

# Tracking wolves and lynx in northern Slovakia, winter 2008/09

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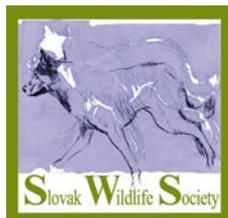


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*Photo: View across the Liptov plain looking NE from the Nízke Tatry Mtns to the Tatra National Park, showing the central part of the study area.*

## Introduction

In order to improve the quality of information available for wolf (*Canis lupus*) conservation management in Slovakia, the Slovak Wildlife Society (SWS)<sup>1</sup>, with financial support from the Wolves and Humans Foundation (WAH)<sup>2</sup>, launched the Slovakia Wolf Census Project in 2005. On the basis of our own fieldwork as well as consultation with local experts, pack distribution and size were mapped, thereby producing an estimate of the total number of wolves in the country, national in scope but verifiable locally. Estimates of population size were also obtained using three other quantitative methods and compared with official hunting statistics (Rigg 2007). The results were presented at the 8<sup>th</sup> Conference on Research and Conservation of Mammals in Slovakia, held in October 2007 (Rigg 2008), as well as at seminars in Poland and the Czech Republic.

It was proposed to repeat the census in 2006/07 but there was insufficient snow in many areas for most of the winter. The following year was also considered, but by then the funding available was insufficient. Besides the intrinsic difficulty of estimating numbers of elusive species in the wild, another problem often encountered during the original census was the reluctance of some local experts to collaborate and share information, which was crucial to the project methodology. Given these experiences, a more realistic approach seemed to be to gradually refine results in one or more model areas, with a greater proportion of fieldwork conducted by SWS.

With this in mind, in December 2008 WAH provided funding for 16 days of staff time for SWS to monitor wolves in the Liptov region of northern Slovakia. As it often occurs in the same areas as the wolf, the lynx (*Lynx lynx*) was also included in the study. Fieldwork was planned for January–February 2009 but, as there were good conditions for snow tracking earlier, work began in December. Fifteen days were used for fieldwork, with the remaining day reserved for analysing and reporting results. This is of course relatively little for this type of work, so the project is best regarded as a pilot study to gain experience and assess methodology as well as to provide some baseline data. However, some comparison with results from the 2005/06 census was possible. Data obtained have been analyzed both qualitatively and quantitatively, to give an impression of the types of information that a larger-scale study could provide although, due to small sample sizes, statistical analyses have for the most part not been used.

## Study area

Fieldwork was conducted in an area of c.460 km<sup>2</sup> in the Upper Liptov region of northern Slovakia where wolves and lynx, as well as brown bears (*Ursus arctos*), were known to occur (fig. 1). The study area included parts of the Tatras and Low Tatras (Nízke Tatry) National Parks as well as part of the Liptov plain, a mosaic of field-forest-meadows with scattered villages and the town of Liptovský Hrádok (popn. 8,600). Elevation ranged from 600 to 2,248 m a.s.l. Within the National Parks, coniferous forest predominated, Norway spruce (*Picea abies*) being the most common tree species, with some mixed forest, particularly in the southern portion of the study area, as well as sub-alpine and alpine habitats in the north. The main species of wild ungulates present were red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*) and wild boar (*Sus scrofa*). Liptovský Mikuláš district, of which the study area formed part, had a mean human

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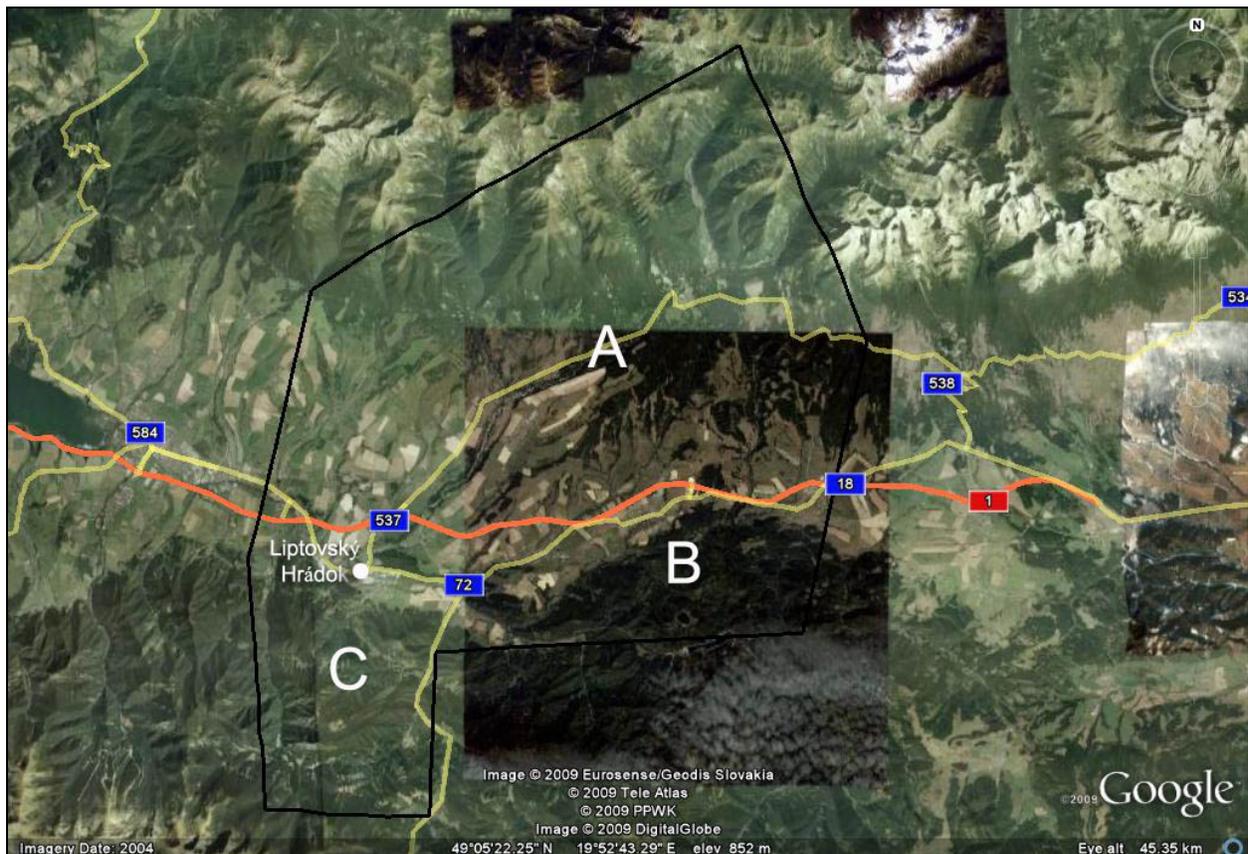
<sup>1</sup> URL: <http://www.slovakwildlife.org>

<sup>2</sup> URL: <http://www.wolvesandhumans.org>

population density of c.55 inds./km<sup>2</sup> and an average road density of 0.27 km/km<sup>2</sup>. There were no substantial human settlements in core areas of National Parks but forestry, hunting and recreation were common activities even within protected areas.

The study area was divided into 3 sub-units: Area A encompassed part of the Západné Tatry Mountains and the Liptov plain north of Highway D1/E50, from Žiarska Valley to Važec; Area B comprised foothills of the Nízke Tatry Mountains between the highway and the Čierný Váh River, to the east of Road 72 and west of the village of Važec; and Area C included part of the Nízke Tatry Mountains and their foothills south of the highway, from Jánska Valley in the west as far as Road 72 in the east. As these 3 areas were separated by roads with breaks in forest cover and a higher degree of human activity, one of the aims of the study was a preliminary investigation of the degree to which such zones appear to present a barrier to large carnivores.

**Fig. 1** Location and sub divisions (A–C) of the study area (boundary shown in black) in Upper Liptov, northern Slovakia. Yellow lines are single carriageway roads; the orange line is a highway. Mountains at the top of the image are the Západné Tatry and Vysoké Tatry, both within the Tatras National Park. Part of Nízke Tatry National Park forms the lower portion of the image. Between the National Parks, running west-east, is the Liptov plain.



## Materials and methods

Wolf and lynx presence and abundance were determined by snow-tracking in December–February. Routes to be surveyed on foot, cross-country skis or snow shoes, according to snow conditions, were selected in order to cover the majority of the study area, with a focus on localities where large carnivores had been seen or tracked in previous winters. Area A was

surveyed most intensively, as it was thought to include the majority of a resident wolf pack's territory, with a smaller number of routes in Areas B and C to provide broader coverage. In all, a total of c.200 km were surveyed (fig. 2). The majority of fieldwork was done within 1–2 days of snowfall. This was not possible in mid–late January, as there were no new snowfalls then and existing snow cover was reduced by higher temperatures.

When tracks of wolves or lynx were found, their location and direction were noted. They were then followed as far as possible. Although this meant that survey routes were not predetermined for their entire length, the average distance covered before tracks were found, and the proportion of all routes on which tracks were found, could be used as quantifiable measures of carnivore abundance. Following tracks provided additional data on habitat use, movements, activities and behaviour as well as samples for analysis of diet and DNA. In the case of wolves, it was essential to follow tracks in order to accurately determine group size, as wolves travelling together often stepped in each others' footprints or temporarily separated.

A handheld GPS receiver (Garmin GPSMap® 60CSx) was made available in mid-January and this was used to record locations of tracks found from 25.01.09. The receiver was switched on when tracks of wolves or lynx were found and was left on as they were followed, a track log with points at intervals of c.8m or c.15 seconds thereby being automatically recorded. Significant locations (prey, scats, scent marking, changes in group size, etc.) were also marked manually as waypoints. On 11.–24.02.09, locations with several ungulates ( $\geq 3$  individuals within c.50m) were also marked as waypoints. Saved locations and tracks were analyzed using MapSource software and a digitized topographic map of Slovakia (Garmin/Conan Slovakia Topo v2).

Some supplementary, less detailed information was provided by various people frequenting the study area. This was not included in analyses of systematically gathered data but it helped complete the picture by indicating if the results obtained from the survey seemed representative.

## **Results**

### **Abundance**

The average distance covered before large carnivore tracks were found was 19.3 km ( $n = 7$ ) in the case of the wolf and 26.1 km ( $n = 4$ ) for the lynx. No signs of bears were found. Tracks of 1 or more wolves were found on a total of 5–6 of the 15 trips (33–40%); lynx tracks were found on 2 trips (15%), including on 07.01.09, when wolf tracks were also seen c.3 km away (tab. 1).

If it is assumed that the identified wolf tracks were made by at least 8 different individuals (3+1 in Area A, 1 in Area B and 2+1 in Area C), then the average population density across the whole study area was 1.7 inds./100 km<sup>2</sup>. However, it is possible that some separate tracks were left by the same individuals, for example the single individual tracked in Area B on 02.02.09 could have been the same wolf tracked <4 km away in Area A on 07.01.09. Conversely, from the data available, the possibility cannot be discarded that there were more than 8 individuals, for example there may have been 2 different groups of 3 wolves in Area A.

In the case of lynx, if it is assumed that the identified tracks were made by 4 different individuals (1 in Area A and 2+1 in Area B), then the average population density at the time of the study was 0.9 inds./100 km<sup>2</sup>.

It is of course possible that not all wolves and lynx present in the study area were detected. Non-invasive genetic analysis, telemetry, camera traps or more intensive tracking could increase confidence in distinguishing different individuals and reduce the risk of errors of omission.

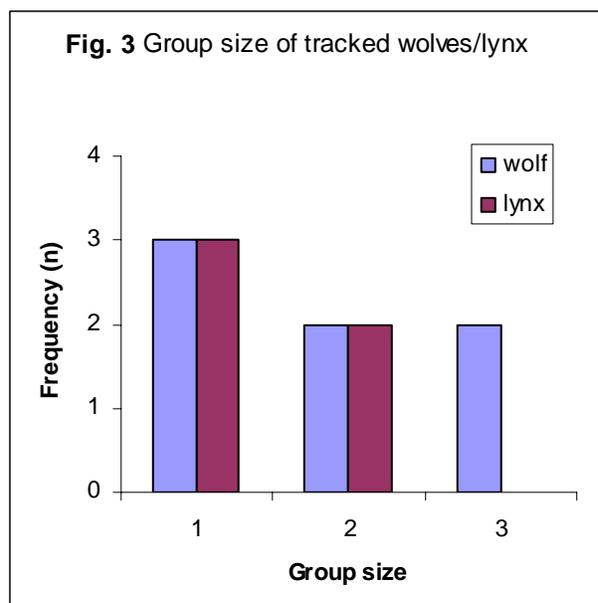
Date	Area	Route	Distance (km)	Tracks
09.12.08	B	Vážec – Východná – K. Lehota	18.6	-
26.12.08	A	Tri Studničky – Podbanské – Hybe	17.0	3–4 wolves
31.12.08	C	L. Hrádok – Jánska	5.3	-
01.01.09	A	Podbanské – Tichá – L. Kokava	26.1	-
03.01.09	A	Žiar – Jakubovany – L. Hrádok	18.4	-
07.01.09	A	Podbanské – Hybica – Východná	11.2	1 lynx, 1 wolf
09.01.09	C	Hradská hora	3.1	(2 wolves?)
25.01.09	B	Čierný Váh – sedlo Muránsko	7.1	1+2+2+1 lynx
27.01.09	C	L. Hrádok – Smrekovica	4.5	-
02.02.09	B	Východná – Vážec	7.2	1 wolf
06.02.09	C	N. Boca – Črchľa – Kráľov stôl – Jánska	14.6	2+2+1 wolves
11.02.09	A	Podbanské – Tichá	23.4	3 wolves
16.02.09	A	Podbanské – Račková – Jakubovany	19.9	-
18.02.09	A	Podbanské – Pálenica – Vážec	14.1	-
24.02.09	C	L. Porúbka – Záhorie – Stanišovské – Jánska	9.3	-

**Tab. 1** Routes walked/skied and large carnivore tracks identified in Liptov region, winter 2008/09.

### Group size

Up to 8 separate sets of wolf tracks (either single individuals or groups) were found (1 observation was equivocal: tracks of 2 canids seen on 09.01.09 might have been made by dogs). The number of wolf tracks found together ranged from 1 to 3–4 individuals (fig. 3), with an average of 1.9 wolves travelling together (excluding uncertain observations). It is very likely that 2 separate sets of prints of 2 individuals seen on 06.02.09 were actually made by the same wolves within a short period of time, as they were in the same locality and were the same size. It is quite likely, but not certain, that 3–4 wolves tracked on 26.12.08 and 3 wolves tracked in the same general area on 11.02.09 were actually the same individuals. Group size was evidently subject to change, as 1 of the 3 wolves tracked on 11.02.09 separated from the other 2 after several kilometres of travelling together, and on 06.02.09 a single wolf was followed for c.750m, after which it was joined by a second individual.

Five separate sets of lynx tracks were found. The number of lynx tracks found together ranged from 1 to 2 individuals, with an average of 1.4 lynx travelling together (fig. 3). Because they were the same size and in the same general locality, it is very likely that 2 separate sets of prints of 2 individuals and 2 separate sets of prints of 1 individual seen on 25.01.09 were actually made



by the same lynx within a short period of time: presumably a female with young (or possibly a pair) and a lone individual, perhaps a male.

### **Home ranges**

The data collected are insufficient to say very much meaningful about the size of area utilised by the various individuals and groups that were tracked. Only one quantitative estimate of total home range size can be produced and it is very speculative, being reliant on 2 unverifiable assumptions. If it is assumed that wolves tracked on 26.12.08 and 11.02.08 were from the same pack (the same individuals?) and that, based on tracking in previous years, the total combined distance they travelled on those 2 days was not less than the average diameter of their home range, then this pack's home range was  $\geq 200 \text{ km}^2$ . The group of 3 wolves tracked on 11.02.09 travelled rapidly south from deep within the Západné Tatry Mountains, where there was no sign of any ungulates at that time of year. A third assumption therefore seems reasonable: that they had crossed over from the Polish side of the main ridge to the west or north. If so, this could mean that their home range was actually substantially larger, unless some of the observed movements were extra-territorial forays.

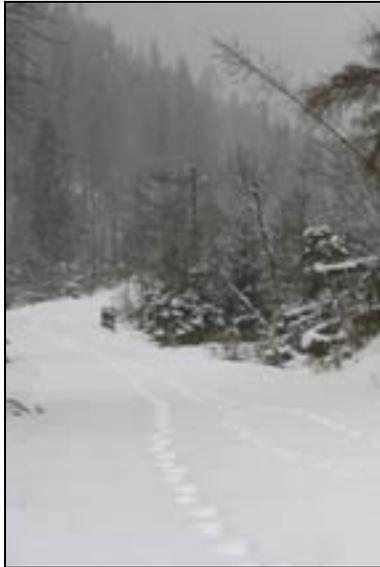
### **Habitat use and movements**

Wolf tracks were found from 780m (below left, 02.02.09) to 1,400m a.s.l., which was near timberline (below centre, 06.02.09), with the most frequently used areas at c.800–1,100m a.s.l. Wolves occurred in a wide variety of forest habitats, from submontane to high montane vegetation zones. They passed through riparian forest, dense stands of young spruce and more open stands of mixed or older forest. Sometimes they avoided open areas and other times they crossed meadows (below right, 02.02.09) as well as areas cleared of wind-throw. They were never seen to enter stands from which substantial wind-throw had not been cleared. Lynx tracks were found in or near coniferous and mixed woodland between 750m and 1,100m a.s.l., also occasionally crossing open areas such as meadows. GIS analysis of a greater quantity of data, for example in ArcView, could provide detailed information on habitat use and selection.

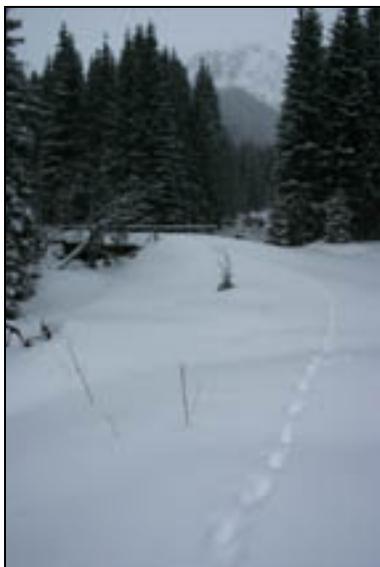


Wolves and lynx often used forest roads, probably most often at night, presumably because it allowed them to save energy and cover ground faster. For example, on 11.02.09 tracks of 3

wolves were followed along an asphalt road in Tichá Valley for a distance of c.7.5 km passing between stands of fallen trees left in situ since a storm in 2004 (below left). A lynx tracked on 07.01.09 saved energy not only by using a forest track (below centre) but also by walking in tracks left by a cross-country skier (below right).



Groups of wolves sometimes travelled in single-file, those behind stepping in the footprints of the first (below left, 11.02.09). They did this not only in deep snow but sometimes also when there was only a thin layer of snow, although they were then less careful about stepping exactly in the lead individual's footprints. Wolves walked along frozen streams (below centre, 06.02.09), as did foxes (*Vulpes vulpes*) and martens (*Martes spp.*). Larger streams were crossed at snow- or ice-bridges (below right, 02.02.09) or, if travelling along a forest road, by bridge (below left).



Different types of snow evidently influenced wolves' ease of movement, with implications for their ability to catch prey as well as their energy expenditure. When snow was compacted or the

upper layer was icy, wolves could walk along the surface, in some cases barely leaving a print (below left, 06.02.09). However, in soft snow with brittle or no crusting, they sometimes sank down into the snow to a considerable depth (below right, 06.02.09).



Single carriageway roads with low traffic volumes were not barriers to movement. Wolves crossed Road 18 between the villages of Važec and Východná (1 individual tracked on 02.02.09; photo below left) and Road 537 at Podbanské (3 individuals tracked on 11.02.09). They were also able to get from one side of Highway D1/E50 to the other by going under a raised section (1 individual tracked on 02.02.09; below left) at a point also used by red and roe deer, wild boar, foxes and brown hare (*Lepus europaeus*). On several occasions wolves made short detours into forest cover, apparently to avoid crossing open areas near buildings (below right).



## Feeding ecology



While tracking 2 lynx in Area B on 25.01.09, the remains of a young roe deer were found which the lynx had fed on and almost certainly killed. This seemed to have happened recently, probably within 6–36 hours. The carcass was near the edge of a small clearing (<100m diameter) in an area with signs of recent logging (above left). There was very little evidence of pursuit or struggle, so presumably the deer had been taken by surprise and quickly killed. The upper part of its left ear was torn off, its left flank had been largely consumed (above right) and part of its liver was on a nearby tree stump. Some of the surrounding snow had been scraped towards the carcass, possibly to cover it, and there were 2 different sets of tracks of 2 lynx leading both to and from the site, so the lynx appeared to have left and then returned to feed. Two lynx scats were collected from the clearing itself, where there was a profusion of tracks, the lynx apparently having played: jumping and sliding on the snow. Another, large scat had been collected c.2 km away earlier in the day, of a lynx travelling alone, perhaps a male.

The partial remains of 1 red deer and 1 roe deer were found while tracking wolves, consisting of a lower leg with hair and hoof in the former case (below left, Area B, 02.02.09) and leg bones stripped of flesh and bitten through in the latter (below centre, Area C, 06.02.09). In both cases the wolves had passed the remains without breaking stride. Only 2 wolf scats were found throughout the course of fieldwork, 1 in Area C on 06.02.09 and 1 in Area A on 11.02.09. Once analysed, these samples will be added to the SWS database of wolf diet, which by the end of 2008 contained results from more than 180 wolf scats.



## Behaviour

In total, 1 or more wolves were followed for c.25 km and 1 or more lynx for c.4 km. This gave an opportunity to record several types of behaviour that could be discerned from their tracks.

Wolves behaved differently in areas with versus without potential prey. In a valley with few or no deer in winter, 3 wolves tracked on 11.02.09 travelled directly along a forest road and stopped only to urinate and defecate. In contrast, 2 wolves tracked on 06.02.09 branched off their route several times to follow fresh tracks of ungulates. A single wolf tracked on 02.02.09 travelled for several hundred metres on snow-covered ice at the edge of a stream (see photograph of riparian habitat above). This area was frequented by ungulates so it may have been looking for carcasses, or possibly for water birds, although it did not seem to pay much attention to tracks of a capercaillie (*Tetrao urogallus*) (above right). The wolf turned off a forest road and headed down to the stream at a point which took it past the lower leg of a red deer (above left). Wolves also seemed to carefully check hunters' feeding sites for ungulates, for example partially circling round them or sitting down nearby, examples of which were seen on 26.12.08 and 02.02.09. Likewise, other locations of concentrated prey activity were checked, including young spruce stands and the edges of meadows.

Another evident behaviour related to scent marking, territoriality or possibly reproductive status. The pack tracked on 11.02.09 travelled along a forest road for several kilometres and 2 of its members (though not the third) used raised leg urination to leave at least 15 scent marks at the side of the road on low hanging branches (below left), saplings, tall clumps of grass and a concrete post (below right), on average at intervals of  $\leq 450\text{m}$  (intervals may have been shorter, as some scent marks could have been covered by fresh snow). None of the other wolf tracks followed showed so many signs of this behaviour. For example, the pack tracked on 26.12.08 also travelled along a forest road for several kilometres but with no sign of scent marking. This difference could be due to the sex or dominance status of the individuals present or the relative location within their territories or it might be associated with the timing of the breeding season.



Signs of play were also found. In the case of lynx this was seen at a kill site (see the section on feeding ecology above). Two wolves that met on a meadow on 06.02.09 sat or lay down (below left), continued for a short distance together and then made short, bounding dashes back and forth (below centre) and rolled about in the snow (below right) before travelling on together.



### **Supplementary observations**

R. Dobrovodský found fresh tracks of 2 wolves at c.900m a.s.l. in Area A on 01.01.09. M. Straka saw wolf tracks in the montane zone of Area A on 11.01.09 and bear tracks at higher elevations during the Christmas/New Year holidays and on 06.01.09 and 11.01.09. A TANAP ranger had seen no signs of large carnivores at higher elevations in Tichá Valley on 11.02.09 but reported tracking wolf, lynx and bear the previous week. M. Mazur saw tracks of 1 wolf on 25.01.09, c.4 km west of Area A at c.1,000m a.s.l. These observations support the finding that wolf groups in the study area were relatively small in January–February.

## Discussion and conclusions

Fifteen man-days of fieldwork is a relatively short amount of time in which to obtain substantial findings about elusive and wide-ranging species such as the wolf and lynx. Nevertheless through the use of systematic methods and careful observation, it has been possible to produce quantifiable results. Using a standardised methodology such as this should allow objective comparison between areas and over time.

The Slovakia Wolf Census Project in 2005/06 revealed enormous inaccuracies in official game statistics relating to large carnivore numbers. Even the State Nature Conservancy of the Slovak Republic had probably been over-estimating wolf numbers substantially. This and an apparent downward trend in wolf numbers over the last decade emphasises the need for careful, ongoing monitoring using more reliable methods to assess population size.

From the data obtained during the present study it can be surmised that in the second half of winter 2008/09 there was 1 wolf pack with 3 members in the Tichá–Hybica area, with 1 or more lone individual(s) at least partly overlapping their territory. Two wolves used the area between Nižná Boca and Jánska Valley and there was probably another individual in Jánska Valley at the same time. Only 1 wolf was tracked in the area south of Highway D1/E50 and east of Road 72. It had come from north of the highway, so could have been the same individual that was tracked in the Tichá–Hybica pack's territory. Certainly 3 and very likely 4 different lynx were detected in the study area as a whole. Genetic analysis, telemetry or more intensive snow tracking would be required to increase confidence in distinguishing different individuals and groups.

Group sizes of tracked wolves were rather small, averaging 1.9 individuals ( $n = 7$ ). During the Slovakia Wolf Census Project, the Tichá–Hybica pack had 6 members. In February 2007 and 2008 there was a pack of 5 wolves in Area B. These differences could be indicative of a population decline, of bigger packs permanently or temporarily splitting into smaller sub-units (perhaps in relation to the breeding season, dispersal or prey availability) or a combination of both. In Estonia, where wolves are hunted fairly intensively, as in Slovakia, typical group size falls from 4–5 members in November–December to 1–2 in February (Valdmann *et al.* 2004).

Having had this opportunity to gain further experience in monitoring large carnivores, SWS hopes to strengthen collaboration and secure funding for a more ambitious project beginning in 2010.

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