked cat noted during spotlighting and which was camera-trapped was not shot on the estate.

Information on sources of feral cats - It is believed that sources of ferals are generally to the east of the estate around nearby farms and villages.

Estate D

Wildcat sightings by estate staff - At 2100 on 15th February 2009 a large striped cat was seen with the aid of a spotlight and binoculars sitting on a dead tree in remote pine forest. It was watched for around 30 seconds before it moved away. Its ears had been folded flat. On the 3rd January 2010, a ring-tailed cat was seen. At 1730 on the 24th March 2010 a cat was watched for around 20 seconds at a distance of up to 10m. It was walked through a field, jumped onto a wall, looked at the observer before disappearing. The cat had a thick, ringed tail with a blunt tip but no dorsal stripe. There were no white markings, including on the chin, and the body markings were stripy with no evidence of spots. On 5th April 2010 a cat was observed in a spotlight during deer-scaring. It had a thick, ringed, blunt ended tail but with a half length dorsal stripe. It also had long, thick, horizontal stripes running down its back. This may have been a hybrid. A tabby-marked cat with a thick ringed tail (but with a continuing dorsal stripe) was seen on 21st March 2011 and judged to be a hybrid. On 12th September 2011, an estate keeper saw a young cat with stripy flanks, and ringed, blunt tail, run across a nearby public road.

Opportunistic camera trapping - 2 Project camera traps have been variously deployed across the estate since 30th January 2010. Initially one was baited with valerian, while one was baited with carrion, but both are now baited with carrion. No wildcats have been photographed to date. However, a short-coated silver tabby with a thin tapering tail, presumably a feral, was photographed on 29th March 2010. There was no other photographic evidence and no roadkill carcasses were retrieved locally.

Sightings on estate by non-staff - At 1030 on the 24th March 2010, two visitors observed a cat for several minutes at a distance of as close as 10m. It was described as being larger than a domestic cat, with a thick, ringed tail. It appeared to have shorter legs than a domestic cat and had a stripy body. The witnesses did not think the cat had a stripe down the tail. This may well be the same cat seen by estate staff later the same day as the descriptions of the cats are similar and location is only 1.5 km to the east of this sighting. A young, tabby-marked cat was observed in April 2010 running across an estate track. In early August 2011 a member of the public saw a tabby-marked cat during the day crossing a track, while a river bailiff saw a mother and two juveniles (all tabby-marked) crossing a public road at night on 21st August 2011. Photos of definite cat footprints and possible cat faeces were taken at a remote site near the upper edge of a pinewood on 25/1/12.

Details of sightings of feral cats evading control - A large tabby-marked cat with a thick tail was observed by estate admin staff around estate office on 16th December 2010. This was initially reported as a wildcat sighting but a subsequent sighting by gamekeeping staff led to the conclusion it was a feral cat. The same cat escaped from a cage trap in January 2011 and has not been seen since.

Information on sources of feral cats - Nearby villages and farms suspected.

Estate E

Wildcat sightings by estate staff - One keeper watched what he regarded as an adult wildcat for 10 minutes during the day in the week commencing 6th February 2012. He described it as having a tapered tail tip, but all the other features, for example thick, ringed tail and stripy coat indicated wildcat.

Opportunistic camera trapping - 2 unbaited Project camera traps have been variously deployed by the head beat keeper on the wooded lower ground of the estate since March 2010. These cameras started to pick up cats during the autumn and took 13 photos of cats from September 25th, although 11 of them were taken since 25th December. These appear to show at least five cats: 3 domestics (one tabby, one black and one tortoiseshell); 1 hybrid (well-marked apart from 4 white feet); and one potential wildcat. All the domestic photos were taken at different locations from where the hybrid and wildcat had been photographed. As of Feb 2012, two baited cameras were deployed in woodland in the west of the estate but no recorded no cats.

Other photographic evidence - Two kittens were handled and photographed by a member of the public on 10th June 2011. Despite being very docile, these looked like wildcat kittens, although one may have had white paws. If so, it may be the offspring of the white-footed cat shot in March. No roadkill carcasses were retrieved locally.

Sightings on estate by non-staff - A holidaymaker reported a mother and kitten playing in amongst pines on low ground on 26th September 2011. Both cats had white on their chests and the mother was described as having broken stripes on her torso and a dorsal stripe coming onto her thick, ringed, blunt tail, so the cats were probably hybrids at best.

Details of sightings of feral cats evading control - a large black cat was seen in late May 2010 but was not shot because it was near a holiday cottage and the keeper could not be sure it was not a visitor's pet. A ginger and white cat has been seen on 3 occasions in the spotlight at one location but was considered a probable pet.

Information on sources of feral cats - none obvious, other than potentially the farm where a female feral had been shot.

Appendix 7: SNH commissioned-report on the assessment of 19 wild-living, tabby-marked cat carcasses



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COMMISSIONED REPORT

ARCHIVE OF WILD-LIVING CAT SPECIMENS ASSOCIATED WITH THE CAIRNGORMS WILDCAT PROJECT

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TABLES **7**

Table 1: Basic data including locations, collecting dates, body measurements and weights of 19 wild-living cats mainly from the eastern Scotland; A (adult), SA (subadult), J (juvenile). Identifications follow strict and relaxed pelage criteria or skull characters (*), if pelages could not be preserved, from Kitchener *et al.* (2005)

Table 2a: Key pelage characters scores (7ps) for 11 wild-living cats with their identification following relaxed and strict wildcat definitions after Kitchener *et al.* (2005).
 b. additional eight pelage character scores and pelage character totals (tps) for all 15 pelage characters.

Table 3: Skull character scores (SCT) for five skull characters of 17 wild-living cats from eastern Scotland with identifications based on these scores following Kitchener *et al.* (2005).

FIGURES **13**

Figure 1 Locations of cat specimens analysed by NMS in 2011.

It should be noted that the working definition of a wildcat used by the Cairngorms Wildcat Project is based on the same criteria as described in this report, but with an emphasis in the field on the tail characteristics, i.e. a striped tabby cat with a thick blunt-tipped tail with distinct bands and where the dorsal stripe ends at the base of the tail.

1. Introduction

Introgressive hybridisation with domestic cats, *Felis catus*, is widely recognised as being the most significant threat facing the Scottish wildcat, *Felis silvestris* (Kilshaw *et al.*, 2010; Kitchener *et al.*, 2005; Macdonald, *et al.*, 2004). Recently Kilshaw *et al.* (2010) found significant correlation between some genetic markers and seven key pelage characters developed by Kitchener *et al.* (2005), based mainly on a sample of wild-living cats collected mainly in eastern Scotland from 1992-1995 (Balharry and Daniels, 1998). Using the strict 7PS pelage score, none of the cats collected by Balharry & Daniels (1998) were identified as wildcats and only eight of the total sample of 192 cats were considered to be wildcats based on both their genetics (microsatellites) and pelage (Kilshaw *et al.* 2010). This evidence increases concern over the level of threat caused by introgressive hybridisation to the remaining Scottish wildcat population, which has been estimated to number between a few hundred to a few thousand individuals (Kitchener *et al.*, 2005). However, there has been no further analysis of pelage patterns of wild-living cats since 1995. This report aims to present further data on 19 cats collected in Scotland since 1999 with an emphasis on animals collected mainly as road casualties as part of the Cairngorms Wildcat Project, which was launched in 2009 in order to implement monitoring and conservation action for the Scottish wildcat.

2. Methods

Nineteen wild-living cats collected mainly as road casualties from the Cairngorms National Park (with some outliers – see Figure 1) were measured and weighed according to normal field protocols; total length, tail length, hind foot length, ear length, body weight and gut length were recorded where possible for each cat. Cats were placed in three age classes: Adults (fully fused epiphyses of long bones), subadults (epiphyses unfused at one end of long bones); and juveniles (epiphyses unfused). Pelages of wild-living cats were prepared so that they could be scored for pelage characters, using the method of Kitchener *et al.* (2005). Seven key pelage characters (7PS) and eight subsidiary characters were scored. Total pelage scores (TPS) were compared for all examined cats. In addition five skull characters (distal nasals pit, relative length of nasals, shape of proximal nasals, shape of parietal suture, and development of the angular process) were scored and summed to give total skull character scores (SCTs) for each skull following Kitchener *et al.* (2005) and Yamaguchi *et al.* (2004).

With agreement from SNH, skins and skeletons will be registered as part of the National Museums Scotland collections where they will be made freely available for use by researchers. Muscle samples have been taken from all cats and will be made available to the continuing molecular research being carried out by the Scottish Wildcat Genetics Group, based at the Royal Zoological Society of Scotland.

3. Results

Location data, collecting dates, measurements and weights are presented in Table 1. Pelage character scores are presented in Table 2. Skull character scores are presented in Table 3. Identifications of wild-living cats using a combination of pelage and skull character criteria are also shown in Table 1.

A total of 19 cats, nine females and 10 males, was available for analysis although, owing to poor preservation conditions, only 11 pelages and 17 skulls were available for detailed scoring of characters. Cat collecting dates ranged from 1999 to 2010 and locations were mostly from areas in and around the Cairngorms National Park and surrounding region, with one outlier from north-west Sutherland. Some locations are a bit vague, owing to poor recording of data when they were collected; some data are being sought from collectors to improve the overall accuracy and quality of data for this sample. Additional cats from outside the area that were processed at the same time are included in the results in order to increase sample sizes to a reasonable level. Pelage and skull character scores are not affected by the sex of the cats, so that both sexes could be combined for a total sample.

Measurements and body weights showed that males were on average 12.75% longer and 51.5% heavier than females. However, the female sample contained mainly juveniles, so that the sample from this study cannot reliably inform population statistics. However, in other studies wildcat males were on average 7.64% longer and 15.5% heavier than females (Kitchener 1995).

Eleven cats could be scored for pelage characters, but only 10 of these had a complete set of the seven key pelage characters (Table 2a). Two definitions of the Scottish wildcat were proposed by Kitchener *et al.* (2005); the strict definition requires that all seven key characters score at least two each with a minimum total score of 19, whereas the relaxed definition requires that all key characters also score two each, but with a total minimum pelage score of 14. The relaxed definition is useful in field situations, where it may not be possible to evaluate all pelage characters fully or clearly, but it will identify cats which are likely to be wildcats even if seen only fleetingly. Five were identified as hybrid and five as domestic under the strict definition, but under the relaxed definition three were identified as wildcats, three as hybrids and four as domestic cats. Seventeen cats could be scored for skull characters (Table 3), but because many of the skulls had been crushed in RTAs, only 13 have total skull character scores. However, because some skull characters were scored for broken skulls, it was possible to give an identification for most skulls (Table 3).

4. Discussion

A sample of 19 wild-living cats mainly from the Cairngorms National Park and the surrounding region was analysed for pelage and skull characters. Owing to loss of

pelages due to decomposition prior to collecting and loss of skulls owing to collisions with vehicles, it was not possible to obtain a complete set of data for all cats.

However, using a combination of both pelage and skull characters, it was possible to identify all but two cats with certainty. There was a high degree of correlation between the strict pelage identification and the skull character score identification (Tables 2 and 3) as had been found by Kilshaw *et al.* (2010). Gut lengths and indices (gut index = gut length/head and body length) (Table 1) were greater for domestic cats than most hybrids as expected. Using this combination of characters, seven cats were identified as hybrids, five as domestic cats and three as domestic/hybrid. The relaxed pelage identifications classified three cats as wildcats, but Kilshaw *et al.* (2010) showed that cats identified using this criterion were genetically not separable from hybrids and domestic cats, so this definition should only be used with caution.

Overall, the results here are consistent with those reported by Kilshaw *et al.* (2010) for a larger sample of wild-living cats from across Scotland in the early 1990s that were collected by Balharry and Daniels (1998). The results of this study suggest that most of the wild-living cats in the Cairngorms National Park are hybrids and feral domestic cats in about equal proportion (cf. 46.2% hybrid and 52.1% domestic in the Balharry and Daniels (1998) sample (Kilshaw *et al.*, 2010). However, camera-trapping by both the Cairngorms Wildcat Project and Kilshaw & Macdonald (2011) has shown that some wildcats are present in this area. The sample in this study was biased towards road casualties, which may be more likely to affect hybrids and domestic cats. As conservation action to benefit wildcats in the Cairngorms National Park continues, it will be interesting to see if there is a change in the 7PSs and SCTs of road-killed cats as the wild-living cat population changes. It is vital to continue to collect and archive wild-living cats from throughout Scotland to ensure that fine-scale changes in populations over time can be monitored.

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Table 1: Basic data including locations, collecting dates, body measurements and weights of 19 wild-living cats mainly from the eastern Scotland; A (adult), SA (subadult), J (juvenile). Identifications follow strict and relaxed pelage criteria or skull characters (*), if pelages could not be preserved, from Kitchener *et al.* (2005)

a. Females (F)

ID/Sex	Age	Location	Grid ref.	Date	Donor	Cause of death	Total length (mm)	Tail length (mm)	Hind foot length (mm)	Ear length (mm)	Weight (g)	Gut length (mm)	Gut index	Identification Strict (Relaxed)
F1	SA/J	Rymore, Tulloch, Nethy Bridge	NH985164	Sep-02	Bob Proctor	RTA	795	145	114	59	3400	1410	2.169	Hybrid (Wildcat)
F2	SA	Banffshire, Ordiquill, near Cornhill	NJ575557	21.9.03	Roy Leverton	RTA	870	275	125	56	3750	1345	2.26	Hybrid (Hybrid)
F3	J	near Garlyne, Nethy Bridge	NJ025205	5.10.00	SNH, Achantoul, Aviemore	RTA	760	260	115	53	1950	1445	2.89	Domestic (Domestic)
F4	J	A837 Lochinver-Inchnadamph, Assynt	NC245230	11.11.99	Andy Summers	RTA	695	220	105	53	2050	1110	2.337	Hybrid (Hybrid)
F5	J	Near Grantown on Spey	NJ033266	18.10.09	Cairngorms Wildcat Project via SNH		620	210	83	44	1300	1445	3.524	Domestic (Domestic)
F6	J	Near Grantown-on-Spey	NJ034265	17.10.09	Cairngorms Wildcat Project via HWP		600	205	90	52	1320	1310	3.316	Domestic (Domestic)
F7	J	near Nethy Bridge		17.2.09	RZSS, Highland Wildlife Park		725	220	113	57	2450			Hybrid*
F8	A	Drumfork Estate, near Glenshee	NO12-70-	9.10.08	SNH, Achantoul, Aviemore	Shot	835	245	115	57	3600	1360	2.305	Hybrid*
F9	SA	Badenoch and Strathspey		arrived 1.2.10	RZSS, Highland Wildlife Park		785	223	100	50	2750	1615		Domestic/ Hybrid *
Means							742.8	222.6	106.7	53.4	2507.8	1380	2.653	

b. Males (M).

ID/Sex	Age	Location	Grid ref.	Date	Donor	Cause of death	Total length (mm)	Tail length (mm)	Hind foot length (mm)	Ear length (mm)	Weight (g)	Gut length (mm)	Gut index	Identification Strict (Relaxed)
M1	A	Ballintean, Glen Feshie	NH845015	11.10.01	SNH Aviemore	Found dead in outbuilding	925	280	118	57	2700	1690	2.62	Not identified – specimen in poor condition
M2	J	Drumtochty Glen, Auchenblae	(NO72-78-)	26.10.02	CEH Banchory		790	285	120	54	2950	1380	2.733	Not identified – specimen in poor condition
M3	A	Grantown to Bridge of Brown road	NJ064236	1.5.99	SNH Aviemore	RTA	845	280	128	64				Hybrid (Wildcat)
M4	A	Duackbridge, Nethy Bridge	NH997205	17.8.09	Cairngorms Wildcat Project via SNH,	RTA	880	270	125	54	5440	1780	2.918	Domestic (Domes)
M5	SA	A944 nr Strathdon	NJ325101	6.5.07	David Hetherington via SNH		895	300	127	58	4450	1884	3.166	Domestic (Hybrid)
M6	A	Mondhuie, Nethy Bridge	NH993207	12.8.09	Cairngorms Wildcat Project via SNH	RTA	875	325	127	57				Hybrid (Wildcat)
M7	A	Tersets Farm, Drumoak, Aberdeenshire	NO779991	17.3.09	Cairngorms Wildcat Project via SNH		810	260	135	56	4800	2150	3.909	Hybrid*
M8	J	Laggantygown Cemetery (Loch Vaa)	NH910175	16.10.09	Cairngorms Wildcat Project via HWP		600	200	105	53	1600	1450	3.625	Domestic/Hybrid*
M9	A	?Badenoch and Strathspey		Arrived 21.5.07	?SNH, Aviemore		875	295	121	57	3850			Domestic*
M10	J	South end of Kingussie	NH748005	28.1.09	Cairngorms Wildcat Project via HWP	RTA	880	278	126	58	4600	1310	2.176	Not identified – specimen in poor condition
Means							837.5	277.3	123.2	56.8	3798.8	1663	2.969	

Table 2a: Key pelage characters scores (7PS) for 11 wild-living cats with their identification following relaxed and strict wildcat definitions after Kitchener *et al.* (2005). b. Additional eight pelage character scores and pelage character totals (TPS) for all 15 pelage characters.

a.

ID	Dorsal line	Tail tip shape	Tail bands	Broken stripes on flank	Spots on flank and rump	Nape stripes	Shoulder stripes	7PS	Strict definition	Relaxed definition
F1	3	2	3	2	2	2	2	16	Hybrid	Wildcat
F2	2	2	3	2	2	1	1	13	Hybrid	Hybrid
F3	1	1	1	2	2	1	1	9	Domestic	Domestic
F4	3	1	2	3	2	1	1	13	Hybrid	Hybrid
F5	1	1	1	1	2	2	1	9	Domestic	Domestic
F6	1/2	1	2	1	1	2	1	9/10	Domestic	Domestic
M1	2	2	3	-	-	-	-	-	-	-
M3	3	2	2	3	2	2	2	16	Hybrid	Wildcat
M4	1	1	1	2	2	1	1	9	Domestic	Domestic
M5	1	1	2	2	2	2	1	11	Domestic	Hybrid
M6	2/3	2	2	3	3	3	3	18/19	Hybrid	Wildcat

b.

ID	White chin	Cheek stripes	Spots on underside	White paws	White flank	Colour of tail tip	Hind stripes	Ear colour	TPS
F3	3	3	2	3	3	3	3	2	31
F4	3	3	3	3	3	3	3	2	36
F5	1	2	1	1	1	3	1	1	20
F6	3	2	3	3	3	3	1	1	28/29
M1	-	-	-	-	-	2	-	-	-
M3	2	3	2	3	3	3	3	2	37
M4	3	3	3	3	3	2	3	1	30
M5	2	3	2	3	3	3	1	1	29
M6	3	3	3	3	3	3	-	2	-

Table 3: Skull character scores (SCT) for five skull characters of 17 wild-living cats from eastern Scotland with identifications based on these scores following Kitchener *et al.* (2005).

ID	Angular process development	Anterior nasals shape	Posterior nasals in pit	Nasal length compared with maxillae	Parietal suture shape	SCT	Identification
F1	3	3	3	1/2	2	12/13	Hybrid/Wildcat
F2	3	1/2	2/3	3	3	12/14	Hybrid/Wildcat
F3	1	2	2	3	3	11	Domestic/Hybrid
F4	1	-	-	--	-	-	?Hybrid/Domestic
F5	1	1	1	1	2	6	Domestic
F7	1	2	2/3	3	1	9/10	Hybrid
F8	3	1/2	2	2	2/3	10/12	Hybrid
F9	3	-	?2	-	2	-	Domestic/Hybrid
M1	3	1	1	2	1	8	Domestic
M2	3	-	-	-	-	-	-
M4	3	1	1	3	1	9	Domestic
M5	1	3	1	3	2	10	Domestic/Hybrid
M6	3	3	2	1	3	12	Hybrid
M7	3	3	2	3	1	12	Hybrid
M8	1	1	3	3	2	10	Domestic/Hybrid
M9	1	1	1	3	1	7	Domestic
M10	-	-	2/3?	-	2	-	-

Figure 1

