

Scottish Natural Heritage

Commissioned Report 360

Scottish Wildcat Survey 2006-2008





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COMMISSIONED REPORT

Commissioned Report No. 360

Scottish Wildcat Survey 2006-2008

For further information on this report please contact:

Dr Mairi Cole
Scottish Natural Heritage
Silvan House
231 Corstorphine Road
Edinburgh
EH12 7AT
Telephone: 0131 316 2600
E-mail: mairi.cole@snh.gov.uk

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The Scottish Wildcat Survey 2006-2008

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Summary

Previously wildcat sighting data (surveyed by NCC 1983–87) indicated strongholds in areas of Scotland such as the Cairngorms, The Black Isle, Aberdeenshire and Ardnamurchan. The current survey indicates a similar but less widely distributed population with isolated populations in the west. The report suggests a number of reasons for this however it is difficult to draw too many conclusions from the data. Pelage characters were used to confirm records because of the difficulty in recognition and differentiation between wildcat and other cats. Wildcat tail features, i.e. banded tail and blunt tip, together with striped coat pattern were the most commonly seen pelage characters.

Wildcats still appear to be more abundant in the east than in the west. In Scotland wildcats can survive near settlements if they are undisturbed. Domestic and feral cats should ideally be restricted in core wildcat areas with clear guidance for pet owners in the future where wildcats occur so that hybridisation is minimised. Alternatives should be discussed to control feral cats in these areas. Vets, the Cats Protection and estate keepers should be involved in the future discussion on control of domestic and feral cats.

Background

The European wildcat is evolutionarily distinct from the feral domestic cat. Wildcat pelage, as described by Kitchener *et al.* (2005), is the best technique available for identifying wildcats although this has not been used extensively in the field. The last comprehensive survey by the NCC was carried out between 1983–87 prior to legal protection for this species. This showed that the wildcat was more abundant in the east than the west of Scotland. This survey attempted to repeat the NCC survey and included consultation and interviews with farmers, game-keepers and land managers. It attempted to use the pelage characters devised by Kitchener *et al.* (2005) to test which characters were effective in the field.

Main findings

The highest percentage of squares with wildcat records (probable and possible records combined) is in Aberdeenshire, followed by Inverness-shire, Ardnamurchan and Morvern, then Perthshire and the central highlands. The highest number of positive records have grid references beginning with NM followed closely by NJ, NH and then NO and NN. This showed the majority of the distribution in the north and east of Scotland with a localised population in Ardnamurchan and Morvern.

Pelage criteria were tested to see if any were significant in field observations. Positive traits on tabby cats such as striped flanks and hindquarters, a blunt tail with distinct bands and the number of stripes, indicate a wildcat. Negative traits, such as white paws and spots on the flanks and hindquarters, can be used to rule out an animal as a wildcat.

For further information on this project contact:

**Dr Mairi Cole, Scottish Natural Heritage, Silvan House, 231 Corstorphine Road, Edinburgh EH12 7AT
Tel: 0131-316-2600**

For further information on the SNH Research & Technical Support Programme contact:

Policy & Advice Directorate Support, SNH, Great Glen House, Leachkin Road, Inverness, IV3 8NW.

Tel: 01463 725000 or pads@snh.gov.uk

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1. Introduction

The Scottish wildcat is an iconic animal to many Scots, with a fierce reputation and an ability to survive harsh conditions and other historical challenges. Few people have seen a wildcat and even those working regularly on the land in wildcat habitat only see them very infrequently.

The Scottish wildcat *Felis silvestris* is the only native member of the Felidae living in Britain and is now found only in Scotland. The Scottish wildcat has been listed as one of 31 species in need of priority action under Scottish Natural Heritage's *Species Action Framework*, a five-year programme to provide a strategic approach to species management in Scotland. In the case of the Scottish wildcat, there is a need to identify the range and population size prior to setting conservation measures. Wildcats meet criterion 1a of the Species Action Framework as a species for conservation action by virtue of its decline in range and abundance over the past 100 years. The results of this survey will help to target suitable management action to be targeted in particular areas. It is a top predator in the British context, and is therefore a species which is likely to increase the profile of species management work and benefits to biodiversity. The Scottish wildcat is a UKBAP Priority Species as part of the Priority Species and Habitats Review. It is included on the Scottish Biodiversity List. It is also listed on Annex IV of the EU Habitats Directive.

The last survey of the Scottish wildcat was undertaken over 20 years ago by the Nature Conservancy Council [NCC] (Easterbee *et al.*, 1991), and led to the protection of wildcats in Britain. The NCC survey was carried out between 1983-87, and the survey findings indicated that the wildcat was more abundant in the east than the west of Scotland.

The NCC survey established a baseline of wildcat distribution and status in Scotland. The current Scottish Wildcat Survey aims to use the NCC information to identify trends over the past 20 years and to set a baseline for which future changes in status can be compared.

The Scottish wildcat is one of Britain's rarest animals. One of the main threats to its existence is believed to be inter-breeding with feral and domestic cats. Due to their secretive nature and the wild land they inhabit, clear, prolonged or repeated sightings of wildcats are rare. Reliably separating sightings of true wildcats from those of feral and hybrid cats is difficult.

The wildcat had been shot and trapped as a predatory pest throughout history. Prior to legal protection the Game Conservancy Trust recorded large numbers of cats culled annually, with a reported 274 killed on 40 shooting estates in central, eastern and north-eastern Scotland in 1984-1985 (Easterbee *et al.*, 1991). In the NCC survey, killing was reported in 62% of 10km squares where wildcats were found.

Cats found on roads are used to verify wildcat records when they are handed over to the National Museum of Scotland in Edinburgh and analysed by experts to assess whether they fit the specimen type. This is one way of removing any doubt about verification of wildcat records but as there are few wildcat deaths by road kill it is not a very effective method for estimating distribution.

Disease and parasites can be passed from feral cats to wildcats. These may also affect wild populations of cats.

Habitat fragmentation, loss and degradation are a continual concern for biodiversity and changes in forest type, forestry operations and land use may cause harm to wildcat

populations. Wildcats prefer good cover to hunt and shelter and any changes in these conditions may cause disturbance to wildcat territory and populations. This will be expanded on in the discussion section.

Objectives of the Scottish Wildcat Survey 2006-08

The principal objective of the Scottish Wildcat Survey 2006-08 was to repeat the previous 1983-1987 survey (Easterbee *et al.*, 1991) to obtain comparable information on the current distribution of the species in Scotland. In addition we designed a test to identify whether individual pelage characteristics used by Kitchener *et al.* (2005) were useful in the field and if so which ones.

2. Background

2.1. History of the Scottish wildcat

Palaeogeological evidence suggests that the present Scottish wildcat is the descendant of continental European ancestors isolated after the last Ice Age as the sea level rose approximately 7,000-9,000 years ago. Wildcats are also found in some parts of Northern Europe, extending from northern France, southern Belgium and Germany to the Caucasus and Turkey. The European wildcat is taxonomically distinct from the feral or domestic cat.

The wildcat was once found throughout mainland Britain. However, through the loss of habitat and hunting, it began to decline in the early 1800s and was lost from England and Wales by 1862. By the end of the 19th century the wildcat was becoming scarce in Scotland (Langley & Yalden, 1977). Accounts by St John (1893) and Mackenzie (1921) highlighted the rise of game-keeping in Scotland and attitudes toward vermin indicated a wish to exterminate both wildcats and foxes. Nethersole-Thomson (1951) gives figures for the killing which took place in Glen Garry, where 198 wildcats were killed in three years, and in Glen Quich where 207 wildcats were killed over 19 years. These may have been an exaggeration to impress estate owners but there was a substantial decline in numbers. Although general information prior to 1900 is sparse, Langley & Yalden (1977) inferred killing was the primary cause of their dramatic decline from 1800 onwards and the decline in carnivores during this period matches well with the increase in game-keeping. The decline in Scotland continued into the 20th century and the range was confined to the north and north-east by the 1920s. During the First World War, forests were planted and started to re-grow which gave the wildcat much-needed cover; it then re-occupied much of central Highlands. According to records, there was a small expansion in range which was considered to be a reflection of increased numbers.

Data on predator control and incidental capture of wildcats is very limited since their protection and there is no reliable data to determine this. Although data collection in the past may have been biased, and should be interpreted cautiously, a re-analysis of historical data by Balharry & Daniels (1998) suggested that the abundance of 'wild-living' cats showed more records for the period 1921-60 than for the periods 1881-1920 (when records tended to be from the west) and 1961-80 (when records tended to be from the east).

There are a number of problems that are likely to face wildcats today including habitat loss and indirect human causes such as disease from domestic cats. As stated earlier,

hybridisation with domestic cats is a significant issue but it is unclear how long hybridisation has been taking place.

2.2. Legal Status

The Scottish wildcat is protected under the Wildlife & Countryside Act 1981 (as amended) and is identified as a European Protected Species on the Conservation (Natural Habitats, &c.) Regulations (1994) (as amended). The Scottish wildcat *Felis silvestris* is classified as Vulnerable by the International Union of Conservation of Nature [IUCN] Red List 2000. The European wildcat is also listed under Appendix II of the Bern Convention 2002, and Appendix II of the Convention on International Trade in Endangered Species [CITES] 1973.

2.3. Research

There has been a significant increase in research into wildcats over the last few years with specific research focused on hybridisation in Britain and some parts of Europe. The first Scottish wildcat type specimen was collected in 1904, at least 2000 years after the introduction of the domestic cat to Britain. Defining a Scottish wildcat has proved difficult due to years of potential hybridisation. In the absence of wildcat specimens prior to the arrival of the domestic cat, there is no measure of the extent to which the type specimen was itself hybridised.

A recent scientific paper (Kitchener *et al.*, 2005) provides a definition of Scottish wildcats based upon seven clearly visible pelage characters. These seven pelage characteristics were developed from museum specimens and dead cats collected over many years and were donated by various sources throughout Scotland.

Kitchener *et al.* (2005) identified seven key characters that distinguished wildcat from domestic cat:

1. the wildcat shape of the stripes on back of neck (more wavy)
2. two stripes on shoulders
3. tail should be bushy
4. tail with a blunt black tip
5. tail with distinct rings
6. stripes along lower back and
7. dorsal line which stops at the start of the tail.

Kitchener *et al.* (2005) also carried out statistical analysis which looked at variations in the above seven pelage characters using a scoring system based on three types of cat: domestic, hybrid and wildcat. This gave 21 different characters. Under their system, the perfect wildcat has a score of 63; the domestic cat a score of 21. The indication is that there is a range of cats living in the wild but the cats tend to fit the three types, with some overlap between hybrids and wildcats.

2.4. Morphological and pelage characters

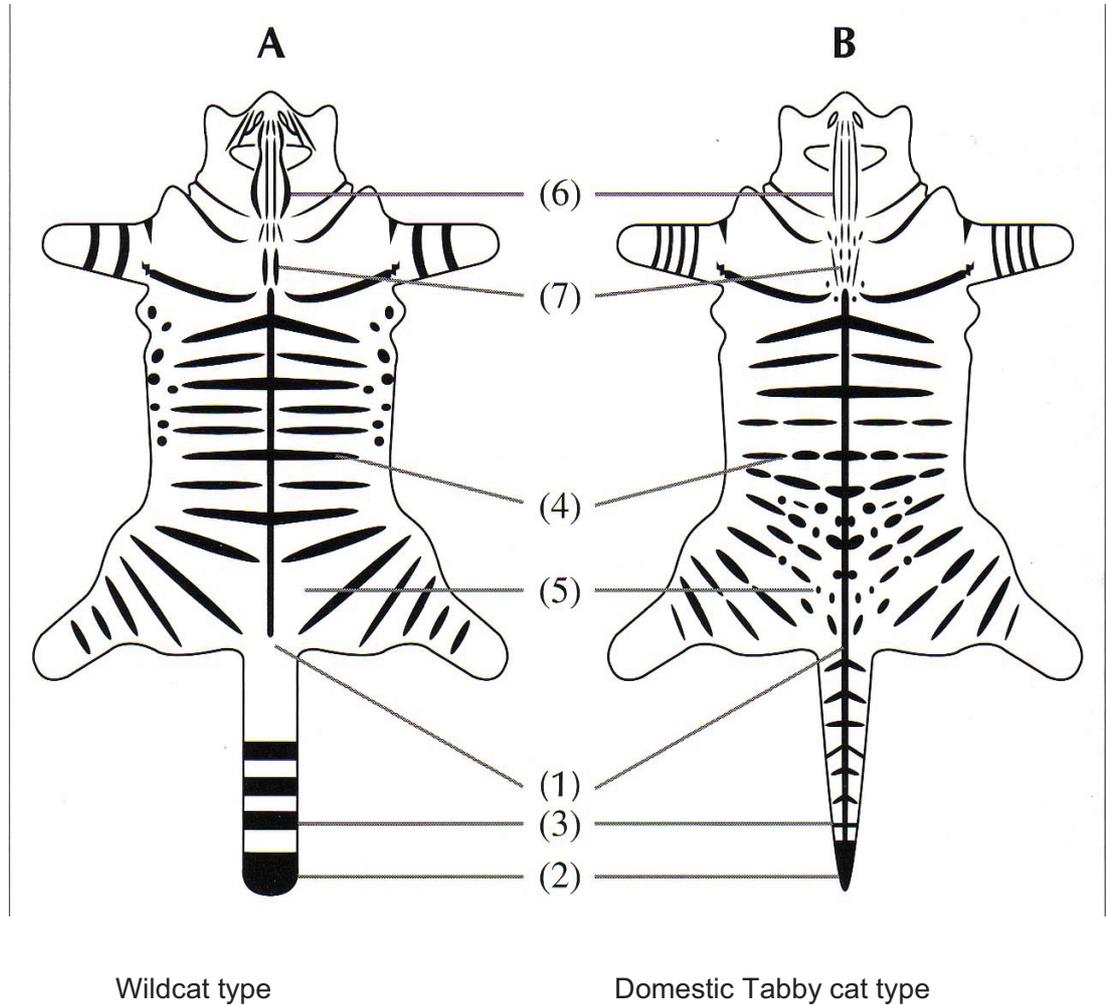
A study of 31 wild-living cats was conducted from 1995 to 1997 in an area with wildcats (Daniels *et al.*, 1998). Using samples obtained in this study, Balharry & Daniels took an alternative approach to defining the wildcat, based on gut, limb and cranial measurements rather than pelage. Pelage was used after the other characteristics (gut/limbs/etc) to confirm whether it was compatible with their method. 74% of cats caught had striped tabby pelages while 26% had other (non-tabby) phenotypes. The results suggested that pelage alone was useful in discriminating between wildcats and other cats but other morphological characters in conjunction with these can also be useful. Cats were classed as group 1 cats with shorter intestines and longer limb bones and group 2 cats with longer intestines and shorter limb bones. Group 1 cats were considered to be more like wildcats and group 2 cats were more like domestic. When pelage was also analysed, there were statistically significant results between the two groups. In general group 1 cats had more stripes on the body, legs and tail, and were more likely to have other markings traditionally associated with wildcats such as rounded tails, black paw pads and no white on the paws or chest, white on the groin (Corbett, 1979). However this research came before Kitchener *et al.* (2005) and the seven pelage characters, which is more practical for use in field recording of wildcats.

The non-wildcat characters were also important in the above research. A white muzzle or white paws are not identified as wildcat characteristics in the Kitchener *et al.* (2005) paper but subsequent discussion suggested that the analysis showed this not necessarily to be the case (Kitchener *pers. comm.*). He reported that, in his opinion, the main difference is in the depth of colour, with the muzzle of a wildcat being 'an off-white colour'. This is consistent with some cases where there appears to be a significant amount of white around the muzzle area and even on the throat and bib in cats certified by 'experts' as wildcats. The presence of white coloration about the face is, therefore, not a reliable character to use to eliminate possible wildcat sightings. It is also possible that the amount of white on wildcats is subject to change through time as an adaptation to high altitudes. This is demonstrated by the Siberian race of wildcat (*Felis silvestris caucasica*) which has significantly more white on the face and underside than the European race, though the Siberian cats also experience a significant amount of hybridization with feral cats (Kolesnikov, 2003).

Another potential way to distinguish wildcats is from their genetics. Genetic markers which could distinguish European from Asian and Scottish from European wildcats would provide a definitive identification for the species. Work is still underway to clarify the value of recent progress and it will take some time to develop this for use in the field. Road kills can help to give some clues to wildcat distribution, their genetics and other morphological features in the light of sightings being unreliable.

Stahl & Artois (1991) carried out a comprehensive status survey, using questionnaires and an extensive literature review. The authors highlighted the importance of establishing data collection networks, and praised the results of such efforts in Scotland (Easterbee *et al.*, 1991) and Hungary. However, Ragni (1993) cautions against unreserved acceptance of survey results, finding a high degree of error (39%) among experts (e.g. zoologists, natural history museum curators, hunters, veterinarians, game wardens and professional naturalists) asked to distinguish between specimens of European wildcat and domestic cat.

Figure 1 Seven pelage characters useful to diagnose a free-ranging tabby cat (B) from a Scottish “wildcat” (A) (reproduced from Kitchener *et al.*, 2005)



Seven Key Pelage Characters

1. extent of dorsal stripe
2. shape of tail tip
3. distinctness of tail bands
4. broken stripes on flanks and hindquarters
5. spots on flanks and hindquarters
6. shape and number of stripes on nape
7. shape and number of stripes on the shoulders

2.5. Population Estimates

The most recent population estimate for Scottish wildcat was published by Harris *et al.* (1995) who estimated 3500 wildcats in Scotland based on distribution data and extrapolation of radio tracked data.

2.6. Previous surveys

The first survey of wildcats was carried out by Taylor, in 1946, on Forestry Commission land and further surveys were undertaken by Jenkins in 1962 based on questionnaires. Jenkins found that wildcats had apparently increased their range and Hewson (1967) saw wildcats distributed fairly widely over the northern half of Scotland above the central lowlands. Both of these surveys were based on estate records and, although their methodologies were different, they generally indicated that wildcat ranges expanded since 1914.

2.7. The 1983-87 NCC survey

The methods of collecting the data for the NCC survey were based on:

- the use of hunting, game or predator bags;
- determination of sites by sightings;
- corpses from road traffic accidents; and
- interview and questionnaire.

The methods used by the NCC focused on sightings supplemented with corpses from road traffic accidents. This “enabled differentiation between wildcats (or close hybrids) and domestic/feral cats and obvious hybrids”. The NCC survey included gamekeepers, forest workers, fox-hunters and hill shepherds because they live in wildcat ranges and work outdoors when wildcats are active. Records and general observations from knowledgeable field recorders on the present decline and status of wildcats can be useful, and these carefully targeted observers provided the bulk of the results. Other methods, such as systematic surveys of specific areas and looking for signs of the species, were ruled out because wildcat tracks and signs cannot be distinguished from domestic or feral cats. Records were collected from 499 10km squares in Scotland, with more than 400 people supplying over 700 observations.

The problem of how to define Scottish wildcats had received relatively little attention in the NCC survey and the accuracy of identification through pelage characteristics was not considered. Further research on the wildcat specimen type addressed some of the problems with identification in the field but subsequent evidence shows that the issue is much more complex than originally thought.

Easterbee *et al.* (1991) attempted to assess the status of wildcats by asking respondents about perceived changes in the numbers of wildcats. 34% of interviewees thought that wildcats were declining, 58% thought there had been no change and 8% said that the population was increasing. As mentioned above, these results should be interpreted with caution as the authors themselves highlighted the fact that respondents were understandably unsure on how to distinguish between wildcats and other cats.

The 1983-87 Scottish wildcat survey included a press release to national newspapers and informed the general public by means of posters throughout Scotland in local

government offices and shops. The distribution of the wildcat in Scotland from the survey is shown in Figure 2. The report concluded that wildcats were widely, but unevenly, distributed throughout central and northern Scotland.

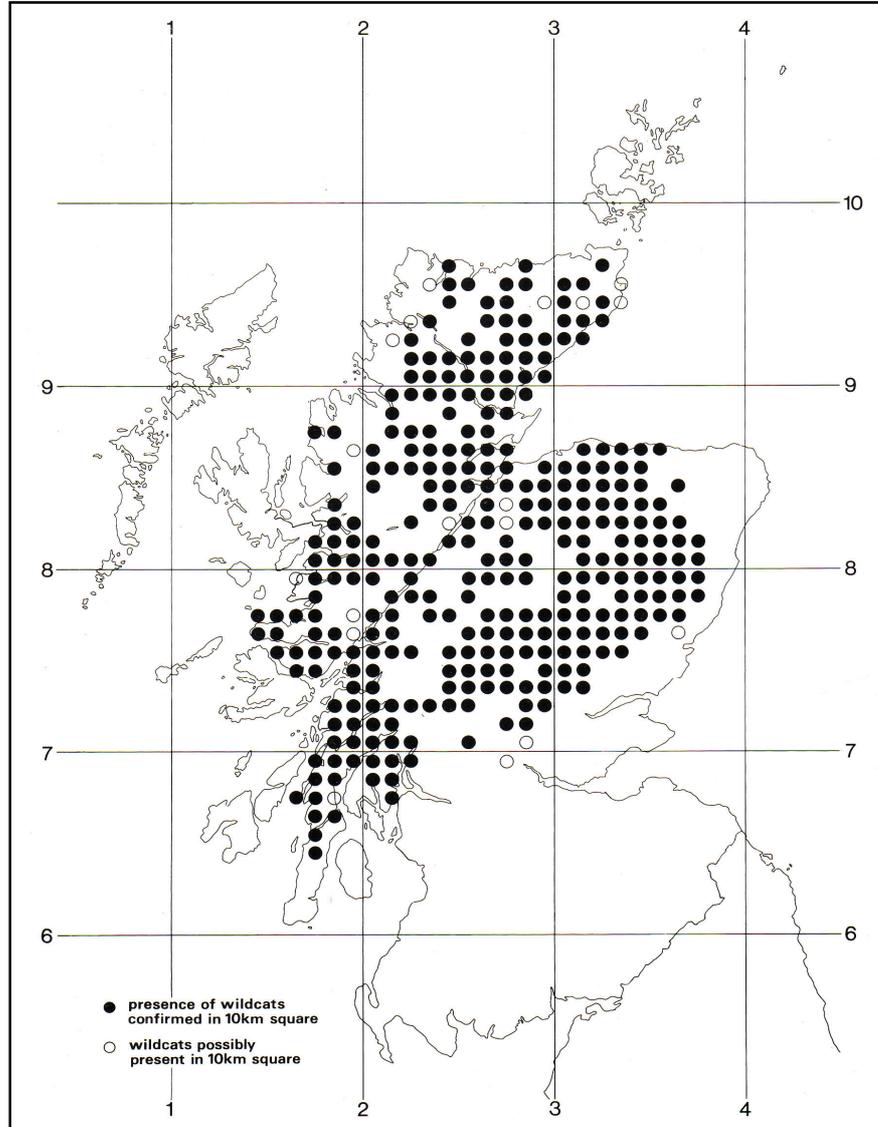
2.8. Other surveys

A survey by Daniels *et al.* (1998), based on live-trapping and road kill/carcass records, suggested that wildcat distribution was limited to the north-east of Scotland (primarily Perthshire, Angus, Grampian and the eastern Highlands), with a small residual population in Argyll and Lochaber. Balharry & Daniels (1998) also estimated density in Glen Tanar, Deeside, suggesting that there were 30 wildcats per 100 km² and an estimated 8 wildcats per 100 km² in the Ardnamurchan.

2.9. Changes since the last NCC survey (methods and results)

The 1983-87 survey obtained results primarily from estates and landowners. The current survey obtained responses from a wider range of sources but, due to time constraints, the number of responses obtained from keepers and landowners was limited.

Figure 2: The distribution of the wildcat in Scotland 1983-87 (From Easterbee *et al.*, 1991)



3. Methods

3.1. Scope of the study

The principal objective of the current survey was to collect sightings of wildcats using the observers to describe any wild-living cats they see, and then use the descriptions they provided to identify cats with wildcat ancestry *a posteriori*. This used all records and all information received, making no distinction about the ancestry of the cat recorded but asking for detailed information which could be used to distinguish a “type” of cat. The methods used for the survey design were similar to those used by NCC in 1983 based on:

- sightings;
- corpses from road traffic accidents; and
- interview and questionnaire.

Previous survey methods which had been used, such as game bags from returns on vermin control, were no longer valid because wildcats have been fully protected by law since 1988. Other new methods which might have been used, such as lure posts for collecting cat hair, camera traps and live film, were not appropriate given the need to replicate, as near as possible, the previous NCC survey.

The main methods used to collect information were:

- questionnaire forms;
- leaflets;
- website and online form;
- interviews and other contacts;
- previous biological records.

3.2. Sightings Data

There were two alternative approaches which could be adopted when soliciting observation: (a) to describe *a priori* what we thought constituted a wildcat, and then ask observers to provide records matching this pattern or (b) to ask observers to describe any wild-living cats they saw, and then use the descriptions they provided to identify cats with wildcat ancestry *a posteriori*.

The first approach is problematic in that, in their keenness to see wildcats, some observers may (subconsciously) fit their sighting to the description, or even ignore the description altogether. Consequently, the data model for the current survey assumed that the second, potentially more scientifically rigorous *a posteriori*, approach was adopted but noted that:

- Observers may be discouraged from submitting long, detailed, questionnaires with many questions.
- Detailed descriptions of a sighting may be error-prone particularly if, as is likely, the event was short-lived, and occurred some time ago (c.f. evidence on reliability of eye witness testimony).

- Naturalists often rely on an amalgam of characters to identify species (e.g. 'jizz' for birds) and even experienced observers may be hard pushed to separate out the individual characters underlying that identification.

The survey was initiated by producing a diagrammatic model of the data sources. This was designed to inform the methods for collecting the information so that each type of data could be easily linked to the source, address and contact details with a date and location of the sighting. This was used to design the database (see Appendix 1), identify the most important data types and sources of information. Further information could then be added to this data to supplement the essential information and make judgments about cat sightings. The structure of the database is described using an Extended Entity Relationship Model (Elmasri & Navathe, 2000), which is the type of data model most widely used for conceptual database design.

All estates over 5,000 acres were identified and contacted initially via letters with accompanying questionnaires. These included estates which had previously recorded 10km² wildcat county records (from the 1983-87 survey). Further letters were sent to all public, private and non-governmental wildlife organisations in Scotland within the previous 1983-87 survey boundary. Additional contacts were made out with these areas by other means later in the survey. In all, over 500 letters were sent and these letters generated further responses and contacts throughout wildlife, land management and conservation organizations. In addition SNH and Forestry Commission acted as "agents" in many cases, with local area staff distributing leaflets and promoting the general message to generate further sighting records.

Leaflet design was targeted towards the general public. Leaflets were distributed providing details of the survey and asking observers to submit sightings (see appendix 2). The leaflet outlined what type of description was required (e.g. coat pattern, tail shape and coloration, white in coat) but did not specify which particular features identify a wild cat.

An attempt was made to set a systematic standard using key questions based on Kitchener's seven point pelage criteria and other key pelage characters, such as white paws or spots, which may indicate a non-wildcat type. These latter characters were called "spoilors". Further information was also gathered to assess habitat type and previous experience with wildcats if there was any.

A spreadsheet was set up to collate information once data was generated. There were a number of assumptions based on the above methods for collecting the information. All questionnaires and leaflets were designed to assess cats that presented any form of tabby type pelage. It should be noted that Kellas cats were, therefore, ruled out based on the fact that there have been so few correlating with wildcat genetics and morphology recorded in the wild. However, we generally encouraged any tabby cat sighting to be recorded where they appeared to be free-living, i.e. cats that appear to be wild on observation or in wild situations that are not close to occupied buildings or adjacent to suitable habitat.

Records were collated dating back ten years (1998-2008). The last attempt to collate wildcat data in Scotland, with specific reflection on the hybridisation issues, were Daniels' *et al.* field studies on wildcats which took place during the mid- to late 1990s (1998).

3.3. Questionnaire design

The questionnaire was designed to provide information on cat characteristics as observed by recorders. This enabled analysis of the data gathered using the seven key pelage characters, with additional questions based on habitat and closeness to buildings and roads. A copy of the questionnaire is included in appendix 3.

The initial means of collecting data for the survey was via a letter and postal questionnaire distributed to land managers and field workers across the documented range of the species. This targeted the area previously covered by the NCC survey and encouraged observers to provide details of sightings. Using a questionnaire allowed the format of the descriptions provided by observers to be guided and included questions to assess the knowledge and expertise of the observer. Postal questionnaires enabled more detailed and structured information to be collected on both of these aspects than would result from casual observations. Neither provided the same opportunity to obtain the level of detail which was possible in an interview format.

A website was also set up presenting background information on the survey and providing a conduit through which to submit records. The questionnaire was available as a download from the website and could be submitted electronically.

Initial questionnaire returns and correspondence as a result of the initial letters were followed up, especially where there were positive sightings, missing information, multiple records and other contacts. Records from estate owners, factors and keepers (or whoever our initial letter was passed to) may have included photographs taken of the cat, the state of the cat at the time of the observation (i.e. alive or dead) and the observer's evaluation of the sighting including their previous experience of seeing wildcats.

All returned questionnaires were catalogued and presented in the database. This information allowed us to identify positive sightings and follow up initial contacts with interviews. The information generated from the initial responses also gave further contacts which could be followed up with additional letters and questionnaires.

3.4. Leaflet design and distribution

The second stage of the survey targeted the public. A leaflet was designed based on previous mammal surveys and using many of the questions from the questionnaire. This was intended to be more user-friendly and present a simplified version of the questionnaire. This was made widely available to members of the public or any interested party.

The leaflets were distributed across the previous NCC survey area and were also sent to SNH and Forestry Commission Scotland offices. 5,000 leaflets were produced and distributed over north and west Scotland, from Durness and Ullapool to Argyll. Leaflets were distributed between Inveraray, Oban, from the Trossachs (Aberfoyle) to Perthshire and Angus (Brechin to Stonehaven in the east). This followed a general line north of the Highland Boundary fault. Large numbers of leaflets were placed in SNH, Forestry Commission, council offices, shops and visitor centres with large and small sub post offices being used in more remote areas. Tourist information centres were also used and an additional print run of 5,000 was required to cover the north and east (Aberdeenshire) and Fort William and surrounding area.

3.5. Interviews and trusted observers

Responses from gamekeepers, land managers, farmers, biological record centre managers, conservationists and individuals with an interest in or records of wildcats were followed up with personal interviews. Sighting location, previous wildcat experience and perception of local population trends were all collected during these interviews. In many cases, personal interviews often led to further contacts and records being offered. This approach often also led to a better indication of the knowledge of the recorder and allocated a score to them as either experienced or inexperienced (based on questioning at interview on their previous wildcat experience and knowledge).

SNH supplied many contacts, including conservationists and ecologists to naturalist societies. Further, personal contacts included wildlife tourism businesses and ecological consultancies involved in the preparation of ecological and environmental fieldwork. Previous wildcat experts were interviewed including all the major contacts that had previously worked with or had some knowledge of wildcats.

Some sighting records were followed up by interviews to gain further information on pelage characters for each individual sighting and, where possible, to obtain further information, contacts and details of previous sightings of wildcats or feral cats in the area. We also asked more questions about the current status of wildcats in the observer's area based on their knowledge. This enabled comparison with similar recorders in the area to determine whether the recorders had similar impressions of the numbers of wildcats in the area. Many of the experienced recorders were aware of the difficulties in identification but these trusted observers were often much more familiar than most with the Kitchener pelage characters and the type-specimen. We, therefore, included them in the trusted observer dataset. It was valuable to collect dead wildcats wherever possible, as these can be analysed and studied to prove whether they fit all the other tests (e.g. morphological and anatomical criteria) for wildcats. All dead wildcats were passed to the National Museum of Scotland in Edinburgh (Natural History Department) for further analysis and study.

3.6. Wildcat pelage analysis

Records were obtained from a range of sources and had inherent differences in quality. As a result, analysis required these first to be standardised. Pelage characters for wildcats were originally developed from museum and dead cat specimens and were untested as a field key. Therefore under field conditions, several other environmental factors became important in determining a wildcat sighting including the brevity, timing, duration and light conditions of each recording. These problems influenced the accuracy of the data and it became necessary to analyse the pelage characters for objective testing. Many records were incomplete but this was an inherent limitation of gathering details based on observation alone. Some records had additional photographs, which helped in the overall assessment and categorisation.

Where possible, missing information was obtained at the interview. These records were retained as we attempted to assign a probability to the cat records based on the pelage criteria, location and experience of the recorder.

The seven pelage characters were analysed using a multivariate, observed versus expected statistical analysis. Our assessment was based on pelage as the primary consideration recorded by the observers. Obviously the more pelage information recorded, the more accurate the record. However, for a 'probable' record, the

information must contain all the key pelage characters and no spoilers, or must have been seen by an experienced observer.

Some records fulfilled all the wildcat pelage criteria, were from experienced observers and were from areas that we did not expect to see wildcats. These could not be ruled out and were retained for analysis. Where inexperienced observers saw what they believe to be wildcats, we tried to conduct interviews to build up the knowledge of the observer and give greater credence to the results. Where there was an additional element, such as geographical location, which gave further dubiety to some records, the experience of the observer and location ultimately became more important in making a decision about a probable/possible or unlikely wildcat location. Some observers, particularly in e-mail or telephone submissions, stated their name and the location and they had seen a wildcat but did not describe the pelage. This data proved difficult to justify and attempts were made to contact them and illicit more information, or to get them to complete the questionnaires. Questionnaires were not always returned following this which left us with a set of information which had to be categorised as 'possible' wildcat. Where the recorder was inexperienced, and the sighting from a previously unrecorded locations, e.g. a city in the central belt, they were categorised as 'unlikely' records.

3.7. Data entry and storage

Inconsistencies in methods of data collection presented difficulties for collation and comparison. The free-text supplied on some responses were insufficient to interpret in relation to the key questions of the survey as the recorder had not "ticked the boxes" or gave insufficient location information. Many of these recorders were contacted but further information was not always available. Some simply could not remember the exact location or detail required about their sighting. In addition to the spreadsheet, the data was also incorporated into a relational database.

The previous NCC survey had used the ITE Land Classification system to investigate the main habitat types being used by wildcats. These classes are longer used and, therefore, could not be compared. Where available, habitat data was incorporated for possible future use. The record was scored for whether it incorporated the classes "Farmland", "Woodland" or "Mountain and Moorland", although the leaflet data had a more complex set of habitat categories that sub-divided the woodland types into "Coniferous", "Broad-leaved" and "Mixed", and additional categories including "Garden" and "Urban".

3.8. Map production and analyses

Previous NCC survey records were mapped using tetrads (10 km grid square resolution) to show presence or absence in a grid square. This survey used a similar approach also included non-wildcat records.

Confidence levels were assigned to all the records based on the information provided. In each of these assessments, the more complete the information the better the confidence level, although some characteristics had a stronger weighting than others. Weighting was also given to experienced observers. Information, such as location, was sometimes limited and very broadly represented, e.g. four figure grid references or an unspecific sighting date. We therefore opted for three categories to identify the likelihood of an individual record

- probable wildcat (1);
- possible wildcat (2); and
- other records (3) that are generally unlikely to be wildcat sightings.

Data and statistical analysis used the above categories to effect a sample division however the main use was to determine the distribution of wildcats within the survey region.

Ordnance Survey maps were used to show the presence of each of these categories, grading the symbol in size to reflect the density of records. Maps were prepared using ESRI ArcView. Only records with valid grid references were retained and mapped, however there was significant variation in the resolution of the grid references, from 100 x 100 km grid to 10m resolution. Unless greater resolution could be obtained, records with only a major grid reference were rejected from the scope of the survey.

3.9. Statistical analysis

The degree of correlation between the categories the cats, as described in Section 2.4, were measured using the pelage class for each feature based on Kitchener *et al.* (2005). Character classes that tend to be positively correlated with probable wildcats, we would expect the correlation to be high, e.g. up to 100%. Negative correlations would have a lower value, going down to -100%. In practice we find that most character classes have a positive correlation, but this is much lower for pelage character classes found more in non-wildcat samples. In the case of some pelage characters, the sample size was large enough that a basic chi-squared test could be conducted on a contingency table of the pelage character class scored against the wildcat record type for each pelage character feature.

Records were given a numeric score based on the values given by Kitchener *et al.* (2005). These were -1 for non-wildcat characters, 1 for wildcat characters and 0 for intermediate. Correlation between specimen classification and pelage characters was A scored by adding the scores of all the records for each combination of a wildcat category (probable, possible or non-wildcat) and a diagnostic pelage feature (e.g. rings on tail), then dividing by the total number of records. Thus, if there was a perfect correlation between the sample group and the probable/definite wildcat characters, the value of this statistic would be 1.00, while if the correlation with non-wildcat characters was perfect, the value would be -1.00.

To determine whether these values were statistically significant, a simple two-way contingency table was drawn up for each character, comparing the frequency of each character class in the sample groups to that of the sample as a whole. The table was a 2x3 table of score (1 or -1) against sample group type (probable, possible or non-wildcat). A value of chi-squared was calculated for this and tested for significance at the 95% confidence level and two degrees of freedom. This assessment is based on a broad interpretation of the seven pelage characters (positive ticked boxes) and is quite limited based on the information received in all the questionnaires and leaflets.

3.10. Overall data management

Data submissions came in four main forms (questionnaires, leaflets, emails, interviews) and although the original methodology aimed to remove variation in data quality, this

proved difficult. This included significant data cleaning (e.g. standardising dates and locations) to bring records up to National Biodiversity Network (NBN) standard. Questionnaires proved to be the most useful (when complete), followed by the leaflets and then casual records such as NBN, Scottish Wildcat Association (SWA), and emails and telephone messages.

Some records which were submitted did not have enough data to meet our criteria on one or all of the elements such as precise enough location, date, pelage or other character or contact information. Fortunately there were generally few records of this quality and they were subsequently excluded from the analysis. The records submitted cover a relatively narrow period from April 2007 to October 2008.

SNH and Forestry Commission staff forwarded records and provided an additional network of contacts. There was a good feedback from the public sector and charities such as the John Muir Trust [JMT], the Royal Society for the Protection of Birds [RSPB] and the Scottish Wildlife Trust [SWT] as well as personal contacts.

Final assessment on the SWA and some other records was required to verify the records. Unfortunately not all information provided fell into a standardised dataset and without some qualification statement on some datasets such as general emails and records it would have been very difficult to assign a category and confidence to the records. Therefore any record described as a tabby, with a lack of clear information (without spoilers such as white on paws and other domestic traits) was regarded as a possible wildcat. Although not entirely satisfactory, it was sometimes the only option available to judge a record on.

3.11. Area based observations

Easterbee *et al.* (1991) recorded data for particular areas, e.g. the opinion of the respondent on the abundance and population trends of wildcats on their estate and information on “Killing or Threat”, “Feral cats” and “Evidence of hybrid animals”. Previous surveys such as Taylor’s (1946) survey of the presence of wildcats on Forestry Commission properties in Scotland also used an area-based recording unit, as do databases from any source recording the presence and absence of wild cats within 10 x 10 km squares. In contrast, the current survey uses a single cat as its core recording unit, attributing characteristics to these. If required, the current database could be extended to encompass area-based data, allowing data from previous studies to be included. However, there is currently no provision to allow observers to record area-based observations in the current database (e.g. wildcats present on my estate regularly over the last five years).

3.12. Media launch

The Scottish Wildcat Survey was launched publicly at The Highland Wildlife Park by the Scottish Environment Minister. This generated a much greater awareness and response. The media enthusiasm instigated by TV and radio coverage was significant, with a notable increase in the general feedback and sighting records following.

4. Results

4.1. Information received

The wildcat survey received information from many sources (numbers in brackets indicate final count of records accepted).

- Postal Questionnaires (31)
- Web-based Questionnaires (54)
- Leaflets (69)
- Emails (67)
- Letters (17)
- Phone Calls (4)
- Interviews (13)
- National Biodiversity Network - NBN (25)
- Scottish Wildcat Association - SWA (169)
- Other Records from Trusted Observers (58)
- Total (482)

A total of 482 validated responses were received from the survey. This does not include NBN records. There were a total of 55 interviews, with many recorders having previously submitted information in other forms such as postal questionnaires, leaflets or email responses. The data records them in the first format to avoid duplication. The number of experienced trusted observers (58 out of a possible 452) was quite low representing 13% of the total.

National Biodiversity Network records were recorded in most cases prior to the inception of the wildcat survey in 2006 and were therefore generally unverified accounts of wildcat sightings. Some of these records were followed up with interviews if they were recorded within the 10-year period to October 2008 and they generated useful information from often experienced sources.

Questionnaire and leaflet information tended to be the most comprehensive records with interviews also useful as they were more targeted and complete. The general advantages of these forms over the NBN were the additional information regarding the pelage characters and the questions posed re experience and sighting information.

Scottish Wildcat Association records were submitted at the end of the survey period and included all records of possible wildcat sightings based on web-based information published by the Association. Reports included any evidence to support a wildcat sighting, its location and a general assessment by the author on its likelihood of being a wildcat or feral cat. A review of this information was undertaken to verify these results based on Kitchener pelage criteria, experience and location and in some cases images of the cats.

Table 2 The number of records in each 10km square with associated pelage information (positive records are probable wildcats).

Grid Square	Number of Records (positive)	Number of positive Records with Pelage Data (%)
HU	1 (0)	N/A
HY	2 (0)	N/A
N0	1 (1)	0
NB	1 (0)	N/A
NC	20 (5)	0
ND	16 (5)	2 (40)
NF	2 (0)	N/A
NG	5 (1)	1 (100)
NH	85 (35)	7 (20)
NJ	102 (36)	19 (52)
NM	68 (38)	2 (5)
NN	53 (19)	7 (36)
NO	72 (24)	1 (4)
NR	9 (3)	2 (66)
NS	28 (1)	1 (100)
NT	7 (0)	N/A
NU	1 (0)	N/A
NX	1 (0)	N/A
SD	1 (0)	N/A
SE	1 (0)	N/A
SH	1 (0)	N/A
SX	4 (0)	N/A
TL	1 (0)	N/A

4.2. Coverage and wildcat distribution

Figure 3 shows all cat records covered by the survey in Scotland during the period 2006–08. The current survey employed 10km Ordnance Survey grid squares which relate to the last NCC survey. The grid maps show the presence or absence of records within a 10 x 10 km grid square, with filled circles showing that a probable wildcat (category 1) has been recorded there. Open circles show where the sightings are no better than 'possible' (at best category 2).

Figure 4 shows the distribution of all wildcat records generated from the survey. This includes the categories for 'probable' wildcats, 'possible' wildcats and other cats (section 3.8) recorded between 1998 and 2008.

Figure 5 shows the frequency of wildcat records in each 10x10 km square. The frequency of records reflects the effort in some areas where community involvement was taken to great lengths to help the survey objectives especially, for example, within the Cairngorm National Park and on the Black Isle.

Figure 6a and 6b compare the 1983-87 and the 2006-08 wildcat distributions. The distribution shows there is a distinct shrinkage in the distribution between the two surveys (although as we discuss later, there may be several good reasons for this).

The distribution of responses is widespread. This extends into the borders with one or two records from England, one of which cannot be discounted based on the description of the cat.

Reliable sources also discussed the possibility of re-introductions into the Scottish borders and northern England. This would cause problems with using the geographical location as a creditable method of discriminating against some records based on unlikely location. These records have been included and, where pelage characters were observed and fit the wildcat pelage, they are 'possible' wildcats. Without pelage characters, or with limited characters but experienced observers, they are 'possible' wildcat records. With no pelage details and inexperienced records they are 'unlikely'. This is similar to having to rule out the likelihood of Kellas cats being significant in the wildcat population.

4.3. 'Probable' and 'possible' wildcat records

The overall distribution of probable wildcat records fell distinctly from a line north of the Highland Boundary fault from Aberdeenshire to Loch Lomond and into Argyll. In contrast, the possible records stretched from the Clyde and Forth estuaries, except for the few mentioned in the borders and England. If we discounted the few records south of the Highland Boundary fault (based on the geographical assumptions above), the distribution is not so dissimilar to the previous NCC survey range. Generally the detailed records also showed some relationship to human settlements and movements, with people recording cats near to roads, houses and areas associated with forestry, woodland and scrub, and farmland, albeit often marginal. There were few records from remote areas such as the central highlands, Wester Ross and the flow country away from the coasts. These relatively uninhabited "wilderness areas" have fewer people and therefore the areas were more likely to generate fewer records and sightings of wildcats. This does not necessarily mean that none are present, simply that none were recorded during the period of the survey. There were large numbers and significant patches of records showing high frequency of probable and possible wildcats in Aberdeenshire, the Cairngorms and Inverness-shire with coastal areas around Caithness and Sutherland

extending down to Arnamurchan and the Morvern peninsula and Argyll. In general the data shows wildcats within the valleys extending from the high plateaus in areas such as the Cairngorms, Sutherland, and the central highlands and along coastal areas. Casual observations, through the interviews and other discussions with observers, suggested that many wildcats occupy the river margins in remote sites. These used to be more intensively farmed but are now neglected and contain unimproved habitats such as grasslands and scrub with forest and woodland. Many trusted observers also noted rabbits as a favourite source of prey in these areas, especially in the north east.

Island populations were also recorded as 'probable' and 'possible' sightings but, where pelage characters complied fully with Kitchener's seven pelage characters, a 'probable' sighting was recorded. However all previous surveys seem to suggest wildcats were not present on the Scottish islands. Some sightings were on Mull and Arran, Orkney and Lewis, but there are none on any of the other Scottish islands. There was a high frequency of sightings from Mull which was surprising as wildcats had not been recorded there before and although some photographic evidence proved feral cats lived on Mull, wildcats could not be ruled out entirely with a large number of cats recorded here with good pelage characters. Arran also delivered a few records and even more convincingly a few photographs of what appear to be wildcat kittens in a den.

The relative distribution of the probable/possible wildcat sightings raised another interesting point. The distribution of "possible wildcats" tended to be over the same range as the "probable" (except for a few south of the Highland Boundary fault), but curiously with a more even frequency throughout. The possible records also extended further south from probable wildcat range the most likely outcome being observation error or lack of information with the sighting. These other possible wildcat records, based sometimes on quite limited information, could not be entirely ruled out especially when some of the key pelage criteria are recorded. Geographical information alone could not rule out the possibility of wildcats occurring if the description and recorder is bona fide. There were some outliers (e.g. Northumberland, Mull), but the overall look of the maps shows very similar geographic recording patterns to previous surveys and latterly distribution patterns from maps produced by Balharry & Daniels 1998. The curious exception was the Black Isle where there was a hot spot of possible records as well as a concentration of more definite records (and historical presence of wildcats) – this might indicate the possibility that these records at least in part include a distinct population. It was also very difficult to draw any further conclusions regarding hybrids from the results, but we tried to apply common sense and where we had limited records from unreliable sources and little evidence, erred on the side of caution and assumed these were only at most possible sightings and more likely non-wildcat records.

Figure 3: Distribution of all wildcat records in Scotland 2006-08

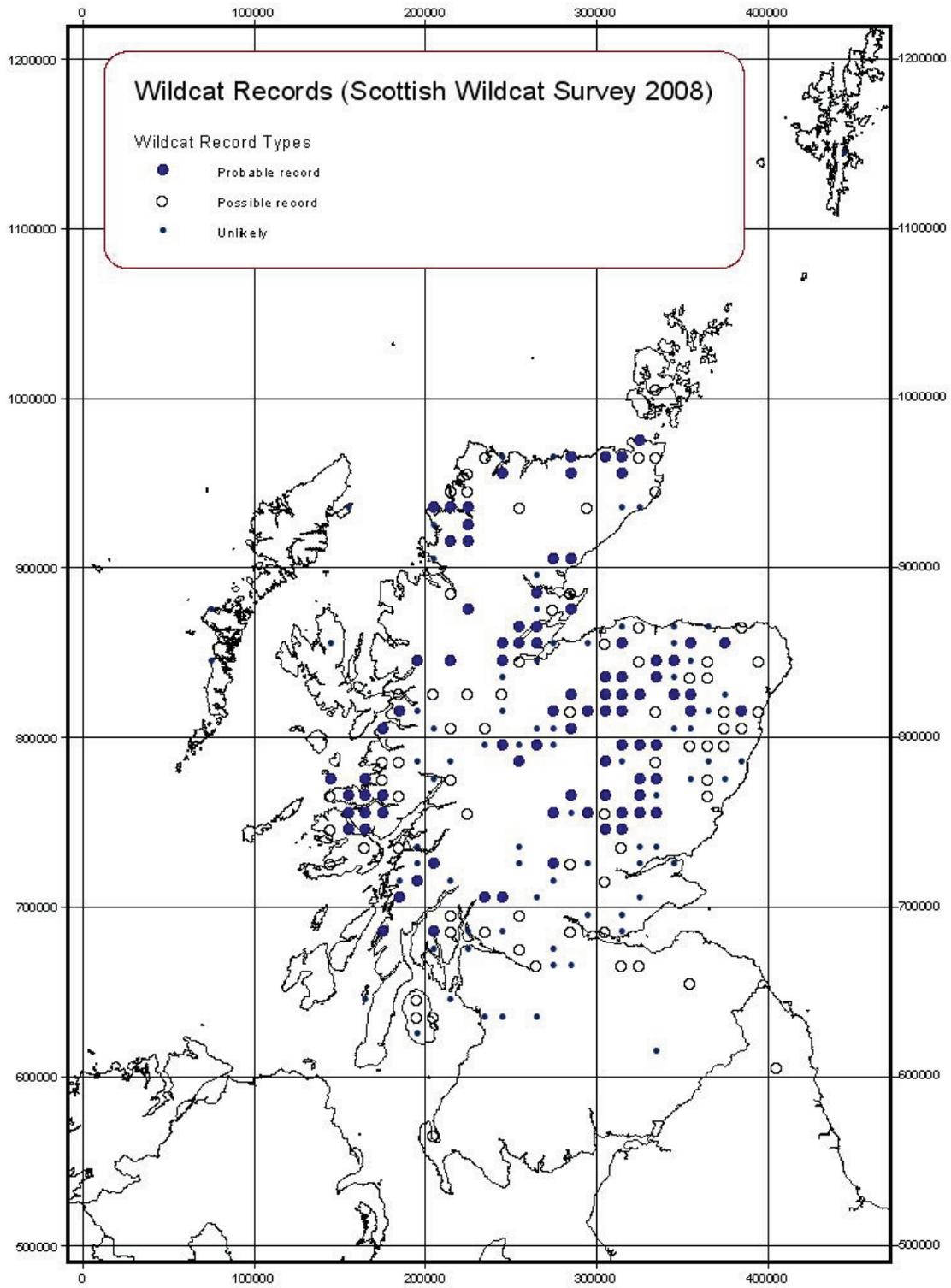


Figure 4: Wildcat distribution in Scotland 2006-08

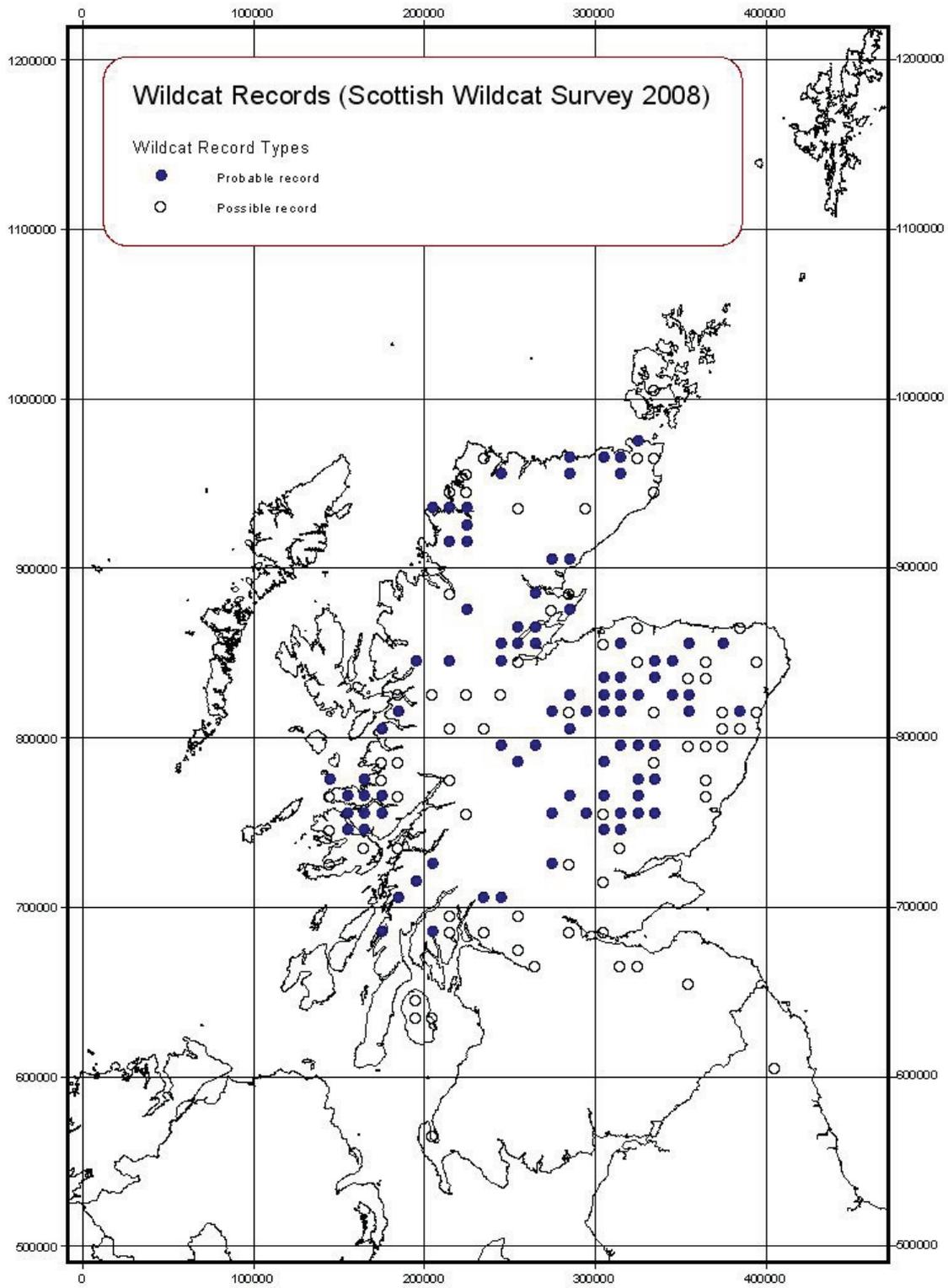
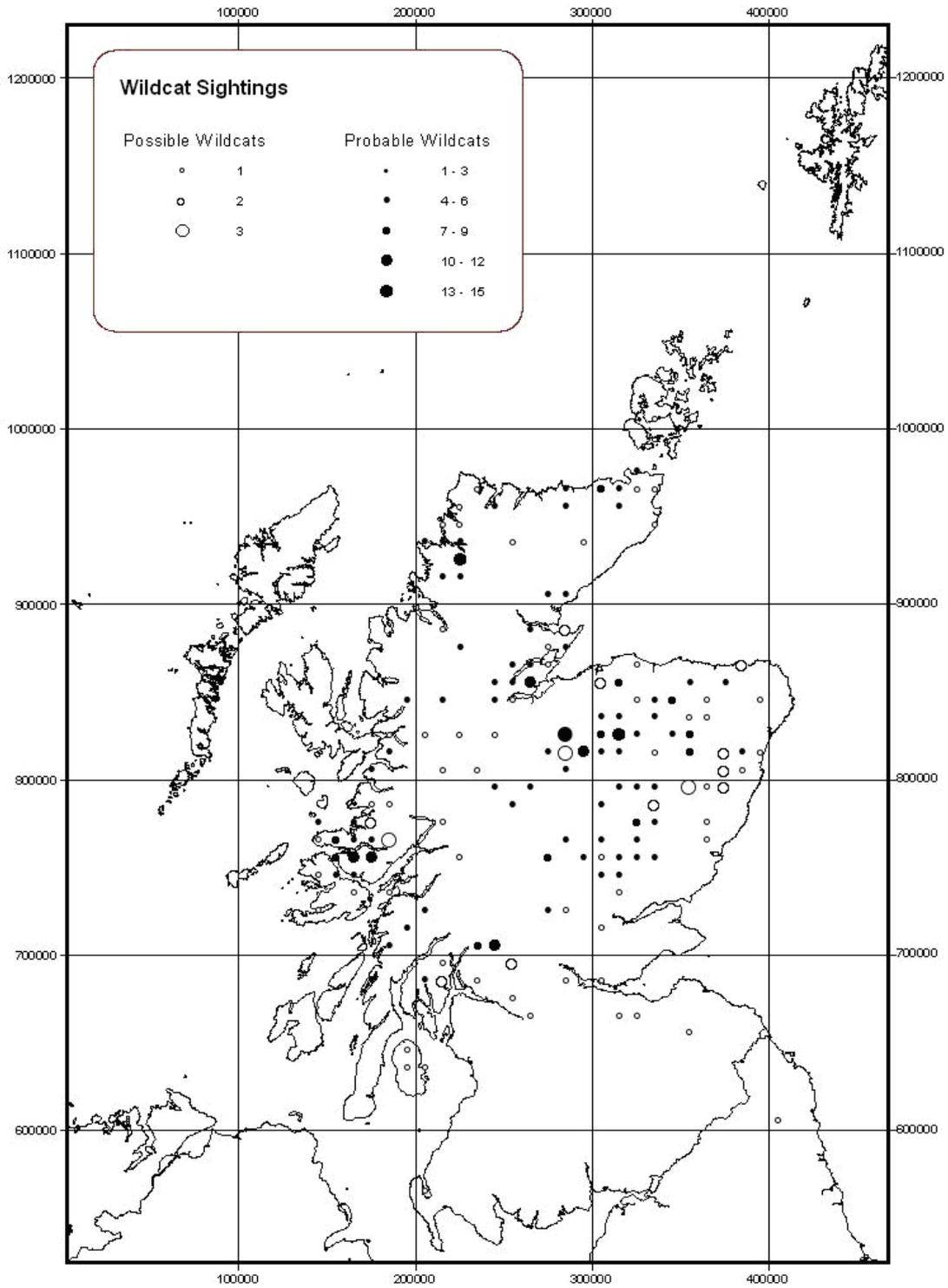


Figure 5: Probable and Possible wildcat sightings



4.4. Comparison from 1983–87 to 2006–08

It is not possible to make direct comparisons between the distribution of wildcats obtained in this survey and the results of previous work because of the differences in the way in which data was collected and variations in the areas surveyed. However some broad generalisations can be made.

Figure 6 shows the previous NCC survey and the present survey together for comparison. The interesting findings point to little change in the overall distribution of established wildcat records from the NCC survey to this one. The most positive records, i.e. probable wildcat sightings in a square, were for NM followed closely by NJ and NH; the same as the findings of the previous survey. Using a term previously coined in the NCC survey, it is presumed that wildcats are established (wildcats regularly recorded each year) in NM, NJ and NH showing a northerly distribution, but the fact that we found them in less significant numbers in NO and NN showed that there are relatively good numbers potentially south of the core areas since 1983.

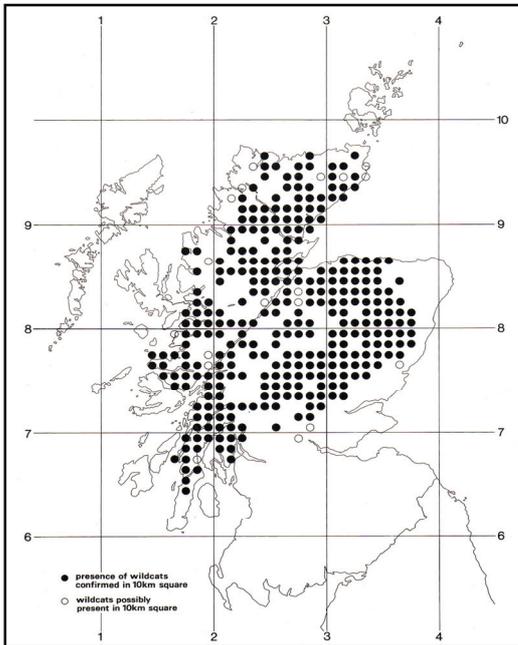


Figure 6a: Records of wildcats from the 1983-87 survey

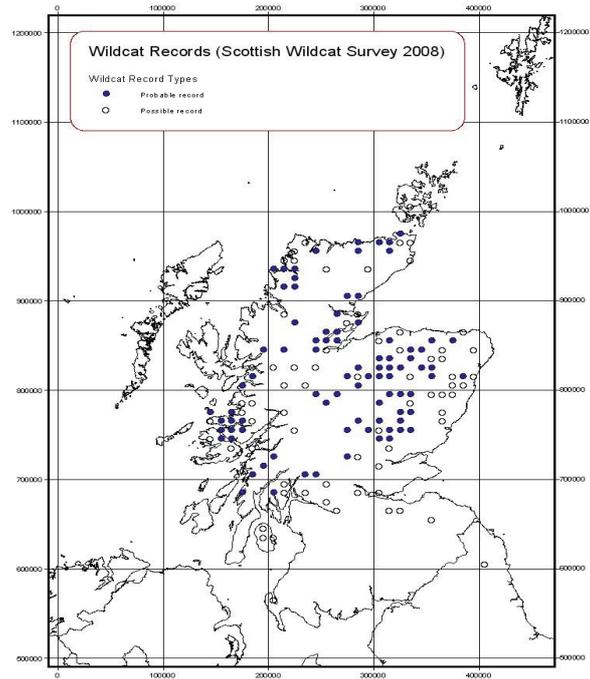


Figure 6b: Records of wildcats from the 2006-08 survey

The distribution of "possible wildcats" also extended further south in the 2006-2008 survey and these possible wildcat records, based sometimes on quite limited information, could not be entirely ruled out especially when some of the key pelage criteria are recorded. Geographical information alone could not rule out the possibility of wildcats occurring if the description and recorder is bona fide.

The 1983-87 survey also indicated the records were more accurate than the 2006-08 survey with more confirmed wildcats present in their survey a result of their method of predominantly carrying out personal interviews with gamekeepers, forest workers, fox hunters and hill shepherds.

4.5. Wildcat identification characteristics (pelage) in the field.

A table showing the frequency of recorded pelage characters from the questionnaires and the leaflets is shown below.

The questionnaire data characters relating to the tail were widely recorded, and there are fewer observations with no information than is the case with the other types of character. Only the note of whether the pattern is a tabby pattern has a greater score count. The character involving stripes on the flanks has a moderate score count, but there are relatively large numbers of records where the presence of white on the feet or muzzle has not been seen. It can also be seen that there are very few records in the tail features for the "non-wildcat" type of score, for example tail tip not blunt or not black.

This further supports the suspicion that observers are selecting tail characters in reporting sightings. However the questionnaire was sent to the recorders who were from the farming, game-keeping and landowner community and others that included trusted observers that were targeted at the start of the survey. Therefore the better knowledge of these people in relation to identification of wildcats may be evident here with a wider number of wildcat pelage characters confirmed during observation.

Further details of the precise relationship between the characters and the categories the cats were classified into are presented in the statistical analysis.

The leaflet data show characters that have a high percentage of records relate to tail features or overall coat pattern: "stripes all over" may be considered essentially equivalent to the "tabby" character of the questionnaires. Characters relating to the detailed appearance of the stripes have a very low or absent score rate, but there are a moderate number of records for features relating to frequency and distribution of spots on the coat. Surprisingly perhaps, the feature for "black tail tip" has a low score here, with only three records. This may be due to the less experienced recorders being unaware of the pelage criteria to look for.

Table 5: The frequency of recorded pelage characters recorded in questionnaires

<i>Pelage Feature</i>	<i>Pelage Feature Classes</i>	<i>Count</i>	<i>Percentage</i>
Coat Pattern	<i>Tabby</i>	60	70
	<i>Other</i>	21	25
	<i>No Information</i>	7	8
Stripes On Flanks	<i>Distinct</i>	49	58
	<i>Indistinct</i>	19	22
	<i>No Information</i>	20	24
White On Feet	<i>Yes</i>	29	34
	<i>No</i>	3	4
	<i>No Information</i>	56	66
White On Muzzle	<i>Yes</i>	20	24
	<i>No</i>	19	22
	<i>No Information</i>	49	58
Tail Shape	<i>Blunt Tip</i>	65	76
	<i>Intermediate</i>	5	6
	<i>Tapering Tip</i>	2	2
	<i>No Information</i>	16	19
Colour Of Tail Tip	<i>Black</i>	61	72
	<i>Other</i>	2	2
	<i>No Information</i>	25	29
Rings On Tail	<i>Distinct</i>	64	75
	<i>Indistinct or Fused</i>	10	12
	<i>Other</i>	1	1
	<i>No Information</i>	13	15

Table 6: The frequency of recorded pelage characters in leaflets

<i>Pelage Feature</i>	<i>Count</i>	<i>Percentage</i>
Dorsal line to Shoulder	3	4
Dorsal line to Tail-base	10	14
Dorsal line to Tail tip	6	9
Tail tip Tapered	3	4
Tail tip Blunt	49	71
Tail bands Distinct	23	33
Tail bands Indistinct	2	3
Tail bands Dark	47	68
Tail bands Light	2	3
Stripes all over	46	67
Stripes on Shoulders Only	0	0
Stripes on Hindquarters Only	0	0
Stripes None	0	0
Flanks & hindquarters with stripes only	0	0
Flanks & hindquarters with spots only	16	23
Flanks & hindquarters with fewer spots	12	17
Flanks & hindquarters with fewer stripes	2	3
Flanks & hindquarters with no stripes or spots	1	1
Black tail tip	3	4
Stripes and spots	3	4

4.6. Statistical Analysis of Pelage Data

In an attempt to determine the value of particular pelage characters for field identification, a score was devised to show the strength of a particular character in any one of the classified groups. This form of correlation and has been described in the methodology. The results are shown in Table 7. Values are recorded as percentages and the negative values correspond to non-wildcat traits. A table of scores prescribed is given in appendix 4 and relate to Kitchener *et al.* (2005) and pelage characters.

Table 7: Pelage character scores from sighting records

	Probable	Possible	Unlikely/Other
White on Chin	-23	-11	9
White on Paw	100	100	-40
Extent of Dorsal Line	17	70	-33
Shape of Tail Tip	95	98	64
Colour of Tail Tip	100	100	93
Distinctness of Tail Bands	100	96	68
Tabby Coat Patterns	88	73	32
Broken Stripes on Flanks and Hindquarters*	76	22	19
Spots on Flanks and Hindquarters	67	0	0
Stripes on Nape	100	80	-11
Stripes on Shoulder	100	67	50

* In practice the quality of stripes on the flanks and hindquarters were only recorded as “distinct” or “indistinct”. We record “intermediate” (2) for indistinct stripes.

Generally, there is a higher positive value of “probable” wildcat sightings, which is to be expected, and most characters grade down in value for “probable” through “possible” to “unlikely” sightings. Probable records therefore have more of the wildcat pelage character features. Strictly speaking we would expect large negative values for the non-wildcat records, but where this has not happened it is likely to be because most observers would have been intentionally seeking wildcat sightings rather than reporting random observations of cats, and key pelage characters may not have been seen.

The records for the “Extent of Dorsal Line” are slightly anomalous in that there is a higher preponderance of ‘possible’ wildcat sightings strongly showing the wildcat character (line stops at tail base) than for sightings believed to be true wildcats.

Table 8: Statistical analysis of the correlation between the type of cat and the classes of pelage character for each character

Character	Number of classes	Degrees of Freedom	Chi-squared Value (X_0)	Significance Level ($P(X) > P(X_0)$)
White on Chin	2	2	0.58	0.75
White on Paw	2	2	10.91	0.0043
Extent of Dorsal Line	2	2	6.88	0.032
Distinctness of Tail Bands	2	2	2.80	0.25
Tabby coat patterns	2	2	12.93	0.0016
Broken Stripes on Flanks and Hindquarters	3	4	14.50	0.0059

Table 8 shows the statistical analysis based on a chi-squared test on contingency tables where each character is scored against the type of wildcat record by counting the records assigned to each class. The test determines the statistical significance of the correlation between the type of cat (probable wildcat, possible wildcat or other) for each character. Some characters had too few records to test, while others, especially relating to the shape and colour of the tip of the tail, were recorded as being predominantly one type (namely with blunt black-tipped tails), so that again there were too few records in the other classes (wildcat characters) to carry out a meaningful statistical test.

The results show that the scores for “White on Chin” and the “Distinctness of Tail Bands” are not significant. The situation with the former character has been described earlier in the report. The results merely confirm that white around the muzzle area is not a useful character for discriminating between wildcat and other cats.

It might be surprising that tail band features show little difference between the groups. In this case it is probably because the characters of the tail were the most well-known to the recorders (especially in the questionnaires) suggesting this potentially selects for trusted observers or more experienced recorders. Some characters would be pre-selected by people reporting a possible sighting if they had prior knowledge and the tail is an obvious feature to see. The other possible assumption may be that people were simply not seeing much more than the tail and hybrids may well have these features; it just depends on the quality of sighting and level of hybridization.

The extent of the dorsal line and white on the paw and foot are other characters that show significant differences between the classes, the white on the foot because it is a definitive negative character, which help the assessment and point to non wildcat characters.

4.7. Dead wildcats

It was originally hoped that dead wildcats would be included in the assessment for the survey to verify wildcat sightings as this may help our findings and be a form of cross-reference. However this was not part of the NCC study as far as we were aware but, as it was legal to take wildcats prior to 1988, some may have been recorded like this. All cat details were recorded for this survey. One dead wildcat was collected at an interview and appeared to fulfill all the pelage criteria for wildcat.

4.8. Interviews

All the interviewees (many of whom were trusted observers) were asked to give an indication of whether they felt wildcat numbers were increasing or decreasing in the area. These were based strictly on personal observations. People also gave their views on other factors such as killing issues, hybridization and habitat change.

Of 55 respondents, none said they were increasing, 17 said they were stable and 17 decreasing in their area. The rest (21) offered no view on the status of the population in their area.

4.9. Limitations of the Survey

The limitations of the survey were mainly due to the difficulty in seeing the pelage characters clearly enough to make a judgement about whether a wildcat or other cat was observed. Identification of wildcats in the field is difficult. Unless a wildcat is found dead, or there is a good view for a long period of time or with photographs or film footage, it is difficult to categorically state you have seen a wildcat.

The experience of recorders, such as farmers and gamekeepers, was assumed by the NCC survey to be a major element in identifying wildcats. It was assumed that certain groups of recorders could recognise wildcats. This information was often discussed at interview and the recorder would describe the sighting giving some indication of the pelage and any differences from specimen type where a clear sighting was available. In some cases this may have involved accidental trapping and release. However a rigorous and standardised test above this questioning was not undertaken so there may have been some subjectivity in this assessment.

It has also been informally reported by people working with wildcats in zoos and breeding programmes that seasonal pelage variations occur, particularly during summer months. The pelage characteristics are only one element of the identification of the wildcat in the field and other factors such as their morphology and behaviour need to be addressed.

There was limited response obtained from estate workers, hill shepherds, and gamekeepers. This was the main shortcoming of this survey.

5. Discussion

The identification of wildcats using the key pelage characters described above is dependant upon the sighting duration, view and light conditions. 13% of recorders were trusted observers and many records are likely to have derived from poor quality sightings where observers may only have seen the tail and/or a brief glimpse of the flanks and head. The sightings were therefore very variable, with many incomplete questionnaires and leaflets making it difficult to determine critically whether people were seeing wildcats.

The previous NCC survey may have had a higher success in gaining records from keepers who had seen cats at close quarters. This may have given more assured reports from this group of recorders than were obtained in the present survey. The experience of recorders may also be a factor in identifying wildcats accurately and we questioned recorders at interview on this subject to get further insight into their experience. The previous NCC survey targeted gamekeepers, fox hunters and hill shepherds and we also engaged with these groups. However it proved difficult to get much feedback from them. This may have been due to the absence of wildcat on estates or due to the changes in legal status which reduces the chances of them seeing animals in the course of their work.

The records we generated were mostly from the public and statutory agencies, particularly foresters and SNH staff. With public records we tried to gain knowledge of previous experience by asking guided questions, such as "Have you seen wildcats previously?" or "Do you have other relevant experience?" in interviews and during other conversations.

The previous survey showed the preference of wildcats for land use classified as varied lowland margins with heterogeneous land use and often afforested upland margins with valley slopes.

5.1. Distribution and Status

Island populations of wildcats have not been previously recorded but there is apparent evidence of these from this survey. Unless animals have been overlooked historically, these must have reached colonized since the last survey or have been introduced to the islands. Some of the records were indicative of wildcat showing all pelage characters but in previously unknown locations for wildcats. These cannot be discounted.

Wildcat "hot spots" do occur in the records with a large number recorded for the Cairngorms, Tayside and Aberdeenshire as well as outlying areas of Arnamurchan. These are locations where, historically, there have always been wildcats recorded in significant numbers. However there also appear to be areas where there are no records, especially large areas of the north-west Highlands, Wester Ross and parts of north Stirlingshire. Records were generally from more lowland areas indicating that wildcats are not an animal of mountain plateau. Some cat paw prints were found here but could not be conclusively identified as wildcat. Some hill walkers recorded seeing wildcats adjacent to mountainous areas but these records were limited to the lower lying areas and straths. There was a lack of records from mountainous and remote areas. There were many more records in coastal areas.

Records of wildcats occur near settlements in Scotland and there was a frequent occurrence of wildcat sightings in and around towns such as Aviemore and some other smaller villages in the Cairngorms and Ardnamurchan. In particular some of these

sightings were alongside recent new housing developments which have encroached onto wildcat habitat, characteristically tall grasslands along river margins with thickets of scrub and tree cover and good rabbit populations. Historic evidence suggests wildcat populations have always established territories in these areas and may still exist very close to these new developments. However sightings are rare in these areas, probably because of their nocturnal habits and people being unaware of the distinction between wildcats and their domestic cousins in their environment.

5.2. Pelage characteristics

One of the pelage character analyses was to identify which of the seven characteristics were most often seen/reported by observers. The purpose of this was to get an idea of how practical/obvious the features were under field conditions. The most common characters observed were the tail features and the striped appearance. As a tool for identifying wildcat in the field, these are easily observed. Without these, judgment about the records accuracy depends on someone's word and experience. Obviously additional information on pelage was essential, which is why most of the positive records originate from questionnaires and leaflets, followed by those from trusted observers.

With respect to wildcat pelage analysis, in the ideal scenario all pelage characters would be observed with wildcats and non-wildcats clearly defined, accurately classified and the character being scored makes a perfect distinction between the classes. In this case we would expect the score for the wildcats to be 100%, while that for the non-wildcats would be minus -100%. All characters are important in identification of a wildcat. In the statistical test some characters were more significant than others when observed. Individual characters can introduce a bias into the score, whether this is a large and significant difference or a smaller distinction that can only be detected by statistical tests. Because our questions were based on positive and negative correlations, such as the broken stripes on flanks and hindquarters, the non-wildcat pelage characters correlate to non wildcat records. A truly representative statistical analysis would have to draw comparisons between observed pelage data and independently assessed categories of cat by a more rigorous procedure where it has been determined precisely what defines the categories (wildcat, hybrid, domestic) and where a clear protocol for diagnosis has been laid down. Without this, any statistical study will inevitably introduce an unknown measure of autocorrelation in relating the results back to initial assumptions about the classification procedure. Unfortunately, the present study, based as it is on public sightings and other reports of varying quality must inevitably suffer to some degree from this drawback.

The reason for carrying out this scoring exercise was to find a more quantitative way of determining which pelage characters are more reliable or whether they are all required for determining, or contributing towards the determination of, true wildcats. Observer quality must also be based on a largely subjective assessment of the observers own description of their experience and qualifications.

The tabby coat pattern, and distribution of spots and stripes, show clearly different values between the groups. For example, for the character "broken stripes on flanks and hindquarters", the score is 76 for probable wildcats, 22 for possible wildcats and 19 for non-wildcats. This character shows a very clear difference between the probable wildcats and the other groups. Other characters show similar trends, though some were too rarely recorded to be able to carry out a statistical test and so the figures cannot be considered reliable. Additionally characters relating to the tail do not provide a clear

distinction between the groups. This is likely to be due to the statistical analysis used and the ability to distinguish these characters in the field. However, in this case, this may be due to observer bias pre-selecting sightings of wild-living cats based on their tail characteristics.

Kitchener *et al.* (2005) set a clear description for wildcat pelage but it is recognised that, unless a wildcat is observed in great detail in the field, the quality of the judgment to determine a wildcat is bound to be tinged with some doubt.

Previous researchers, including Easterbee *et al.* (1991), described wildcats with white around the muzzle area. The statistical analyses and chi squared test based on individual characters are not useful for distinguishing the difference between wildcats and feral cats alone. The main core pelage characters such as the blunt black tipped tail were commonly recorded but could not be tested due to insufficient sampling, but any negative characters such as white on paws are known spoilers. The wildcat pelage characters tested did not all prove statistically significant although some were, and this was because there was not always a significant number of characters recorded. So, as far as pelage is concerned, the information points to some characters being more evident than others in field identification but, as a whole, all are need to positively record wildcats. The tail band features show little difference between the probable, possible and non-wildcat groups so the records submitted did not show a significant difference between hybrids and wildcats.

A statistical analysis should draw comparisons between clearly observed pelage data and independently assessed categories of cat. This requires a rigorous procedure which precisely defines the categories (wildcat, hybrid, domestic) and has a clear protocol for diagnosis laid down. Without this, any statistical study will inevitably introduce an unknown measure of autocorrelation relating the results back to initial assumptions about the classification procedure. Unfortunately, the present study, based as it is on public sightings and other reports of varying quality will inevitably suffer to some extent from this drawback. Methods where the whole cat can be observed, and all the pelage details noted, would prove more successful in determining wildcats in the field.

5.3. Population trends

Interviews generated data on pelage together with subjective information about the relative population of wildcats in a given area. Further analysis of the location of those interviewed and their comments revealed the majority of the views on decreasing numbers related to ND, NO and NH. The survey distribution maps seem to conform to Daniels *et al.* (1998) distribution maps which closely resemble our distribution in Figure 4, and include NM and NJ. Generally the impression is that wildcat numbers are stable in the core areas NJ and NH as well as NM. However other interviewees expressed concern that they see fewer wildcats these days and this was particularly evident in NC and ND in the far north, and possibly in NO and NN. Many farms had been abandoned in Caithness and some feral cats were known to have been left behind (M. Legg *personal communication*). Changes in land use may play an important part as marginal farms are completely neglected resulting in changes of habitat type from grassland to scrub which may favour wildcats.

5.4. Killing

The Kitchener pelage characters were referred to in many of our interviews and a good proportion of observers were aware of these criteria. There were, however, still a number of keepers who were unaware of some of the key characters. Retired keepers were more willing to discuss the issues.

The control of cats is an integral part of management on sporting estates in Scotland (Reynolds & Tapper, 1996). During Daniels' fieldwork in 1997, 42% of radio-tracked cats were killed during predator control procedures. Current control methods include snaring and lamping (shooting at night with a bright light), neither of which is able to discriminate between wildcats and feral domestic cats. Snaring accounted for 58% of recorded wildcat mortality in one estate in 1979 so, whilst there is little current information on incidental capture rates, the use of snaring may continue to present a problem.

5.5. Hybridisation

It is unclear how hybridisation is affecting the wildcat population. There is little research in Scotland to determine the degree of hybridisation between wildcats and feral cats although it is speculated that future genetic tests may be able to identify the genetic purity of the population. Figure 3 identifies unlikely wildcat records with these more likely to be hybrids or feral cats. There was considerable overlap with wildcat records as well as some records on the edge of the wildcat range. This survey indicates that, based on the results and distribution of probable and possible wildcats, there are still core areas for wildcats. More detailed research is required to clarify the situation, preferably along the lines of the methodology of the Daniels *et al.* (1998) field study to trap cats (see below).

Hybridisation is more likely in areas where there are numerous domestic cats and therefore human populated areas are more at risk than remote areas. The purest remaining populations are most likely to be in the remote north and west, especially coastal areas that have been continuously occupied by wildcats and have low domestic and feral cat numbers. If taken to a logical conclusion, and interbreeding occurs between wildcats and hybrids or domestic cats, then some pelage characters will be similar hybrid animals, causing confusion when observed in the field.

In terms of a field test for wildcat pelage it is likely that we can only be relatively subjective and say that any wildcat with a bushy tail with a blunt black tip and stripy pattern is a wildcat. However we would add that any cat with white feet or white markings on the body (except the throat and muzzle) is not a wildcat.

5.6. Other cat studies

Feral cats have not been studied except by Balharry & Daniels (1998) in their paper on wild-living cats in Scotland. It is interesting to note that there is, therefore, little detailed information about the relationship between wildcats and wild-living cats and much of the research to date explores hypothesis rather than fact. This leaves many unanswered questions about wildcat and feral cat inter-relationships, habitat availability for two potentially competing animals and the question of hybridisation.

Seasonal variations in coat pattern have been reported and therefore great care should be taken to ensure that wildcats are preserved and natural variation is allowed to be maintained.

5.7. Habitat loss, fragmentation and damage.

Several development projects were reported to us with wildcat populations thought to be within the development area. However, with no evidence of their presence, no mitigation had been proposed. If correct, this may damage wildcat habitat and range. At present it is very difficult to find dens or even signs of wildcats even when there have been regular sightings from reliable sources. Further evidence is required to substantiate this but these records were passed to SNH for further consideration.

6. Conclusions

6.1. Evaluation of the technique and comparisons with the previous survey

The distribution of wildcats identified by this survey is similar to the previous 1983-87 survey. However, there are some key issues to note.

a) *Legal context*

The previous survey was conducted prior to the introduction of legal protection in 1988. This resulted in some of the methods used in the previous survey, e.g. game bags, being unavailable for the current work. New approaches to survey wildcat in the future would be beneficial.

b) *Survey methodology*

The success of the survey is heavily dependent on the movements of recorders in remote areas. The ongoing need for records and feedback from remote locations indicates the importance of having the support of the landowning community. This consultation spanned a period of 2 years compared to the previous survey which was conducted over a significantly longer time period (1983-87). The latter demonstrated greater success in gathering records from trusted observers. It also illustrated a wider range in wildcat sightings than recorded between 2006 and 2008.

Various options for identifying wildcats have been presented by Balharry & Daniels (1998) and by Kitchener *et al.* (2005). However, the latter (pelage) method was most useful for undertaking a wide ranging distribution survey. Not all characters may be seen in the field unless the animals are observed clearly with all the pelage characters recorded. However because of the complexities and difficulties in identification, future methods should include ground-truthing to test observations by tracing wildcats in the field against observations because most people never see them well enough. A strict protocol is required for any observation and it may be more productive to use a team of surveyors around the country to sample the wildcat population in selected areas.

c) *Survey results*

Wildcat sighting data appear to indicate wildcat strongholds in Ordnance survey squares identified by NJ, NM and NH. The status of wildcats is less clear in other areas. The Easterbee survey range was, in comparison, more extensive throughout Scotland and extended well beyond human settlements. It showed the presence of wildcats in many squares not recorded by this survey, especially in Sutherland, Caithness and along the Great Glen and into Argyll. The distribution of these records was more extensive and occurred into the higher mountain ranges in the north and west, often where there were low human densities and places where only people working on the land would go.

Records have been submitted of possible wildcats in several new areas such as the Borders, Northumberland and Ayrshire. These are most unlikely to be wildcats but there is some knowledge to support the view that wildcats are being moved around the country and therefore new populations may already have established (A. Kiggins *personal communication*).

6.2. Conservation recommendations

Future wildcat surveys should focus more on evidence-based techniques. This will help for wide-ranging population, density and comparative studies and may increase our understanding of wildcat dispersion and behaviour. Trapping may be required under license employing similar techniques as those used by Balharry & Daniels (1988) to determine wildcats and closely related hybrid populations. Other sampling techniques, for example hair catching with the aid of lure sticks, may be possible once genetic methods become available. Camera traps could be used in known wildcat territories.

Similar techniques may also be necessary to assess development impacts. This should include clear guidance on future wildcat survey methods.

The previous NCC survey identified considerable areas of suitable habitat in southern and eastern Scotland. These should be taken into account in the event that other locations were to be considered for the possibility of re-introduction of wildcats.

Engagement with landowners is paramount to secure conservation of the species. This includes control of feral cats, and retaining cover and prey on suitable sites. There is some scope for this through management agreements.

Clear guidance is required for pet owners of domestic cats and farm cats where wildcats occur so that hybridisation is minimised. Alternatives should be discussed to control feral cats in these areas. Vets, the Cats Protection and estate keepers should be involved in these discussions.

New development pressures, such as quarries, recreational and access facilities and wind farms, may also impact on wildcats. Felling large areas of woodland for these removes cover and shelter and may be a threat to wildcats in some areas. Suitable habitat enhancement and retention of some cover in these areas is necessary to conserve the wildcat populations already present. A key to this is to establish an acceptable wildcat survey methodology which can clearly identify wildcats in the field.

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Appendix 1: Database design

Field structure of the database tables

The following table shows the database fields employed in the table of records of sightings. Records have been standardised as much as possible. However, observations on pelage characters have separate sets of fields for the leaflet data and the other sources.

<i>Field ID</i>	<i>Description</i>	<i>Data Class</i>
RowID	Database record identifier	Record identification
RecordID	Record unique ID	
Source	Source of record, e.g. questionnaire, leaflet, etc.	
Observer_Ref	Unique observer ID	Data about observer
Surname	Surname of observer	
Firstnames	Observer's first names	
StartDate	NBN Compliant Date Information	Data about the observation
EndDate	NBN Compliant Date Information	
DateType	NBN Compliant Date Information	
Time	Time Data	
Time_Type	Time Data	
Location	Location of Sighting	
GridReferenceOriginal	Original Grid Reference submitted	
GridReference	Valid Grid Reference	
Precision	Precision of Grid Reference	
Upland	Sighting in upland habitat	
Farmland	Sighting in farmland habitat	
Woodland	Sighting in woodland habitat	
HabitatDetail	Free-form habitat description	
BAPHabitat	Not used currently	

Appendix 1: Database design

WhereSeen	Free-form information about sighting	
DistanceFromBuildings	Distance from nearest buildings	
DistanceFromBuildingsNumeric	As above - numeric field	
DistanceFromRoads	Distance from nearest road	
DistanceFromRoadsNumeric	As above - numeric field	
NumberOfCats	Number of cats	Core data about the cat
NumberOfAdults	Number of adult cats	
NumberOfKittens	Number of kittens	
Description	Free-form description of cat(s)	
CatAlive	Cat alive or dead	
CauseOfDeath	If dead, apparent cause of death	Pelage data
CoatPattern	e.g. tabby, tortoiseshell	
StripesOnFlanks	Are there stripes on flanks?	
WhiteOnFeet	Is there white on the feet?	
WhiteOnMuzzle	Is there white about the face?	
TailShape	Tail blunt or tapered?	
ColourOfTailTip	Colour of tail tip	
RingsOnTail	Are there distinct "wildcat" rings on the tail	
AdditionalComments	Any further comments	Information relating to the possible validity of the record
OwnEvaluation	Does the observer believe the sighting to be a wildcat?	
Why	If so (above), what is the main reason?	
Confidence	How confident is the observer in their assessment?	
SeenBefore	Has the observer seen wildcats before?	

Appendix 1: Database design

RelevantExperience	What is the observer's relevant experience of wildcats?	
Contact	Is there contact information	Further miscellaneous data about the record
Status	Working field to score the records state	
Images	Images if present	
SubmissionDate	Date of submission if relevant	
SubmissionTime	Time of submission if relevant	
LF_Habitat_CW	Coniferous woodland	
LF_Habitat_BW	Broad-leaved woodland	
LF_Habitat_MW	Mixed woodland	
LF_Habitat_Unimproved	Unimproved land	
LF_Habitat_Garden	Garden	
LF_Habitat_Urban	Urban	
LF_Dorsalline_Shoulder	Dorsal line extends to shoulder	
LF_Dorsalline_Tailbase	Dorsal line extends to base of tail	
LF_Dorsalline_Tailtip	Dorsal line extends to tip of tail	
LF_Tailtip_Tapered	Tail tapered to tip	
LF_Tailtip_Blunt	Tail blunt at tip	
LF_Tailbands_Distinct	Distinct tail bands	
LF_Tailbands_Indistinct	Tail bands indistinct	
LF_Tailbands_Dark	Tail bands are dark	
LF_Tailbands_Light	Tail bands are light	
LF_Stripes_Allover	Stripes all over coat	
LF_Stripes_Shoulders_Only	Stripes on shoulder only	
LF_Stripes_Hindquarters_Only	Stripes on hindquarters only	
LF_Stripes_None	Unstriped	
LF_Flankshq_Stripes_Only	Flanks and hindquarters with stripes but no spots	

Appendix 1: Database design

LF_Flankshq_Spots_Only	Flanks and hindquarters with spots but no stripes	
LF_Flankshq_Fewer_Spots	Flanks and hindquarters with spots and stripes, but fewer spots	
LF_Flankshq_Fewer_Stripes	Flanks and hindquarters with spots and stripes, but fewer stripes	
LF_Flankshq_Nostripesorspots	Flanks and hindquarters with neither stripes nor spots	
LF_Blacktailtip	Tail tip is black	
LF_Stripesandspots	Stripes and spots generally are present	
LF_Catsameaspicture	Is the cat similar-looking to the illustration in the leaflet	
DG_Conclusion	Coded confidence assessment for probable wildcat sighting	Information about final conclusion and confidence level
NH_Conclusion	Working field for assessing confidence	
AD_Conclusion	As above	
Justification	Brief justification for the final conclusion	

Flanks or hindquarters

- Spotted only
- Striped only
- Fewer spots than stripes
- Fewer stripes than spots
- Neither stripes nor spots

Do you have a photograph of the cat that you can supply for us?

Was the cat alive or dead?

If dead, what was the cause of death (*tick a box*)

Road kill Other

Name _____

Address _____

Tel _____

Email _____

We are also interested in collecting any dead wild or feral cats you may find. If you have any information on location of a carcass, please call the number below.

Would you like more information and/or would you like to be involved in the more detailed interview and questionnaire survey?

Yes No

Please contact Adrian Davis on **01350 727201** or mobile **07761673231** or e-mail: **naiadecology@hotmail.co.uk**

Alternatively write to:

Naiad Environmental Consultancy
Birnam Guest House
4 Murthly Terrace
Birnam
Dunkeld
PH8 0BG

The Scottish Wildcat Survey is a three year project to systematically survey wildcats throughout Scotland and is funded by Scottish Natural Heritage under the Species Action Framework. www.snh.org.uk/speciesactionframework

You can also complete this survey form online at: www.naiadecology.co.uk

speciesaction
 FRAMEWORK

**SCOTTISH
 NATURAL
 HERITAGE**

**DUALCHAS
 NADAIR
 na h-ALBA**



The Scottish Wildcat is the only native cat in the British Isles. Although originally distributed throughout Britain, the species suffered a marked decline in numbers in the 19th century due to deforestation and persecution, and is now restricted in its range. Scottish Wildcats are now one of Britain's rarest mammals and may be in serious danger of extinction

One of the major problems for wildcat is their ability to interbreed with feral and domestic cats (which were originally introduced to Britain more than 2,000 years ago). This dilutes their genetics and creates hybrid animals whose appearance can be confused with wildcat. In many cases, there is little distinction between these animals but research has identified the following as helpful points to distinguish between them:

- Shape of tail tip;
- Appearance of tail bands ;
- Broken stripes on flanks and hindquarters;
- Length of dorsal line;
- Spots on flanks and hindquarters;
- Stripes on nape;
- Stripes on shoulder.

Research has shown that wildcats live predominantly on the forest edge, between the uplands and the lowland margins, where there are low human populations and where domestic and feral cat numbers are low. They generally forage on rabbits and on other mammals such as voles.

The Scottish Wildcat Survey 2007-2008

The last survey of Scottish wildcat was conducted in 1983-87. Since then, there has been little data collated to help monitor any changes in wildcat numbers or range. It was estimated, in 1995, that there could be as few as 3,500 wildcat left in Scotland.

We need your help to determine the current status of wildcats in Scotland

- Have you seen a wildcat?
- Where have you seen or heard about wildcats?
- Do you know anyone who has seen a wildcat?
- Are there feral (i.e. wild-living domestic) cats and domestic cats in your area?

We are also interested in your sightings of feral cats that are living in your area.

If you can help, please fill in the following information overleaf and send it to the address given.



Scottish wildcat survey

Seen where? National grid reference:

Place name (*preferably from Ordnance Survey map*):

When? (*Please give date as precisely as possible*)

Type of Habitat:

- Coniferous woodland
- Broadleaf woodland
- Mixed woodland
- Unimproved land
- Farmland
- Moorland/bog

Can you say if the cat had the following (*please tick any which apply*):

- Dorsal line**
- To shoulders
 - To base of tail
 - To tip of tail

- Shape of tail tip**
- Tapered
 - Blunt

- Tail bands**
- Dark
 - Light
 - Distinct
 - Indistinct

- Stripes**
- All over body
 - On shoulders only
 - On hindquarters only
 - No stripes

Appendix 3: Survey questionnaire

Scottish Wildcat Survey

Please help us to determine the current status of the Scottish Wildcat by submitting any recent sightings of wild-living cats in Scotland on this questionnaire. The Scottish Wildcat is the only native cat in the British Isles. Although originally distributed throughout Britain, the species suffered a marked decline in numbers in the 19th century due to deforestation and killing, and is now restricted to Scotland. Scottish Wildcats are now one of Britain's rarest mammals and may be in serious danger of extinction.

The last survey of Scottish wildcats took place over 20 years ago. The purpose of this survey is to provide updated information on their distribution to allow conservation measures to be implemented efficiently and effectively. Scottish Wildcats interbreed with feral (i.e. living in the wild) domestic cats. Indeed, this is one of the main threats to their continued existence as a distinct species. Therefore we would also like a better understanding of the distribution of feral domestic cats in Scotland. Separating wildcats from feral domestic cats in the field can be very difficult, particularly given the existence of hybrids. For both of these reasons we would like observers to use this questionnaire to submit all recent sightings (i.e. within the last five years) of wild-living cats, whether they think they are feral domestic cats, or wildcats. Any photographs or videos of sightings would be extremely useful, and we would be very grateful if you could provide copies of any such images along with the questionnaire. If you are unable to give details on sightings of individual cats, general information on cat sightings in your area during this time would also be useful.

Additional copies of this questionnaire can be obtained from Adrian Davis at the address/phone number given below. They can also be downloaded from www.naiadecology.co.uk by following the wildcat survey link. Questionnaires can also be submitted electronically to Adrian at naiadecology@hotmail.co.uk

This questionnaire can be used to record sightings of both live and dead cats. We are also very interested in obtaining carcasses of dead wild-living cats. Often, such cats are found on roads. If you find such a cat:

- Park safely and watch out for other traffic
- Make sure you do not compromise your own safety or that of other road users.
- Check for signs of life before touching the animal (if alive, do not touch it).
- If animal is badly squashed, or you are not able to collect it, please take photos (showing tail, shoulders, flanks, muzzle and feet if possible).
- Use plastic bags or gloves to recover the body.
- Securely seal the body in plastic bags and keep it cool (ideally deep-frozen).

Phone Adrian Davis on 01350 727201 for instructions (you may be asked to post the body in packaging supplied by Adrian, or we may be able to arrange for the carcass to be collected from you).

Please use this questionnaire to provide further details. If you are providing a carcass please include the questionnaire within the same package. Alternatively, if the carcass could not be collected, or is not required, please submit the questionnaire to the postal address given below along with any photographs taken.

Appendix 3: Survey questionnaire

We are also keen to obtain carcasses which have died in other ways. In particular, we would be particularly interested in animals accidentally killed during legal predator control activities.

Many thanks in anticipation for your help with this survey.

Appendix 3: Survey questionnaire

Scottish Wildcat Survey

Please complete the form as fully as you can, but even partially completed forms will provide valuable information. We fully expect that during many sightings, only a small number of the coat characteristics will be clearly seen.

Personal Details

Name: _____

Address: _____

Postcode: _____

Phone Number: _____

e-mail: _____

We may want to contact you to obtain further details of your sighting. If you do not want us to contact you again, please tick the following box.

Your sighting

Date: _____

Time: _____

Location of cat (Please describe as accurately as possible, giving name of nearest town, road, hill or forest as appropriate and/or a postcode).

Ordnance Survey Grid Reference (6 figure):

Habitat (if roadside carcass, surrounding area):

Mountain and moorland

Farmland

Forest and woodland

Other, please specify:

Distance from nearest building:

Distance from nearest road:

Number of cats

Adults

Kittens

Appendix 3: Survey questionnaire

Description of cat

(Where more than one adult is seen, please use additional questionnaires to describe each adult. Do not describe kittens).

Cat alive? Yes No

If dead, apparent cause of death:

Coat pattern

Black and white Black Tabby Tortoiseshell Other Not seen

Stripes on flanks

None Indistinct Distinct Not seen

White on one or more feet

Yes No Not seen

White on muzzle

No Yes Not seen

Tail shape

Blunt tip Intermediate Tapering tip Not seen

Colour of tail tip

White Black Other Not seen

Rings on tail

Absent Indistinct or fused Distinct Not seen

Additional comments

Your own evaluation of the sighting

Do you think your sighting was a Scottish wildcat or a feral cat?

Feral domestic cat Wild cat Don't know

Why?

How confident are you of your identification?

Definite (100% sure) Probable (75% sure) Possible (50% sure)

Have you seen wildcats previously, or do you have other relevant experience (e.g. local gamekeeper or farmer, naturalist)? If so, please provide details

Appendix 4: Table of Pelage Data Scores

Character	Sighting:	<i>Unlikely</i>	<i>Possible</i>	<i>Probable</i>	<i>Total</i>
	Character Score				
White on Chin	1	7	10	7	24
	2	0	0	0	0
	3	3	8	5	16
	Total	10	18	12	40
White on Paw	1	10	0	0	10
	2	0	0	0	0
	3	12	8	10	30
	Total	22	8	10	40
Extent of Dorsal Line	1	7	1	1	9
	2	2	1	3	6
	3	3	8	2	13
	Total	12	10	6	28
Shape of Tail Tip	1	4	0	1	5
	2	9	1	0	10
	3	34	62	39	135
	Total	47	63	40	150
Colour of Tail Tip	1	1	0	0	1
	2	0	0	0	0
	3	26	33	29	88
	Total	27	33	29	89

Appendix 4: Table of Pelage Data Scores

Distinctiveness of Tail Band	1	1	0	0	1
	2	12	2	0	14
	3	30	49	37	116
	Total	43	51	37	131
Tabby Coat Patterns	1	12	6	2	20
	2	2	0	0	2
	3	24	37	28	89
	Total	38	43	30	111
Broken Stripes on Flanks & Hindquarters	1	15	23	27	65
	2	13	11	4	28
	3	8	13	2	23
	Total	36	47	33	116
Spots on Flanks & Hindquarters	1	3	1	0	4
	2	0	4	1	5
	3	3	1	2	6
	Total	6	6	3	15
Stripes on Nape	1	5	0	0	5
	2	0	1	0	1
	3	4	4	2	10
	Total	9	5	2	16
Stripes on Shoulder	1	0	0	0	0
	2	1	1	0	2

Appendix 4: Table of Pelage Data Scores

	3	1	2	1	4
	<i>Total</i>	2	3	1	6



Scottish Natural Heritage is a government body responsible to the Scottish Government.

Statement of principles:

Scottish Natural Heritage – the government body that looks after all of Scotland's nature and landscapes, across all of Scotland, for everyone. Our 5 strategic priorities are:

- Caring for Scotland's nature and landscapes
- Helping to address climate change
- Delivering health and well being
- Supporting the Scottish economy
- Delivering a high quality public service

Find out more at www.snh.gov.uk

Policy and Advice Directorate,
Great Glen House,
Leachkin Road,
Inverness IV3 8NW
www.snh.gov.uk



Scottish Natural Heritage
All of nature for all of Scotland