

# Excursion to Glenogil Estate

## Scotland 26. IV. – 30. IV. 2015



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**With best thanks to Baron Ferdinand von Baumbach and his family to have had  
the possibility to work in the beautiful landscape of Glenogil**

**For excellent support during our field work we thank all the gamekeepers,  
Andy, Liz, Louise and Christie.**

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## Content

1. Introduction.....	4
2. Investigation area.....	4
3. Hunting, wildlife and landscape management.....	7
3.1 Ungulates.....	7
3.2 Mountain hares and rabbits.....	7
3.3 Predator management.....	8
3.4 Grouse.....	9
3.5 Grouse Management.....	10
3.6 Ducks and geese.....	12
4 Methods.....	14
4.1 Spotlight counting of mountain hare.....	14
4.2 Bivouacs of grouse.....	14
4.3 Line counting of birds by all-terrain vehicle.....	16
4.4 Mapping of birds territories.....	16
4.5 Survey of courtship places of Black Grouse.....	16
4.6 Birdsongs and sightings (non-systematic).....	16
4.7 Commented species catalogue of birds.....	17
4.8 Collecting feathers of the Black Grouse.....	17
5 Results and discussion.....	18
5.1 Spotlight counting.....	18
5.2 Counting of bivouacs of grouse.....	24
5.3 Line counting of birds by all-terrain vehicle.....	29
5.4 Courtship places of Black Grouse.....	34
5.5 Commented species catalogue of birds.....	36

## 1. Introduction

The landowner of the Glenogil Estate, Scotland invited Dr. Daniel Hoffmann and Prof. Wolfgang Rohe to visit his land. With a group of students we could undertake a field trip from 26.04. to 30.04.2015.

The excursion was conducted to get to know the country and with the objective of survey the bird species in the area and also to test different field methods for counting birds and other species. We investigated the practicability of approved survey methods as a basis for more special studies and potentially for long term monitoring of birds and other relevant species.

In fact of the political discussion about a ban on driven grouse shooting, our data should provide an indication if a ban will have positive or negative effect on the grouse population, birds in general and other species that have relevance to wildlife conservation.

## 2. Investigation area

Glenogil is a small settlement ca. 7,5 miles north from Forfar. The distance to the coastline of the northern Sea is about 15 miles. Glenogil Estate covers about 9400 ha (23000 acres) and includes the boundaries of Glenquiech, Glen Moy (Glenmoy) and Gella. In the Southeast the area of Fern and in the northeast it is Nathro that are parts of the investigation area.



Figure 1: Townsite of Glenogil, Scotland

Geographically Glenogil Estate is positioned between Glen Clova and Glen Lethnot in the Angus Glens. In the north of Glenogil Estate the Cairngorms National Park is located.

The landscape is characterized by smaller burns that have built V-valleys between the hills. Near the settlement of Glenogil the Water Noran delivers the Glenogil Reservoir with fresh water. In the west the Water Cruick flows from north to south in another deep V-valley.

In the south of Glenogil the Burn of Ogil is partly a natural boundary of the estate. The height is about 200 m a.s.l.

The highest hills are the Dog Hillock and the Hill of Glansie with a height above sea level of about 700 m (2300 feet).

In the lowlands agricultural production of grain is dominating but also potatoes play an important role and on the grasslands cattle are grazing. Most important cattle breed is the Aberdeen Angus but also Belgian Blue, Charolais and Limousin are frequent.

Agriculture and forestry shift from the lowlands to the higher areas and the hills. Small forests and forestations can be found in the transient area along the hillside toe.

Grassland and widespread terrain surfaced with heather is dominating the landscape up to the highest hills.



**Figure 2: Diversified landscape along the hillside toes of Glenogil Estate**

From the hillside to the hills sheep are grazing on an extensive level. Important breeds are the Scottish Blackface and Texel. Both breeds show different grazing behaviour while Texel have quite low home ranges so they graze more intensive in its habitat the Scottish Blackface is migrating more spacious.

Sweet grass, rush and sedge are common along the burns but heather is the most important cover of vegetation in the higher and more arid sites.

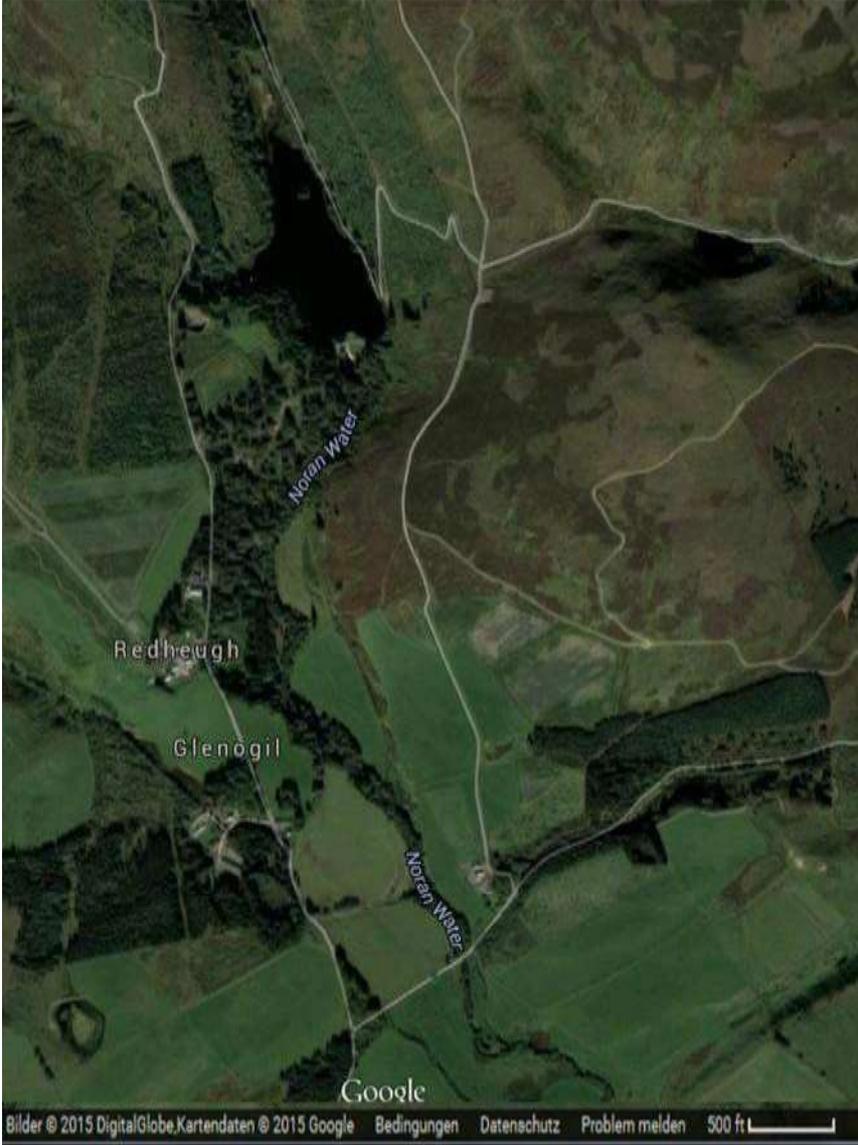


Figure 3: The Noran Water Reservoir in the transient area from lowlands to the higher sites in Glenogil Estate

### **3. Hunting, wildlife and landscape management**

At Glenogil Estate 11 Gamekeepers and 1 Headkeeper are responsible for predator control, grouse management, heather burning, organization of the shootings and so on.

Their main task is the management of the population of grouse with special focus on the heather sites. Along the burns and lower sites pheasant, red and grey partridge can be hunted and are released for shooting. But there is also a natural reproduction especially in pheasant and grey partridge.

The exceptionally high population of grouse is not only interesting from the perspective of conservation but also is an important economic factor. Without this economic dimension a management on this scale is unimaginable.

#### **3.1 Ungulates**

As mammals red and roe deer are hunted. The populations of both ungulates are strictly regulated on the one hand to reduce browsing in the forestations and hunting on red deer is on the other hand very intensive because they carry many ticks. Ticks count as one of the most important causes of mortality in chicks of the grouse. Red deer is also excluded by an electric fence around the estate but nevertheless some individuals or packs jump over

In context of ticks the grazing with sheep is also critical but sheep are medicated against infestation to reduce infestation rates.

#### **3.2 Mountain hares and rabbits**

Mountain hares and rabbits are two more hunted mammal. Rabbits can be found in the lower sites very frequently and soil erosion can be a consequence of their digging activity. Hunting during autumn and winter is very high but rabbits produce an enormous animalistic biomass so their ecologic role as alternative prey can be identified as very important for conservation. The pressure of predators to their potential prey such as grouse, black grouse, lapwing, curlew, mountain hare and many other ground-breeding birds is considerably reduced because the rabbits are so numerous.

The mountain hare in Glenogil and the neighbouring estates is very common. At the higher sites this indigene lagomorph species can be found all over the day instead elsewhere on the British islands the mountain hare is often described as declining. During the excursion we organised a spotlight counting of hares with the gamekeepers as to see in following chapters.

The hunting for mountain hares is executed with driven hunts on a few days during autumn and winter.

### 3.3 Predator management

Besides hunting for birds, ungulates and lagomorphs an intensive predator management is executed over the whole area. Overall about 2000 traps are installed and are controlled every week. The control can be passed by car because all traps are positioned near the roads. A cage is put on the top of the trap to avoid catching birds of prey. The traps are not baited and the opening of the wired cage is big enough for stoat, weasel and rats. These three species can be termed as important predators for grouse chicks and chicks of all other ground breeding birds. These kinds of traps are almost exclusively positioned at the heather sites.



Figure 4: traps to reduce *Mustela*-species and rats with wired cage to avoid catching birds of prey

To reduce the population of carrion crow along the burns and the smaller valleys the gamekeepers established crow traps. This kind of trap is very effective to reduce carrion crow with a live trap. Corvids and especially the very common carrion crow cause a high mortality amongst clutches and chicks. Controlling the population of carrion crow can be seen as an important part in conservation of endangered species.



Figure 5: Life trap to regulate the population of carrion crow

Beside other predators the red fox can be identified as most important predator for hares and ground breeding birds. Without sustainable reduction of fox population reproduction success of prey species will always stay at a minimum level that maybe leads to a local or regional extinction of susceptible species.

Foxes are killed by lamping all over the year. The gamekeepers have equipped the all-terrain vehicles with rotatable lamps on the top of the car's roof. About 1,5 hour after sundown they start lamping, each gamekeeper on his own run. When foxes are illuminated they normally stay for some seconds and that is enough time to shoot. This kind of reducing is one of the most effective methods but it demands a high work input from the keepers.

When there is snow there is possibility for snow tracking foxes. The gamekeepers look for recent footprints and follow the tracks to the den.

### 3.4 Grouse

Hunting grouse starts in mid-August. Numerous beaters walk along the heather sites in an abovementioned direction to drive the raising grouse to the shooters.

Shooters usually are waiting in butts positioned in a line of 10 stands. This kind of driven grouse shooting takes a high level of organization and can be effective but it is essential to have very good knowledge about the behaviour of the birds..

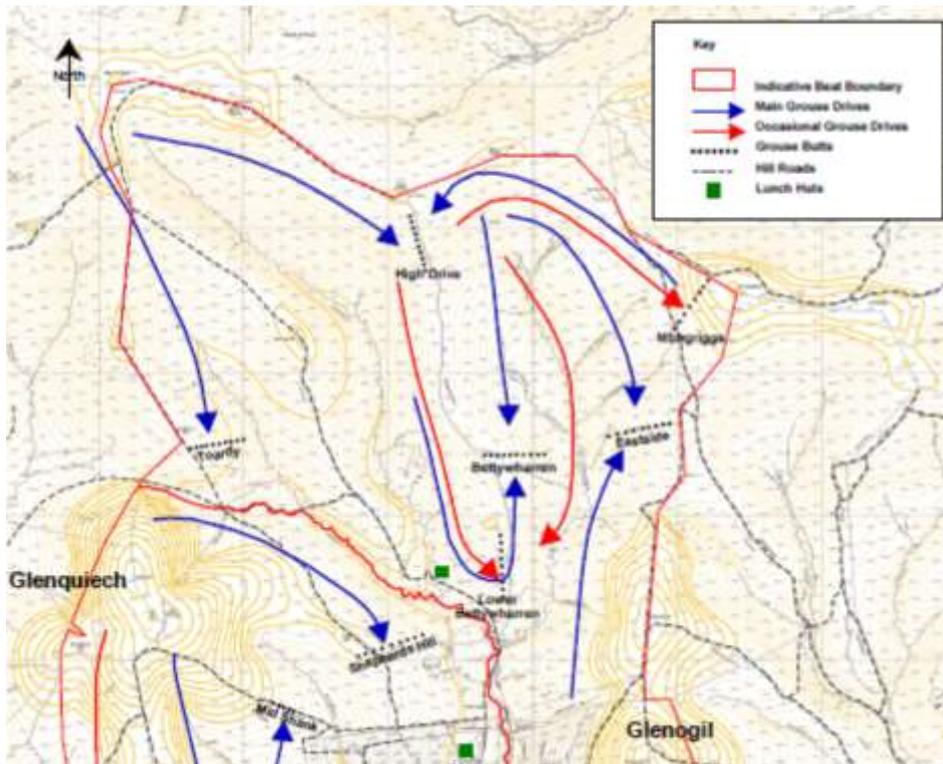


Figure 6: Map extract from a well prepared driven grouse shoot with butts for shooters and tracks for beaters

### 3.5 Grouse Management

To obtain ideal living condition and high survival rates of grouse there are installed more than 500 artificial pools in the whole of Glenogil estate. The pools are located along the roads and will be filled with fresh water during arid periods by the gamekeepers to adequately provide for the birds. Beside the grouse many other species especially birds benefit from this measure. The pools are usually cleaned twice a year.

Near most of the pools there are feeding boxes with granular vermicides but there is a total of more than 2000 feeding boxes in the whole area. Each box is pinpointed by GPS data and to make it easier to find them again they are marked by white plastic bars.

To deworm the grouse reduces the intestine parasites and leads to a higher fitness level of the birds.

Another measure to increase the health of grouse is trapping them with nets. Almost 90% of the adult birds were caught in late autumn to dispense each with a fluid vermicide. Before releasing the grouse were ringed.



Figure 7: Concrete pool as watering place for grouse with feeding box aside

An important part in grouse management is burning heather systematically. During a year about 30 plots with old heather are burned to enable generation of the plants. Old heather plants have a height of almost 50 cm and are very thick so they can't be a suitable habitat for grouse or other ground breeders. Chicks especially need to run on earth but that is impossible in thick heather shrub. Otherwise old heather doesn't produce as much seed as younger plants do. In this context old heather is less attractive as habitat for grouse and other bird species.

To control heather the fire strips are mulched to the neighbouring plots by the gamekeepers. The plots don't have a predefined size but are as big as needed to burn old heather down.

By this burning there is generated a mosaic that is characteristic for this landscape. The heather mosaic with burned places and different age classes offers a highly variable habitat. Ground breeders such as grouse can find food, cover, rest, hatching sites and have the possibility for sun bathing and grooming. These measures of management are best practice for a high biodiversity especially in ground breeding birds and many insects.

For grouse that live pairwise and defend their territory during breeding season this mosaic reduces intraspecific stress. Lower social interaction increases hatching success and the high variability in habitat structure enables high density.



Figure 8: Heather patches in different age classes as a result of burning are an important condition for high diversity and density of the avifauna

### 3.6 Ducks and geese

Among ducks and geese especially mallard duck is the most frequent. Greylag goose is breeding successful at Noran Reservoir and along the burn valleys they become more and more frequent for feeding.

The Mallard uses the subnatural burn courses as breeding habitat just as well the small standing water bodies.

Hunting on ducks and geese is undertaken few times in autumn and winter. There are butts beside the small ponds that can also be found in the valleys sometimes.



Figure 9: Pond with butts for duck hunting

## 4 Methods

During the four days excursion we could get good impression of the area of Glenogil Estate. Before this trip there is no knowledge about ecological studies in the area so we first had to test different methods for ecological survey.

Analog maps from the area were available and provided a basis for the fieldwork. To enter localities in the map exactly with coordinates and for further investigation it would be helpful to get digital maps to work with a geographic information system.

### 4.1 Spotlight counting of mountain hare

Spotlight countings were undertaken at night of 28.04.2015 with six all-terrain vehicles. The gamekeepers have prepared the vehicles with rotatable spotlights on the roof so we could illuminate the terrain in all directions. This was the first systematic spotlight counting in the area to determine the density of mountain hare so it was also a test if this method is practicable in general in the area of Glenogil. With spotlights it is possible to detect hares in a range of 150 m with the naked eye. With digital maps it will be possible to estimate density of mountain hares in the area but some preliminary work will be necessary because of the hilly terrain it is not always possible to survey 150 m.

One driven mile was the provisional measuring unit for our field mapping of hares. All hares and also other species were documented in a data entry form as to find in the appendix.

### 4.2 Bivouacs of grouse

The Scottish grouse uses bivouacs in heather and these places can be easily found because of the numerous faeces.

The frequency of the bivouacs is assumed to be a rate of relative abundance of grouse in this habitat.

During our surveys we selected plots of 20m width and 50m length that were examined systematically by three persons. All bivouacs were counted and documented in a data sheet. The single plots were all charted in maps and the plant cover was characterized. We differed between pasture, moss, recently burned heather, older burned heather and old heather. The field workers estimated the plant cover in the plot.

The meaning of this method was to calculate a habitat preference for grouse in relation to different growth stages of heather. Like other methods this was also used as a feasibility study.



Figure 10: Typical bivouac of grouse (aside some faeces of mountain hare)

To get a deeper insight in the behaviour of grouse the calculation of habitat preference is assumed to be reasonable. To establish or to keep effective management measures it is important for discussion with conservationists or politicians to have a reproducible and recognised method for calculation. Only ecological and biological facts must be basis for planning and implementation of conservation measures.

We calculated habitat preference referred to LILLE (1996) that means to be a recognized approach (HÖTKER, 2001; PETRY & HOFFMANN 2004). Habitat preference cannot be calculated as a simple quotient of occurrence and area, because different frequencies of habitats will influence the result.

The calculation is operated by the following formula:

*Formula 1: Habitat preference referred to Lille (1996):*

$$\text{Habitat preference} = \log(r/\sqrt{p}),$$

While  $r$  is the percentage share in bivouacs in one type of habitat and  $p$  is the percentage share of this habitat type in relation to the total area that is examined.

### **4.3 Line counting of birds by all-terrain vehicle**

Because of the surface area of Glenogil estate with more than 9000 ha it is impossible to investigate the terrain during four days without vehicles as resource. The line counting by vehicle is assumed as effective and reproducible method and is here used as a first quantitative survey. Birds often don't flee from cars so the observability in the low vegetation and near the roads of the Glenogil hills often is good. Otherwise birdsongs cannot be heard that well.

The vehicles were manned with one driver and two observers so good surveillance was assured.

At walking speed each mile was driven and all sightings of birds were documented in data sheets and all tracks were delineated in maps.

Sightings of grouse were differentiated as pairs and single birds. All other bird species were registered as individuals.

### **4.4 Mapping of birds territories**

Mapping of bird territories is a time-consuming method to determine breeding density (Bibby et al. 1996, Südbeck et al. 2005). To define a nesting site or to map the reasonable suspicion of breeding it is necessary to repeat the survey after 7 to 10 days. More than that at least 3 repetitions are obligatory.

To test the feasibility of the method we examined two sites that were surveyed one time. The results were documented in analog maps.

### **4.5 Survey of courtship places of Black Grouse**

Black grouse generally use special courtship places where the males court the females that will mate with the biggest cocks. Beginning in the middle of April to mid-May the cocks come together on these places every year. This time is best for surveying Black Grouse in a region. The gamekeepers have best knowledge of all courtship places in Glenogil so we had best preconditions to map this species. The places can often be surveyed from roads and because cars don't disturb the birds we normally stayed inside the vehicle. For further investigations maybe camouflage tents can be used at mating places that are off the tracks.

### **4.6 Birdsongs and sightings (non-systematic).**

Birdsongs are very important as report of birds in an area. By this method first of all the presence of a species can be documented but there is no hint if the species is breeding there. Besides singing of course sightings of birds confirm presence but

only if special behaviour, nesting sites or fledglings can be watched there is sufficient information to define a species as “breeding”.

During this excursion birdsongs and sightings were used as a part of the screening of the avifauna.

#### **4.7 Commented species catalogue of birds**

The commented species catalogue of birds contains information from all methods. Each bird species that was identified exactly is recorded in the catalogue.

#### **4.8 Collecting feathers of the Black Grouse**

At Glenogil estate there is a superior population of black Grouse and that’s why we collected feathers from the courtship places as reference samples and potentially to expand the project to other Scottish areas.

We collected feathers from three mating places respectively 10 from each. The molecular biological information should give information about the state of preservation of the black grouse population in Glenogil.

## 5 Results and discussion

### 5.1 Spotlight counting

Spotlight counting was conducted synchronized with 6 all-terrain vehicles. In total 32.5 miles (51,8 km) were driven. In consideration of unavailability of digital maps there is no possibility to calculate densities at the moment.

Heather is one of the most important plants in the area but it is possible that mountain hares cannot be seen when they are hidden. Numbers or densities represent minimum stocking.

During the drives on 28.04.2015 227 mountain hares could be counted. As aforementioned this is a minimum stocking but the bias is unknown at the moment. Further studies with IR-camera equipment could verify the results of spotlight counting to determine a correction factor.

If lamping of hares will be continued maybe fewer tracks are sufficient but random samples must be representative for the whole area.

During this first feasibility study the gamekeepers lamped both sides of the area by turning the lamps. To avoid overlooking of hares it is recommended to concentrate on one side of the vehicle. In addition the reproducibility will be increased.

As first evaluation the spotlight counting of hares can be seen as suitable for a monitoring of mountain hares in Glenogil. To increase reproducibility and to calculate the lamped area it will be necessary to get digital maps.

Mountain hare is the only indigene lagomorph species of the British islands and its population is decreasing in many parts of the UK. From this view it is recommended to establish the spotlight counting in reference areas such as Glenogil to monitor the development of population. Without this data the sustainability of the species will be more and more discussed by conservationists and politicians with the aim to abolish hare hunting.

Spotlight counting of hares is an international accredited method to determine population densities and a manageable amount of work is needed to get valuable data.

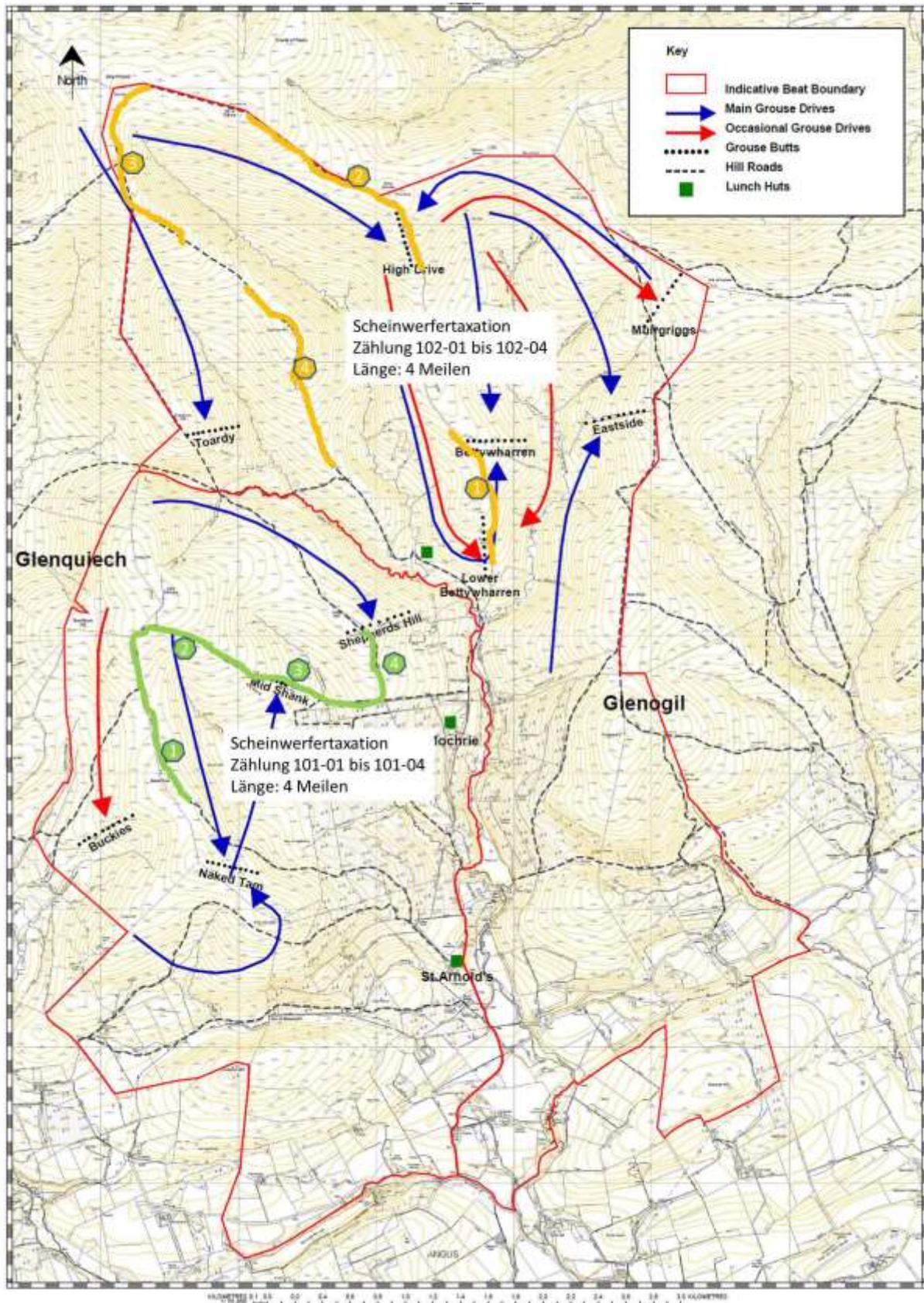


Figure 11: Spotlight counting of mountain hare at Glenogil Estate from 28.04.2015 – lamping areas 101 und 102

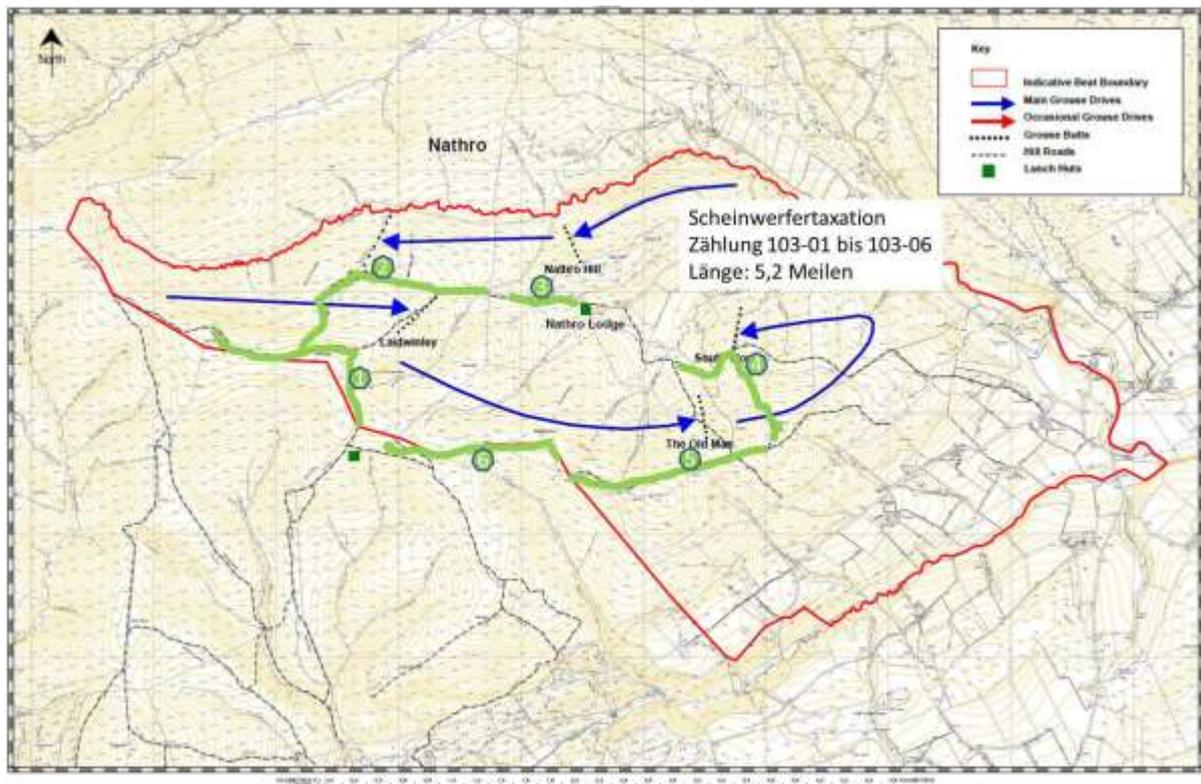


Figure 12: Spotlight counting of mountain hare in Glenogil Estate from 28.04.2015 – lamping area 103

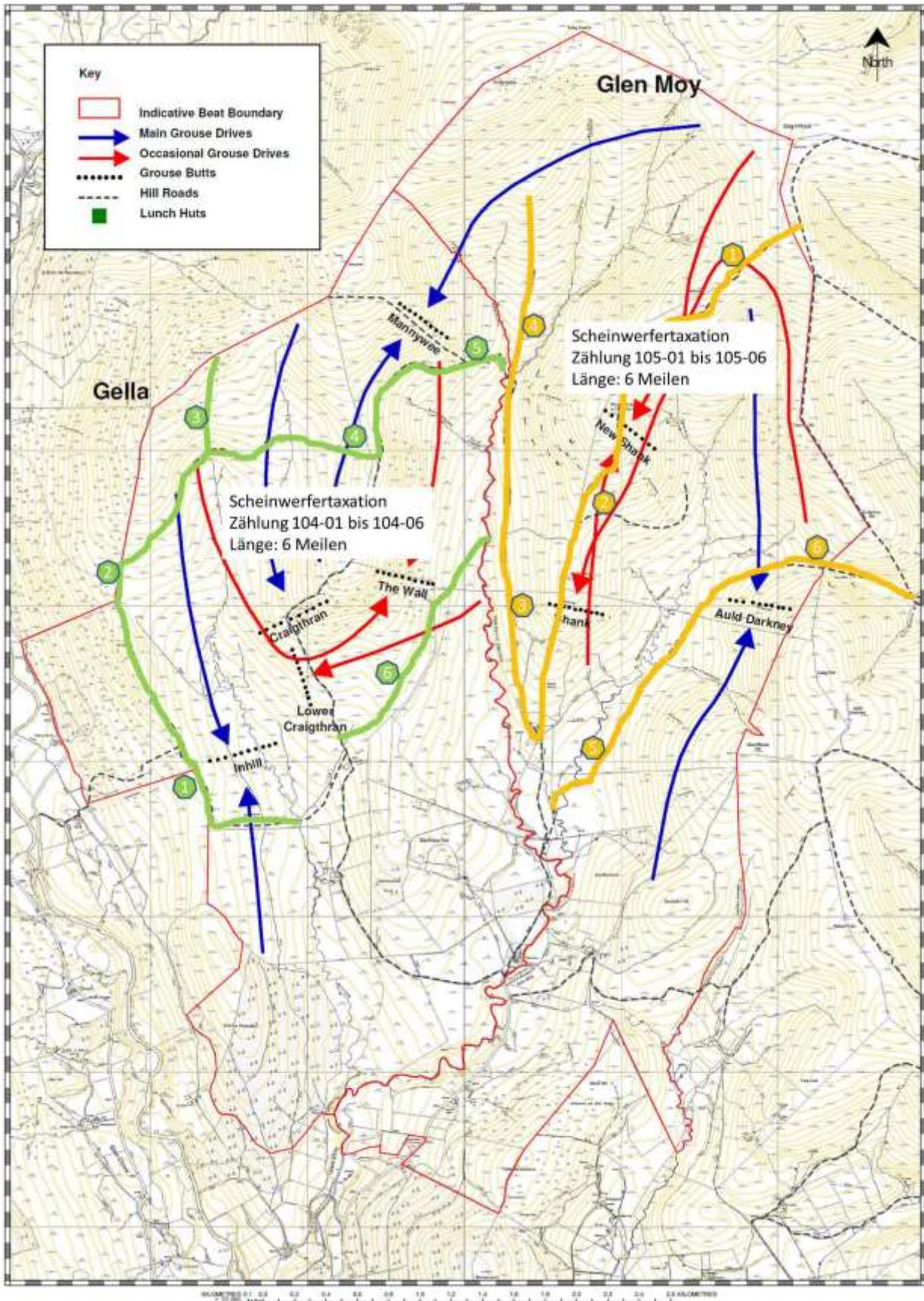


Figure 13: Spotlight counting of mountain hare at Glenogil Estate from 28.04.2015 – lamping areas 104 und 105

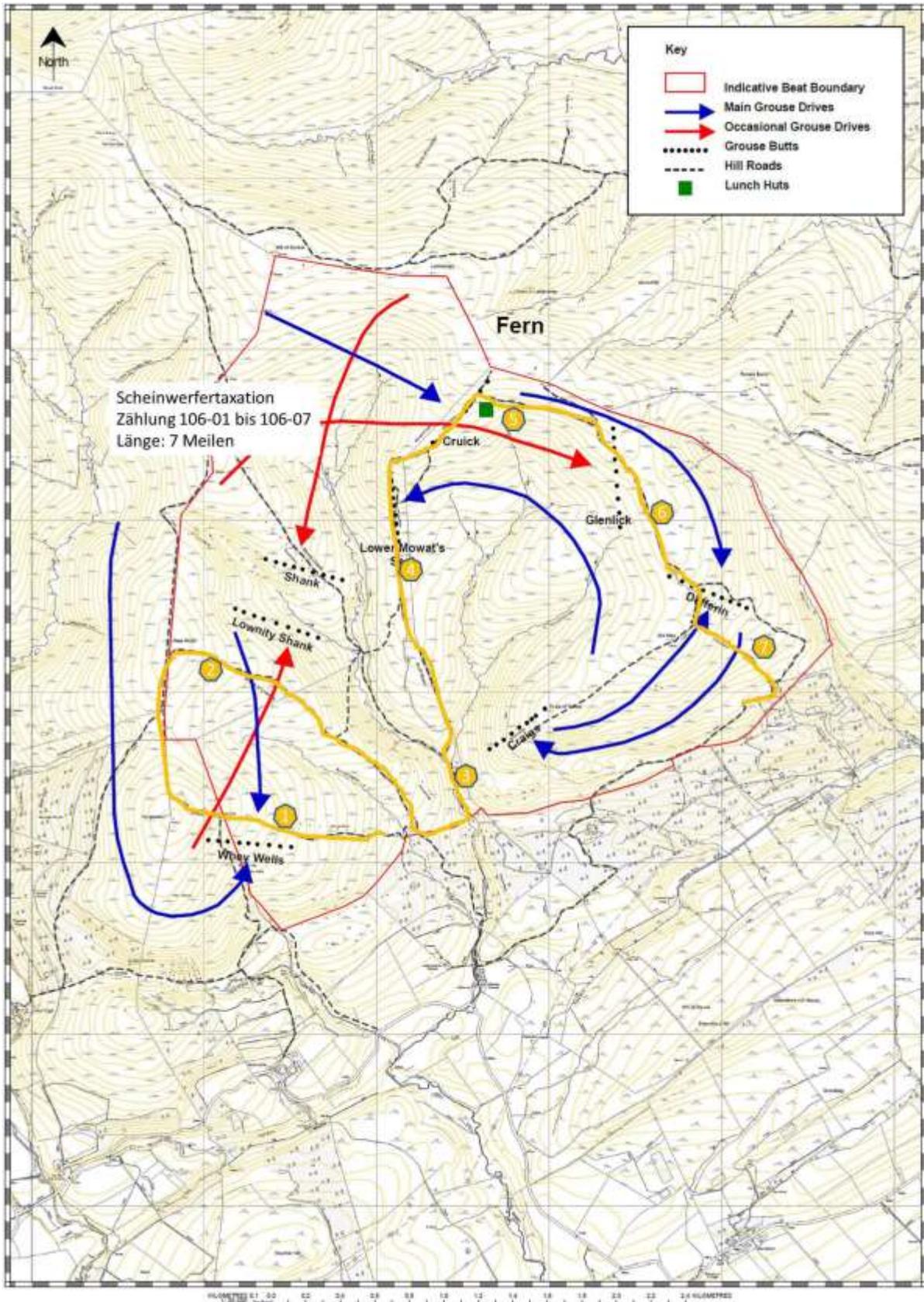


Figure 14: Spotlight counting of mountain hare at Glenogil Estate from 28.04.2015 – lamping area 106

As abovementioned actually it is not possible to calculate density. Therefore mountain hares are indicated as number of hares counted per mile. This determines a relative abundance and the areas can be compared. In „Glenogil“ and „Nathro“ we found similar results while at „Glen Moy“ and „Fern“ mountain hare numbers seem to be lower in 2015.

Table 1: Results of spotlight counting of mountain hares in six areas

	101	102	103	104	105	106
Area	Glenogil	Glenogil	Nathro	Glen Moy	Glen Moy	Fern
Distance (miles)	4	4	5,2	6	6	7
Sum of mountain hares	46	37	60	18	34	32
Hares per driven mile	11,5	9,3	11,5	3	5,7	4,6

If the results of both tracks in Glenogil and the tracks in Glen Moy are merged it becomes more obvious that frequency of hare in Glenogil is similar to Nathro but we found less than half of hares in Glen Moy and Fern.

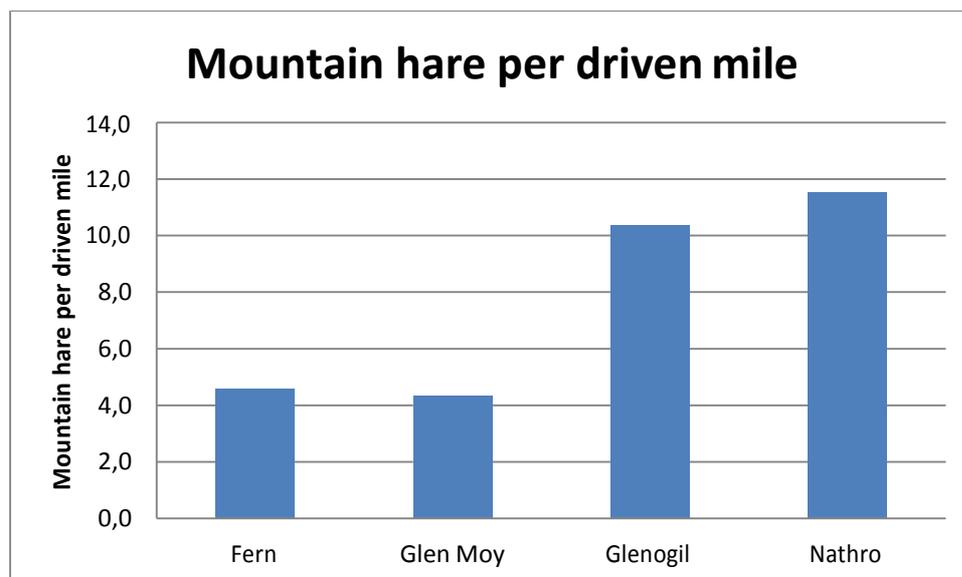


Figure 15: Comparison of 4 areas at Glenogil Estate by counted mountain hares per driven mile during spotlight counting in spring 2015

A repetition of spotlight counting will clarify things if the results can be confirmed. Because mountain hare is hunted in winter the hunting bags will also give information about the quality of the results of lamping. It is recommended to repeat the counting in autumn before hunting of hares will start.

## 5.2 Counting of bivouacs of grouse

We assumed that grouse prefer special habitats for the bivouacs (4.2).

At the start of the bivouac counting we differentiated additional „moss“ but after the first two counting areas we didn't so any more. Moss can be found in many bivouacs but it is not the structure forming agent of the vegetation. So moss is not assessed in following samples and calculation of habitat preference does not include moss

As essential for the choice of bivouacs by grouse the vertical structure of plant cover in combination with niches on the ground is assumed to be most relevant.

So far this method is not described in known literature but as a new approach it is needed to be discussed and it only can give advice about choice of bivouacs. During a year the availability of adequate resting places for grouse and equally for other birds is an important factor for the steady populating of a region.

We analyzed 18 spots at 1000m<sup>2</sup> and differentiated 1. heather, 2. burned heather, 3. recently burned heather, 4. pasture and 5. heather without management.

Heather and heather without management can be substantially differentiated by the plants height and the density of plants above ground.

Heather that was burned several years ago is totally regenerated. The plants show the characteristic floweriness and between the plants lots of niches can be found. In contrast unmanaged heather is very dense above ground and flowers can be found only on the top of the plant where they are almost unreachable for grouse.

Table 2: Results of surveying and mapping the bivouac of grouse on 18 areas (each 1000m<sup>2</sup>)

Area / position	Area No.	Heather	Burned heather	recently burned heather	pasture	Unmanaged heather	Sum
<i>lower Bettywharren, north</i>	2	72	43		4		<b>119</b>
<i>lower Bettywharren, north</i>	3				1		<b>1</b>
<i>lower Bettywharren, north</i>	4	57					<b>57</b>
<i>lower Bettywharren, north</i>	5	34		158			<b>192</b>
<i>lower Bettywharren, north</i>	6	27	84		3		<b>114</b>
<i>lower Bettywharren, north</i>	7	2	13		2		<b>17</b>
<i>lower Bettywharren, north</i>	8	37					<b>37</b>
<i>South of Mannywee</i>	9	37	7				<b>44</b>
<i>South of Mannywee</i>	10	57					<b>57</b>
<i>South of Mannywee</i>	11	84					<b>84</b>
<i>South of Mannywee</i>	12	36					<b>36</b>
<i>South of Mannywee</i>	13	48			13		<b>61</b>
<i>South of Mannywee</i>	14	118					<b>118</b>
<i>South of Mannywee</i>	15	17	25				<b>42</b>
<i>South of Mannywee</i>	16		89			9	<b>98</b>
<i>eastern New Shank</i>	17		21	5	7	1	<b>34</b>
<i>eastern New Shank</i>	18			9			<b>9</b>
<i>eastern New Shank</i>	19	31			6		<b>37</b>
<b>Total</b>		<b>657</b>	<b>282</b>	<b>172</b>	<b>36</b>	<b>10</b>	<b>1157</b>

In total 18.000m<sup>2</sup> were surveyed and mapped and we found 1157 bivouacs of grouse. 57% (n = 657) of the bivouacs were found in heather. This stadium of plant regeneration is a result of a consequent management by rotated burning. In burned heather we found 24% (n = 282) and 15% (n = 172) were located in recently burned heather. This distribution is not a synonym for a preference because the frequency of occurrence of the different heather classes varies.

Table 3: Frequency of occurrence of different habitat types in 1000m<sup>2</sup>-areas

Area / position	Area No.	Heather (m <sup>2</sup> )	Burned heather (m <sup>2</sup> )	Recently burned heather (m <sup>2</sup> )	pasture (m <sup>2</sup> )	Unmanaged heather (m <sup>2</sup> )
<i>lower Bettywharren, north</i>	2	800	200			
<i>lower Bettywharren, north</i>	3	1000				
<i>lower Bettywharren, north</i>	4	1000				
<i>lower Bettywharren, north</i>	5	500		500		
<i>lower Bettywharren, north</i>	6	500	500			
<i>lower Bettywharren, north</i>	7	300	700			
<i>lower Bettywharren, north</i>	8	1000				
<i>South of Mannywee</i>	9	750	250			
<i>South of Mannywee</i>	10	1000				
<i>South of Mannywee</i>	11	1000				
<i>South of Mannywee</i>	12	1000				
<i>South of Mannywee</i>	13	850			150	
<i>South of Mannywee</i>	14	1000				
<i>South of Mannywee</i>	15		200		100	700
<i>South of Mannywee</i>	16	100	900			
<i>eastern New Shank</i>	17		350	300	300	50
<i>eastern New Shank</i>	18			1000		
<i>eastern New Shank</i>	19	900			100	
<b>Total</b>		<b>11700</b>	<b>3100</b>	<b>1800</b>	<b>650</b>	<b>750</b>

Heather in regenerated state is most common in our investigation area (65%). The frequency of bivouacs in a habitat type therefore is not a measure for habitat preference. A calculation of habitat preference is essential (see chapter 4.2).

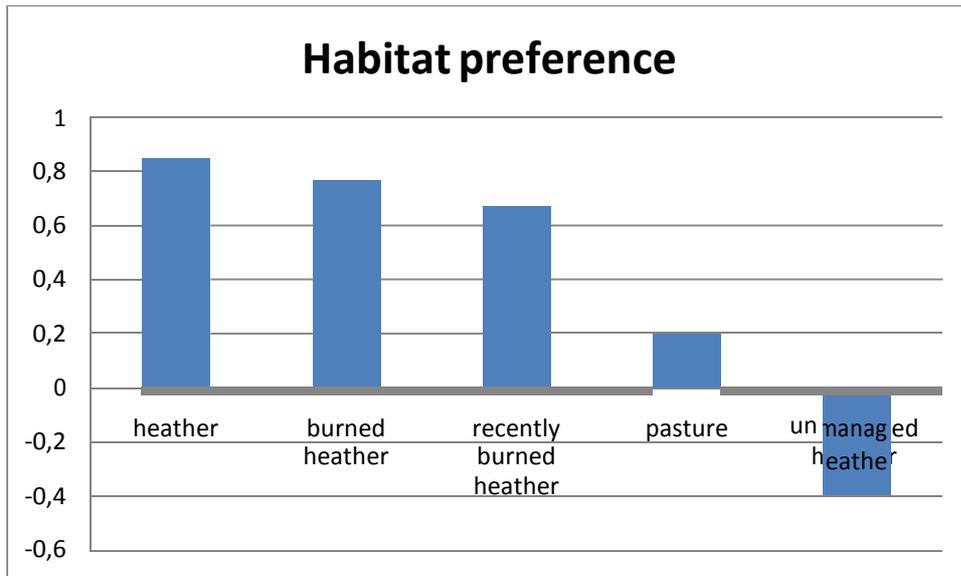


Figure 16: Habitat preference for bivouacs of grouse in 18 areas

The values of habitat preference normally vary between 1 and -1 which values exceeded 0,3 mean a preference. Values between 0,3 and -0,3 mean no significant preference but a preference less than -0,3 denominates that grouse avoid this habitat.

All stages of managed heather are preferred by grouse significantly. Pasture is used for bivouac as it was expected statistically with a slight positive tendency.

Therefore heather without management is avoided by grouse actively. Also this is the first study about attractiveness of different habitat types for grouse it can be shown that the quality of landscape as wildlife habitat is correlated positively with habitat management such as burning in this case.

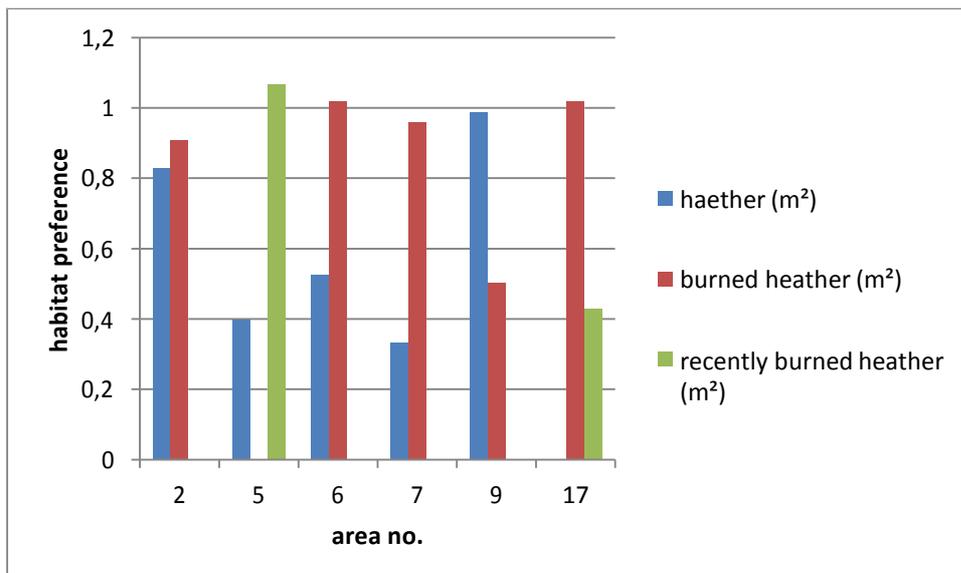


Figure 17: Comparison of habitat preference values for heather in different stages of regeneration for single areas

The habitat preference on some of the areas could be compared directly. With the exception of area no. 9 the stage „burned heather“ reaches higher preference values than „heather“. This stage of burned heather makes it possible for grouse to run on ground, they have high visibility to detect predators early but also the coverage is adequate to hide from predators. Recently burned heather has always positive value of habitat preference but the older stage of regeneration seems to be a bit more favoured (see area No. 17).

For a final analysis the random sample is still too small but the described tendencies should be occasion for further investigation. The selection of bivouacs by grouse means an important demand which is relevant for population density in an area. Without managing heather by burning population will be lower so that heather management is essential for effective conservation.

It is demanded to expand the studies to get also information about preferences for selection of breeding and feeding habitats.

### 5.3 Line counting of birds by all-terrain vehicle

The line counting by all-terrain vehicle was conducted on 24 sections each with a length of 1 mile. Most individuals have been found of grouse (n = 225) that often is easy to detect by car. Meadow pipit is also common and we documented 191 individuals.

Figure 18: Extract from the complete table about selected bird species mapped during line counting in late April 2015

Area	Section	Nr.	Grouse, single	Grouse pair	Grouse, individuals	Meadow pipit	Wheatear	Curlew	Lapwing	Golden plover
	<i>South slope</i>									
Nathro	high	1	15	6	27	12	1	2		
Nathro	lodge	2	6	0	6	35	2			
Nathro	lodge	3	0	0	0	8		2		
	<i>South slope</i>									
Nathro	low	4	6	1	8	16	1	1	9	
Nathro	Fortsetzung	5	11	4	19	16	1	4		
Nathro	Fortsetzung	6	2	1	4	9	2	2	1	
Fern	Glenlick	7	3	1	5	10	2			
Glenogil	reservoir	8	2	0	2		2			
Fern	Whey Wells	9	9	1	11	6				
	<i>Lownity</i>									
Fern	Shank	10	8	0	8					2
Fern	Shank	11	9	2	13	3	1			
Glenogil		12	6		6	34				
Glenogil		13	10	1	12	7			1	
Glen										
Moy		14	2		2	6		4	11	
Glen										
Moy	Shank	15	6		6	3		2		
Glen										
Moy		16	6	3	12					
Glen										
Moy		17	12	2	16	1				2
Glenogil		18	12	6	24			3		
	<i>Lower Betty</i>									
Glenogil	Wharren	19	14	1	16	2				
	<i>Betty</i>									
Glenogil	Wharren	20	13	2	17	2		1		
Glenogil	High Drive	21	0	0	0	7		1		
Glenogil	Dog Hillock	22	5	3	11	1				
	<i>LBW Hütte;</i>									
Glenogil	Tal	23	0	0	0	13		1		
	<i>Tal bis</i>									
Glenogil	Reservoir	24	0	0	0					
<b>Total</b>			<b>157</b>	<b>34</b>	<b>225</b>	<b>191</b>	<b>12</b>	<b>23</b>	<b>22</b>	<b>4</b>

Curlew, lapwing and wheatear also are common species in Glenogil. Two pairs of golden plover were proved on the hills and while golden plover population is decreasing in most parts of its distribution area or even is extinct in former ranges the population in Glenogil estate is stable. According to the gamekeepers statement 20 to 30 pairs of golden plover breed in the area and breed there successful. In comparison to this in Germany only 6 to 8 pairs breed there in total as to refer in the newest atlas of breeding birds of Germany.

The results of our mapping differ between the lower parts of the area and the hills. In the meadows shorebirds are very common while in the heather regions up the hills grouse is the most common species. In comparison to other regions ground breeders in total are very numerous in the whole area as a result of sustainable high breeding success. Lack of breeding success in comparable landscape is one of most important factors why populations of ground breeders decrease in many parts of their distribution area. The combination of habitat management (burning heather and grazing sheep or cattle in an extensive way) and the intensive hunting of generalist predators makes it possible for ground breeders to realize high breeding success. Also the mountain hare profit from this measurements and show stable population

trends.

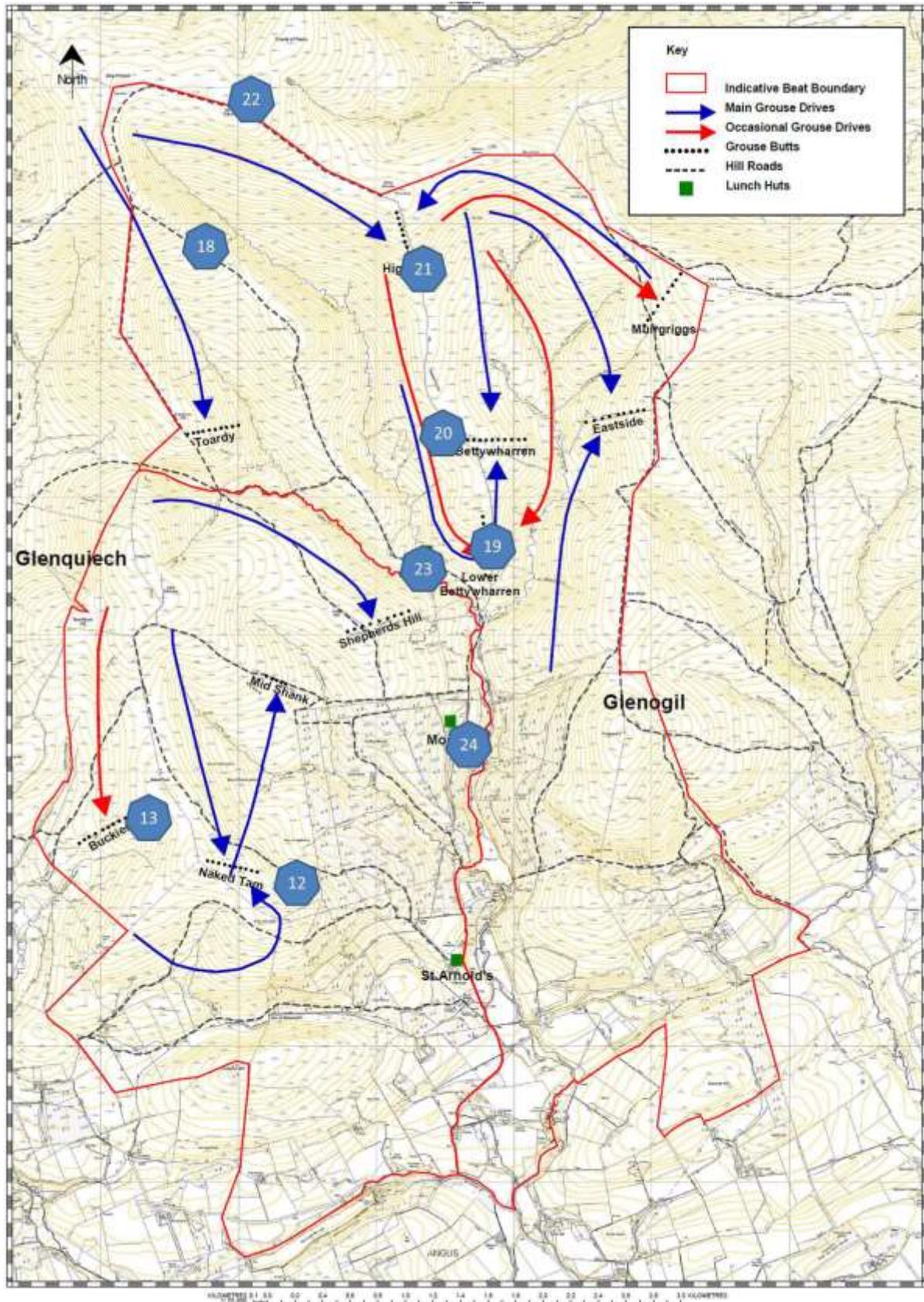


Figure 19: Location of line counting routes in Glenogil and Glenquiech

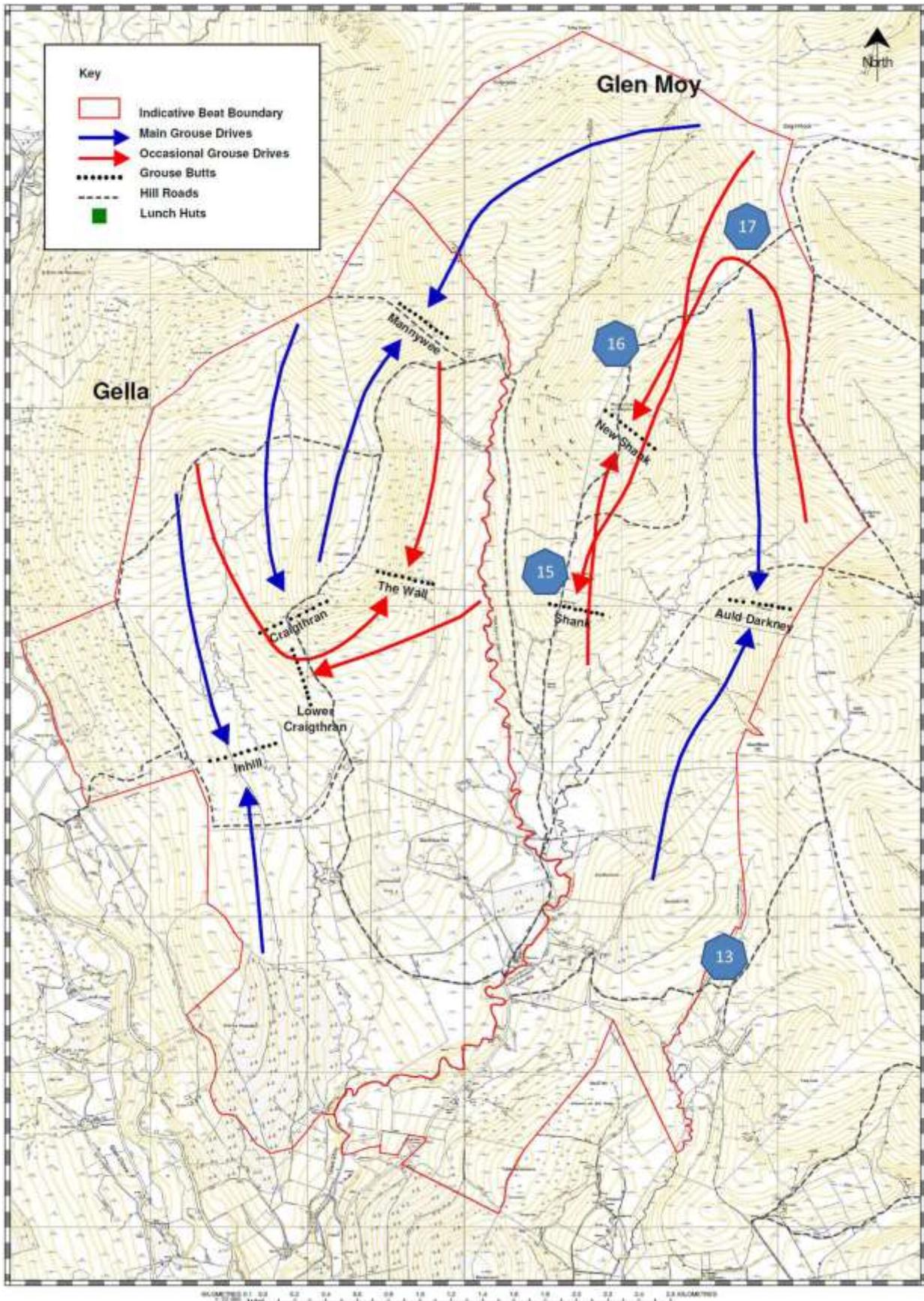


Figure 20: Location of line counting routes in Glen Moy

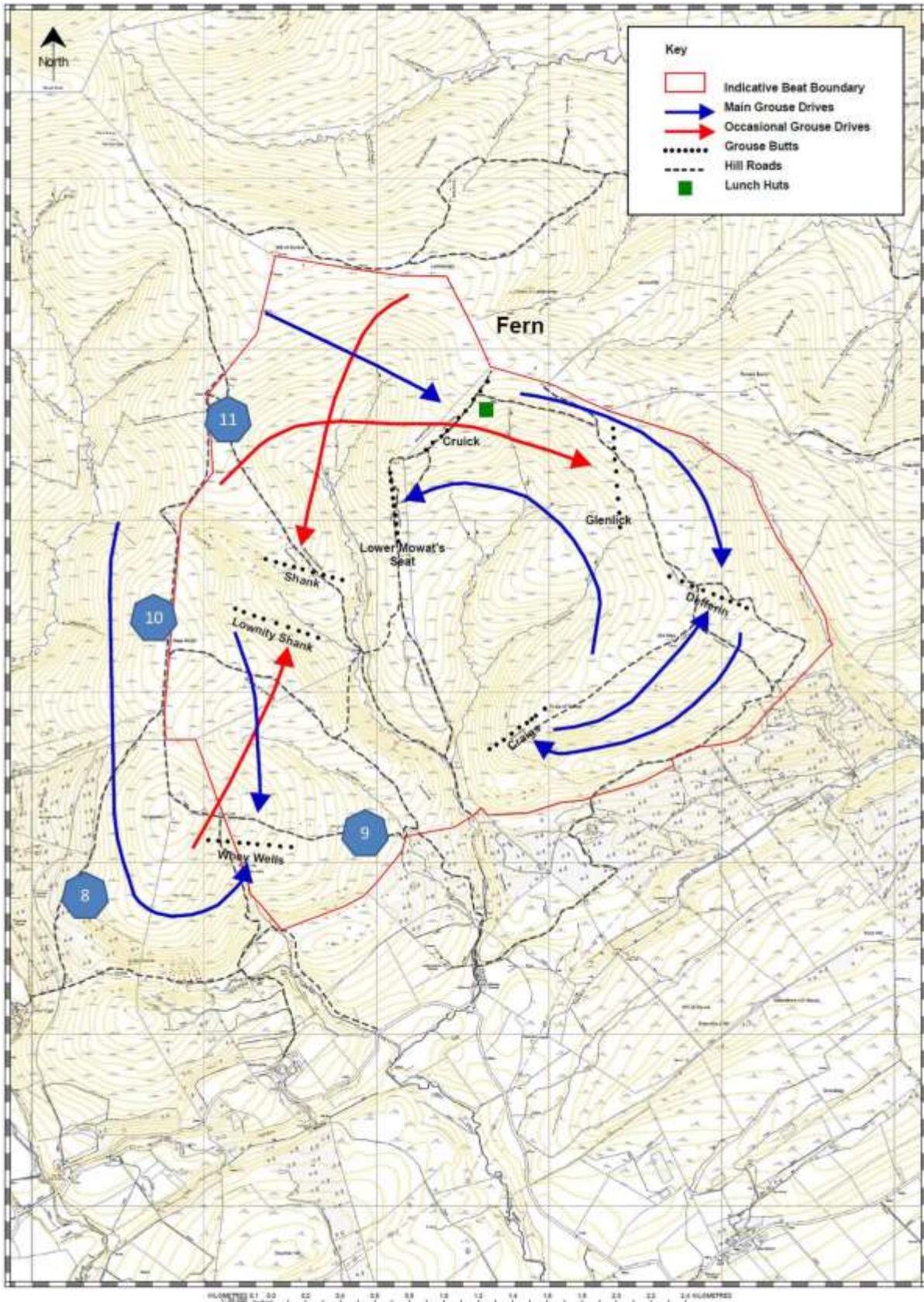


Figure 21: Location of line counting routes in Fern

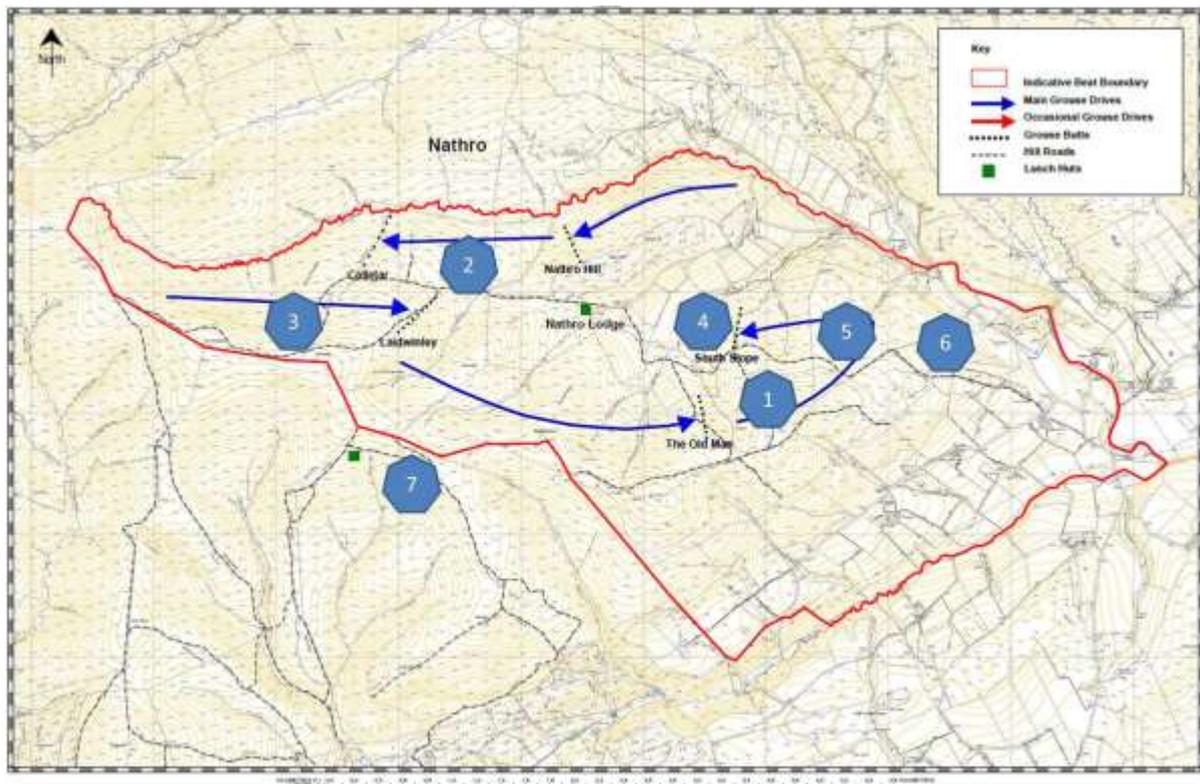


Figure 22: Location of line counting routes in Nathro

Actual we only have access to analogue maps that's why the data analysis cannot be completed in a biogeographical context. In the future these data can be used as basis for a monitoring program. Occurrence, abundance, dispersal of species in the area and in habitats and population trends can be illustrated.

#### 5.4 Courtship places of Black Grouse

At the time of the excursion black grouse were displaying very intensive and we could observe them on the courtship places especially in the early morning and in the evening. Like many other ground breeding birds black grouse is endangered in many parts of its range in Europe and populations decrease widespread. Bad habitat conditions and high population of generalist predators are the main factors for the decrease. At Glenogil estate on the one hand we find excellent habitat conditions and on the other hand the intensive management of predators leads to high breeding success and high survival rates in adults and especially chicks. Special investigations about breeding success and survival rates would be very interesting to compare these data with unmanaged areas.

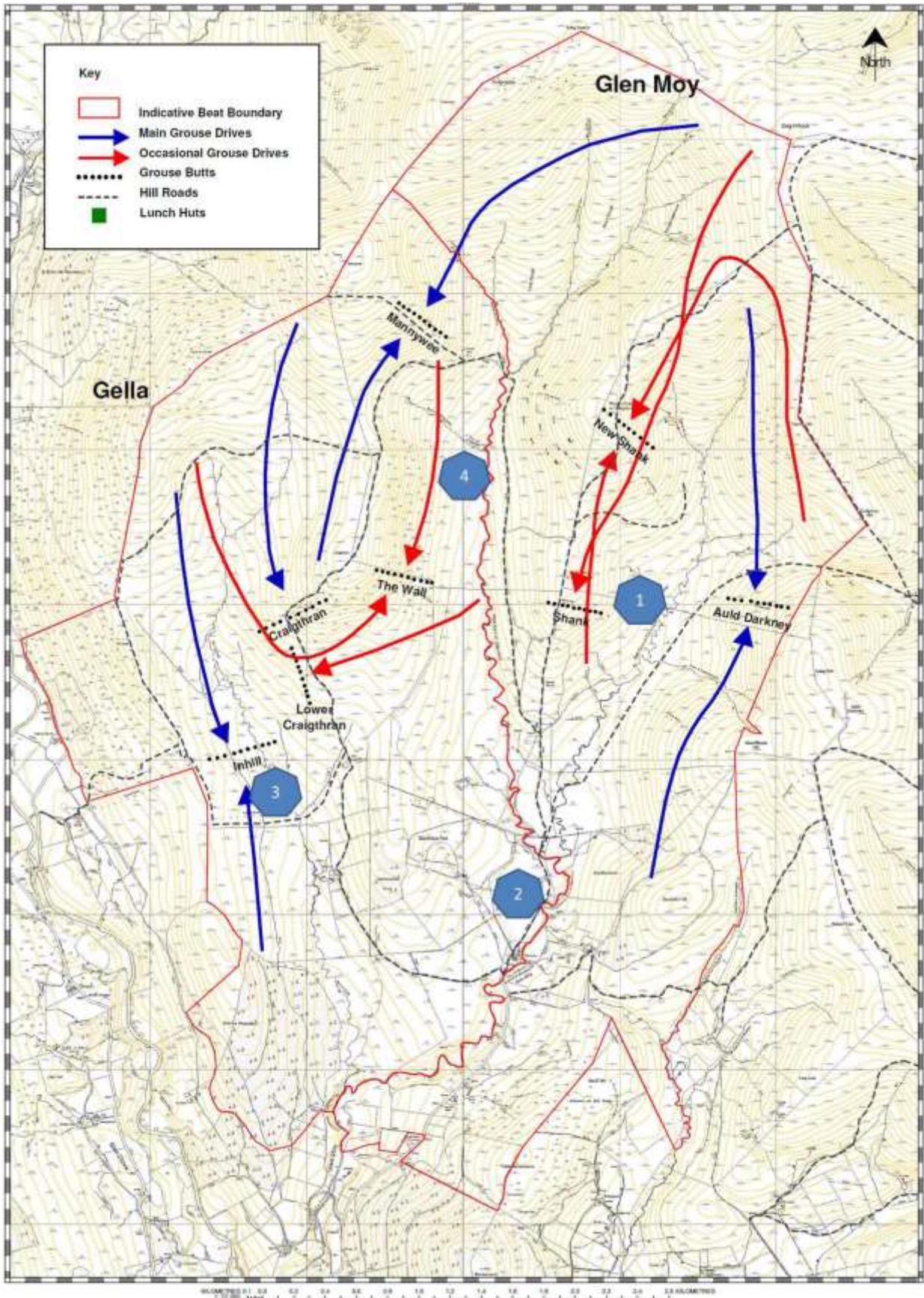


Figure 23: Courtship places of Black Grouse at Glenogil Estate in April 2015

On the four courtship places we found 16 (no. 4), 16 (no. 2), 19 (no. 3) and 20 (no. 1) mating cocks of black grouse. In total that means a minimum population of male black grouse of 84 individuals. During a more intensive monitoring in the early morning of 27.04.2015 at mating place no. 1 we counted a maximum of 24 cocks and 6 hens at 5:55 a.m..

One more courtship place is placed next to the border of Fern and 15 displaying cocks were counted there.

To examine the genetic variability of black grouse at Glenogil estate, we collected 30 feathers from mating places no. 1 to no. 3 respectively 10 from each place. During report generation the results of the molecular biological analysis is not finished yet.

## 5.5 Commented species catalogue of birds

Because of bad weather conditions (cold and precipitation frequency with snow and hailstorm) and a short time for examination the number of detected birds must be declared as a minimum list.

Table 4: Commented species catalogue of birds

Scientific species name	German Name	English Name
<i>Ardea cinerea</i>	Graureiher	Grey Heron
<i>Cygnus olor</i>	Höckerschwan	Mute Swan
<i>Anser anser</i>	Graugans	Grey-lag Goose
<i>Anas platyrhynchos</i>	Stockente	Mallard
<i>Anas penelope</i>	Pfeifente	Wigeon
<i>Aythya fuligula</i>	Reiherente	Tufted Duck
<i>Haliaeetus albicilla</i>	Seeadler	White-tailed Eagle
<i>Aquila chrysaetos</i>	Steinadler	Golden Eagle
<i>Buteo buteo</i>	Mäusebussard	Buzzard
<i>Accipiter nisus</i>	Sperber	Sparrowhawk
<i>Milvus milvus</i>	Rotmilan	Red Kite
<i>Falco peregrinus</i>	Wanderfalke	Peregrine Falcon
<i>Falco tinnunculus</i>	Turmfalke	Kestrel
<i>Lagopus lagopus scoticus</i>	Schottisches Moorschneehuhn	Red Grouse
<i>Tetrao tetrix</i>	Birkhuhn	Black Grouse
<i>Alectoris rufa</i> *	Rothuhn	Red-legged Partridge
<i>Perdix perdix</i>	Rebhuhn	Grey Partridge
<i>Phasianus colchicus</i> *	Fasan	Pheasant
<i>Haematopus ostralegus</i>	Austernfischer	Oystercatcher
<i>Vanellus vanellus</i>	Kiebitz	Lapwing
<i>Pluvialis apricaria</i>	Goldregenpfeifer	Golden Plover
<i>Gallinago gallinago</i>	Bekassine	Snipe
<i>Scolopax rusticola</i>	Waldschnepfe	Woodcock
<i>Numenius arquata</i>	Großer Brachvogel	Curlew
<i>Tringa hypoleucos</i>	Flußuferläufer	Common Sandpiper

<i>Tringa totanus</i>	Rotschenkel	Redshank
<i>Larus fuscus</i>	Heringsmöwe	Lesser Black-backed Gull
<i>Larus argentatus</i>	Silbermöwe	Herring Gull
<i>Larus ridibundus</i>	Lachmöwe	Black-headed Gull
<i>Columba palumbus</i>	Ringeltaube	Wood Pigeon
<i>Cuculus canorus</i>	Kuckuck	Cuckoo
<i>Asio flammeus</i>	Sumpfohreule	Short-eared Owl
<i>Tyto alba</i>	Schleiereule	Barn Owl
<i>Dendrocopos major</i>	Buntspecht	Great spotted Woodpecker
<i>Alauda arvensis</i>	Feldlerche	Skylark
<i>Riparia riparia</i>	Uferschwalbe	Sand Martin
<i>Anthus pratensis</i>	Wiesenpieper	Meadow Pipit
<i>Motacilla cinerea</i>	Gebirgsstelze	Grey Wagtail
<i>Motacilla alba</i>	Bachstelze	White Wagtail
<i>Sturnus vulgaris</i>	Star	Starling
<i>Garrulus glandarius</i>	Eichelhäher	Jay
<i>Pica pica</i>	Elster	Magpie
<i>Corvus monedula</i>	Dohle	Jackdaw
<i>Corvus corone</i>	Rabenkrähe	Carrion Crow
<i>Corvus corax</i>	Kolkrabe	Raven
<i>Cinclus cinclus</i>	Wasseramsel	Dipper
<i>Troglodytes troglodytes</i>	Zaunkönig	Wren
<i>Phylloscopus trochilus</i>	Fitis	Willow Warbler
<i>Phylloscopus collybita</i>	Zilpzalp	Chiffchaff
<i>Oenanthe oenanthe</i>	Steinschmätzer	Wheatear
<i>Phoenicurus ochruros</i>	Hausrotschwanz	Black Redstart
<i>Erithacus rubecula</i>	Rotkehlchen	Robin
<i>Turdus merula</i>	Amsel	Blackbird
<i>Turdus philomelos</i>	Singdrossel	Song Trush
<i>Turdus pilaris</i>	Wacholderdrossel	Fieldfare
<i>Parus caeruleus</i>	Blaumeise	Blue Tit
<i>Parus ater</i>	Tannenmeise	Coal Tit
<i>Parus major</i>	Kohlmeise	Great Tit
<i>Aegithalos caudatus</i>	Schwanzmeise	Long-tailed Tit
<i>Passer domesticus</i>	Hausperling	House-Sparrow
<i>Fringilla coelebs</i>	Buchfink	Chaffinch
<i>Pyrrhula pyrrhula</i>	Gimpel	Bullfinch
<i>Emberiza citrinella</i>	Goldammer	Yellhammer

\*released continuously

The osprey (*Pandion haliaetus*) was not observed but the gamekeepers report about continuous sightings at the Noran Reservoir (e.g. Adam Watson) and an aerie on a pine was mapped. Also on the reservoir mute swan, greylag goose, grey heron, mallard, widgeon and tufted duck could be observed.

The species of seagulls were surveyed on a plowed field where pheasants and song thrushes also were common.

Short eared owls were watched several times in flight on raised stands.

The population of black grouse is decreasing also in Great Britain (especially in England). That's why the species is listed in the red data book and is listed as a priority species in the UK Biodiversity Action Plan (UKAP). In Scotland the Game & Wildlife Conservation Trust (GWCT) assumed responsibility in the local biodiversity action plan (LBAP). At Glenogil estate we found 84 mating cocks and 15 more near the border to Fern. So this area can be identified as best practice region for sustainable conservation of black grouse.

The wood pigeon is very common on the grass lands in the lowlands.

Most of the song birds were observed in shrubs next houses.

In total 63 bird species could be identified. High species diversity in birds is associated with diversified use of landscape at Glenogil estate.

High habitat quality and low density of generalist predators cause a high diversity in bird species. Using the example of Glenogil it can be demonstrated that the combination of habitat and predator management is the most effective conservation strategy.

The high frequency of raptors especially rare species reveals specialist predators not as a danger for biodiversity but identifies generalist predators as an important factor. High populations of generalist predators lead to reduced breeding success, high mortality rates so they reduce the population of their prey in a little while. Intensive reduction of generalist predators is indispensable to prevent their fast increase and to conserve high biodiversity in an area.