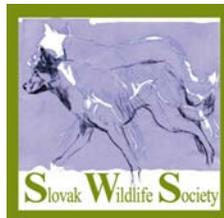


Slovakia Wolf Census Project

Progress report, February 2007

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A. BACKGROUND

A1. Purpose

In order to improve the quality of information available for wolf (*Canis lupus*) conservation management in Slovakia, the Slovak Wildlife Society¹, with financial support from the Wolves and Humans Foundation², launched a project in summer 2005 to census the wolf population in Slovakia. The aim is to map pack distribution and size and hence to produce an estimate of the total number of wolves in the country which will be national in scope but verifiable locally. The results will be compared to existing estimates based on official hunting statistics.

A2. Planned procedure

The survey was planned in two main phases:-

Phase I: (May to October 2005) Project staff will visit protected area, forestry and hunting offices and other authorities, organisations and individuals in order to produce a preliminary map of wolf pack distribution and size based on local expert knowledge. While travelling, project staff will distribute educational materials and visit sheep farms in order to conduct a repeat survey of farm conditions and reported predation to compare with results obtained in 2003.

Phase II: (November 2005 to April 2006) Project staff will visit model areas in order to assess the accuracy of the preliminary map by snow tracking and to amend it accordingly.

A3. Anticipated outputs

1. A country-wide, locally verifiable estimate of wolf pack distribution and size.
2. Quantification of the level of error in hunters' estimates of wolf abundance.
3. Objective conclusions for revision of wolf hunting and conservation management.
4. Articles in State Nature Conservancy and hunting magazines.
5. Presentation of findings at a major international wolf conference.
6. Improved level of cooperation/contact among conservationists, hunters and researchers.
7. Support for a more science-based approach to wolf management.

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

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

B. PROGRESS REPORT

B1. Results of planned activities

Farm survey

During farm visits from 7th August to 24th October 2005 data were collected using a standardised data sheet (see Appendix) on 77 flocks with a total of more than 30,000 sheep, approximately 10% of the national herd. Flocks contained an average of 400.4 sheep, 2.2 shepherds, 2.0 herding dogs and 2.5 guarding dogs of which at least 74% were permanently chained up. According to the statements of shepherds, 25% of flocks ($n = 68$) had lost at least 1 sheep to predation by wolf or bear by the time of the interviews, which were conducted before the end of the grazing season. Reported losses throughout the whole grazing season of the preceding year (2004) averaged 3.1 sheep per flock to wolves and 0.7 to bears, representing 0.8% and 0.2% of sheep respectively. Allegedly, 44% of flocks were affected, but 82% of all reported losses to wolves and 79% of those to bears were concentrated at just 12% of flocks ($n = 41$ and $n = 42$ flocks respectively). Almost half the shepherds interviewed said they rarely or never had problems with wolves or bears. Most losses were reported to occur in late summer and autumn. Flock size, numbers of dogs and how long the head shepherd had worked at the farm seemed to have no influence on numbers of sheep lost to predators. The general ineffectiveness of current preventive measures such as guarding dogs and electric fences was apparently due to their incorrect use: most guarding dogs were kept permanently tethered and electric fences tended to be inadequate and/or incorrectly installed. An overall low average loss, with most damage concentrated at a small proportion of vulnerable farms, agrees with the findings of our more extensive farm survey in 2003.

We also gathered data on additional factors relating to habitat variables and the location of sheep farms. The most important factors in connection with level of losses seemed to be vegetation cover: farms closer to the forest edge and with more overgrown pastures were more likely to have losses. Nevertheless, 74% of 19 shepherds who responded to the question, “What could help prevent attacks by predators?” mentioned shooting predators (10), “nothing” (2), changes in legislation (1) or “I don’t know” (1). Only 3 mentioned preventive measures: guard dogs, avoiding areas with predators, having a herd of cows nearby.

Mapping wolf packs

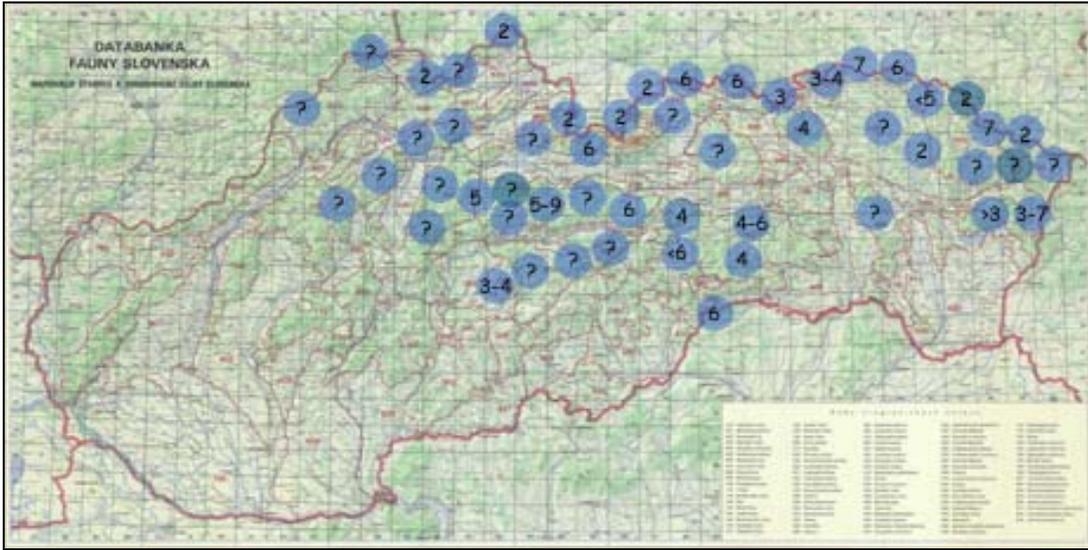
In August-October 2005 and January-March 2006 we conducted fieldwork as well as face-to-face interviews with local experts (state nature conservancy staff, foresters, hunters and others) in north-central, southern and eastern Slovakia. Education materials were distributed during travel. Unfortunately, work was curtailed due to the subsequent unavailability of a key staff member for personal reasons. Nevertheless, by combining our results with those of an annual census project in Poland³ and other sources (e.g. Bučko and Find'o 2007) we have been able to produce a provisional, working version of the estimated distribution of wolf packs across Slovakia up to the end of winter 2005/06 (Fig. 1). We have identified (confirmed, probable or surmised) the occurrence of 52 different wolf packs, including 20 whose territories crossed international borders: 2 with the Czech Republic, 14 with Poland only, 1 with Ukraine only, 1 with Poland and Ukraine and 2 with Hungary. Pack territories are represented on the map by circles equivalent to an arbitrary diameter of c.16 km and an area of 200 km², which is the order of magnitude of wolf home range size reported in scientific studies in the Carpathian Mountains (Find'o and Chovancová 2004, Pčola 2005, W. Smietana pers. comm.). The average size of wolf packs tracked or observed in the Western Carpathians during winter 2005/06 was 4.5 individuals⁴ ($n = 56$, including 41 from the Polish census). The number of wolves with territories wholly or partially within Slovakia was therefore likely to be in the order of $52 \times 4.5 = 234$. If it is assumed that wolves with cross-border territories spend on average 50% of their time in Slovakia, the number of wolves in Slovakia at any given moment in winter 2005/06 was likely to be $234 - (20 \times 4.5 \times 0.5) = c.189$ individuals.

Wolf populations fluctuate in size due to the birth of pups, natural mortality and hunting. The wolf as a species has a high reproductive potential. Average litter size in 17 North American studies reviewed by Fuller et al. (2003) tended to be 4-6. The average litter size reported from a study in eastern Slovakia (Pčola 2005) was 4.0 for pups in dens ($n = 5$) and 3.6 for pups up to 7 months old accompanying an adult ($n = 13$). Fifty wolf packs could therefore, theoretically, produce 200 pups per year if all packs had 1 litter, although some packs might fail to reproduce.

³ URL: <http://www.zbs.bialowieza.pl>

⁴ Poland-Slovakia cross-border packs (mean size 3.9) seem to be smaller than others in Poland (4.8) or Slovakia (4.7), but the difference is not statistically significant; the overall average of 4.5 has been used for calculations.

Fig. 1. Estimated distribution and size of wolf packs in Slovakia, including those with cross-border territories, up to the end of winter 2005/06.



During the period 1997-2005 an average of 88 wolves per year has been officially recorded killed by legal hunting in Slovakia during the open season in winter (Tab. 1). It is known that some of these wolves had cross-border territories (S. Nowak pers. comm.). If total annual mortality due to all causes (legal hunting, illegal hunting and other causes) is arbitrarily considered to have been 150 individuals, theoretically there could have been 234-384 wolves at the start of winter 2005/06 and 84-234 at the end, depending on when pack sizes were determined. As the hunting season is in early winter (1st November to 15th January), whereas sufficient snow cover for monitoring wolf packs persisted until March-April 2006 in many areas, pack size probably tended to be estimated after most mortality by legal hunting so actual numbers were quite likely to be towards the upper end of the ranges given.

The total size of the winter population in the Western Carpathians as well as the Slovak and Polish parts of the Eastern Carpathians, i.e. the whole population⁵ subject to legal hunting by Slovak hunters, was likely to be in the order of:

Poland-Slovakia cross-border packs:	57 wolves in 15 packs
Packs wholly/partly in Polish Carpathians but not in Slovakia:	135 wolves in 28 packs
<u>Packs wholly/partly in Slovakia but not in Poland:</u>	<u>167 wolves in 37 packs</u>
<u>Total:</u>	<u>359 wolves in 80 packs</u>

Disregarding other causes of mortality, this implies that legal hunting in Slovakia removed $88 / (359 + 88) \times 100 = \text{c.}20\%$ of the population. This is slightly below the level which it has been estimated would result in a stable population, i.e. preventing further increase but not causing any substantial decrease (see Fuller et al. 2003). However, the population is subject to poaching in Slovakia as well as in Poland, where it has been asserted (Okarma 2005) that illegal killing has prevented population growth despite a complete ban on hunting since 1998. The population trend in Slovakia according in Poľov 1-01 game statistics during the period 1997-2005 (Fig. 2) and in Poland according to census results in 2000-2006 was slightly downward, which might have been a result of decreased prey numbers and/or high (illegal) hunting pressure (Okarma 2005). The trend in the number of wolves reported legally shot in Slovakia during this period was very slightly upward (Fig. 2). As Hell et al. (2005) have pointed out, however, when the population peaked in the 1980-90s, there were more wolves in Slovakia than at any other time since the 19th century and, viewed on this timescale, numbers are still relatively high.

Current population size can be estimated in at least 3 other ways using available data. Results of monitoring 5 wolf packs in an area of southeast Poland bordering Slovakia (Smietana 2000) suggested that wolf density at the end of winter was c.55-72% of that at the start, i.e. winter mortality accounted for 28-45% (median 37%)⁶ of the pre-winter population. Assuming that total winter mortality in Slovakia has averaged 37%, a loss of 100-150 wolves would suggest a pre-winter population of 270-405 individuals, including those with cross-border territories.

Another estimate can be made by calibrating the level of error in official hunting statistics, which cover the whole country but are known to be highly over-estimated. A tracking census in Poľana Protected Landscape Area (c.800 km²), central Slovakia, in early December 2001 identified 7 resident wolves where Poľov 1-01 hunting statistics for spring 2000 reported 37, i.e. 5 times more (re-calculated from data in Lehocký et al. 2000, 2001, Lehocký 2002). In 2004, rangers in the western portion of the Tatras National Park recorded the presence of 7 wolves in an area where Poľov 1-01 hunting statistics reported 50, i.e. 7 times more. Assuming that an

⁵ Observations in the Ukrainian Carpathians suggest that population density is much lower there than in Poland or Slovakia. It has been assumed for the purposes of this calculation that few wolves disperse to Slovakia from Ukraine.

error of 5-7 times⁷ is consistent among years, recalibrating the Poľov 1-01 total for the whole of Slovakia in 2005 produces a spring population estimate of 166-233 wolves.

Tab. 1. Total of hunters' estimates of wolf numbers in all hunting grounds across Slovakia (Poľov 1-01), the number of wolves shot legally and the number reported found dead. Source URLs: <http://www.statistics.sk/>, <http://www.nlcsk.org/>, <http://www.land.gov.sk/>.

Year	Number of wolves		
	estimated in Poľov 1-01	shot	found dead ⁸
1997	1,330	74	?
1998	1,079	54	?
1999	1,240	69	13
2000	1,281	118	6
2001	1,113	93	3
2002	924	113	3
2003	973	112	3
2004	1,158	86	2
2005	1,165	74	2
average	1,140	88	5

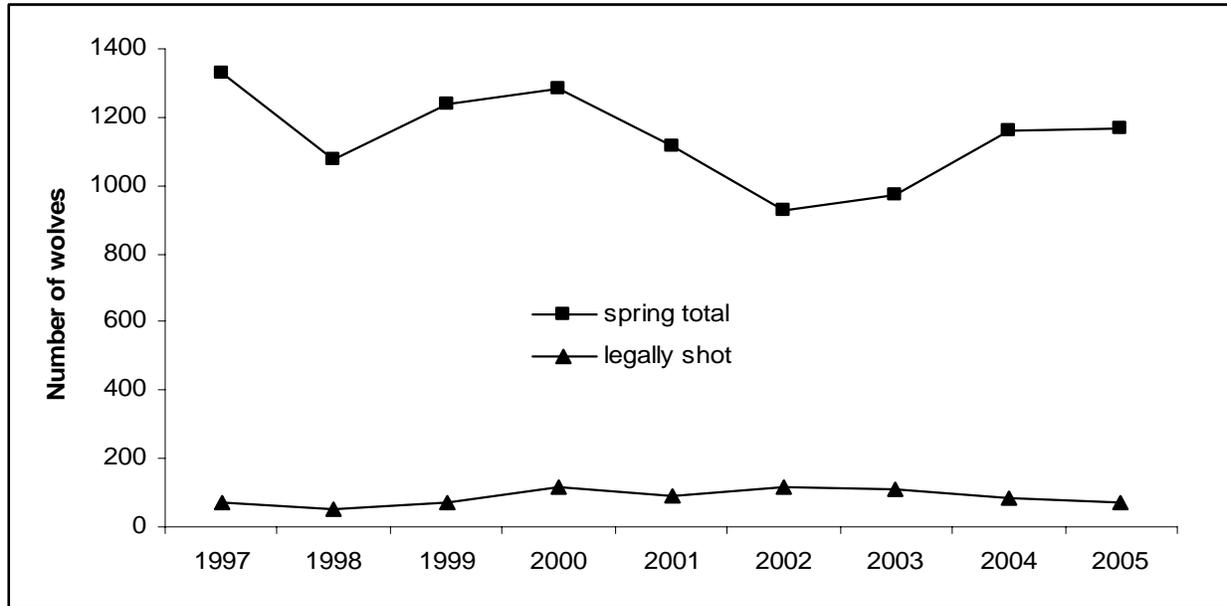
A fourth way of estimating population size is based on estimates of population density and total range. Extrapolating from a population density of c.0.9 ind./100 km² estimated from the Poľana census to the estimated size of occupied wolf range (c.21,000 km², Find'o and Rigg unpub.) suggests a total of c.189 wolves in Slovakia in early winter. However, Poľana is at the edge of occupied wolf range and so density is likely to be relatively low, probably making this an under-estimate. Density in the Polish-Ukraine border region of Slovakia has been estimated at 2.3 ind./100 km² in 2002/03 (Pčola 2005). Extrapolating from this to the national level suggests a winter population of 483 wolves. Density in the northeast seems to be higher than in most other parts of Slovakia, so this is probably an over-estimate. Based on monitoring by rangers, density

⁶ The average reduction in size from autumn to winter/spring of a wolf pack monitored by radio-telemetry in Slovakia's Low Tatras National Park in 1995-2002 was 25% (recalculated from data in Find'o and Chovancová 2004). This result is based on a sample of 1 and so it has not been used for calculations in this report.

⁷ The error could be higher, because the Poľana census and monitoring in the Tatras were done during winter, whereas Poľov 1-01 hunting statistics are based on end of winter estimates.

in the western portion of the Tatras National Park and surrounding area (c.600 km²) seems to be c.1.2 ind./100 km². Using the average of all 3 density estimates (i.e. 1.5 ind./100 km²) and extrapolating to the national level suggests a population of 308 individuals in wintertime.

Fig. 2. Total of hunters' estimates of wolf numbers in spring in all hunting grounds across Slovakia (Poľov 1-01) and the number of wolves reported shot legally. Source URL: <http://www.statistics.sk/>.



Taken together, these various estimates (Tab. 2) suggest that in 2005/06 there were c.270-405 wolves in autumn and c.166-255 wolves in spring living wholly or partially in Slovakia, of which c.40% were in packs whose territories spanned international borders, mainly with Poland. Our spring estimates are only 14-22% of that in the Poľov 1-01 game survey for March 2005, i.e. official hunting statistics seem to overestimate wolf numbers by c.5-7 times. For comparison, the State Nature Conservancy has recently estimated the number of wolves in Slovakia at 400-500 (Kassa 2005) or no more than 500 (Adamec et al. 2005). Paradoxically, a group of Slovakia's prominent game researchers and hunting advocates considered 250 individuals (Hell et al. 2005) to be a more "realistic" estimate of current numbers, presumably referring to the state at the end of March, which is when game stocks are usually assessed. In the State Nature Conservancy's manual for care of Natura 2000 habitats and species (Polák and Saxa 2005), favourable status for

⁸ The number of wolves found to have died due to causes other than hunting is very small but presumably these known cases represent only a fraction of such mortality.

the wolf is listed as being at least 300 individuals or a density of 1.5-3.0 ind./100 km² in main habitat. Our results suggest that these targets are not being met unless pups of the year and wolves shared with neighbouring states are included in population estimates.

Tab. 2. Summary of wolf population estimates for 2005/06 derived using various methods.

Method	Estimated number of wolves		
	autumn	winter	spring
Official annual game survey (Poľov 1-01)	-	-	1,165*
Estimating number and size of individual packs	234-384 [†]	234	84-234 [†]
Extrapolation from winter mortality estimates	270-405	-	170-255
Recalibrating Poľov 1-01 by tracking in model areas	-	-	166-233
Extrapolation of density in model areas to whole range	-	308	-

* This is the most recent figure currently available and is for 31.3.2005; see Tab. 1.

[†] The true value was likely to be nearer the upper than the lower end of this range.

B2. Additional activities undertaken

In August 2005 we collated data on hunters' estimates of potential wolf prey species in our main study areas, the Western and Low Tatra Mountains of Liptov region. In November-December 2005 and 2006 we analysed wolf scats at the Veterinary and Food Institute, Dolný Kubín as part of an ongoing study on wolf diet. We also collaborated with undergraduate student Emma Parry of Sparsholt College, Hampshire, who successfully completed her dissertation on *A comparison of wolf diets in the Low Tatras and Western Tatras National Parks, Slovakia*, in 2006. In order to increase the expertise in wolf census work of Slovak Wildlife Society staff and colleagues, from 23rd July to 2nd August 2006 visits were made to wolf research projects led by Vadim Sidorovich in Belarus and Vladimir Bologov in Russia. The methodology used for the annual census of wolves and lynx in Poland has been translated into Slovak and some of those involved in its implementation have been consulted in relation to conducting similar research in Slovakia. In December 2006 we began fieldwork and interviews with local experts in order to repeat our census in 2006/07, with good data obtained for some parts of north-central Slovakia. Late arrival and early melting of snow across much of the country will probable limit the overall results. Several more scats have been collected during fieldwork.

B3. Difficulties encountered

Estimating numbers of animals in the wild, especially elusive species such as the wolf, is inherently difficult. During the project we have come across several additional problems. Unavailability of a key staff member and failure to secure an adequate replacement impeded work on the original census in 2005/06. While conducting a second census in 2006/07 we have again been affected by staff issues but also by the late arrival (after mid-January) and early melting (February-March) of snow in most of the country. Another limiting factor throughout has been the reluctance of some local experts to collaborate. As we anticipated, there has been a certain amount of suspicion from some foresters and hunters. Even some protected area staff have been slow to share results of monitoring. This seems to be symptomatic of a broader problem rather than being specifically related to us or this particular project. In the worst cases, we have witnessed mutual distrust and poor working relations even among staff of the same institutions. Given these experiences, it would seem that a gradual refining of results and a greater contribution of our own fieldwork are more realistic approaches than our original plans.

B4. Revised project schedule

In 2007 we will continue with fieldwork and consultation with local experts in order to complete the 2006/07 census and, if new information is obtained, revise 2005/06 census results. We plan to present our findings at the 8th Conference on Research and Conservation of Mammals in Slovakia, to be held in October 2007.

Having gained substantial experience already, we hope to strengthen collaboration with protected area staff, forestry offices and hunting officials in preparation to conduct a third census in 2007/08. In addition to mapping pack distribution, work should focus on estimating winter mortality rates by assessing pack size prior to 1st November in comparison to that in late March of the following year as well as estimating numbers and density in model areas and total occupied range in order to calibrate the level of error in the Poľov 1-01 game survey.

In the future, more exact – though also far more expensive, time consuming and difficult – techniques such as telemetry and genetic analysis could be considered to refine the census, for example in order to help distinguish between neighbouring packs, monitor mortality rates, estimate minimum numbers and density in model areas, and so on.

C. PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

On the basis of 4 different quantitative methods, we estimated that in 2005/06 there were c.270-405 wolves in autumn and c.166-255 wolves at the end of winter living wholly or partially in Slovakia, of which c.40% were in packs whose territories spanned international borders, mainly with Poland. The very large proportion of wolves shared with neighbouring states emphasises the importance of cross-border cooperation in order to plan management at the population level. There is an urgent need to develop both national and Carpathians-level management plans for the wolf (and other large carnivores). Taking the whole population in Slovakia and Poland into consideration, our results suggest that legal hunting in Slovakia is below the level at which it has been estimated population increase is prevented. However, the population is also subject to illegal killing on both sides of the border.

We recommend that measures be taken to ensure that hunting pressure is not allowed to increase. Strengthening legal protection without widespread support from key interest groups could risk increasing antagonism to both wolves and conservationists without actually benefiting wolves, a situation reported from Poland. We therefore recommend a cautious approach be taken, ideally with a process of public consultation, when considering changes in legal protection. If it is decided that there is a need to increase protection, priority should be given to measures likely to have most public backing, such as a ban on hunting in National Parks. As in Poland, threats posed by habitat loss, degradation and fragmentation are likely to be of increasing concern in the future unless adequate mitigation measures are taken.

Our results do not support the assertion of some radical environmentalists⁹, that the wolf population in Slovakia numbers less than 150 individuals at the end of winter. Nevertheless, there are probably fewer wolves in Slovakia than has been estimated by the State Nature Conservancy and the apparent downward trend over the last decade emphasises the need for careful, ongoing monitoring. Enormous disparities between Poľov 1-01 game statistics and results of tracking surveys show the importance of developing more accurate methods to assess population size. Our estimates of numbers imply that criteria for favourable conservation status for the wolf as defined in the manual for care of Natura 2000 habitats and species are not currently being met in Slovakia.

⁹ See URL: http://www.wolf.sk/strielanie_vlk.php

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APPENDIX: FARM SURVEY DATA SHEET

Survey of farm conditions and damage caused by large carnivores

1. Name of researcher	
2. Date of visit	
3. Locality (name, coordinates, altitude)	
4. The farm is in a river basin, valley, on a ridge ... ?	
5. How far is the farm from the forest edge?	<100m 100-500m 500m-1km 1-2km >2km
6. Are the pastures open or overgrown with bushes?	
7. How far is the nearest human settlement?	<100m 100-500m 500m-1km 1-2km >2km
8. How far is the nearest asphalt road?	<100m 100-500m 500m-1km 1-2km >2km
9. Flock owner's name, address, telephone (or farm, company ...)	
10. Head shepherd's name, address, telephone	
11. Head shepherd is employed here since ...	
12. How many shepherds are there?	
13. How many sheep do they have?	
14. Do they milk by hand and make cheese on site?	milking: yes no cheese: yes no
15. At night the flock is:	in a sheepfold in the open in a barn
16. Do they have an electric fence?	yes no
17. How many dogs have they got?	guard dogs: ___ herding dogs: ___
18. Of the guarding dogs, how many are ...	chained: ___ free-ranging: ___ released at night: ___
19. Do they use other protection methods? (e.g. firecrackers, lamps, night guarding ...)	
20. Are they interested in improving flock protection e.g. with livestock guarding dogs?	
21. Wolves and bears cause them problems:	constantly often occasionally rarely never
22. According to the shepherds, what would help prevent attacks by predators?	

Notes:

23. **This year** have they had any damage caused by wolves or bears or other losses (e.g. lynx, dogs) ?

in 2005	Date	Time	Weather, other circumstances	Farm location	Number of animals killed	Number of animals injured
Damage by wolf						
Damage by bear						
other loss						

24. In **previous years 2004 or 2003** did they have any losses caused by wolves, bears or other losses?

in 2004	Date	Time	Weather, other circumstances	Farm location	Number of animals killed	Number of animals injured
Damage by wolf						
Damage by bear						
other loss						

in 2003	Date	Time	Weather, other circumstances	Farm location	Number of animals killed	Number of animals injured
Damage by wolf						
Damage by bear						
other loss						