Langridge et al. 2025. Saving wildcats in Scotland: first releases of captive-bred European wildcats. Cat News 84, 6-10pp. Supporting Online Material.

Methods

Ex-situ management: pre-release screening for hybridisation

Wildcats in Scotland are distinguished from a continuum of hybrids and domestic cats using genetic and phenotypic methods.

Hybridisation is quantified using the 35 diagnostic single nucleotide polymorphism (Q35 SNP) test described by Senn and Ogden (2015), which returns hybrid score ('Q' score) estimates for individual samples ranging from 0 (domestic cat) to 1 (wildcat), with the lower and upper boundaries of the 90% posterior probability interval of the hybrid score (known as LBQ and UBQ respectively). Cats with an LBQ ≥0.75 (usually with a Q score of ~0.85) are classified as 'wildcats'; conversely, cats with a UBQ ≤0.25 are classified as 'domestic cats'; everything in between is classified as a 'hybrid'.

Pelage scoring is also used to assess hybridisation (Kitchener et al. 2005) particularly in field scenarios where invasive sampling is not possible, although the correspondence between genetic and pelage scores appears relatively low in the increasingly introgressed wild-living population (Senn et al. 2019). Seven pelage characters (7PS) are scored from 1-3 using defined criteria, with higher total scores denoting more 'wildcat-like' characters and the original threshold of 19/21 for a wildcat (Kitchener et al. 2005), although a lower threshold of 17/21 has been adopted since 2015 for precautionary management of the wild-living population (Campbell et al. 2023).

For conservation breeding, a decision matrix combines quantitative scores from both the Q35 SNP test and pelage scoring as independent lines of evidence to assess suitability for breeding and/or release (see Senn and Ogden 2015 for further details). Hybridisation levels are monitored across the UK captive wildcat population with genetic samples collected during routine veterinary procedures.

In 2022, the first cohort of kittens born at the Conservation Breeding for Release Centre (n = 18) were sampled by hair pluck under manual restraint by a vet during their first vaccinations at 9 and 12 weeks. All individuals passed the minimum genetic threshold of LBQ >0.75: the average Q score was 0.92, with a minimum of 0.85 and a maximum Q = 0.97.

Pelage scoring is not appropriate for kittens and juvenile animals because individual pelage characters have not fully developed, so pelage scoring was undertaken on sub-adult wildcats while under anaesthesia for health checks and collar fitting (see below). Each wildcat was assigned a pelage score by three trained members of the team using the methods developed by Kitchener et al. (2005). Blinded scores were also provided by external experts from photos taken during anaesthesia and a mean pelage score (MPS) was calculated for each wildcat by combing 'on table' and 'photographic' scores. The MPS of the released wildcats in 2023 (n = 19) ranged from 14-19 (mean score = 17 and modal score = 18).

The MPS were combined with genetic scores in a decision matrix using an established protocol whereby cats with an LBQ >0.75 pass the threshold if the pelage score is ≥16 (Senn and Ogden 2015). However, cats with pelage scoring <16 can still pass the threshold if LBQ ≥0.75, as was the case for two individuals with a MPS of 14 and 15, although protocol stipulates that pelage scores of their offspring should be closely monitored where possible.

Further details of the Saving Wildcats ex-situ conservation work including wildcat population management, individual pelage and genetic scores, and the Conservation Breeding for Release Centre are provided in Barclay et al. (In Prep).

Pre-release health checks and collar fitting

Wildcats were trapped in their pre-release enclosures at the Conservation Breeding for Release Centre (CBRC) based at the Highland Wildlife Park (HWP) from the beginning of May 2023 (2-3 weeks prior to their planned release date) and transferred to the on-site veterinary facility.

General anaesthesia (GA) was induced by intramuscular injection of a medetomidine-ketamine-butorphanol combination, followed by endotracheal intubation and maintenance on 100% oxygen and isoflurane if required for adequate depth of anaesthesia. GA was reversed with intramuscular injection of atipamezole, between 60-90 minutes post-induction. Cats were subject to a comprehensive set of health checks including physical examination, blood samples for biochemistry and haematology, survey radiographs, and morphometrics. Cats were given booster vaccinations of Interhas Biofel PCH (Feline parvovirus, feline calicivirus, feline herpes virus), and Merial Purevax FeLV (feline leukaemia virus).

All health check and disease screening procedures were informed by Disease Risk Assessment (Bacon et al. 2025), and protocols were followed to assess whether each cat was accepted, rejected, or conditional for release (Barclay et al. In Prep.). Appropriate further veterinary investigation or treatment, as required, was conducted for cats with a conditional outcome. If a cat passed all preliminary health checks, then a GPS tracking collar (1A Light model, e-obs GmbH, Grünwald, Germany) was fitted by experienced members of the veterinary and field teams, before the cat was returned to the pre-release enclosure to monitor their response to the collar and await additional veterinary diagnostic laboratory results.

GPS-radio collars

The GPS collars were selected because they are lightweight, highly programmable, and have been used successfully with European wildcats and wildcat hybrids across their range (e.g. Jerosch et al. 2017, Migli et al. 2021) including in Scotland (Kilshaw et al. 2023).

The collars were made of soft, flexible silicon, with a hollow centre containing the internal antenna. We added a small (2-3 cm) leather insert to the 'close' of the collar to act as a 'drop-off' mechanism, in the event any cat could not be recaptured for collar removal. Collar sizes (circumference in cm) were estimated in advance based on the sizes of collars obtained from recaptured wildcat hybrids from Kilshaw et al. (2023) and from measurements of captive wildcats and were classified as 'Small' (18 cm), 'Medium' (20 cm) and 'Large' (22 cm). Collars weighed between 67-69 g (small to large size) and when fitted, were an average of 1.9 % of the cats' body weight (see SOM Table T2), which is below the ≤3% recommended by Kenward et al. (2001) to minimise potential impacts on welfare or behaviour.

The collar-mounted loggers can be programmed to collect global positioning system (GPS) locations and tri-axial accelerometer (ACC) data and store this 'on-board' until it can be downloaded via a UHF datalink to a BaseStation unit (e-obs GmbH). The collars also transmit a unique UHF signal ('pinger') so they can be located using conventional radio tracking with a wideband receiver (Alinco DJ-X-11 E, Japan) and Yagi antenna, and the data download begins automatically once the researcher is within range (typically around 100-300 m; up to 10 km with clear line-of-sight, e.g. from altitude).

We used the ACC-informed GPS function to optimise the collection of high-resolution data and the battery life of the collar. GPS fixes were taken every 15 minutes when the cats were active, and every four hours when the cat was inactive (e.g. resting). The loggers recorded ACC on three axes (X, Y, Z) in 4 second bursts every 2 minutes (10 Hz). Collar settings can be changed remotely using a laptop with PuTTY software via direct radio connection between the collar and the basestation. The radio 'pinger' was initially set to transmit between 0900-1600 BST when the wildcats were first released; this interval was reduced 1-3 weeks post-release to 2-3 hr time intervals to prolong battery life. The estimated battery life of the collars using these settings was 8-9 months, but this varied depending on the behaviour of the cat, the ambient temperature, and the other external factors affecting the time to take GPS fixes (capped at 150 seconds).

Soft-release strategy

Releases were planned for early Summer to optimise food availability and weather conditions. Wildcats also needed to be >1 year old (from April-May 2024) to be of sufficient size and weight to safely fit the tracking collars. Wildcats were released in cohorts of 2-4 'familiar' individuals, e.g. same-sex siblings, and unrelated male and female pairs with adjacent enclosures in the CBRC.

We adopted a soft (delayed/supported) release strategy attempting to maximise survival and site fidelity (e.g. Devineau et al. 2011, Simón et al. 2012, Tetzlaff et al. 2019, Resende et al. 2021). Soft-release allows a period of acclimatisation where the wildcats can potentially recover from the acute stress of transfer to the field site and become accustomed to the sounds and smells of a new location, potentially minimising the risk of rapid dispersal motivated by a panic response. It also provides a den site, proximity to other wildcats (positive social cues), and a location for provisioning of (post-release) supplementary food, reducing the immediate risk of starvation for animals that remain in the area.

Soft-release pens were built in groups of 2-4 at four different locations across the Cairngorms Connect release site. The release locations were carefully chosen to minimise risks of human disturbance (particularly from dog walkers), but with access to cover and prey habitat, and accessibility for construction vehicles. The original plan had been to build four pens at two locations (one in the north and one in the south) but high site fidelity of some of the released cats to the pens (through use of supplementary food) necessitated the rapid construction of pens at two additional sites.

The soft-release pen design was based on temporary wildcat enclosures already in use at the RZSS Highland Wildlife Park and comprised a timber frame with 25 mm wire mesh (dimensions 4.8 x 3.6 x 2.5 m) supplied in flat-pack and constructed in-situ (SOM Figure F1). The floors were lined with wire mesh to prevent digging, and the mesh was covered with moss and other soft substrates during construction. The pens had a single human entry/exit (double doors for security) and two 'cat' exit doors located at the top of the pens, to prevent access for dogs and badgers once the pens had been opened. Logs were positioned outside the doors to allow the cats easy access post-release. The pens were fitted with den boxes and climbing structures by the ex-situ keeper team. The lower half was wrapped with hessian fabric to protect the cats from external stresses at ground level, and the interior of the pen was furnished with brash to provide a high level of cover (see SOM Figure F1).

The day before the first wildcats were moved to the soft-release enclosures, scat and urine from the captive wildcats (individuals from that release cohort) were placed in artificial 'latrines' next to tracks and paths around the release pens. Camera traps were placed on most of these sites to monitor use and behaviour of cats that might visit the sites post-release. The purpose of the latrines was to try and provide familiar cues to the wildcats outside the release pens, potentially slowing their dispersal away from the immediate area, and allowing us to monitor their condition from video footage.

Wildcats were trapped from pre-release enclosures at the CBRC by the ex-situ keeper team and transferred to the soft-release pens in groups where possible. Wildcats were transferred straight into a den box inside the pen, and the keeper team visited the pens daily around 8am to feed the cats and check their welfare and behaviour with direct observations and using camera-traps. The soft-release pens were monitored for human disturbance by the field team using remote CCTV cameras (Reolink Keen Ranger PT) and camera-traps. GPS-radio collars were found not to receive GPS fixes through the wire mesh of the soft-release pens so after the first releases, the collar GPS logger was switched on the day before release using the UHF data connection to save battery power while in the pens.

On the day of release, two members of the SW team would arrive at the site around 4am (dawn), park at least ~100 m away and walk to the pens. The ex-situ team member would check the camera-trap footage from the past 24 hours to check there were no obvious welfare concerns or equipment failures (e.g. loss of the collar). If no problems were seen, both team members would silently approach the pens and open all the 'wildcat exit' doors in turn (two doors on each pen), padlocking the doors open and placing the daily food rations on the shelf behind the door as they went. They would then quietly return to the vehicle and leave the site immediately, whereupon the field team could watch for the cats leaving the enclosures on the CCTV cameras. Tracking the wildcats began at 9am on day one of the releases.

Supplementary food, comprising full daily rations of captive diet (500g rats, rabbit, or quail) for each cat, was replaced daily at all pens for at least one week post release and monitored using camera-traps. Water was also provided. Feeding was halted if none of the cats had returned to the pens. It was re-started if the cats returned to the pens after one week. Feeding continued as long as the cats used the resource ('cat-led' weaning). After 2-4 weeks, rations were gradually reduced over time and the behaviour and condition of the cat was closely monitored. Feeding was stopped once the GPS tracking showed potential hunting behaviour (use of prey habitats), increased roaming and exploratory behaviour, and a reduction in visits to the supplementary food.

Wildcat tracking

Tracking was carried out by Saving Wildcats field staff (n = 5), full time (residential) volunteers (n = 6), and contractors (n = 2) using 3 – 5 vehicles per day. Tracking was complicated by the uneven/hilly terrain with the UHF signal requiring "line of sight" to be easily detected. We searched for wildcats by going to the last point where their data were downloaded, or to a high vantage point in the area where the data from multiple wildcats could potentially be downloaded at once. Most tracking and data transfer was done from these vantage points and/or by vehicle where possible, to maximise efficiency. Wildcats were located and their data downloaded and checked every day where possible for six months after the first releases. At this point the tracking was reduced to 5-6 days per week. The high intensity of tracking was to reduce losses through rapid and unpredictable dispersal, and to mitigate threats including starvation, injury, and predator control, by actively managing potential negative indicators (behaviour and/or location).

Data were uploaded daily to the online data repository Movebank (www.movebank.org) and downloaded to Google Earth for quick location and behavioural observation of each cat. ACC data was checked using the online tool Movebank Accelerometer Viewer to be able to quickly identify cases where individuals had unusually low movement or had ceased moving.

Trapping for collar removal/replacement

Wildcats were trapped for collar removal/replacement when the battery level dropped below the level required for consistent GPS fixes to be recorded (<3000 MHz). This was estimated by E-obs software to be around 200 days (7-8 months) post-release, and trapping was planned for Jan-Mar 2024.

Live trapping is very resource intensive and requires veterinary and field staff availability for each night the trap is set. To maximise capture success and reduce resource demands traps were pre-baited (food and olfactory lures inside but locked open and monitored using camera traps) for an extended period of days or weeks prior to being set (trialled and recommended by Campbell et al. 2023). If non-target species were regularly visiting the trap (e.g. badgers *Meles meles*) then the trap was relocated to reduce the chances of trapping non-wildcats. During pre-baiting, rats or parts of rabbit were used and during active trap nights day-old chicks were used (all provided by the ex-situ team). Olfactory lures included valerian tincture and dried root, and urine from captive wildcats extracted under GA during health checks. Traps were set overnight by SW field staff and monitored continuously using trap alarms (Mink Police) and remote live-steam cameras (Reolink Keen Ranger PT).

Remotely monitoring the traps allowed the response team (field and veterinary staff) to rapidly attend to the trapped individual (within 30 mins) using a bespoke mobile vet facility.

After successful trapping, wildcats were transferred to a 'crush cage' (a transfer cage with a restrainer) and anaesthetised by the veterinary team (see general anaesthesia protocol above), who also carried out health checks and took samples for disease screening. The collar was switched off and both the collar and the neck of the wildcat were examined for any problems, such as injury, damage, or tick burden. The fit of the collar was also checked prior to removal. If no health issues were found, a new collar of the same or larger size as appropriate was fitted to the wildcat. Wildcats were then monitored by the vet team for 60 minutes after GA reversal and released when recovered at the location of capture.

Females were targeted for trapping as early as possible (before the end of March), to reduce the risk of trapping late-gestation pregnant females or those with dependent young. All females were carefully monitored during pre-baiting using camera traps and live cameras to assess possible signs of pregnancy or lactation. If either was suspected, trapping was immediately stopped. Trapping took place under licence from NatureScot (Licence number 249931).

Camera trap monitoring

Systematic camera-trap surveys of CC began in winter 2020 and were carried out annually between January-April to monitor the wild-living cat population, prey populations, and other species that may impact, or be impacted by, released wildcats. These cameras would also monitor the behaviour and condition of wildcat's post-release. 120 camera traps (Browning Spec Ops Advantage) were sited in suitable wildcat habitat, primarily habitat edges and linear features, in 1-2km grid squares across the CC area and in areas of contiguous high-quality habitat outside CC, depending on resources and access permission from private landowners. The camera trap survey method is described by Langridge et al. (2021) and follows the same methodology as previous surveys in Scotland (e.g. Campbell et al. 2023). Camera traps were left in place all year-round from April 2022 onwards.

Camera traps were also sited opportunistically across the project area post-release to monitor the body condition and behaviour of the wildcats (e.g. feeding, hunting, and reproduction). Camera-traps were placed at a safe distance from suspected resting or den sites (including potential natal dens) under licence from NatureScot (Licence number 207451).

All cat images are stored and catalogued for individual ID and pelage scoring, including domestic cats (feral or owned status is often unknown) and phenotypic (putative) hybrids. Wildcats were individually identified by the coat markings from reference images taken while they were in captivity.

Feeding behaviour and diet

Feeding behaviour was described using two methods: direct observation from opportunistic visual sightings (by project staff and volunteers or reported sightings from members of the public) or camera-trap records; and indirect assessment of habitat-use from GPS tracking data. Scavenging and caching events were detected through clustering of GPS points, which were investigated on the ground by field officers. Scat samples were collected opportunistically by the field team from June 2023 onwards, and diet metabarcoding data is currently being analysed.

Trapping of first-generation offspring

Kittens were not trapped for sampling until September 2024 when the risks of trap-related disturbance (e.g. abandonment) or injury to either mother or offspring would be minimised. They were trapped at the same time that adult wildcats were also being targeted for collar removal/replacement (either a second round, or females that were not trapped during the first round of trapping in Jan-Mar 2023). Unfortunately, some individuals may already have dispersed away from the mother (they were no longer seen on camera-traps), and some landowners prevented access for trapping, so relatively few kittens were sampled at this time. Kittens were trapped under the same protocols (and licence) as adult wildcats and were also anaesthetised in the field (as above) for health checks and taking samples. As with the captive-bred wildcats, hybridisation was quantified using the Q35 SNP test described by Senn & Ogden (2015).

Data analysis

All data analysis was carried out in the program R (Version 4.2.1; R Core Team, 2020) using various R packages which are detailed in the relevant sections below. All GIS analysis was carried out in QGIS (version 3.24).

Reproduction Events

In Germany, female wildcats fitted with GPS collars showed a clear shift in activity patterns in the period post-birth, and this could be identified using accelerometer (ACC) data (M. Herrmann pers. comm.). The same pattern was also observed in wildcat hybrids in Scotland (Kilshaw et al. 2023). The main birthing period for wildcats is between April – early June (Corbett 1979, Ruiz-Villar et al. 2023). ACC data was checked daily when females were likely to start showing changes in behaviour (April onwards). Particular attention was paid to females that showed signs of pregnancy from any camera trap footage.

We used the Movebank-Acceleration-Viewer (https://www.movebank.org/cms/movebank-content/acceleration-viewer) to create activity plots which provide a rapid summary of the ACC data over 24-hour (or 48-hour) periods and provide a quick way to access changes in activity patterns. We looked for obvious shifts in activity patterns over several weeks, the start of which was assumed to be the birth date when females typically exhibit very low activity for 24-48 hrs followed by a shift in activity patterns to a more diurnal pattern. Birth dates were later corroborated with camera trap footage of kittens where we could gain an estimate of kitten age. We compared the date of the activity shift to the GPS data in QGIS to examine spatial clustering to identify locations of potential natal dens (Kilshaw et al. In Prep. a).

Habitat use

We used the EUNIS (European Nature Information System) Landcover Scotland 2019 dataset obtained from NatureScot under an Open Government Licence (EUNIS 2019). This is a 10 m raster based Landcover map amalgamated from 13 different sources and classified according to EUNIS. We calculated the proportion of different landcover classes (SOM Table T4) within the Cairngorms Connect (CC) Release Site and the area encompassed by the 95% resident home ranges (RHR's) using the *Raster layer unique values report* in QGIS. In addition, we extracted up to date information on the proportion of clearfell across these areas using data from obtained from the HLCM_2022_EUNIS_Level_2 dataset (NatureScot 2025) and from Forest and Land Scotland and included this in the final analysis.

Jacobs Index *D* (Jacobs 1974) was used to evaluate the degree of preference for each habitat type in the CC and the combined area of the RHR's using the formula:

Jacobs index *D* = (r - p)/(r + p – 2rp)

where *r* = represents the proportion of the total number of GPS fixes within each habitat and *p* = the proportional availability of that habitat within the two different areas. The selectivity index varies from -1 (indicating a lower use of that habitat in relation to its availability) through 0 (indicating random use or a proportional use of that habitat in relation to its availability) to 1 (indicating wildcats are showing a strong preference for this habitat in relation to its availability). Habitats were classified into 15 main categories (SOM Table T4).

Dispersal Distances and Resident Home Range Sizes

For this analysis we used the GPS data from the first (n = 19) and second collars (n = 12) to ensure we captured establishment of home ranges and maximum dispersal distances.

Dispersal distance from the soft-release pens were estimated using the package *AdehabitatLT* (Calenge 2006) in R. We calculated the Net Square Displacement (NSD) distance (km) between each consecutive GPS from the time and date individuals left the release pen to the final GPS fix for each individual. We then extracted the maximum dispersal distance (km) for each individual.

We also estimated the dispersal distance (km) to the edge of the resident home ranges to determine how far from their release site individuals established their home range. This was calculated using the *distance to hub* function in QGIS.

Date to the start of home range residency was determined by plotting the NSD (km) values over time since release using the package *plotly* (Sievert et al. 2021) in R and looking for the date that NSD values reached an asymptote for a period of 3 months or more indicating the individual was using the same area over time. This was doubled checked using QGIS. The GPS trajectory for each individual was split at the date of start of resident behaviour and this data was then used for resident Home Range (HR) size estimates.

HR size estimates were calculated in the package *ctmm* (Calabrese et al. 2016) and *ctmmweb* (Calabrese et al. 2021) in R which use continuous-time stochastic movement models and autocorrelated kernel density estimation (AKDE) to produce 95% and 50% home range sizes (km^2) for each individual. Ctmm accounts for irregular sampling fixes and autocorrelation of

GPS data and the accuracy of each GPS fix using the associated error (DOP), which in this case was the horizontal accuracy estimate generated by the e-obs collars for each GPS fix. Ctmm requires individuals to be range resident which can be checked visually by plotting the data in a variogram, resident individuals show a clear asymptote (Fleming et al. 2014). Some individuals showed seasonal behaviour (bell-shaped variogram) in their home range use or showed an upward trend in their variograms suggesting non-residency, in these cases we used the package *segclust2d* (Patin et al. 2020) in R to identify locations that clustered in space and time based on the latitude and longitude of each GPS fix. This method allocates each GPS fix to a separate cluster, plotting out the clusters then allowed identification of individuals that were exhibiting some sort of spatial or behavioural shift in home range but not dispersing (clusters were overlapping slightly). These clusters were then assessed for residency using the variograms. Once range residency had been verified, a series of range resident movement models were then fit to the data, and the best model for each individual selected using AIC criteria (Burnham & Anderson 2003). Model fit was double checked by plotting the best model for each individual against its variogram. HR's were then estimated using the movement models and weighted Autocorrelated Kernel Density Estimation (wAKDE) to account for the use of ACC-informed GPS in the collection of the tracking data. For individuals exhibiting seasonal but overlapping ranges, the mean HR of the different segmented clusters was also calculated (for more details on the home range analysis described here see Kilshaw et al. In Prep. b).

For comparison with other studies on the European wildcat the area (km^2) of 95% minimum convex polygon was also calculated using the package *AdehabitatHR* (Calenge 2006).

The percentage that each individuals HR overlapped with another released wildcat was calculated using the *Overlap* function in QGIS.

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Table T1. Soft-release locations and time of release for 19 captive wildcats released at four different locations in the Cairngorms Connect release site in Summer 2023. Includes wildcat ID, sex, age at release (months), release location, release date, weight (g) at release, time spent in soft-release pens (days), time taken to leave the pens once the doors were opened (minutes) and how many days supplementary food was utilised for immediately after release. Wildcats were weighed at time of transfer from pre-release to the soft-release pens. Highlighted individuals were also provided additional food as a part of supportive management in response to observed changes in behaviour and condition (both individuals from 18/07/23 – 6/9/23).

Cat UID	Sex	Age (months)	Soft-release location	Release date	Weight (g)	Time in soft-release (nights)	Time of release (BST)	Latency to leaving (mins)	Use of suppl. food following release (days)
LOR22	F	12	1	12/06/23	3300	6	04:45	111	0
HAG22	F	12	1	12/06/23	2900	6	04:49	151	0
ALV22	M	14	1	13/06/23	4100	7	04:45	0	0
AIZ22	F	14	1	13/06/23	2950	7	17:50	325	0
CAL22	F	14.5	1	23/06/23	3100	5	04:45	35	110
MAR22	F	14.5	1	23/06/23	2960	4	04:45	75	47
FIN22	M	14.5	1	23/06/23	4030	4	04:45	96	0
FID22	M	14.5	1	23/06/23	4460	4	04:45	431	0
RUM22	M	13	2	09/07/23	3640	4	04:30	150	33
TAT22	F	13	2	09/07/23	3100	4	04:30	246	22
NEE22	F	13	2	09/07/23	2950	4	04:30	418	57
ARW22	F	15	3	04/08/23	3700	3	05:00	7	0
BON22	F	15	3	04/08/23	3550	3	05:00	796	0
LOS22*	F	>6 years	3	20/08/23	3900	3	05:10	65	0
RAN22	M	14	3	20/08/23	3820	5	05:30	345	0
CRY22**	M	15.5	4	22/08/23	4680	4	05:10	2	66
GIL22	M	15.5	4	22/08/23	5050	5	05:00	45	66
WIL22	M	16	4	08/09/23	4670	2	14:30	378	0
CLA22	F	14.5	4	08/09/23	3490	1	14:30	450	0

**LOS22 was wild-caught and taken into the captive breeding programme at HWP in 2018; **CRY22 was castrated prior to release*

Table T2. GPS-collar fitting and performance data for captive wildcats pre- and post-release (n = 19). GPS-collars were fitted several weeks prior to release while cats were under anaesthesia for health checks; the first collar was replaced in-situ where possible when the battery ran out (7-9 months post-release). Shows wildcat unique ID, sex, sibling group, date, age (months), body condition (BCS), weight (g) and neck circumference (mm) when first collared. Body condition scores (BCS) range from 1 (emaciation) to 9 (obese). Twelve individuals were recollared and the lifespan (days) and GPS fix success rate (%) of both collars are shown as applicable. The date of recollaring, BCS and weight at recapture (g), % weight change since first collared (+ or -) and change in neck size (mm) are also shown.

Cat UID	Sex	Sibling group	Collar fitting pre-release						Collar performance (first/second)		In-situ collar removal or replacement				
			Date	Age (months)	BCS	Weight (g)	Collar % body weight	Neck size (mm)	Collar lifespan (days)	GPS fix success (%)	Trapping date	BCS	Weight (g)	% weight change	Change in neck size (mm)
AIZ22	F	1	09/05/23	13	4	3200	2.1	180	219/239	98.1/98.0	29/01/24	5	5000	56.3	40
ALV22	M	2	02/05/23	13	4	4200	1.6	200	259/265	98.2/98.7	29/02/24	5	5000	19.0	10
ARW22	F	3	06/06/23	13	4	3000	2.2	190	209	98.6	-	-	-	-	-
BON22	F	3	06/06/23	13	4	3400	1.9	180	218	98.7	-	-	-	-	-
CAL22	F	1	08/05/23	13	4	3200	2.1	180	195/207	97.8/99.1	24/01/24	4	4000	25.0	10
CLA22	F	4	06/09/23	14.5	3	3490	1.9	185	166	99.4	-	-	-	-	-
CRY22	M	3	18/08/23	15	6	4680	1.4	210	232	98.2	17/04/24	4	4600	-1.7	-
FID22	M	5	16/05/23	13	4	4150	1.7	215	256/3	98.1/100	04/03/24	5	5000	20.5	-5
FIN22	M	5	16/05/23	13	3	3850	1.8	220	211/129	99.6/99.6	13/02/24	5	5000	29.9	5
GIL22	M	3	26/06/23	13.5	4	3900	1.8	195	193	99.3	-	-	-	-	-
HAG22	F	6	03/05/23	11	4	3200	2.1	170	252/216	98.9/99.0	15/03/24	3	4000	25.0	30
LOR22	F	6	04/05/23	11	4	3400	2	180	235/226	98.8/98.0	05/03/24	5	3900	17.6	20
LOS22	F	-	18/05/23	>72	4	4300	1.6	210	34	99.7	-	-	-	-	-
MAR22	F	1	08/05/23	13	3	3200	2.1	185	233/250	99.2/98.5	12/02/24	4	3900	21.9	10
NEE22	F	6	26/06/23	12.5	4	2870	2.3	180	235/210	98.7/98.8	02/04/24	4	3800	32.4	20
RAN22	M	4	15/08/23	13.5	4	3820	1.8	200	181/211	99.1/99.6	12/03/24	4	4200	9.9	15
RUM22	M	6	06/06/23	12	4	3400	2	190	193/187	98.8/97.5	22/01/24	5	5030	47.9	20
TAT22	F	6	26/06/23	12.5	3	3020	2.2	180	206/252	98.5/98.5	06/02/24	4	3700	22.5	20
WIL22	M	3	06/09/23	16	5	4670	1.5	225	261	99.2	-	-	-	-	-

Table T3. Home range (HR) sizes and dispersal distances of captive-bred wildcats (n = 18) and one wild-caught captive female (LOS22) soft-released at four locations in the Cairngorms Connect release site. Shown are cat UID and sex, the number of GPS fixes collected and number of days' data, and 95% weighted Autocorrelated Kernel Density Estimates (wAKDE) of resident HR sizes (km^2), upper and lower confidence intervals and the 95% minimum convex polygon (MCP) HR size estimates (km^2) for comparison with other wildcat studies. The time taken from leaving the soft-release pens to exhibiting range residency (no. of days) is shown as well as the maximum distance dispersed from the release pens (km) and the distance from the release pens to the edge of the resident home range (km), because some individuals explored widely before establishing their ranges closer to the release pens. * Indicates female wildcats with confirmed reproduction, ** indicates neutered male.

				Resident home range size estimates (km2)					Dispersal distance from release pens (km)	
Cat UID	**Sex**	**No. GPS fixes**	**No. days of data**	**Lower CI**	**95% wAKDE HR**	**Upper CI**	**95% MCP**	**Days taken to reach residency**	**Max. distance**	**Dist. to HR edge**
HAG22*	F	8962	468	3.90	4.40	4.93	6.73	156	11.90	9.16
LOR22*	F	8515	461	5.53	5.49	5.92	10.48	58	4.40	1.96
AIZ22	F	7491	458	3.59	3.84	4.09	14.73	31	9.20	5.97
CAL22	F	6118	207	9.29	10.47	11.72	16.93	151	6.30	4.51
MAR22*	F	7222	483	3.76	3.94	4.12	5.01	148	17.70	12.02
NEE22*	F	8789	445	5.24	5.92	6.64	8.03	136	6.10	3.1
TAT22*	F	8724	458	4.89	5.39	5.91	6.69	130	6.30	4.34
ARW22*	F	7328	209	5.75	6.69	7.70	8.49	24	7.90	4.13
BON22	F	7553	218	3.65	4.22	4.84	21.42	10	22.60	5.2
LOS22[1]	F	1186	34			NA		NA	38.96	NA
CLA22	F	6925	166	4.05	4.86	5.74	5.35	100	11.60	9.27
ALV22	M	8974	524	6.24	6.71	7.21	9.15	9	8.50	2.32
FID22	M	6946	259	9.05	10.17	11.37	13.76	18	7.50	2.41
FIN22	M	8106	340	19.19	21.26	23.42	24.87	129	28.60	23.71
RUM22	M	8253	380	10.38	11.30	12.26	15.36	45	8.50	6.02
RAN22	M	6636	392	39.48	44.74	50.33	46.07	17	8.90	5.26
CRY22**	M	6819	232	2.14	2.37	2.62	5.06	66	6.40	3.72
GIL22	M	7243	193	10.79	12.13	13.55	134.49	10	30.20	2.19
WIL22	M	9812	261	11.16	16.39	20.16	33.09	124	45.40	39.4

[1]LOS22 died on 24/09/23 without achieving resident home range status.
**Females with confirmed reproduction*
*** neutered male*

Table T4. Classification of landcover for examining habitat selection preferences for each GPS fix and associated EUNIS categories. Further details on the EUNIS categories can be found online at https://eunis.eea.europa.eu/habitats.jsp. In addition, updated information on clearfell categories was obtained from the HLCM_2022_EUNIS_Level_2 dataset (NatureScot, 2025) and from local Forestry and Land Scotland data officers.

Landcover categories	Habitat classification (EUNIS)
Arable & pasture	I1 Arable land and market gardens E2.6 Agriculturally-improved re-seeded and heavily fertilised grassland including sports fields and grass lawns
Bog	D1: Raised and Blanket bog X28 Blanket bog complexes
Broadleaved Woodland	G1: Broadleaved deciduous woodland G1.8 Acidophilous *Quercus*-dominated woodland G1.9 Non-riverine woodland with *Betula Populus tremula* or *Sorbus aucuparia*
Clearfell	G5.8 Recently felled areas 23: bare ground (HLCM_2022 dataset)
Coniferous woodland	G3: Coniferous woodland G3.4 *Pinus sylvestris* woodland south of the taiga G3.F Highly artificial coniferous plantations
Buildings	J1/J2 Buildings of cities towns and villages / Low density buildings
Fens & wetlands	D2/D4/D5 Fens mires sedge- and reedbeds
Grassland	E Grasslands and lands dominated by forbs mosses or lichens E4 Alpine subalpine and extensive grasslands E1.2 Perennial calcareous grassland and basic steppes E4.3 Acid alpine subalpine and extensive grassland E4.4 Calcareous alpine subalpine and extensive grassland
Heathland	F4.1 Wet heaths F4.2 Dry heaths
Mixed Woodland	G4: Mixed deciduous and coniferous woodland G Woodland forest and other wooded land G6 Exotic woodland and scrub
Montane	K Montane habitats K1 Montane vegetation
Scree	B2 Coastal shingle, B3 Rock cliffs ledges and shores including supralittoral H2/H3: Screes inland cliffs rock pavements and outcrops
Shrub	E5 Woodland fringes and clearings and tall forb stands F2 Arctic alpine subalpine and extensive scrub F4 Temperate shrub heathland F3.1 Temperate thickets and scrub F9.2 Salix carr and fen scrub
Young plantation	G5.7 Coppice and early-stage plantations G5.6 Early-stage natural and semi-natural woodlands and regrowth
Inland Water	C Inland surface waters to represent riparian edges

Table T5. Home range overlap between captive-bred wildcats (n = 18); shows the number of siblings released per individual, number of other wildcats an individual's home range overlaps with; how many of these are same sex; opposite sex or sibling; the mean percentage (%) overlap of an individual's home range with a same-sex or opposite-sex sibling; and the maximum percentage of their home range that overlaps with another wildcat of the same or opposite sex.

			Home Range Overlaps									
Cat UID	**Sex**	**No. siblings released**	**No. other wildcats**	**No. same sex**	**No. opposite sex**	**No. siblings**	**No. same sex sibling**	**No. opposite sex sibling**	**% overlap same sex sibling**	**% overlap opposite sex sibling**	**Max % overlap same sex**	**Max % overlap opposite sex**
AIZ22	F	2	3	0	3	0	-	-	-	-	0.13	37.76
ALV22	M	0	3	1	2	0	-	-	-	-	79.53	33.99
ARW22	F	4	5	2	3	0	-	-	-	-	46.6	86.4
BON22	F	4	3	1	2	1	0	1	-	28.7	7.2	93.4
CAL22	F	2	0	-	-	-	-	-	-	-	0	0
CLA22	F	1	3	0	3	1	0	1	-	54.23	0	91.5
CRY22	M	4	1	0	1	0	-	-	-	-	0	30.78
FID22	M	1	3	1	2	0	-	-	-	-	52.16	50.55
FIN22	M	1	4	2	2	0	-	-	-	-	24.46	3.56
GIL22	M	4	3	1	2	1	0	1	-	10	10.24	10
HAG22	F	4	1	1	0	0	-	-	-	-	8.16	0
LOR22	F	4	2	2	0	0	-	-	-	-	0	86.92
LOSS22	F	0	0	-	-	-	-	-	-	-		-
MAR22	F	2	1	1	0	0	-	-	-	-	9.16	0
NEE22	F	4	6	3	3	2	1	1	30.58	0.08	30.58	89.97
RAN22	M	1	8	3	5	1	0	1	-	5.58	16.57	12.9
RUM22	M	4	6	2	4	2	0	2	-	0.04	65.67	39.33
TAT22	F	4	4	2	2	2	1	1	33.7	0.002	57.7	99.67
WIL22	M	4	0	-	-	-	-	-	-	-	-	-
Mean			3	1.4	2.1	0.6	0.3	1.1	32.1	14.1	24.0	45.1
SD			2	0.9	1.4	0.8	0.5	0.3	1.6	18.9	25.6	37.2

SOM Figures

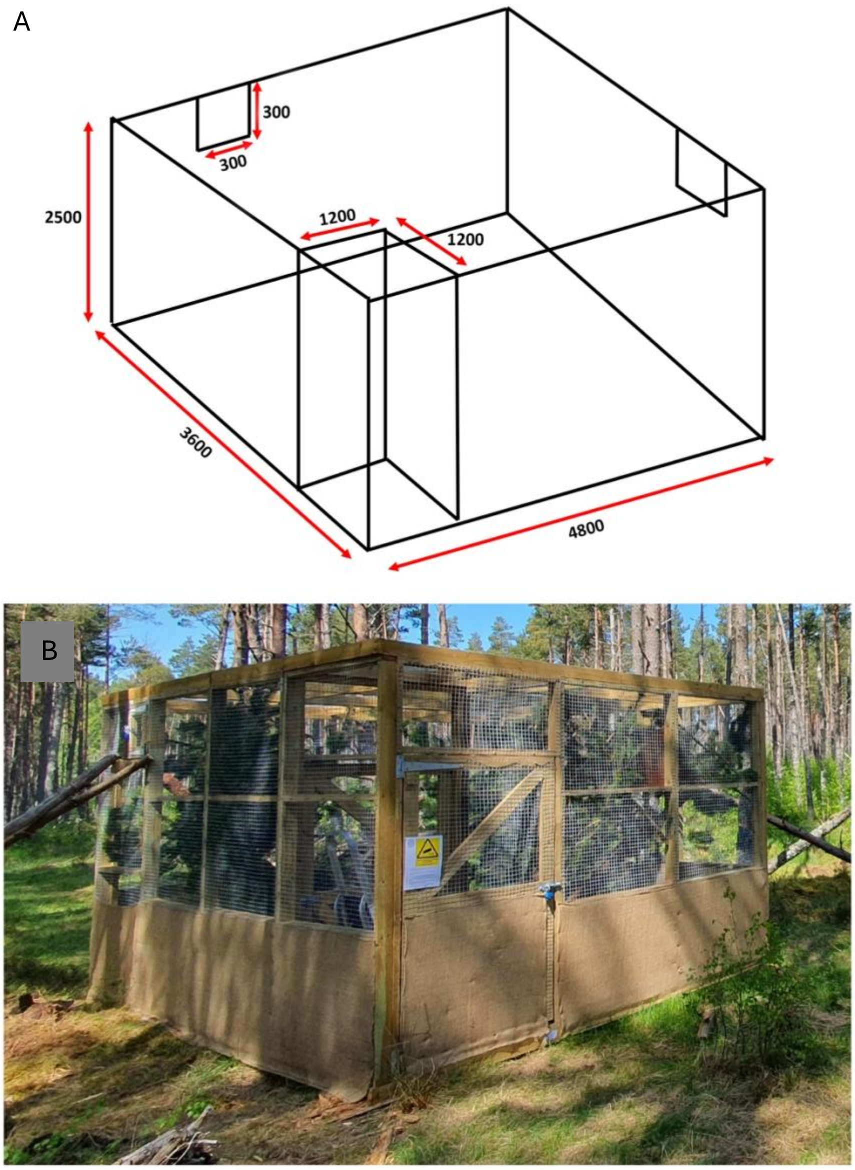

Fig. F1. Wildcat soft-release pen A) schematic with measurements and B) completed constructed in the release site. Measurements are in mm. Photo: Saving Wildcats.

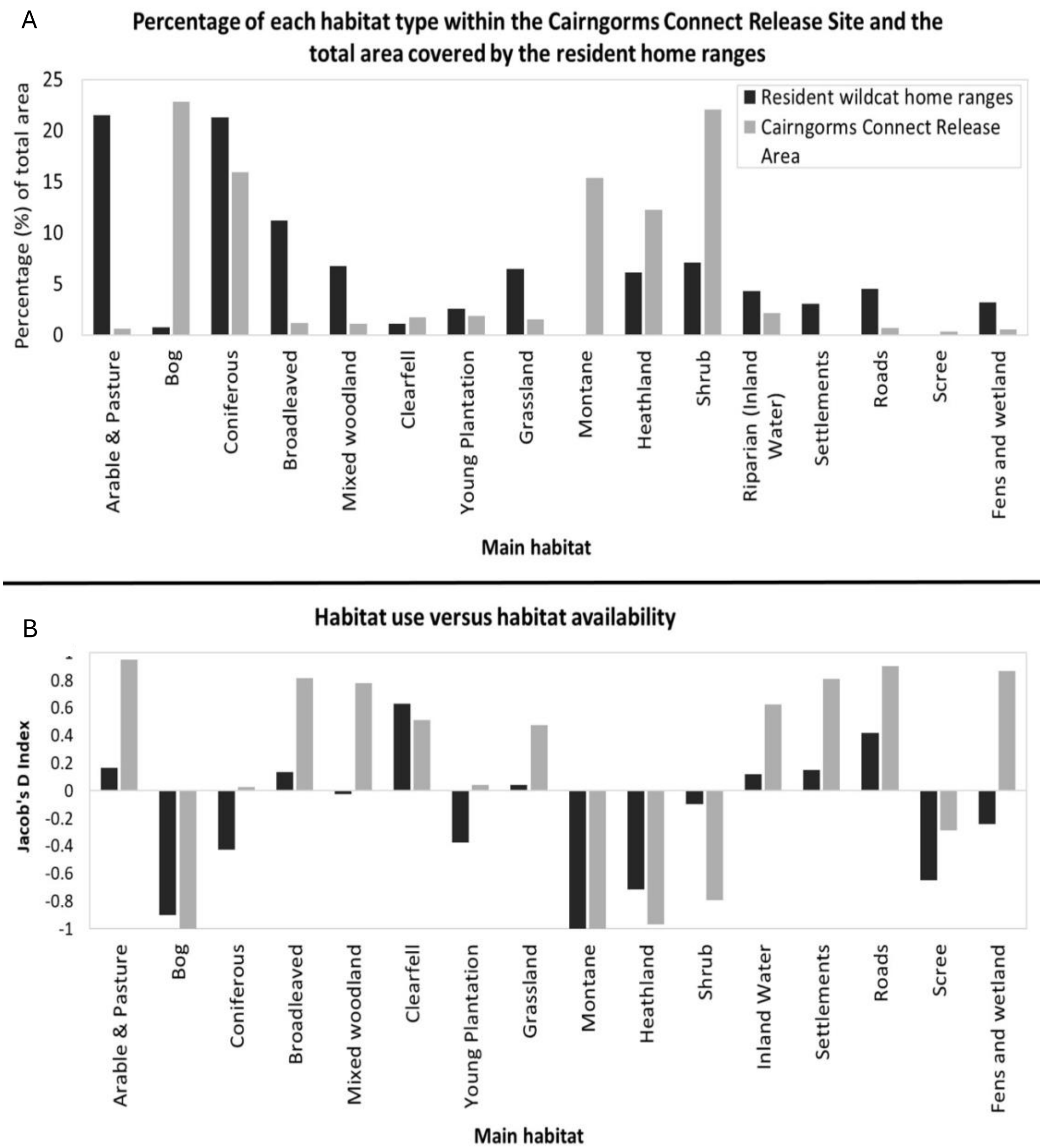

Fig. F2. Habitat use of released captive bred wildcats in the Cairngorms Connect release site (CC) compared to resident home ranges. (A) The proportion of main habitat types within CC and resident home ranges. (B) Habitat use versus habitat availability of released wildcats. Within CC wildcats showed strong selection for arable & pasture, broadleaved woodland, mixed woodland, clearfell forestry, grassland, riparian (inland water) and wetland, areas around farms and rural buildings, and road verges. Within resident home ranges wildcats also showed some positive selection for arable and pasture, broadleaved woodland, riparian (inland water) and areas around farms and rural buildings. Strongest selection was for areas of clearfell and roadside in comparison to their availability. Within resident home ranges wildcats showed avoidance of coniferous woodland, young plantation and scree habitats, and consistently avoided bog, montane and heathland habitats in relation to their availability across the landscape.

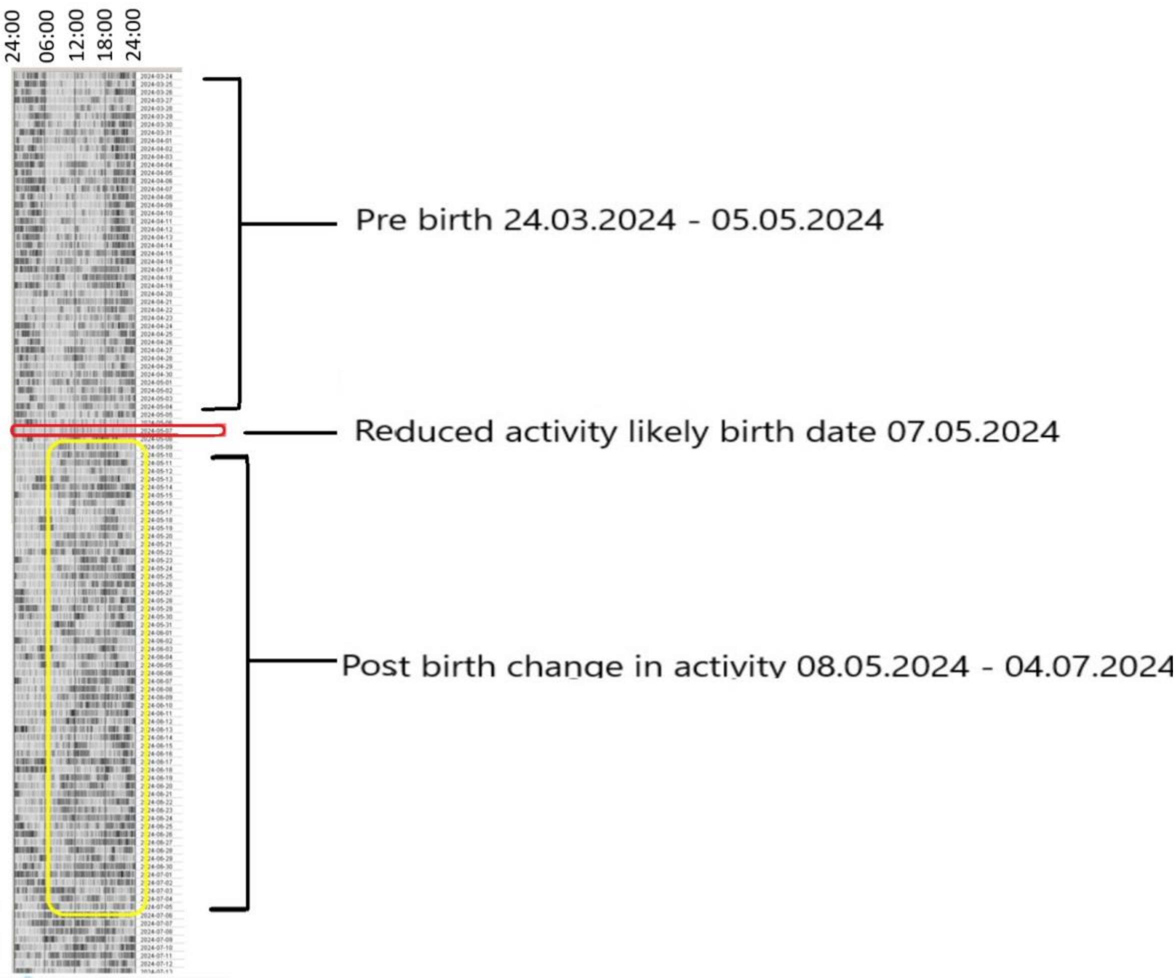

Fig. F3. Activity graph produced in the Movebank-Acceleration-Viewer showing the shift in diel activity patterns of a pregnant individual (MAR22) from a couple of weeks pre-birth where most activity (darker lines) occurred between 1800 – 0600 hrs to post birth where most activity shifted to between 1200 – 2400 hrs. Similar patterns were seen for the other reproducing females. Very low activity over a 24 – 48 hr period followed by a prolonged shift in activity patterns indicates the female has given birth.

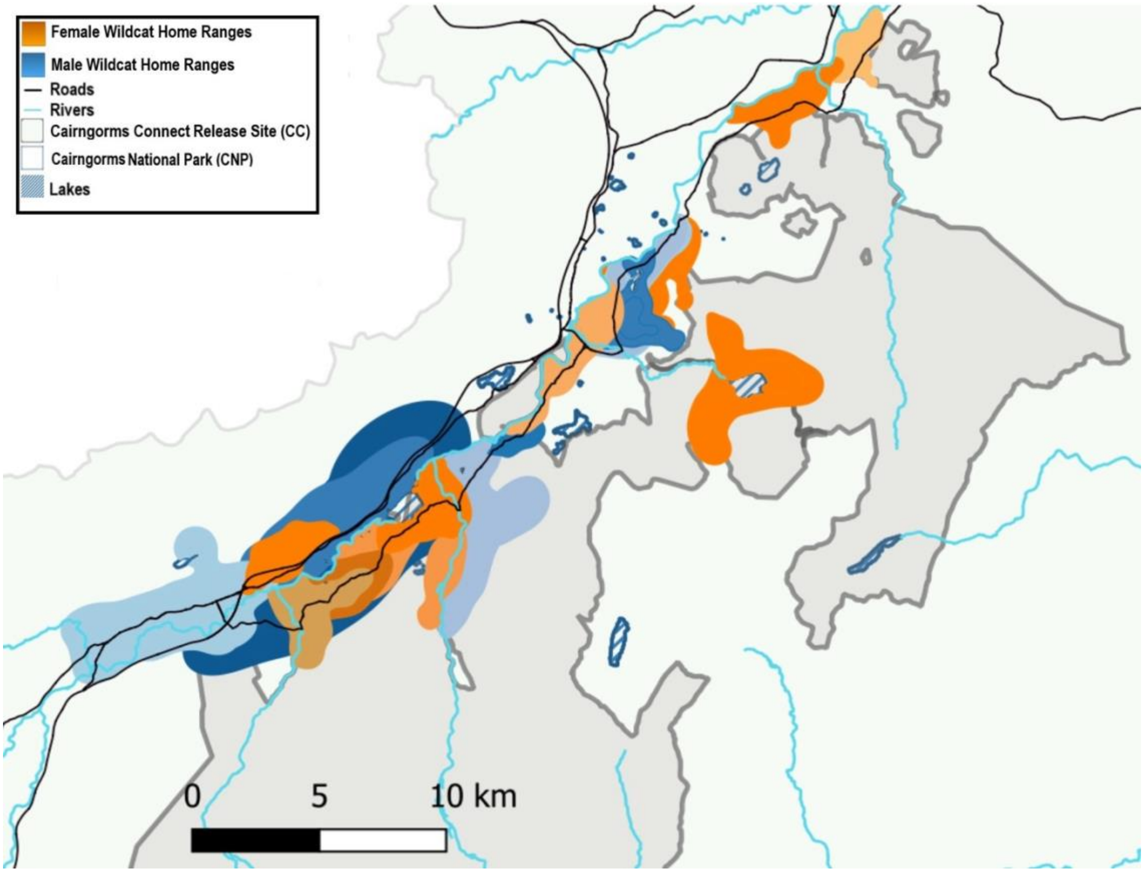

Fig. F4. Overlap of 95% wAKDE resident home ranges of female (oranges) and male (blues) captive bred released wildcats. The River Spey can be seen running through the middle, bordering many of the home ranges.