

# Monitoring of colonies *Marmota marmota latirostris* in the Western Tatras Mts. - II. Section (2005), Baníkov - Ostrý Roháč

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**Abstract.** Results of the second year (2005) of four years lasting research on the occurrence of *Marmota marmota latirostris* in the West Tatra Mts. are given in the paper. Coordinates of all found burrows were obtained by high-accurate GPS data mapper Leica GS20. All coordinates were put into digital maps. The area among Volovec Mt. and Baníkov Mt. was studied. In total, 6,813 burrows were found in the area. They form 50 colonies (family groups), 48 of them are inhabited and 2 of them are uninhabited. The biggest inhabited colony was formed by 359 burrows, the smallest one was formed by 49 burrows. Horizontal amplitude of the occurrence of marmots in the studied area is 13,300 m and vertical amplitude is 635 m. Both natural and anthropic influences on the occurrence of marmots in the area are discussed.

**Key words:** *Marmota marmota latirostris*, monitoring, GPS, endangered, colony, burrow, the West Tatras Mts., Slovakia

## Introduction

The study is a follow-up to my first study on the occurrence of marmots in the West Tatra Mts. (Ballo and Sýkora 2003, 2005, 2006, 2007). Some introductory information (such as e.g. the history of the research of marmot in the West Tatra Mts, the aims and results of monitoring, definition of the studied area, work time-schedule for years 2004 – 2007, methods in detail and references) published in the above mentioned paper are not included again. Research results obtained in 2005 and some additions are given in the paper.

## Material and Methods

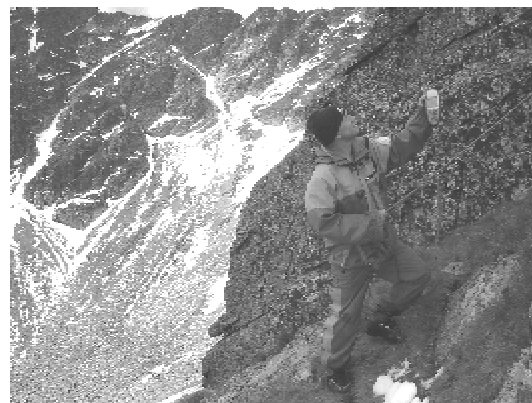
Geographical coordinates of all found burrows have been recorded to create a global picture of the whole colony. At first, maternal (main) burrows evidently occupied by the offspring were localized. It was necessary to come back to the locality several times to confirm the localization of the maternal burrow definitely. The time horizon of the study of such a large territory did not allow to investigate every colony in detail (etology, trophic base, number of individuals).

As maternal burrows all the burrows were considered, in which also last year offspring were found.

In this study the term inhabited colony denotes the site of marmots, where maternal burrow with the offsprings was localized. If maternal burrow was not identified but the colony was evidently inhabited (freshly dug out burrows), the central point of the colony was estimated and its coordinates were considered to be a colony centre. These colonies are denoted by the term a colony without maternal burrow. An abandoned colony is a site with uninhabited burrows, i.e. without signs that the burrows were dug anew this year.

If winter burrow is different from the maternal burrow, it is localized as a common burrow. The winter burrows were not distinguished from other burrows, because the localization continued even in September and October, when the winter burrows could not be identified in the colonies any more (due to meteorologic and geomorphologic phenomena – washing out of the rests of the dug out dry grass filling the burrows and sliding down of the substrate). The plugged winter burrow (before hibernation, or an atypical summer extreme plug) is denoted in this study as the plugged burrow.

Monitoring of the second part of the studied area began on June 11<sup>th</sup>, 2005, when snow cover has been melted and all burrows have been without any snow cover and accessible to localization even at snow bed sites (coordinates of winter burrows at the 40 – 60° slopes cannot be recored precisely before melting of snow due to an oblique digging out of marmots through the snow cover) (Fig. 1). The field research was ended in October 10<sup>th</sup>, 2005, when marmots finished plugging of their burrows before hibernation. In the second year of the research unlike the first year, two other persons helped to record the geographic coordinates of burrows in difficult terrain conditions. In the marmots' habitat 65 working days at 24



**Fig. 1.** Measurement in the 60° slope, Baníkov.

localities were done (Table 1). If calculated for three workers, it represents cca 190 working days. According to the records of digital gypsometer about 1,200 meters of altitude difference were overcome by one person per working day what is about 78,000 altitude meters during the monitoring season 2005.

Each of all colonies was documented by a digital camera and documentational photos of the colonies and marmots' habitat were made. Also anthropic influences - tourism, rockclimbing, skialpinism were orientationally documented. Signs of poaching (digging the marmots out) were found in three localities, where also poaching equipment was found: a pick, a shovel, and a steel snare.

## Results and Discussion

In the second year of the project the central part of the West Tatra Mts., between the Baníkov and the Volovec Mt., was explored including adjacent valleys, trenches, corries and lake surroundings. The studied area is horseshoe shaped string of peaks at the bottom of which the Žiarska dolina valley stretches along the stream and is opened towards southwest. In total, 6,813 burrows forming 50 colonies were found and their geographic coordinates were recorded in the second

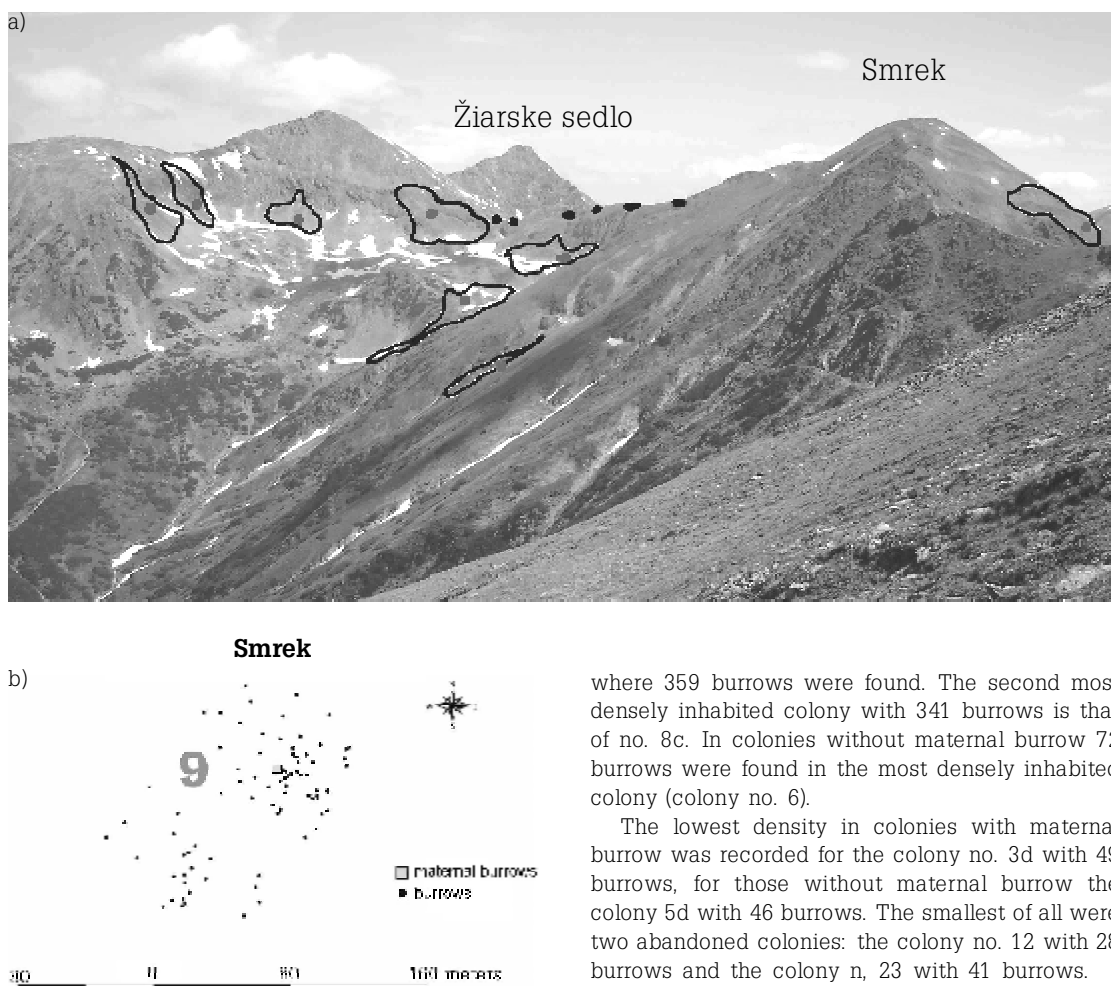
monitored part of the West Tatra Mts. in 2005. Within the 50 colonies 46 were inhabited including a maternal burrow, 2 inhabited colonies without a maternal burrow and 2 abandoned (former) colonies.

The main results of the second year of the research are listed in the Table no. 1. The altitude of the localized maternal burrow is given, or that of the centre of the colony, if the maternal burrow was not found. The total number of burrows includes also the maternal burrow. The coordinates of the maternal burrow are given, or those of the centre of the colony, if maternal burrow was not localized.

The horizontal range of marmot distribution was 13,300 m long and the vertical range was 635 m. The highest situated burrow was found in 2,131 m a. s. l. Baníkov (Fig. 1) (3b. colony, coordinates: X: 372 953,9807; Y: 1 180 212, 6954), the lowest in 1,496 m a. s. l. (19. colony, coordinates: X: 369 845,0552; Y: 1 179 548,2576).

Marmots occur with the highest density in the Žiarske sedlo saddle where 10 colonies (7c, 8a, 8b, 8c, 16a, 16b, 16c, 17a, 17b, 18) with 1,588 burrows were found. Among them, colonies no. 8a-8b-8c, 16a-16b-16c, 17a are the most densely inhabited. They are formed by 1,377 burrows including 7 maternal (Fig. 2a, b, Fig. 3).

In colonies with maternal burrow the highest density of burrows is obvious in the colony no. 19



**Fig. 2.** a) Marmot colonies in the Žiarske sedlo (pass), b) detail of marmot colony No. 9. with maternal burrows.

where 359 burrows were found. The second most densely inhabited colony with 341 burrows is that of no. 8c. In colonies without maternal burrow 72 burrows were found in the most densely inhabited colony (colony no. 6).

The lowest density in colonies with maternal burrow was recorded for the colony no. 3d with 49 burrows, for those without maternal burrow the colony 5d with 46 burrows. The smallest of all were two abandoned colonies: the colony no. 12 with 28 burrows and the colony n. 23 with 41 burrows.

For the purpose of the inter-colony commucation, dispersal paths were found also in the second part of studied area but with different character of the

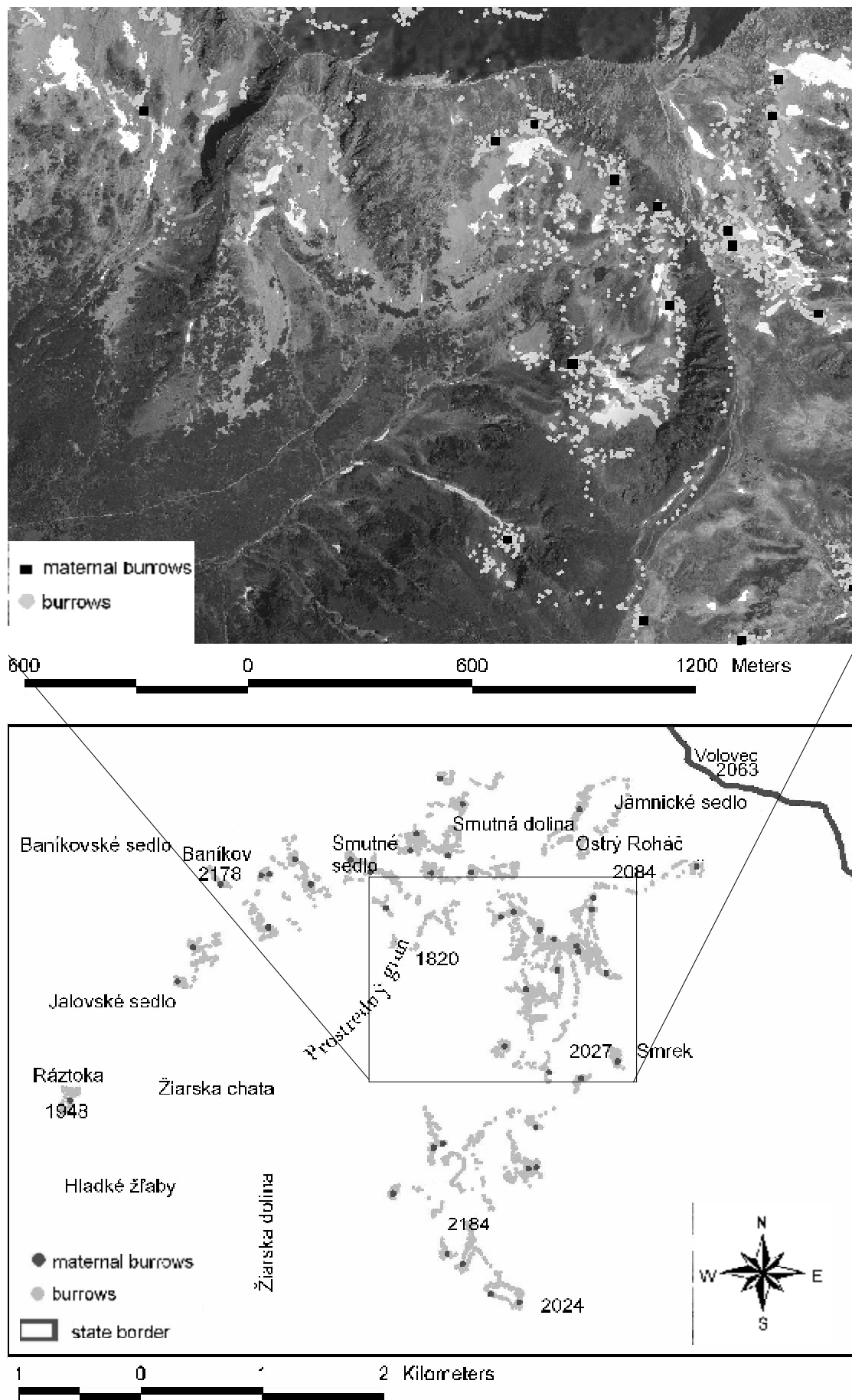


Fig. 3. Marmot colonies in the Žiarske sedlo.

Locality	Coordinates	Altitude m.a.s.l.	Exposi- -tion	Slope incli- -nation	Character of colony	Num. of burrows
1) Below Ráztoka hollow east	X: 374 087,9446 Y: 1 182 146,9368	1,868	E	5 -25°	inhabited	127
2a) Príslop – south	X: 373 207,2465 Y: 1 181 153,4713	1,906	E	40°	inhabited	120
2b) Príslop below the peak	X: 373 080,142 Y: 1 180 867,4242	1,996	E	40°	inhabited	179
3a) Baníkovský corrie - slope of Príslop	X: 372 462,3567 Y: 1 180 704,7581	1,805	NE	40°	inhabited	157
3b) Baníkov - the peak part	X: 372 854,4967 Y: 1 180 347,9108	1,996	E	60°	inhabited	72
3c) Below Baníkovská Ihla – west	X: 372 515,9598 Y: 1 180 273,5989	1,932	S	50°	inhabited	52
3d) Below Baníkovská Ihla – east	X: 372 451,1309 Y: 1 180 263,4654	1,952	S	50°	inhabited	49
4a) Lúčne sedlo – north	X: 372 241,3574 Y: 1 180 137,8747	1,990	S	10°	inhabited	91
4b) Lúčne sedlo – south	X: -372 111,3113 Y: -1 180 342,9215	1,918	S	25°	inhabited	153
5a) Glen between Hrubáand Tretia kopa	X: 371 785,7583 Y: 1 180 143,1441	1,968	S	45°	inhabited	128
5b) Colony below Tri kopy	X: 371 622,0187 Y: 1 180 242,5749	1,917	S	30°	inhabited	206
5c) Colony Tri kopy below Terasa	X: 371 493,6988 Y: 1 180 540,9323	1,770	S	20°	inhabited	66
5d) Prostredný Grúň- western slope, below Smutné sedlo	X: 371 192,0059 Y: 1 180 708,717	1,852	W	20°	inhabited without maternal burrow	46
6) Prostredný Grúň - Nohavica – glen – southern hollow	X: 370 991,1704 Y: 1 180 579,5492	1,888	E	20°	inhabited, without maternal burrow	72
7a) Corrie below Nohavica south –eastern slope	X: 370 556,531 Y: 1 180 620,5957	1,916	E	30°	inhabited	65
7b) Corrie below Nohavica south – hollow central	X: 370 450,6931 Y: 1 180 575,3543	1,916	S	20°	inhabited	223
7c) Plačlivé - western slope	X: 370 237,4896 Y: 1 180 725,7775	1,881	W	30°	inhabited	62
8a) Plačlivé – southern slope	X: 370 120,1182 Y: 1 180 799,9657	1,924	S	20°	inhabited	184
8b) Žiarske sedlo below the ridge of Smrek	X: 370 093,6174 Y: 1 181 062,4222	1,845	W	25°	inhabited	163
8c) Smrečianska priehyba, above spring of the Smrečianka	X: 370 348,5578 Y: 1 181 218,7348	1,798	E	20°	inhabited	341
9) Below Smrek – central glen - west	X: -370 525,7126 Y: -1 181 693,8445	1,791	W	35°	inhabited	87
10a) Glacial corrie Baranec – north –direction Smrek –east	X: 371 033,6185 Y: 1 182 508,6122	1802	N	35°	inhabited	254
10b) Glacial corrie Baranec – north – west	X: 371 111,4653 Y: 1 182 535,5063	1803	N	35°	inhabited	92
11) Baranec – Bystré above Lakeť	X: 371 439,3397 Y: 1 182 919,7356	1921	SW	30°	inhabited	68

continued...

12) Baranec, abandoned colony, central glen west	X: 371 088,0611 Y: 1 183 077,473	2053	W	40°	abandoned	28
13a) Above Studničky, west, below ridge	X: 370 996,9103 Y: 1 183 416,3796	1992	SE	30°	inhabited	73
13b) Central glen of Baranec – Studničky	X: 370 869,9325 Y: 1 183 499,754	1916	S	30°	inhabited	215
13c) Below Mládky - west - Brišné	X: 370 996,8882 Y: 1 183 416,4144	1867	SW	30°	inhabited	106
13d) Below Mládky - east - Brišné	X: 370 869,9309 Y: 1 183 499,7402	1904	SW	30°	inhabited	149
14a) Pusté west	X: 370 331,8882 Y: 1 182 708,9776	1744	E	30°	inhabited	287
14b) Pusté east	X: 370 265,5122 Y: 1 182 696,4038	1727	E	20°	inhabited	86
14c) Slope of Smrek to Pusté	X: 370 268,5445 Y: 1 182 365,9908	1873	SE	30°	inhabited	83
15a) Below Smrek peak – Jamnická – higher	X: 370 161,5875 Y: 1 181 906,4425	2016	E	30°	inhabited	82
15b) Below Smrek peak – Jamnická – lower	X: 369 897,5215 Y: 1 181 958,6246	1854	E	30°	inhabited	67
15c) Smrek glen east	X: 369 597,7414 Y: 1 181 819,4213	1702	E	20°	inhabited	86
16a) Above Záhrady in the ridge to Jamnická	X: 369 689,8196 Y: 1 181 085,3397	1818	N	25°	inhabited	173
16b) Below Žiarske sedlo, Jamnická, above Záhrady – south	X: 369 920,8839 Y: 1 180 901,5889	1862	E	25°	inhabited	220
16c) Below Žiarske sedlo, Jamnická, above Záhrady – north	X: 369 932,2958 Y: 1 180 860,2449	1863	E	30°	inhabited	173
17a) Plačlivé eastern slope, southern colony	X: 369 811,0748 Y: 1 180 554,2073	1867	E	30°	inhabited	123
17b) Plačlivé eastern slope, northern colony	X: 369 797,4407 Y: 1 180 457,3797	1875	E	30°	inhabited	73
18) Glen of O. Roháč Mt. to Jamnická dolina	X: 368 948,8075 Y: 1 180 198,9486	1786	S	30°	inhabited	76
19) Entrance area above the crossroad to Smutná dolina	X: 369 911,9108 Y: 1 179 724,1243	1547	NW	5-30°	inhabited	359
20) Below Nohavica above Smutná dolina – north	X: 370 804,2593 Y: 1 180 247,3187	1833	N	30°	inhabited	239
21a) Below Smutné sedlo	X: 371 125,9996 Y: 1 180 254,1488	1907	N	30°	inhabited	208
21b) Closing part, of Smutná dolina, corrie eastern slope of Turňa	X: 371 293,9225 Y: 1 180 066,077	1988	NE	40°	inhabited	139
21c) Closing part of Smutná dolina, corrie – central	X: 371 241,8894 Y: 1 179 931,2776	1964	E	35°	inhabited	225
21d) Closing part of Smutná dolina, corrie – bottom	X: 370 992,63 Y: 1 180 104,5367	1820	E	5-30°	inhabited	187
22) Eastern glen Zadné Zelené	X: 370 871,3794 Y: 1 179 676,7144	1910	E	25°	inhabited	195
23) Above Velké Roháčske pleso	X: 370 605,138 Y: 1 179 475,7731	1630	NE	30°	abandoned	41
24) Above Štvrté Roháčske pleso, in the slope of Zadné Zelené	X: 371 054,9256 Y: 1 179 466,6703	1745	N	30°	inhabited	64

**Table 1.** The main results achieved during the second year of the project.

connection, in comparison with those found in the first part of studied area (see Ballo and Sýkora 2003, 2006). Due to a different terrain configuration, here the character of connection among colonies is more or less spatial while dispersal paths in the first part of studied area line-shaped. A greater number of shorter inter-colony dispersal paths among these colonies were observed: 2a-2b; 3b-20c/2004; 3c-3d; 7a-7b-7c; 8a-8b-8c-9; 10a-10b, 13b-13c-13d; 16a-16b-16c-17a-17b-18; 21a-21b-21c-21d (Fig. 4).

Both natural and anthropic factors affect the occurrence of marmots. Within natural factors predators and weather anomaly have predominant influence. Golden eagle (*Aquila chrysaetos*) was found to be the main predator of marmots in the studied area. Terrain configuration in the West Tatra Mts. predetermines development of thermic currents suitable for the flight of golden eagle, as was observed during several years of my former research. The hunting area of eagle – marmot colonies – are

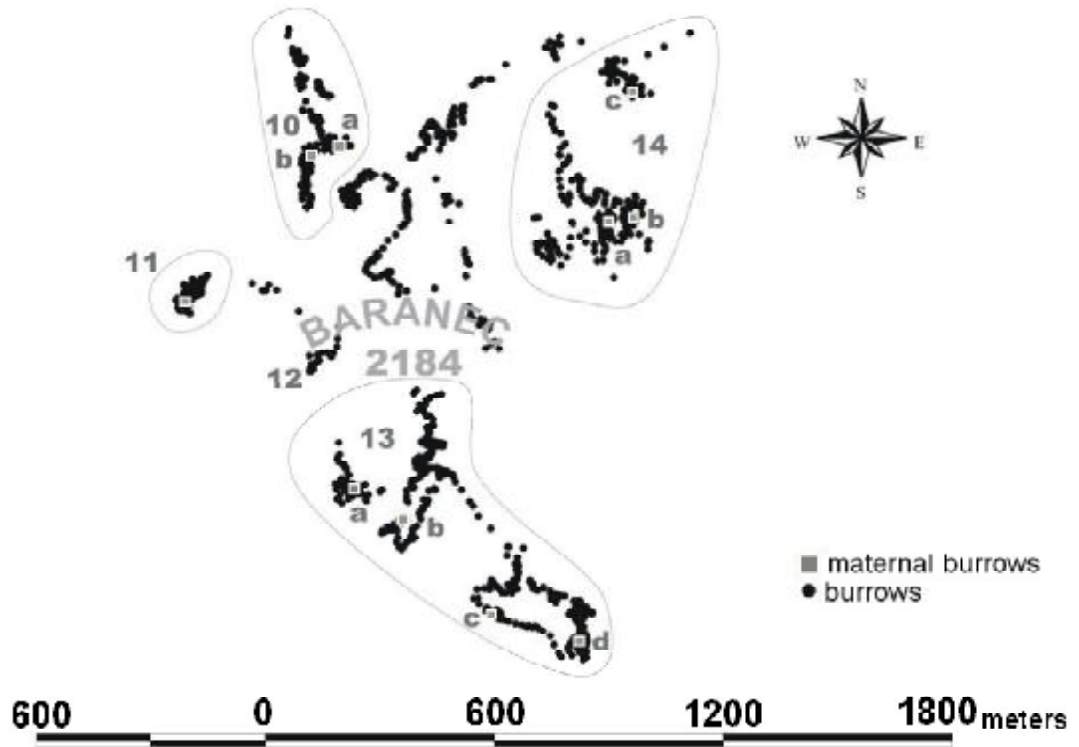


Fig. 4. Marmot colonies - Baranec, for more source information see also Table 1.

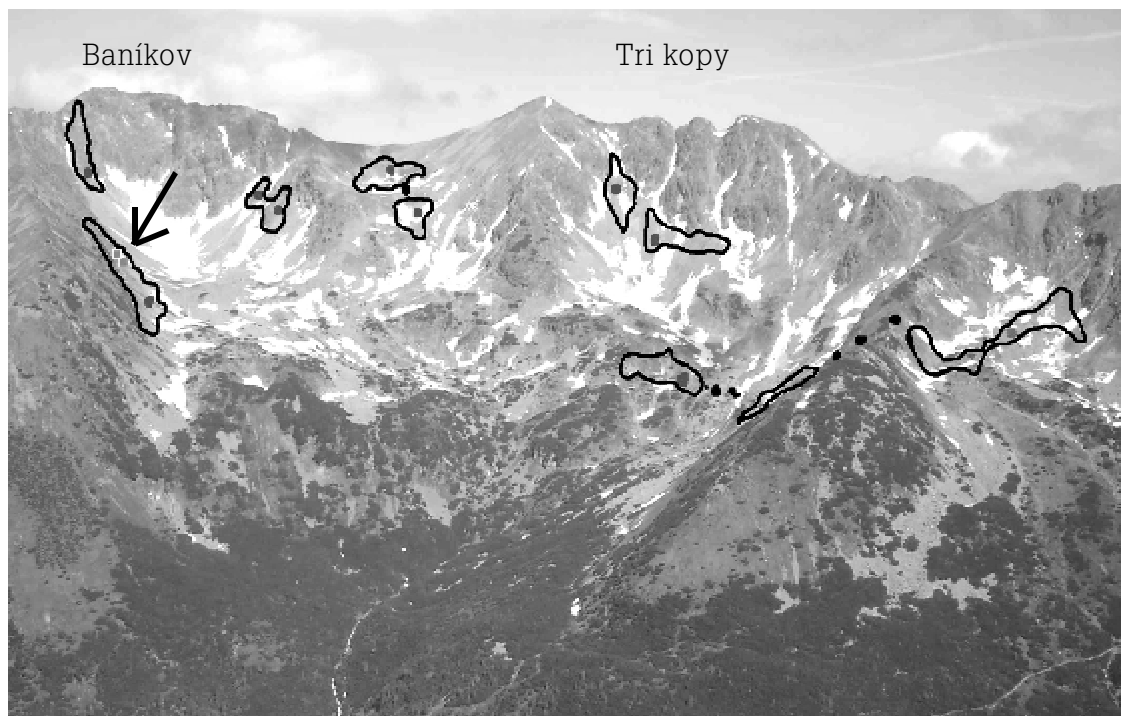


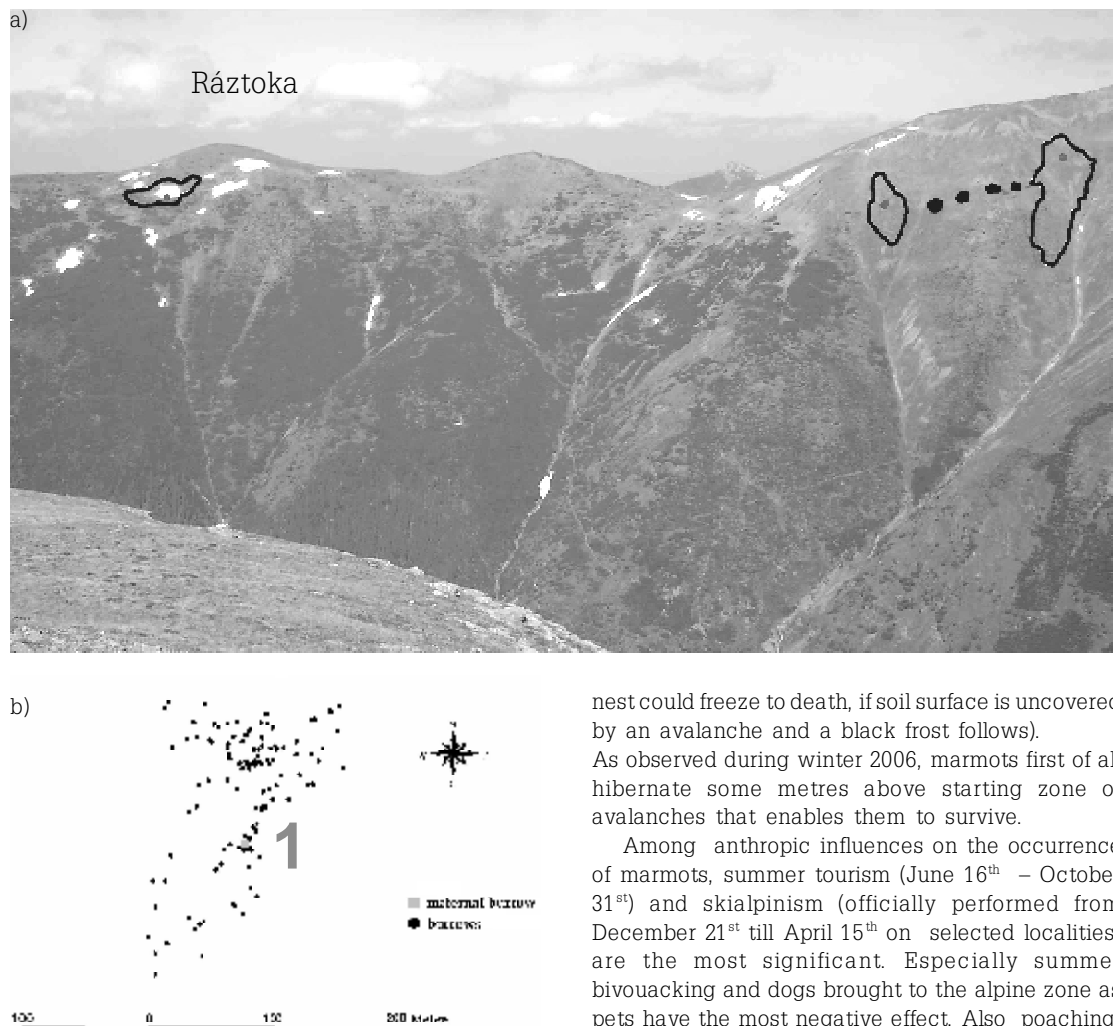
Fig. 5. The arrow indicates the location of frozen dead marmot burrows.

also in the exposed glens with turbulences and in the end of the valleys (Ballo 1997). As we could observe, marmot, as soon as it saw eagle, produced a modulated short, „cut-off“ shrill whistle. This warning call was received not only by other members of the colony, from which the marmot emitted the alarm signal, but also by the other neighbouring colonies in the corrie. After October 10<sup>th</sup>, 2005 (hibernation of marmots), the predator activity of eagle in marmot colonies was observed for three

phenomenon can explain why marmots could freeze and die in a hibernation burrow, how it was observed at the locality sooner in the season (still plugged hibernation burrow was found on September 1, 2005) (Fig. 4).

There are three possibilities where a hibernation place can occur in colonies on avalanche slopes:

1. above starting zone of an avalanche,
2. at the end of avalanche tracks,
3. in an avalanche track (in this case a hibernating



**Fig. 6.** a) Marmot colonies in the Ráztoka, b) detail of marmot's colony No. 1. with maternal burrow.

following days. The eagle was observed only when flying over for its prey in the foothills. The tracks of other predators (lynx, fox) were found in the studied habitat by TANAP guards (colonies 17a; 17b; 18 ).

As soon as the avalanche danger had been over, avalanches released in the marmot habitat were studied and documented. In some particular colonies, the place of marmot hibernation is precisely known, even being below a snow cover. Checking 3a colony (Baníkovský kar corrie – Príslop slope) on January 2, 2006, I found a released avalanche in the area of the colony. A full-depth slab avalanche 15 x 30 m in size uncovered the soil substrate. During January 2006, arctic frosts reached the area. No fresh snow fell, so the hibernating marmots lost the isolation – 1.5 meters thick snow cover. The observed

nest could freeze to death, if soil surface is uncovered by an avalanche and a black frost follows).

As observed during winter 2006, marmots first of all hibernate some metres above starting zone of avalanches that enables them to survive.

Among anthropic influences on the occurrence of marmots, summer tourism (June 16<sup>th</sup> – October 31<sup>st</sup>) and skialpinism (officially performed from December 21<sup>st</sup> till April 15<sup>th</sup> on selected localities) are the most significant. Especially summer bivouacking and dogs brought to the alpine zone as pets have the most negative effect. Also poaching, as a specific anthropic influence, was documented in colonies no. 5c, 8a a 10a.

Colony no.1 (below the Ráztoky peak) is isolated, it is about 1,200 m far from the nearest colony (no. 2a). Considering the isolation, we assume inbreeding in the isolated colony (Fig 6a, b).

Chovancová (1993) states that the minimal number of marmots in one colony is 3-4 individuals. According to this assumption, we estimate at least about 170 individuals in 49 inhabited colonies in the second part of studied area and about 100 individuals in 26 inhabited colonies in first part.

## Conclusion

Monitoring of marmot's colonies (*Marmota marmota latirostris*) in 2005 brought current information on the occurrence of this rare glacial relic in central part of the West Tatra Mts., among the Baníkov and the

Volovec Mt. The timetable of the four years lasting research was kept, about a half of the West Tatra mountain region has been monitored. Obtained results of the research can be applied in practical management in Tatra National Park. Based on the research results, a tourist path from the Parichvost valley up to the Baníkov Mt. has been re-routed farther from the inhabited colony.

The third part of studied area among the Volovec and the Bystrá Mt. was monitored in 2006. The results of this research will be published in 2007 when also the whole project will end by monitoring of the fourth (last) part of the West Tatra Mts.

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