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Expedition report

Chamois, wolves and bears of the Nízke Tatry mountains, Slovakia

in partnership with the
Carpathian Wildlife Society
(CWS)

Expedition dates: **15 August – 10 September 2004**

Report published: **January 2005**

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Abstract

This report details the first results of the study on Tatra chamois (*Rupicapra rupicapra tatrica* Blahout 1972) and large predators in the Nízke Tatry Mountains conducted by Biosphere Expeditions and the Carpathian Wildlife Society from 15 August to 10 September 2004. Human impact, avalanches, climate change, predation and other reasons unknown might all seriously influence the long-term survival of the local, critically endangered, small and isolated chamois population totalling fewer than 90 individuals. The primary goal of this study was to illuminate interrelationships between chamois and their potential predators including wolf, lynx, bear and golden eagle. 57 sightings were used to delineate the shape and size of the chamois range during late summer. Based on an accurate tally conducted on 7 September 2004, 50 chamois inhabited an area of 2,428 hectares encompassing alpine habitat above the timberline. The population density of chamois was 2 individuals per 100 hectares. A study of interrelationships between chamois and large predators was initiated by use of indirect methods such as analysis of large predator scats and comparison of alpine habitat used by chamois and their potential predators. 49 bear and 15 wolf scats were analysed. Bear diet was predominantly composed of wild plants (44.0%), insects (33.9%) and cultivated plants (13.6%). Wasps (17.0%) and ants (12.7%) were the most frequently consumed groups of insect. Only one bear scat contained wild boar remains. The main prey species of wolf was red deer (47%) followed by wild boar (40%). None of the predator scats contained chamois remains. Individual vigilance levels of grazing chamois were used as a measure of anti-predatory behaviour. Single males spent more time in protective behaviour than females within maternal herds. We presume that non-lethal effects of predation on the chamois population outweigh lethal effects. Predator-induced microhabitat shifts by chamois into safe but less energy-profitable cliffs and the complete avoidance of woodland may limit further expansion and growth of the population. We outline conservation issues, which have not been taken into consideration before.

Správa pojednáva o prvých výsledkoch výskumu kamzíka (*Rupicapra rupicapra tatrica Blahout 1972*) a velkých predátorov v Nízkych Tatrách, ktorý zrealizovali Biosphere Expeditions a Spolocnost pre Karpatskú Zver v dnoch od 15. augusta do 10. septembra 2004. Antropické faktory, lavíny, klimatické cinitele, predácia a iné neznáme príciny môžu vážne ovplyvnit dlhodobé prežívanie malej izolovanej populácie kamzíka, ktorej pocetnost dosahuje menej ako sto jedincov. Hlavným cielom výskumu bolo objasnenie vztahov kamzíka a jeho ptenciálnych predátorov vlka, rysa, medveda a orla skalného. Pre znázornenie tvaru a velkosti areálu v neskorom letnom období sme použili 57 pozorovaní kamzíkov. Presné scítanie z dna 7. septembra 2004 zdokumentovalo výskyt 50 kamzíkov na ploche 2428 ha nad hornou hranicou lesa. Populacná hustota bola 2 jedince/100 ha. Zapocali sme so štúdiom vztahov kamzíka a velkých predátorov. Použili sme nepriame metódy výskumu; analýzu trusu velkých šeliem a porovnaie využívania alpínskeho prostredia šelmami a kamzíkom. Analyzovali sme 49 vzoriek trusu medveda a 15 vzoriek trusu vlka. Hlavnú potravu medveda tvorili divo rastúce rastliny (44,0%), hmyz (33,9%) a kultúrne rastliny (13,6%). Najcastejšie konzumovanými skupinami hmyzu boli osy (17,0%) a mravce (12.7%). Jedna vzorka trusu medveda obsahovala zvyšky diviaka. Hlavnou potravou vlka bola jelenia zver (47%) a diviak (40%). Ostražitost jednotlivých kamzíkov pri pasení sme použili ako kritérium antipredacného správania. Samotársky žijúce samce strávili viacej casu pozorovaním okolia ako dospelé samice v materinských criedach. Predpokladáme, že nesmrtné úcinky predácie viacej ovplyvnujú kamzíciu populáciu, ako priame straty spôsobené koristením. Predátormi spôsobené využívanie menej úživných skalných biotopov a úplné vyhýbanie sa lesnému prostrediu, pravdepodobne obmedzuje další rast a expandovanie kamzícej populácie. Nacrtli sme niektoré ochranárske problémy, ktoré dosial neboli uvažované.

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1. Expedition Review

M. Hammer (editor)
Biosphere Expeditions

1.1. Background

Biosphere Expeditions runs wildlife conservation research expeditions to all corners of the Earth. Our projects are not tours, photographic safaris or excursions, but genuine research expeditions placing ordinary people with no research experience alongside scientists who are at the forefront of conservation work. Our expeditions are open to all and there are no special skills (biological or otherwise) required to join. Our expedition team members are people from all walks of life, of all ages, looking for an adventure with a conscience and a sense of purpose. More information about Biosphere Expeditions and its research expeditions can be found at www.biosphere-expeditions.org.

This expedition report deals with an expedition to the Nízke Tatry (Low Tatras) National Park in Slovakia, which ran from 15 August to 10 September 2004. The expedition monitored critically endangered chamois (mountain goat) populations and their interrelationship with large predators, such as wolves and bears. The expedition team surveyed chamois by direct observation on the alpine meadows and cliffs, recorded their signs, such as tracks, scats and markings. The expedition team also recorded the signs of wolves and bears in the high mountain habitat and forests below. All this in a first-ever concerted effort to ascertain how many chamois, wolves and bears live in the area and whether wolves and possibly bears are predating on chamois.

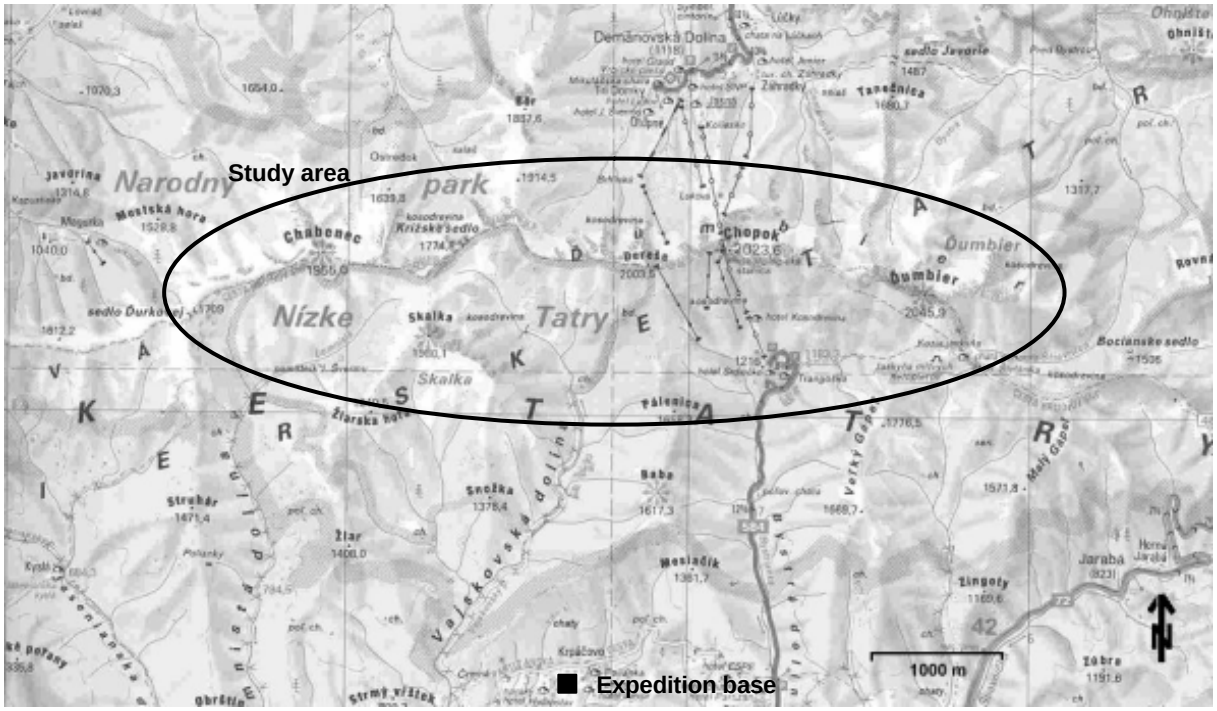
1.2. Research area

The Western Carpathian mountains cover much of Northern Slovakia, and spread into the Czech Republic with Moravia to the east and Southern Poland to the north. They are home to many rare and endemic species of flora and fauna, as well as being a notable staging post for a very large number of migrating birds.

Within these Western Carpathian mountains is the Nízke Tatry National Park, which was established in 1978. It extends over an area of 2200 km^2 of which 800 km^2 forms the core area and 1400 km^2 the buffer zone. Altitude above sea level ranges from 400 to 2043 m. The main ridge extends east to west over a distance of about 100 km. Forest cover in the area is 90%. The main trees are Norway spruce, beech and fir. The timberline is composed of Norway spruce and in some places beech, between 1400 and 1500 m. Above the timberline is a zone of dwarf pine, then a habitat of alpine meadows and cliffs. The buffer zone of the park is relatively densely populated. Meadows, pastures and arable land extend around the villages. The forests are managed and pastures are used for grazing livestock, mainly sheep and cattle. However, in summer the grazing of livestock on alpine meadows is forbidden (a herd of cows was observed close to the main ridge on one occasion where grazing is allowed around the area of Zamoska hola for a few weeks every summer).

The territory of the Park is divided into a number of districts where both hunting and tourism are permitted throughout, including most of the core area (but tourism is forbidden on the rocky ridges of the study area). The most important ungulate is the red deer. Roe deer are also present in substantially lower numbers, along with a small population of wild boar. A small isolated native chamois population of fewer than 90 individuals inhabits this area above the tree line. The other large predators besides the wolf are the brown bear and lynx. The wolf was exterminated from the park in the 1960s but reintroduced into the area again at the end of the 1970s.

The research area spreads over the central part of the park dominated by the highest peak called Dumbier (2043 m). Up to now little data has been gathered on the ecology and behaviour of the large wild mammals and many of the birds in Slovakia.



Map of the study area.

1.3. Dates

The expedition ran over a period of four weeks divided into two two-week slots, each composed of a team of international research assistants, scientists and an expedition leader. Slot dates were:

15– 27 August | 29 August – 10 September 2004.

Dates were chosen to coincide with the summer peak of chamois births and with the early autumn Indian summer period of high feeding activity.

1.4. Local Conditions & Support

Carpathian Wildlife Society

On this project Biosphere Expeditions is collaborating with the Carpathian Wildlife Society (CWS), a Slovakian non-profit-making research and conservation organisation bringing together people with a shared interest in the research and conservation of large mammal and bird species in the Western Carpathian mountains. Established in 1994 by the expedition's local scientist Dr. Slavomir Find'o, the CWS is a young and dynamic organisation working to raise national, and international awareness and increase understanding of the rich and varied wildlife of the Western Carpathians, with particular emphasis on endangered or threatened species. The CWS aims to find real world answers to conflicts between wildlife and local people.

Expedition bases

The expedition team was based in the recreational area of Krpacovo in a wooden cottage with showers and some modern amenities. Team members shared double or triple rooms; breakfast and a lunch pack was prepared at base by the expedition team on a rota basis and dinner was taken at a local restaurant on days that the expedition team returned to the valley. On ridge days, when the expedition team spent several days on the mountain, meals were either prepared by the expedition team or by mountain hut staff. Vegetarians were catered for. There were also some guesthouses situated near the base, which included restaurants open to the public, and some shops.

Field communications

The only available telephones suitable for international calls were in the nearby guesthouses about 5 - 10 minutes walk from the base. In general mobile phone coverage was very good, but in some spots, such as deep valleys, signal reception was poor. When working in groups during the day, contact between groups and the base was by radio (where possible through line of sight) or by mobile phone. Each group also carried as part of its safety equipment a set of flares for emergency communication.

Transport & vehicles

Team members made their own way to the Bratislava assembly point. From there onwards and back to Bratislava all transport was provided for the expedition team. Transport to and from base camp, and around the study site was by the Biosphere Expeditions Land Rover Defenders or by Slavomir Find'o's Suzuki 4x4.

Medical support & insurance

The expedition leader was a trained first aider, and the expedition carried a comprehensive medical kit. Further medical support was provided via a network of mountain rescue stations. There are two hospitals in the nearby towns of Banska Bystrica (30 km from base) and Brezno (10 km from base). In case of immediate need of hospitalisation, and weather permitting, helicopters of the mountain rescue service or from the hospital in Banska Bystrica were available.

All team members were required to carry adequate travel insurance covering emergency medical evacuation and repatriation. There were no serious medical incidents.

1.5. Local Scientist

The expedition's local scientist was Dr. Slavomir Find'o, an associate of the Forestry Research Institute in Zvolen. He was born in 1953 in Slovakia. His Master's degree in Forestry is from the Forestry University of Zvolen and his PhD from the Slovak Academy of Sciences. He has been researching large ungulate impact upon forest vegetation since 1976 and lately large carnivores, particularly wolves, in the Slovak Carpathian mountains. He has introduced modern research methods into the study of wildlife in Slovakia (e.g. radio-tracking) and has made a considerable contribution to wolf conservation. Over the last few years he has also been involved in resolving the problem of large predators' depredation on livestock. He is the director of the Carpathian Wildlife Society, which he established in 1994.

1.6. Expedition Leader

This expedition was led by Dominic Hall. Dominic studied Mathematics at Nottingham University and has been recovering ever since. His rehabilitation has involved flitting between life as an editor for an educational publishing company, and going on expeditions, mainly in the tropics of Central America and South East Asia. He fell in love with expedition life on a gap year programme after university and has now led a large number of expeditions with a variety of organisations, most recently to the remote Maliau Basin, deep in the rainforests of Borneo. He is a qualified Mountain Leader and spends every spare minute walking and climbing around his Lake District home.

1.7. Expedition Team

The expedition team was recruited by Biosphere Expeditions and consisted of a mixture of all ages, nationalities and backgrounds. They were:

15 – 27 August 2004

Bjørn Aslaksen (Norway), Katie Bunting (UK), David & Brooke Cooperstein (USA), Jane Eades (UK), Kirk Fischer (Canada), Alexander Milne (UK), Martyn Roberts (UK), Kathleen Ryan (Ireland), Andrew Sansom (New Zealand), Lottie Walter (UK), Gail Weinstein (USA). Also: Claudia & Matthias Hammer (Biosphere Expeditions).

29 August – 10 September 2004

Nadine Andrews (UK), Lucy Benfield (UK), Alex Chappelow (UK), Nancy Galloway (UK), Janine Hierzig (Luxembourg), Sonja Käßmann (Germany), Petra Lembcke (Germany), Alexander Milne (UK), Anja Möricke (Germany), Claire Swienton (UK), John Tollefsen (Norway).

1.8. Expedition Budget

Each team member paid towards expedition costs a contribution of £990 per person per two week slot. The contribution covered accommodation and meals, supervision and induction, special non-personal equipment, and all transport from and to the team assembly point. It did not cover excess luggage charges, travel insurance, personal expenses like telephone bills, souvenirs etc., as well as visa and other travel expenses to and from the assembly point (e.g. international flights). Details on how this contribution was spent are given below.

Income	£	
Expedition contributions	24,603	
Expenditure		% of which spent directly on project
Lodging and food includes all board & lodging (valley & mountain)	4,256	100
Transport includes car fuel UK – Slovakia return, Biosphere & scientist vehicle fuel	1,233	100
Equipment and hardware includes research materials & gear etc purchased in UK & Slovakia	1,655	80
Staff & project support includes local and Biosphere staff salaries, travel and expenses to Slovakia and donation towards Carpathian Wildlife Society	4,109	100
Administration includes registration fees, sundries etc	684	100
Team recruitment Slovakia as estimated % of PR costs for Biosphere Expeditions	4,800	100
Income – Expenditure (unadjusted)	**7,866**	
Income – Expenditure (adjusted to % spent on project)	**8,197**	
Total percentage spent directly on project	**68%**	

1.9. Acknowledgements

This study was conducted by Biosphere Expeditions which runs wildlife conservation expeditions all over the globe. Without our expedition team members, who are listed above and provided an expedition contribution and gave up their spare time to work as research assistants, none of this research would have been possible. The support team and staff, also mentioned above, were central to making it all work on the ground. Thank you to all of you, and the ones we have not managed to mention by name (you know who you are) for making it all come true. Biosphere Expeditions would also like to thank Land Rover, Cotswold Outdoor, Globetrotter Ausrüstung and Gerald Arnhold for their sponsorship.

1.10. Further Information & Enquiries

More background information on Biosphere Expeditions in general and on this expedition in particular including pictures, diary excerpts and a copy of this report can be found on the Biosphere Expeditions website www.biosphere-expeditions.org.

Enquires should be addressed to Biosphere Expeditions at the address given below.

2. Chamois, wolves and bears of the Nízke Tatry Mountains

Slavomir Find'o
Carpathian Wildlife Society

2.1. Introduction

The Tatra chamois is a native species of the Western Carpathians, but survives only in the mountains of the Tatry (High Tatra on the Slovak and Polish side) and the Nízke Tatry (Low Tatra in Slovakia). The species is effectively separated by more than 15,000 years from the other European populations of chamois. In 1971 the Tatra chamois was described as a separate subspecies (Blahout 1972).

Despite total protection over the last 40 years, the number of chamois in the Tatry has gradually dropped. Currently the total number of both isolated populations is estimated at fewer than 300 individuals. The most extensive studies on chamois mortality and population decline have been conducted by Chudík (1969, 1974), Blahout (1972 a, b, c, 1976), Chovancová & Gömory (1999).

In the Nízke Tatry, chamois became extinct, probably due to climate change, at the end of the last Ice Age (Holocene). Between 1969 – 1976 chamois were reintroduced from the Tatry to the Nízke Tatry, when 30 animals were used to re-establish the population (Blahout 1976, Radúch & Karc 1983). The newly established population increased rapidly, recolonised suitable habitats and the numbers peaked between 1989 – 1995. During this period, park staff recorded the population's highest numbers at up to 120 – 140 individuals. Recently the numbers have plummeted to fewer than 90 individuals. The reasons for this rapid decline are unknown. Besides severe winter conditions and human disturbance, such as on-trail and off-trail hiking, paragliding etc., predation is suspected to limit population growth. The wolf, lynx and golden eagle are reputed to predate occasionally on chamois. Brown bear, fox and ravens are common scavengers of chamois carrions. As documented from other mountain areas in Europe and Asia, the latter three species can take mountain ungulates, but such events have not been observed in Slovakia.

Many animal species exhibit a decrease in the per capita birth rate at small population size or density, a phenomenon known as the Allee effect (Allee 1931). Under Allee conditions, many of the factors at work in small populations (genetic drift, loss of genetic variability, demographic fluctuations, environmental stochasticity) begin to work cumulatively, and the population is unable to avoid an extinction vortex (Courchamp et al. 1999, Stephens & Sutherland 1999). An often cited example is the analysis by Berger (1990, 1993) showing that populations of fewer than 50 bighorn sheep have a very high probability of extinction within 50 years. One way that an Allee effect can be generated is by the reduction of beneficial social interactions in populations with fewer individuals,

such as when anti-predator strategies (vigilance, dilution effect) become inefficient in small groups of prey (Courchamp et al. 1999, Stephens and Sutherland 1999). Because species subjected to a strong Allee effect may be more susceptible to catastrophic population collapse with only a slight increase in mortality (Courchamp et al. 1999), wildlife managers need to understand the potential impact of predation on small populations. Knowledge of predation risk factors and anti-predator behaviour can be used to predict which individuals are most vulnerable and help generate methods to conserve wild populations (Blumstein 2000).

Overwhelming evidence suggests that mammals modify their behaviour in the presence of predators, including increased vigilance, site abandonment, selection of safer habitat, and greater wariness (Kie 1999, Berger et al. 2001). In particular, a large body of evidence indicates that the proportion of an animal's activity budget devoted to vigilance reflects its overall risk of predation. Vigilance behaviour is positively correlated with increasing predation risk as determined by body size, presence of young, habitat structure, distance from cover, group size, and position within a group (Kie 1999, Steenbeek et al. 1999, Altendorf et al. 2001, White et al. 2001, Childress and Lung 2003, Wolff and Van Horn 2003). Importantly, vigilance has been found to increase in populations subjected to predation compared to populations with reduced or no natural predators (Boving and Post 1997, Berger et al. 2001, Laundre et al. 2001, Wolff and Van Horn 2003). Because actual predation events are rarely – if ever – observed, vigilance level can be a useful measure of predation risk.

The long term survival prospect of both small isolated chamois populations in Slovakia is uncertain. This concern initiated the study on chamois-predator interrelationships in the Nízke Tatry. The report refers to the findings collated during August and early September 2004.

The goals of this study were to

(1) Conduct a chamois population survey before the breeding season and in early spring for identification of winter mortality.

(2) Ascertain size, sex-age composition and distribution of chamois groups with regard to type of habitat and disturbances caused by humans.

(3) Analyse large carnivore diet via an examination of scats/faeces collected in chamois habitat and surrounding mountain forests. Within this, concentrate on the identification of percentage of mountain ungulates in bear diet.

(4) Describe interactions between chamois and other wildlife species. Locate signs of large predator activity and their presence in the chamois habitat. In detail describe observed interrelationships between chamois and predators.

(5) Characterise chamois anti-predatory behaviour.

(6) Co-operate with park staff and relevant scientific institutions on a radio-tracking study of chamois and food analysis.

(7) Compare findings obtained in this study within the Nízke Tatry Mountains with other results achieved on the above subjects.

2.2. Materials and Methods

Field work

Work in the field was conducted from 15 August to 10 September 2004, generally in teams of two or three. Team members underwent a three to four day training period prior to data collection. Work was done primarily on foot, using public hiking trails and logging roads or hiking cross-country. The daily trails were situated either in woodland or in alpine habitats. Across the whole study area signs of large predator activity (tracks, footprints, bear trees etc.) were surveyed and wolf and bear scats were collected. Whenever chamois were sighted, group size was recorded, together with composition, and a map reference of the group. Additionally behaviour of chamois was observed and interactions with other wildlife species and human beings were recorded. Observations were entered onto three different datasheets (chamois observations, animal encounters and tracks of predators). Scats of predators were put in plastic bags and labelled. All findings and observations were geographically coded using a Silva GPS (World Geographic System 84). For navigation, topographic hiking maps 1:50,000 or 1:25,000 were used. Any unclear footprints or doubtful signs of animal activity were photographed for proper identification later at base. Any important, questionable or dubious observations were immediately debated in the field via radio or mobile phone communication. Daily fieldwork terminated at base with a briefing. Each working pair handed over completed datasheets and reported their daily findings and observations to the rest of team. Researcher and expedition leader outlined plans for the next day, delineated daily survey routes and set tasks for each pair of team members.

Scat analysis

For the analysis of scats the standardised method commonly used in wildlife research was used (e.g. Capitani et al 2003, Ciucci et al 1996). Prior to analysis all scats collected were appropriately re-identified in the lab. The main criteria used for scat identification were size, shape, smell, colour and macroscopic diet remains. Bear scats were often confused with red deer summer faeces, and wolf faeces with smaller and medium sized predators. Improperly identified and very old scats were excluded. Both expedition slots in total collected 49 bear and 15 wolf scats. These scats were deep frozen and later used for analysis of diet composition.

Defrosted scat samples were leached using a sieve under cold running water and clear diet remains air-dried. Bear scats included seeds, leaves, grasses, berries, fruit, insect and mammal remains. Most of the wolf scats contained one food item. The indigested remains included hairs, bones, milk teeth and hooves of young ungulates. In some cases, hairs were identified by comparison with a collection of mammal hairs, after thoroughly examining their length, thickness, shape and colour. For precise identification of other mammalian species, microscopy was needed. The pattern of the outermost layer of animal hairs (cuticular prints) was compared with reference samples and a reference atlas (Dziurdzik 1973). The percentage of each food item in the sample was estimated.

GIS analysis

Geographic information system (GIS) analysis is a useful tool for a spatial analysis of (biological) findings. In this study ArcView software was used to compare spatial organisation of chamois herds in relation to the distribution of predators' signs of activity. Geographically coded (readings of x and y coordinates from GPS) field data was overlapped with the aerial images of the study area. Most of the GIS coverage in Slovakia including aerial photographs is logged in the old eastern bloc JTSK coordinate systems commonly used in the former Czechoslovakia. This coordinate system unfortunately is incompatible with any western coordinate systems. Therefore all GPS readings obtained in the field (WGS 84 coordinate system), had to be transformed into the JTSK coordinate system. In practice this meant that all WGS 84 locations had to be manually plotted on a military map 1:25,000 and from this map the new UTM coordinates were derived. Finally it was possible to transfer UTM coordinates into JTSK with the use of special software. The process of transforming the coordinates was the most time-consuming part of the data assessment.

2.3. Results

2.3.1. Chamois

Numbers and spatial organisation of herds

The chamois range in the Nízke Tatry is situated alongside the main mountain ridge above the timberline, in the central part of the mountains. This area comprises rugged rocky habitat, alpine meadows interspersed with patches of blueberry meadows, solitary willows and dwarf pine (*Pinus mugo*) stands, which contour the upper timberline. Tatra chamois avoid forest habitat and normally utilise open landscape near the cliffs. This behaviour and probably some other reasons restrict chamois distribution and prevent habitat utilisation below rocky areas. The chamois range described is based on 57 sightings collated during the study. Linking the outermost locations of observed chamois delineated a polygon encompassing an area of 2428 hectares (see Fig 2.3.1a). This area does not include the two side ridges used by chamois, the Ludárova hola and the Štiavnica, where team members could not venture during this first expedtion year, as access was denied by the National Park authorities.

The expedition team attempted to estimate the total number of chamois within the alpine area where research was allowed. During the study, females with kids and other adult goats aggregated into three maternal herds. These big herds sometimes split temporarly. Only mothers with their kids stayed together at all times. Thus we repeatedly sighted smaller, separated groups from the same social unit. All herd members, however, used the same well-defined territory, which allowed a tally of the total number of a herd (after exclusion of dubious counts). The total size of the maternal herds mentioned in the text below refers to the maximum observed number of the same herd during the study.

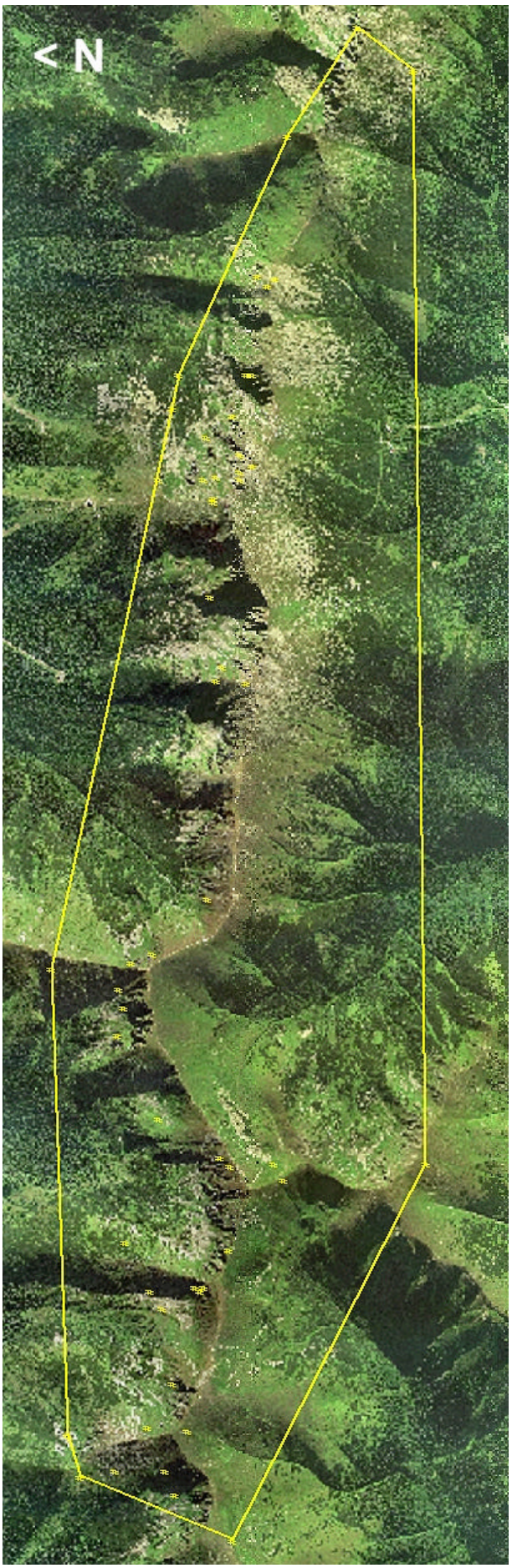


Fig 2.3.1a. Chamois distribution in the Nízke Tatry mountains.

Yellow lines delineate chamois range (total 2428 hectares).

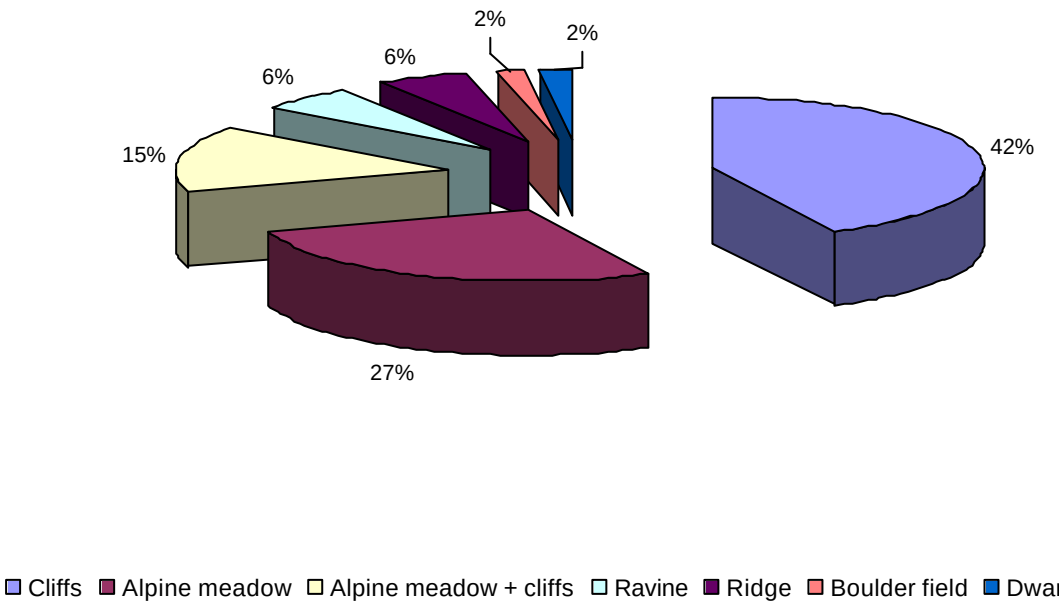
Yellow dots signify indvidual chamois sightings.

The western section of the range between the summits of Chabenec and Ostredok was occupied by a group of 13 animals. The area around the summit of Dereše was occupied by a herd of 12. Another large herd of 11 or 12 utilised an area between the summits of Chopok and Konsko. Besides these three main herds, the area was used by lone adult males and small groups of yearlings, which had separated from the maternal herds the previous spring. The most accurate population survey was carried out on 7 September 2004. In total 50 chamois were recorded comprising 14 kids < 1 year (28%), 25 adult females (50%) and 11 adult males plus yearlings. Of 25 adult females, 14 (56%) were seen to have produced a kid. The population density was 2.06 individuals per 100 hectares. The number of chamois observed on 7 September 2004 represents the majority of the whole chamois population of the Nízke Tatry. Over the last few years the total number of chamois reported by park staff ranged from 80 to 90 individuals. This means that the remaining 30 - 40 individuals should occupy the only two remaining side ridges, the Štiavnica and the Ludárova hola. As access was denied to these two ridges in year one of the expedition, the total number of chamois in the Nízke Tatry could not be ascertained accurately.

Habitat use

The main habitat types within the chamois range include alpine meadows, cliffs, ridges, ravines, boulder fields and dwarf pine (see Fig. 2.3.1b). Alpine meadow is a general term for an open landscape covered mostly by grasses and sedges. A more detailed classification of non-woody vegetation communities was outside the scope of this study.

Fig. 2.3.1b. Habitat use by chamois



The use of main habitat types by chamois varies greatly. Chamois appear to prefer cliffs (42% of observations) and alpine meadows (27%) or a combination of both (15%). Cliffs, boulders or other surrounding habitats near rocky terrain are used to minimise the risk of predation. The chamois is a cliff-dwelling ungulate utilising rugged terrain for self-protection. Despite this chamois need to graze several times during the daytime on open alpine meadows to satisfy their nutritional requirements. Anti-predatory and optimal foraging strategies resulted in heavy utilisation of the cliffs and adjacent alpine meadows (84% of all observations). Selection of suitable microhabitats mitigates extreme weather conditions (shade in hot summer, sunny slopes in winter, spots protected from wind etc.). The landscape use by chamois reflected the avoidance of heat stress during warm late summer days. During the daytime most animals were observed on the north facing slopes. The main ridge and southern slopes were utilised only at night as shown by tracks found and night observations.

Human disturbance seriously limits habitat utilisation seasonally and during daylight hours. During the summer holiday period of July and August, hundreds of hikers walked the public paths that run along the main and side ridges. In order to avoid these hikers, chamois retreated to northern slopes and side ridges further away from the main crest during the day. Normally after 18:00, when hikers left the main ridge, chamois were observed to return from the northern valleys and graze on the alpine meadows alongside the hiking trail.

Interrelationships of chamois and predators

The primary goal of this study was to illuminate the impact of predators and raptors on the chamois population. The chamois was reintroduced to the study area from 1967 to 1975 when wolf, bear and lynx were less common than at present. Incidences of wolf and lynx predation on chamois particularly in the Tatry Mountains are summarised by Bališ & Chudík (1976) Chudík (1974), Radúch (1994), Radúch & Karc (1983). Radúch (1994) also described two attempted attacks by wolves in the Nízke Tatry. Successful wolf attacks on chamois were also recorded in Belanské Tatry (part of the Tatry Mountains). Old articles from the Tatry, however, referred to the lynx as the main predator of chamois (Bališ & Chudík 1976, Chudík 1974).

Bears, after leaving their dens in spring, commonly survey mountain slopes in search of ungulate carcasses. They sometimes attempt to find the remains of wolf and lynx kills. Bear predation on mountain ungulates is known in Asia, but not in Europe (Filonov 1989).

Both unsuccessful and successful golden eagle attacks on chamois kids were reported by Blahout (1976). Blahušiak (1993) and Kadlecík et al. (1995) found the remains of chamois kids in an eagle's nest in the Velká Fatra Mountains and Blahout (1976) observed a golden eagle carrying a chamois kid.

To record events of chamois predation within the study area directly is all but impossible in practice. To assess predation effects on chamois, we therefore used indirect methods such as predators' scat analysis and a comparison of landscape use by both chamois and predators.

The distribution of large predator signs were compared with the locations of chamois herds (Fig. 2.3.1c). As mentioned above, chamois exclusively utilise rugged habitats above the timberline, especially cliffs and surrounding alpine meadows. When disturbed by predators or human beings, chamois normally retreat to cliffs. Such protection behaviour can be observed easily. The use of open landscape provides good visibility and helps chamois to recognise possible danger early. Many authors explain the use of areas above the timberline as anti-predatory behaviour (e.g. Baumann 2004). In contrast to chamois, predators need to hide under forest cover during the daytime and use alpine habitat only at night as shown by the locations of signs of activity (scats and tracks). Wolf signs were found on the main and side ridges in the western section of the chamois range characterised by easily accessible alpine meadows with little human disturbance. This area extends from the saddle Durková in the west to the saddle Polana in the east including the side ridges of Bôr and Skalka.

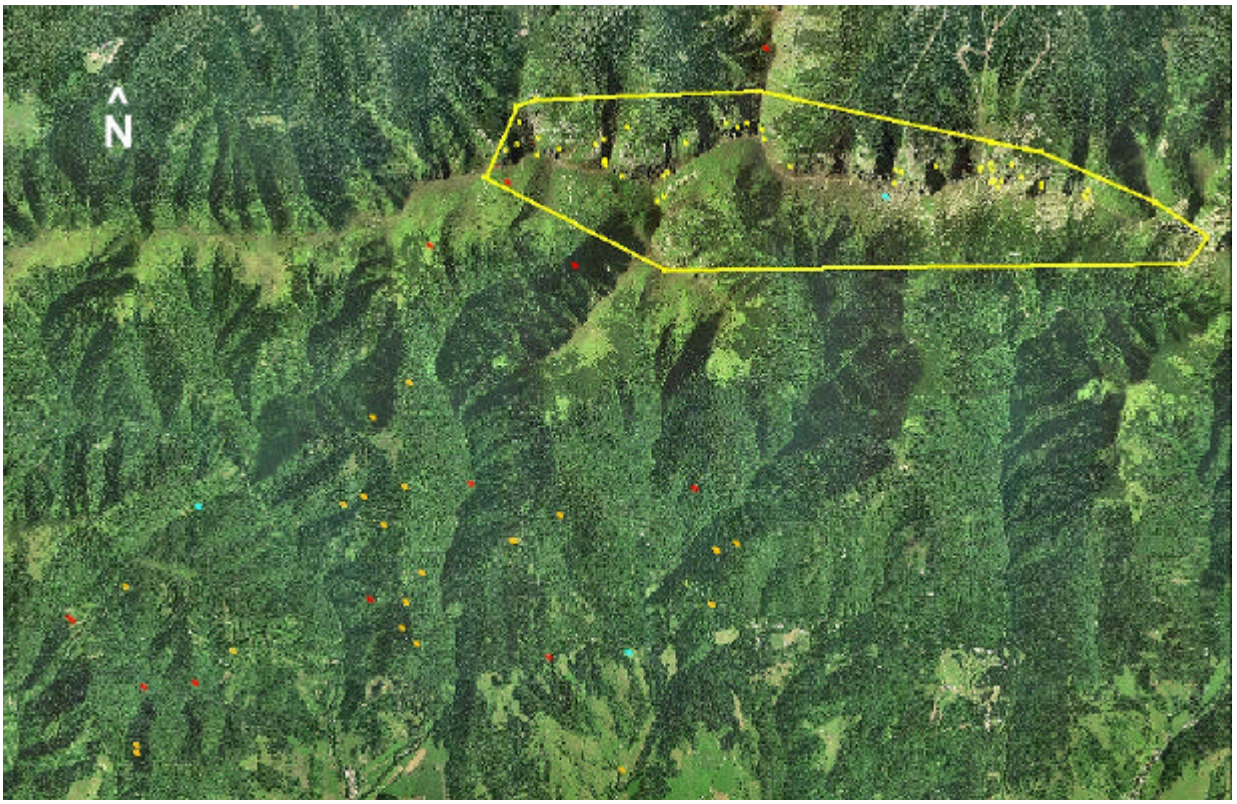


Fig. 2.3.1c. Chamois distribution and large carnivore tracks. Yellow lines = chamois range (total 2428 hectares). Yellow dots = chamois sightings. Gold = bear track. Red = wolf track. Blue = lynx track.

Chamois usually suffer from human presence in the area, but can also sometimes benefit (see below). Negative effects usually come in the form of disturbance including habitat avoidance, a prolonged rutting season and hence a late parturition (kids born late have little chance of survival in the first winter) etc. Chamois more or less tolerate hikers and outdoor sports. As regards positive effects, interesting anecdotal evidence suggests that chamois pursued by wolves resorted to hikers for safety (Radúch 1994).

Signs of bear were found almost exclusively in woodland and near the timberline. Some bear scats were collected in alpine habitat south of the summit of Chopok between the mountain lodge Kamenná chata and the hotel Kosodrevina. Hikers use both places intensively and several human-habituated bears have been reported from this area in the

past. Based on recent observations by foresters, lynx are probably more abundant than wolves within the study area. In spite of this only few lynx tracks were recorded, one near the summit of Chopok. Recently two unverified events of chamois predation by lynx were reported (07.03.2001 & end of November 2000) (Mayer 2004).

In alpine habitat golden eagles were observed eight times in the space of three days (Fig. 2.3.1d). It appears that eagle activity was concentrated within the chamois habitat only on certain days, as different team members observed probably the same birds in a short period of time (03.09.2004 – 4 observations, 04.09.2004 – 1 observation and 07.09.2004 – 3 observations). Two adults and one young bird at least were seen. While adults utilise their well-delineated territories, young birds roam widely at the end of summer. This meant that different young birds and just one pair of adults were observed. Most of the time eagles scanned the cliffs and soared alongside the main and side ridges. Twice eagles were seen in the vicinity of chamois, but did not show any interest in them. Two ravens spent five minutes mobbing a young eagle, which was sitting on a rock 100 m away from a resting mixed group of 7 chamois including 3 kids. Neither chamois, nor eagle showed any interest in each other. Two adult eagles scanning the slopes did not disturb a group of 13 chamois about 200 m away.

However, chamois-eagle interaction (03.09.2004) described below by a team member gave a different impression: “We were scanning the cliffs and spotted a single adult female in the rocks on the side ridge opposite – approx. distance 200 - 300 m. It was approx. 200 m from the top of the ridge. Our attention was drawn by calls of two ravens on the top of the ridge. They were calling and when we looked they were mobbing a golden eagle, which was sitting on the ridge. At this time the chamois showed no interest. Then the chamois got up and began to contour round the slope, grazing as it went, heading round below the eagle. When it was directly below the eagle approx.150 m away, it seemed to notice it. Then it began moving more quickly round the slope trotting, looking over its shoulder towards the eagle, trotting again until it passed by and disappeared from our view into more cliffs.”

The eagle did not show any interest in the chamois. Nevertheless the chamois appeared alert and concerned, quickly moving from the exposed area into the cliffs.

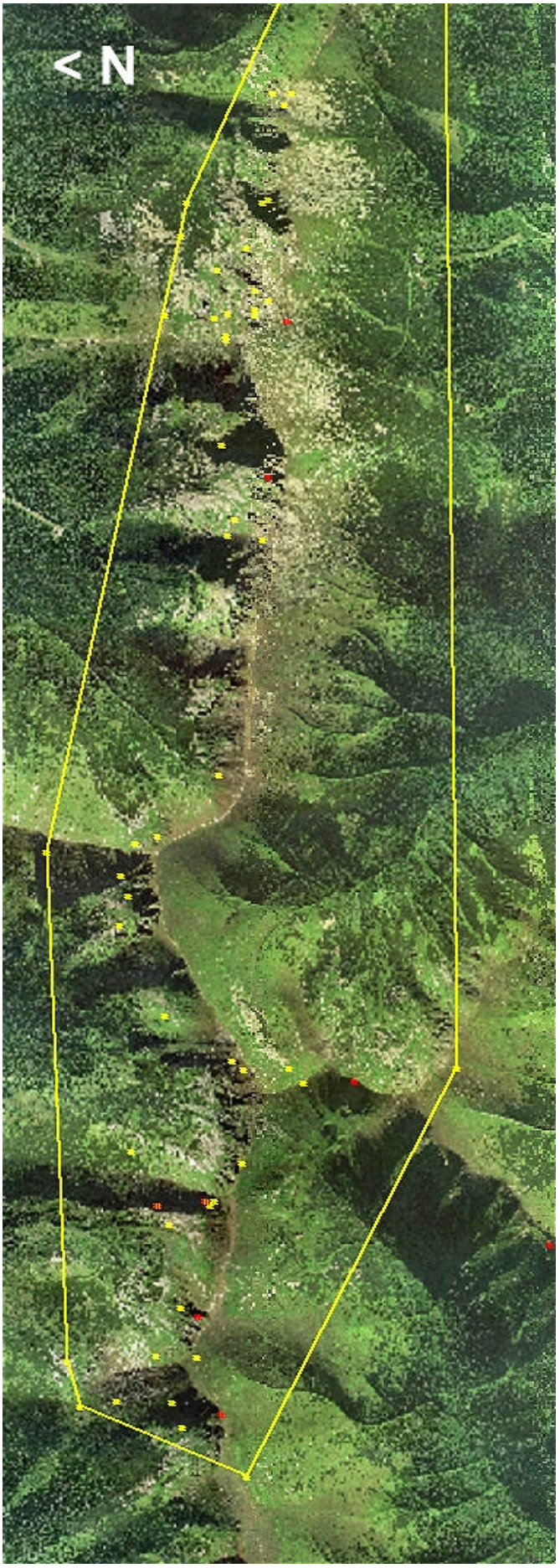


Fig 2.3.1d. Chamois (yellow markers) and golden eagle observations (red markers).

Chamois-human interrelationships

Chamois in the Nízke Tatry are constantly subjected to human impact. Three mountain lodges (Štefánikova chata, Kamenná chata and Durková) are open to the public all year round. The area is used for summer and winter outdoor sports, peaking during the summer holidays and in winter. In general chamois tolerate human presence. Nevertheless the response of chamois to people is difficult to predict.

Grazing chamois are vulnerable to predation. Therefore feeding animals usually survey the surrounding area 1 - 3 times per minute (Bauman 2004, Mayer 2004).

To test individual vigilance levels, grazing chamois were chosen randomly from a herd to count the number of alert postures with head up per 10 minute span. Individual vigilance was defined by the following criteria: the focal animal (1) had its head raised above shoulder level, (2) was standing and not moving, (3) had stopped other activities such as feeding, (4) surveyed its surroundings with its attention fixed on the environment, and (5) had its ears cocked forward. Additional data recorded for each sample included focal animal age-sex category, time and date, group size and type, and any relevant comments. A total of 13 observations of individual vigilance were conducted (Table 2.3.1a).

Table 2.3.1a. Individual vigilance of chamois (10 minute sample of focal animal).

ID	Sex-age category	Herd size	Individual vigilance (number of times animal looked up within 10 minutes)	Aware of observer	Observation distance (m)	Reaction to human disturbance
1	Adult male	3	16 x	No	1000	No
2	Adult male	1	28 x	No	1000	No
3	Adult male	1	Constantly alert	Yes	200-10	Slowly moved away
4	Adult male	1	Constantly alert	Yes	70-60	Slowly moved away
5	Adult male	1	10 x	Yes	50-200	No
6	Adult male	1	Constantly alert	Yes	270-40	Slowly moved away
7	Adult female + kid	3	13 x	No	1000	No
8	Adult female + kid	12	3 x	No	250	No
9	Adult female	9	7 x	Yes	150	No
10	Adult female	8	Constantly alert	No	800	No
11	Adult female	7	4 x	Yes	250	No
12	Adult female	13	17 x	No	750	No
13	Yearling female	3	1 x	Yes	300	No

Adult males showed two different behaviour patterns. If aware of a human being, they stopped grazing and continually watched the incoming observer. When the distance between the animal and the observer was reduced to 10 – 60 m one male moved slowly away. Other adult males raised their heads from 10 to 28 times per 10 minutes, 8 on average 18 x (N=3). Some of the adult females within maternal herds continually patrolled grazing group members from strategic locations. We did not select these animals for vigilance observations. Adult females performed an alert posture with raised head from 1 to 17 times per 10 minutes, on average 7.5 x (N=6). One adult female that had not been aware of people, stopped grazing and constantly surveyed the surroundings. Preliminary observations indicate that single males spend more of their activity budget in protective behaviour than females in larger groups (average herd size was 7.8 individuals). Besides individual vigilance, future research should consider observations of group vigilance to elucidate protective behaviour of the whole social unit (Mooring et al 2004). As shown by other studies, group vigilance of a maternal herd is a more effective anti-predatory strategy than the individual vigilance of lone males. In the Swiss Alps, for example, lynx killed chamois males more frequently than females (Bauman 2004).

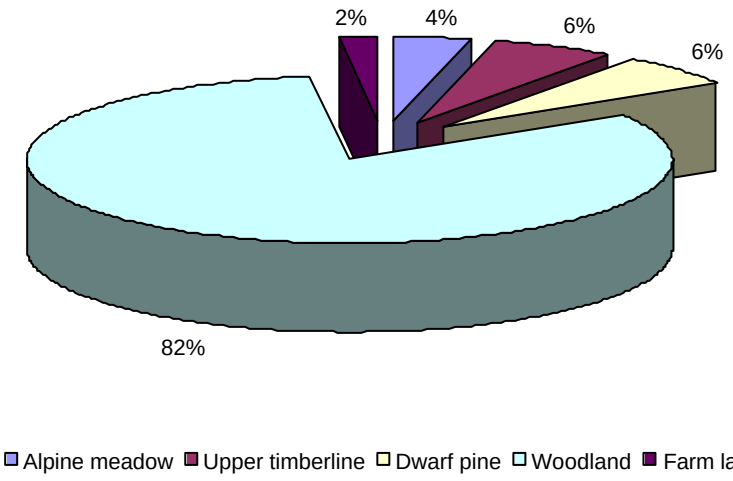
Chamois are fairly tolerant of various human disturbances including hiking, downhill skiing, mountain climbing etc. as all these activities are more or less regularly conducted around the study site. Therefore restricting movements of park visitors to approved public hiking trails and sites is strongly recommended. Chamois escape distance ranged from 10 to 70 m (N=6). These distances are extremely small in comparison with those of other ungulates. Any unusual human behaviour, e.g. surprise reactions to the presence of chamois, evoked immediate chamois anxiety and an escape reaction. The network of hiking trails and all areas of human activity are well known to the chamois and as such are avoided by them during daytime.

2.3.2. Predators

Bear diet

Bear summer diet is described based on analyses of 49 scats.

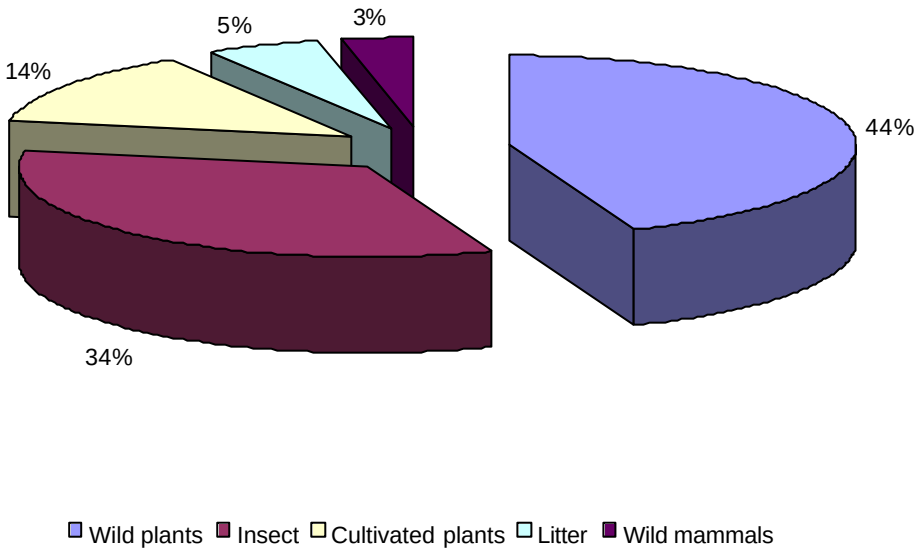
Fig. 2.3.2a. Location of bear scats by habitat types.



These scats were collected in the following habitats: woodland (N=41), upper timberline (N=3), dwarf pine (N=3), alpine meadow (N=2) and farmland (N=1). 82% of scats were found inside forested areas and only 12% (N=8) above the timberline (Fig. 2.3.2a). The elevations of bear scat locations ranged from 795 to 1825 m.

Wild plants were the most frequent food item (44.0%) consisting mainly of raspberries, blueberries, grasses and herbs (Fig. 2.3.2b). One old scat sample, dating back to early spring or winter, contained beech nuts. An unusual finding was the seeds of Cornelian cherry (*Cornus mas)*. This shrub grows on warmer limestone sites on foothills around the village of Jasenie. Cultivated plants eaten by bears at the winter feeding sites of red deer constituted 13.6%.

Fig. 2.3.2b. Composition of bear diet (N = 49).



Bears commonly utilise food provided by hunters for ungulates at winter feeding sites, thus the old scats from early spring contained wheat, oat and silage. Additionally bears fed on apples, pears and plums originating from various sites such as gardens, deer feeding site and fruit trees interspersed across the study area. It was assumed that most of this fruit was eaten by bears in the wild.

Table 2.3.2a. Summer food of the brown bear in the Nízke Tatry Mountains (number of faeces = 49).

Food item / group		N	%	Remarks
Wild plants		52	44.0	
	Raspberries	24	20.3	
	Grasses, herbs	20	17.0	
	Blueberries	6	5.1	
	Beech nuts	1	0.8	Winter or late spring food
	Cornelian cherry	1	0.8	*Cornus mas*
Cultivated plants		16	13.6	
	Wheat	8	6.9	
	Oat	1	0.8	
	Silage	1	0.8	
	Apple*	4	3.5	
	Pear*	1	0.8	
	Plum	1	0.8	
Litter / detritus		6	5.1	
	Roots	2	1.8	
	Wood	1	0.8	
	Bark	1	0.8	
	Stones	2	1.7	Accidentally eaten
Insects		40	33.9	
	Wasps	20	17.0	*Vespula vulgaris, Vespula germanica*
	Ants	15	12.7	
	Bumble bees	1	0.8	
	Other insects	4	3.4	Mostly beetles
Wild mammals		4	3.4	
	Wild boar	1	0.8	
	Small mammals	3	2.6	
Total plant food		74	62.7	
Total animal food		44	37.3	
Grand total		118	100	

While collecting food on the forest floor, bears also accidentally consumed various components of litter including roots of herbs, bark, wood and inorganic material such as soil, sand and small stones (Table 2.3.2a).

Taking into consideration possible predation of bears on wild ungulates, special attention was paid to animal food items. Animal food constituted 37.3% of the summer food diet composed mainly of social hymenopteran insects (33.9%) such as wasps, ants and occasionally bumble bees. The remains of insect include the hard chitinous body parts, heads, thorax, legs and wings. No insect eggs were found and only a few cocoons. *Vespula vulgaris* was the most frequently eaten wasp (17.0%). Only one scat sample contained a different wasp species, *Vespula germanica*. Both species build their nests

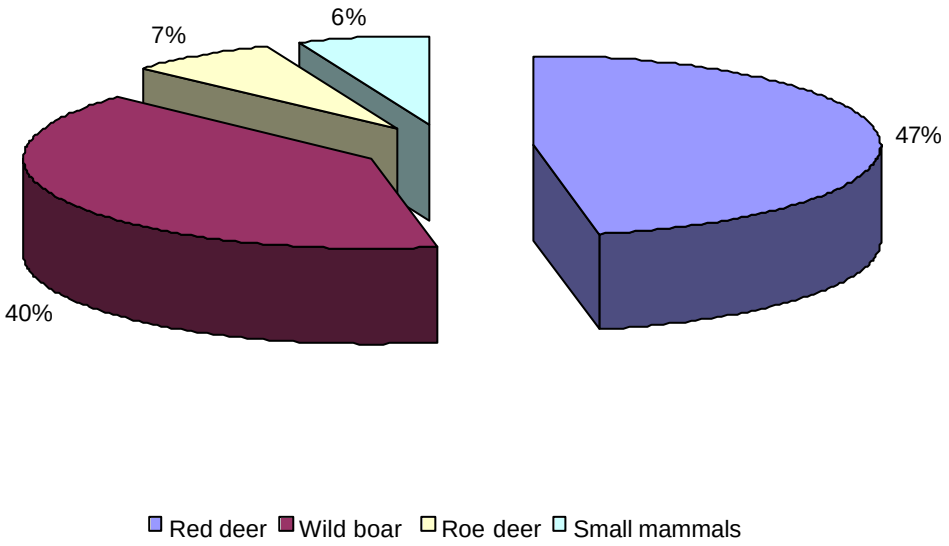
underground or in decaying trunks. Wasps were eaten at night together with their nests. Besides the remains of the nests, a wasp nest parasite beetle *Metoesus paradoxus* was found. Ants of the genus *Formica* represented the second most important animal food component (12.7%). Bears also, and presumably accidentally, consumed some predatory beetles such as carabids.

Mammal remains composed only 3.4% of the bear diet. One sample collected in the woods at 825 m altitude contained wild boar hairs and raspberry seeds. However, it was not possible to ascertain whether the bear killed the wild boar or scavenged the carcass. Small mammals were identified in two scat samples. No chamois remains were found in any of the samples.

Wolf diet

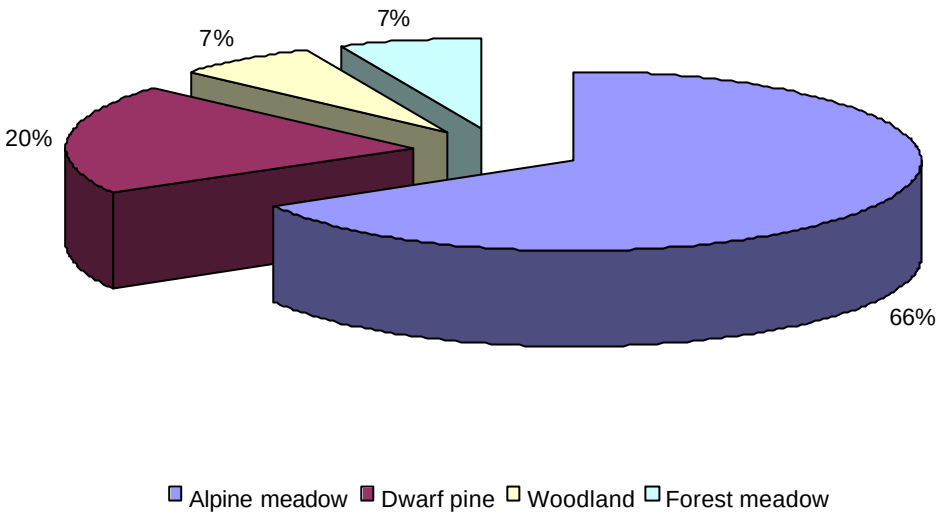
In accordance with other studies from the Carpathians, wolves predominantly preyed upon wild ungulates (FINDO 2002). As Fig. 2.3.2c shows the main prey species was red deer 47% (n=7) followed by wild boar 40% (n=6). The wolves apparently preferred (or were more successful at hunting) young animals less than one year old. The ratio adult/young was 1 : 1.3 in red deer and 1 : 4.9 in wild boar, respectively. Piglets were more exposed to predation than red deer fawns. In spite of the fact that adult boars possess formidable weapons and can pose a real threat to wolves, piglets defended only by their mother are highly vulnerable to predation.

Fig. 2.3.2c. Composition of wolf diet (N = 15).



Of the total number of wolf scats (n=15) collected during the study up to 86% were located in alpine habitat (Fig. 2.3.2d). This finding clearly demonstrates that wolves commonly use alpine, and therefore chamois habitat during the summer time.

Fig. 2.3.2d. Location of wolf scats by habitat types.



The frequency of occurrence of roe deer was 7% and small mammals 6%. Grasses were not included in the target food items. Wolves eat grasses as an anti-flatworm treatment or they regurgitate surplus stomach acids together with the foliage. A small amount of grass was found in 10 scat samples (67%). Only one sample contained more than 70% of grass.

None of the wolf scats collected above the timberline from 1598 to 1975 m contained chamois remains. The scats were situated on hiking trails or places commonly used by people during daytime. Thus wolves use alpine (chamois) habitat for moving only at night. So far there is no evidence of wolves hunting wild animals on alpine meadows. During the study no wolf predation on domestic animals was reported although flocks of sheep continuously grazed the area around the villages of Dolná Lehota, Jasenie and Predajná.

2.3.3. Other observations

Forest dwelling ungulates seem to be in low numbers across the study area. Red deer were observed only three times and roe deer once and there were several signs of wild boar activity. However, red deer pellets were common across the study area mostly on the northern facing slopes and in ravines with good forage sites during the late summer.

Team members encountered bears twice (at Snožka, one bear of unknown sex: 22.08.2004; at Pálenicka, one female with a cub: 10.09.2004). Hikers observed a medium sized bear (28.08.2004, 23:00 h) just a few meters above the base at Krpácovo.

Two team members reported two or three wolves howling for five minutes (03.09.2004, 00:15 h) from the summit of Skalka towards the direction of Pálenicka.

Marmots (always just one individual) were observed ten times and their whistles heard many times. Two different localities with freshly used burrows were found (south of the summit Dumbier and at the head of the Špíglová valley under the summit Durková). In

both areas a network of pathways (grass trampled by marmots) connected the entrance holes.

Often ravens were witnessed scanning the main and side crests or mobbing raptors such as the golden eagle (03.09.2004, side crest near Dereše, 03.09.2004, main ridge near the summit of Skalka) and a peregrine falcon (04.09.2004, summit of Konsko). Normally only one or two birds were flying alongside the main crest, although a big flock numbering up to 50 birds was also seen (04.09.2004, east of the summit of Chopok). Chamois-raven interactions were not recorded.

Within the alpine habitat the following birds of prey were seen: golden eagle, lesser spotted eagle, common buzzard, sparrowhawk, goshawk, kestrel, hobby and peregrine falcon.

In addition to the tracks of large predators and wild ungulates, footprints of foxes, martens and red squirrels were found. 20 bear trees were discovered across the mountain forests, but the locations of these trees are not shown on Fig. 2.3.1c because they all overlapped with bear tracks recorded nearby.

Several times the tracks of domestic dogs were spotted even within the chamois habitat. These dogs belong either to local people or to park visitors. Stray dogs are uncommon within the study area as local foresters cull them quickly. Sheep and goats were grazed only in the foothills of the Nízke Tatry, as grazing of domestic animals is not allowed in alpine habitat (although a herd of cows was observed to be grazing near the main ridge on one occasion). During the study no wolf or bear attacks on livestock were reported.

2.4. Conclusions & Discussion

This report details the first results of the study on chamois and large predators in the Nízke Tatry Mountains conducted by Biosphere Expeditions and the Carpathian Wildlife Society from 15 August to 10 September 2004.

- 57 sightings were used to delineate the shape and size of the chamois range during late summer. The chamois range, excluding the two side ridges of Štiavnica and Ludárova hola (where the study was denied access), extends over an area of 2428 ha and exclusively encompasses alpine habitat above the timberline.

- Based on an accurate tally conducted on 7 September 2004, 50 chamois inhabited the study area. Their sex and age structure was 25 adult females, 14 kids and 11 adult males and yearlings.

- The population density of 2 chamois per 100 hectares is fairly low in comparison with other areas, e.g. in the Alps.

- An account of interrelationships between chamois and large predators has been started using indirect methods such as scat analysis of large predators and comparison of alpine habitat used by chamois and its potential predators: wolf, bear, lynx and golden eagle.

- During the study no direct interactions between chamois and large predators were observed. One event of chamois wariness of a soaring golden eagle was witnessed.

- To assess possible impact of large carnivores on chamois population, 49 bear and 15 wolf scats were analyzed (no lynx faeces were found). In the alpine (chamois) habitat a total of 66% of wolf and 16% of bear scats were collected.

- Bear diet was predominantly composed of wild plants (44.0%), insects (33.9%) and cultivated plants (13.6%). Wasps (17.0%) and ants (12.7%) were the most frequently consumed groups of insect. Only one sample contained wild boar remains. None of the bear faecal samples contained chamois.

- The main prey species of wolf was red deer (47%) followed by wild boar (40%). Roe deer, small mammals and grasses constituted the remainder of the wolf diet. None of the wolf fecal samples contained chamois.

- Individual vigilance level of grazing chamois was used as a measure of protection (anti-predatory) behaviour. Vigilance level was ascertained as the number of alert postures with head up during a 10 minute period. It was found that single males spend more time in protective behaviour than females within their maternal herds. Single males aware of approaching people or adult goats patrolling the herd constantly watched an intruder.

- Predators clearly have non-lethal effects in ecological systems. The results of this study suggest that non-lethal effects of predation on chamois outweigh lethal effects in that they govern chamois habitat utilisation and selection. The physical structure of a habitat (e.g. the presence or absence of cliffs) appears to be a key determinant of risk and, hence, of the use of space by chamois. Predator-induced microhabitat shifts by chamois into safe but less energy-profitable cliffs and the complete avoidance of woodland (a phenomenon unknown in areas free of large carnivores) may limit further expansion and growth of the population.

Conservation issues

Although it is difficult to advance complete conservation strategies based on the first results detailed above, it is possible to outline some conservation issues, which have not been taken into consideration by local decision-makers before.

The conservation status of the species of this study differs between species. The chamois, golden eagle and lynx are fully protected, whereas wolf and bear are hunted throughout the park by and large in accordance with the current hunting and conservation regulations (although some poaching can never be fully excluded). Hunting of forest dwelling ungulates (red deer, roe deer and wild boar), which are important prey species for the large predators, is common, if not rampant, across the park. Over-hunting of those ungulates can lead to a higher risk of chamois predation by wolf and lynx, as those predators are forced to switch away from a dwindling supply of their preferred prey species. However, this hypothesis has not been confirmed by the analysis of the wolf and bear faeces, none of which contained chamois remains. So far no data are available on

lynx diet. Sparse sightings of red deer, however, indicated the low numbers of this species, whilst the numbers of wild boar were unknown.

The conservation efforts to sustain the small isolated chamois population that exists in the Low Tatras must take into consideration the non-lethal effects of predation. The results of this study suggest that these non-lethal effects "trap" chamois within the rugged alpine habitat, thus limiting their range and preventing them from distributing to (and breeding in) other areas. To mitigate the risk of chamois predation, sufficient numbers of forest ungulates should be maintained. Conservationists currently focus only on protecting protected species and hunting of ungulates. Limiting the number of ungulates that are hunted and monitoring the ungulate population appears to be of no interest. However, as suggested, above proper monitoring and control systems of ungulate hunting could be an important factor in preventing predation of an already unstable and critically low chamois population. Changing this focus is probably one of the most important steps forward and it is hoped that the data gathered by this expedition will play their part in doing so.

Special attention should also be paid to the lynx population. As shown by the studies in the Alps and the High Tatra mountains, lynx could pose a real threat to the local chamois population.

To date only harmful effects of human presence within the chamois habitat have been debated. There is no doubt that on-trail and off-trail hiking limits the chamois' use of suitable habitats. The impact of other outdoors sports appears to be of lesser importance. The comparison of habitat use by chamois and predators, however, showed that large carnivores, especially wolves, avoid areas heavily visited by hikers. Moreover it is likely that the small escape distance of chamois from park visitors observed by the expedition, is either anti-predatory behaviour or habituation to human beings or both. These findings indicate that chamois can benefit from human presence under certain circumstances, for example by effectively excluding wolves from areas heavily frequented by humans.

Further research

The first results presented here raise issues that should be resolved by further research. Further studies should be conducted within the whole chamois range including strictly protected areas where access was denied to the expedition in 2004. Denied access was basically a political issue, as Park Authorities were unfamiliar and perhaps uncomfortable with the concept of Biosphere Expeditions. It is hoped that this report will allay those fears, thereby opening the entire site to Biosphere Expeditions. This would allow for more accurate estimation of the total size of the chamois population.

Furthermore and provided enough expedition team members can be recruited, research should also be carried out not only in the summer/autumn, but also the following spring to ascertain chamois survival rates over the winter. In addition, spring snow and mud tracking can yield more accurate results on habitat utilisation by large carnivores. An attempt should be made to estimate spring numbers and distribution of red deer and wild boar.

From a scientific point of view, it was highly valued that the data on chamois and their possible predators were collected simultaneously across the whole study area within a short time span. To collect so much data from the large and rugged study area was only possible through the well-coordinated work of passionate team members, who not only helped in data collection, but also funded the study through their expedition contributions. There is no doubt that a combined team labour and funding approach such as that provided by Biosphere Expeditions is absolutely necessary to study predator and prey relationships in areas and countries where funding and labour for such important conservation projects is virtually absent.

Thank you to all team members and the staff at Biosphere Expeditions who made this study possible.

Slavomir Find'o
January 2005

2.5. References

Allee W. C. 1931: Animal aggregations: a study in general sociology. University of Chicago Press, Chicago, Illinois, USA.

Altendorf K. B., Laundre J. W., Lopez Gonzales C. A. & Brown J. S. 2001: Assessing effects of predation risk on foraging behaviour of mule deer. Journal of Mammalogy 82: 430-439.

Bališ M. & Chudík I. 1976: The role of lynx in mortality of wild ungulates in the Tatry National Park. Zborník prác o Tatranskom Národnom Parku 18: 66-79. [in Slovak]

Baumann P. W. 2004: Die Alpen-Gämse, Ein Leben auf Gratwanderung. Ott Verlag, Thun (Switzerland)

Berger J., Swenson J. E. & Persson I. L. 2001: Recolonising carnivores and native prey: conservation lessons from Pleistocene extinctions. Science 291: 1036-1039.

Blahout M. 1972a: Present status and perspectives of the chamois population in the Tatry National park. Lesnícky casopis 13: 401 – 407. [in Slovak]

Blahout M. 1972b: Human impact on chamois in the Tatry National park. Zborník prác o Tatranskom národnom parku. 19: 127 – 168. [in Slovak]

Blahout M. 1972c: Zur Taxonomie der Population von *Rupicapra rupicapra* (Linne 1758) in der Hohen Tatra. Zoologické listy 21: 115-132. [in German]

Blahout M. 1976: The chamois. Príroda, Bratislava. [in Slovak]

Blahušiak M. 1993: An observation of the golden eagle (*Aquila chrysaetos*) nesting behaviour in the Velká Fatra mountains in 1992. Trichodroma. 6, 49 – 51. [in Slovak]

Blumstein D. T. 2000: Understanding antipredator behaviour for conservation. The Open Country 2: 37-44.

Boving P. S. & Post E. 1997: Vigilance and foraging behaviour of female caribou in relation to predation risk. Rangifer 17: 55-62.

Capitani C., Bertelli I., Varuzza P., Scandura M. and Apollonio M. 2004: A comparative analysis of wolf (*Canis lupus*) diet in three different Italian ecosystems. Mamm. Biol. 69(1): 1-10.

Ciucci P., Boitani L., Pelliccioni E. R., Rocco M. & GUY I. 1996: A comparison of scat-analysis methods to assess the diet of the wolf *Canis lupus*. Wildlife Biology 2 (1): 37-48.

Courchamp F., Clutton-Brock T. & Grenfell B. 1999: Inverse density dependence and the Allee effect. Trends in Ecology and Evolution 14: 405-410.

Dzurdzik, B. 1973: The key for identification of hairs of Polish mammals. Acta Zoologica Cracoviensia 18 (4): 73-92. [in Polish]

Filonov K. P. 1989: Ungulates and large predators in wildlife reserves. Nauka, Moscow. [in Russian]

Findo S. 2002: Feeding ecology of the European Grey Wolf (*Canis lupus*) in the Slovak Carpathians. In: Urban P. edt.: Research and protection of mammals in Slovakia V. 43-57.

Gazzola A. et al 2003: Wolf predation and ungulate mortality in Italian Alps. World Wolf Congress 2003 – Bridging Science and Community (Abstract Proceedings) p. 7.

Childress M. J. & Lung M. A. 2003: Predation risk, gender and the group size effect: does elk vigilance depend upon the behaviour of conspecifics? Animal Behaviour 66: 389-398.

Chovancová, B & Gömory, D. 1999: Influence of natural factors on the population of the Tatra Chamois (*Rupicapra rupicapra tatrica*, Bl. 1971) in the Tatry National Park. Folia venatoria 28 – 29: 85 – 97. [in Slovak]

Chudík I. 1969: The reasons of chamois population decline in the Tatry National Park. Ochrana fauny 3: 75-86. [in Slovak]

Chudík I. 1974: The reasons of mortality and impact of large carnivores (Carnivora) upon wild ungulates in the Tatry National Park. Folia venatoria 4: 83-94. [in Slovak]

Kadlecík, J., Macek, M. & Obuch, J. 1995: Diet and feeding activity pattern of the golden eagle (*Aquila chrisaetos*) in the Velká Fatra mountains. Trichodroma. 8, 48 – 60. [in Slovak]

Kie J. G. 1999: Optimal foraging and risk of predation: effects on behaviour and social structure in ungulates. Journal of Mammalogy 80: 1114-1129.

Lamerenx F., Chadelaud H., Bard B. and Pépin D. 1992: Influence of the proximity of a hiking trail on the behaviour of Isards (*Rupicapra pyrenaica*) in a Pyrenean reserve. In: Ongulés/Ungulates 91. Pages 605 - 608. F. Spitz, G. Janeau, G. Gonzales and S. Aulangier editors: Proceedings of the International Symposium, S.F.E.P.M. – I.R.G.M. Paris – Toulouse, France.

Lima S. L. 1998: Nonlethal effects in the ecology of predator-prey interactions. BioScience 48 (1): 25-34.

Laundre J. W., Hernndez L. & Altendorf K. B. 2001: Wolves, elk, and bison: re-establishing the landscape of fear in Yellowstone National Park, U.S.A. Canadian Journal of Zoology 79: 1401-1409.

Mayer V. 2004: Spatial organisation and numbers of chamois in the central part of the Nízke Tatry. Faculty of Ecology and Environmental Design Banská Štiavnica. Thesis 42 p.

Mooring M. S., Fitzpatric T. A., Nishihira T. T. and Reisig D. D. 2004: Vigilance, predation risk, and the Allee effect in desert bighorn sheep. Journal of Wildlife Management 68(3): 519-532.

Radúch J. 1994: Both are a part of nature. Tatry 2, 14-15.

Radúch J. & Karc P. 1983: Current status and outlook of the chamois population in the Nízke Tatry National Park. Zborník prác o Tatranskom Národnom Parku 24: 61-82. [in Slovak]

Steenbeek R., Piek R. C., Van Buul M. & Van Hoof J. A. R. A. M. 1999: Vigilance in wild Thomas`s langurs (*Presbytis thomasi*): the importance of infanticide risk. Behavioural Ecology and Sociobiology 45: 137-150.

Stephens P. A. & Sutherland W. J. 1999: Consequences of the Allee effect for behaviour, ecology and conservation. Trends in Ecology and Evolution 14: 401-405.

Turner J. C., Douglas Ch. L., Hallum C. R., Krausman P. R. and Ramey R. R. 2004: Determination of critical habitat for the endangered Nelson`s bighorn sheep in southern California. Wildlife Society Bulletin 32 (2): 427-448.

White K. S., Testa J. W. & Berger J. 2001: Behavioural and ecologic effects of differential predation pressure on moose in Alaska. Journal of Mammalogy 82: 422-429.

Wolf J. O. & Van Horn T. 2003: Vigilance and foraging patterns of American elk during the rut in habitats with and without predators. Canadian Journal of Zoology 81: 266-271.

3. Expedition leader's diary: Slovakia 2004

13 August

Though it seems a world away it is only four days since we bid our fond farewells to English newspapers, Big Brother (obviously we delayed our departure to catch the final) and the White Cliffs of Dover, which slipped away into a dreary English 'summer' sky. A further eight hours and five countries later we (and our trusty Land Rover) were in Stuttgart for a evening of much needed sleep before again hitting the road – destination Bratislava.

We arrived without event, save for a few curious faces - having picked up a second Land Rover in Germany, we now made a rather impressive sight as we made our various stops along the way. Two fully kitted up Land Rovers were enough to raise an eyebrow or two – one guy even had his photograph taken with them.

We spent an enjoyable evening wandering around the old town of Bratislava where beautiful 17th Century buildings are now springing to life again amidst the hustle and bustle of Slovakia's crème-de-la-crème and holiday makers from the rest of Europe enjoying dinner or a beer in the many cafes.

The next day, after picking up some last minute supplies, we were on the road again and arrived at base to begin a frenzy of unpacking and sorting. Base is a beautiful lodge in the forest below the ridge, which will be our study site. The unpacking now complete, and enticing trips up to look at the study site (and enjoy the sunshine) we are now ready and raring to go, lacking only one thing – team members. Luckily tomorrow we head to Bratislava to meet them. They will be here on Sunday at which point things will really get under way. Watch this space…

15 - 16 August

Having met the team members (Jane already one set of luggage down thanks to airport inefficiencies) we headed off from Bratislava to once again brave the confused stares of passers-by; our Land Rovers which caused enough excitement alone now packed full of rucksacks and slightly dazed looking team members. We got a good early start out of Bratislava and were safely and uneventfully at base camp in time for a lovely spread prepared by Slavo (our scientist)'s wife. Basking in glorious sunshine and enjoying their lunch - team members were happy in the knowledge that the "holiday" had begun.

So in order to dispel that myth we got straight on with the project with an intensive afternoon of training. After five hours at base camp the new team members' heads span with scientific information, wolf print sizes and shapes, Chamois urination techniques, GPS operation, map reading, distance estimation, taking bearings, using radios, digital cameras, spotting scopes and binoculars. By the end, given any item, they didn't know if they should press a button on it, look down it, use it to find their way, eat it or put it in a scat bag. The last of these confusions being potentially quite worrying we decided enough was enough for the day and it was time to enjoy some Slovak cuisine and sample a local lager or two before bed.

The next day was time to go over all that hard theory in practice so, after an hour or so of going over the data sheets we would be using, we headed out into the forest and onto the hills to start to put into practice all the things the team had learned. We were rewarded with a continuation of the glorious weather the team are becoming accustomed to (I can't help thinking the Slovak weather may have a surprise or two for them to come!). As a whole group we spent a very enjoyable day on the hill, with everyone becoming more comfortable with all the techniques they had been taught, ready to start out on the field work proper in the next few days. The biggest reward aside and ahead of the weather however were our first animal prints, with a number of red deer prints but more excitingly two very well defined bear prints - with a rear paw measurement of 24cm - suggesting a large male. We wondered if that explained what looked like very hurried red deer prints and looked forward to what the days to come would bring.

17 - 18 August

After a final morning of recap with the whole team together it was time to let the fledglings fly the nest for an afternoon in small groups to begin the science work proper. Three groups walked different trails, Katie showing a particular talent for bear scat collection though Lotte being the first to pick up an entire specimen! By the end of the afternoon the team had its first haul of seven bear scats - a pretty impressive start. On the return to the meeting point we were informed by radio that one of the teams would be a bit late back to the meeting point, but as the rest of us settled into relaxing, enjoying the sunshine and waiting for them I received a text message saying "had to double back to collect radio - will be there as soon as we can". Hardly an auspicious start and money began to fly as people placed bets as to who the most likely radio-leaving miscreant would be. Despite us trying the radio every few minutes (and doubtless scaring a number of passers by as they heard the now

famous 'talking long grass of the Tatras') it was a good hour later that our questions were answered and a rather sheepish Alex confessed all. No harm done though and with the beginnings of a good tan to show for our extra long wait we headed down the hill with our bear scat haul.

The next day saw further adventures, this time navigationally motivated, as we all struggled to get to grips with the finer points of Slovakian map making and path marking. They have a very clearly thought out set of paths with large coloured lines marking the main trails - matched by coloured marks on trees. This you would think would make our lives easier, but not so when we are not always following the main tourist trails and even when we are, the lines on the map obscure all useful navigational features - and the marks on the trees are often themselves obscured by overgrown foliage. Anyway excuses aside we all covered a good amount of ground (even if some of it more than once!) and saw a good collection of prints and signs including wolf and bear prints (one really good set), a few trees and a telegraph pole damaged by bears and we returned with the obligatory brown envelopes of scat. Tomorrow it's up onto the ridges for some dawn and dusk observations.

19 - 21 August

Two packed days with mammoth walks for many of the team. We headed up on to the main ridge of the study area with the primary objective the observation of chamois activity at dawn and dusk. The team took different routes up to the ridge, checking for animal sign as they went up some pretty steep and exhausting terrain. The team were spilt between two alpine-style mountain huts where they met before heading out again in the late afternoon for some dusk observation positions. This meant more walking again as the teams split up all along the main ridge. It was a beautiful time to be in the mountains and a nice feeling to be heading out as most of the tourists were leaving the hills for the night. The serene dusky light which fell over the mountains was worth the walking alone, but on the science side also proved very fruitful. A number of groups of chamois were sighted across the length of the main ridge including one newborn and a number of yearlings. After two to three hours in their positions, the teams headed back to their respective huts to grab some food and then a few hours sleep before it was time to get up again for dawn observation. Even that sleep was interrupted by snoring in one hut and some sort of party in the other - we would get our own back when getting up at 3.50 in the morning to head out (though I hear the other team left at a very civilized 5.45!). Again long walks to reach observation positions were rewarded. Though on the East the mist meant that not a lot was seen, the team with me in the West were luckier with the cloud and were able to see a number of chamois groups; one of which we were able to observe for over an hour. We also found fresh wolf scat, which had not been on the path the night before. The team headed off exhausted but happy - everyone saw chamois and it feels like we've made some real progress. Back at base camp everyone was zombified and after a meal and a quick trip to the local bar to experience some local beer and traditional music ('experience' being the right word), everyone crashed out early. Today we are enjoying a day off to rest up and catch up all important washing and tidying! Everyone is recharging batteries and looking forward to next week.

22 August

Back to work today but the predicted poor weather has arrived with rain most of the day and strong winds. We therefore concentrated on the forest section of the study area and split into pairs to walk a variety of forest tracks to check for predator sign. Everyone had enjoyable walks but we saw limited sign - although between the whole group we had a collection of prints, scat and bear marked trees. But who needs sign when you can see the real thing - which is exactly what Alex and Bjorn managed today. When walking up one such forest track and joking about seeing a bear they noticed a rustling in the bushes and looked down to see what looked like a log begin to move before looking up at them - it was unclear who was more surprised, but Alex resorted to the training from the first days, made himself big, raised his arms and shouted "I'm bigger than you". The somewhat confused bear took this advice at face value and fled into the bushes. "Anyone who can hear me - this is Alex", crackled the radio, "we've just seen a bear, not 20 metres away from us. I'm not joking".

It's brilliant that two of the team have been so lucky and everyone was green with envy but when one of the other pairs found clear bear prints of a paw measuring over 25cm (a big male), we decided maybe we'd seen the right bear today.

Tomorrow we head back up onto the main ridge in the hope of catching a good window in the weather for some chamois observation - fingers crossed.

23 - 26 August

The team split into two again to stay at two different mountain huts along the main ridge. One team with Slavo drove round to the north side to use the cable car up whilst the other others bounced their way up in the Land Rover with me. Both teams were in position by mid afternoon. The team with me enjoyed a few hours walk in different directions along the ridge and again found some sign of predators and had a very enjoyable evening walk before settling down to cook ourselves some much needed pasta to fuel up ready for the morning. However, the other team had considerably more luck in observing a number of chamois including one group of twelve individuals, which were observed over a period of time.

The next morning my team were up and away by 04.00 setting out into what looked promising conditions. As the light slowly started to come, so did the cloud, rolling in and slumping down onto the ridge, reducing visibility at times to 50 metres. We did manage one chamois sighting nonetheless and people pushed on in difficult conditions to walk along the main ridge and down various side ridges back to base camp. On the top of Skalka, Katie, Alex and I actually managed to get up above the cloud and had spectacular views above the cloud and out to the High Tatras mountains in the distance - it even made the 4 o'clock start worthwhile. On the other end of the ridge, the team had similar conditions but Kirk and Bjorn managed a good sighting and even got a spot of sunbathing in, as their northerly side ridge seemed to benefit from a micro climate all of its own.

The next day we were back in the forest zones again where the maze of forestry roads and walking trails made navigation pretty tricky - we had a full day 'exploring them'! Lotte and Jane in particular explored a very large area and we had an entertaining late afternoon trying to find each other before heading home just in time for dinner.

This morning we have been for our last walks, checking the tracks near base camp for predator sign. Now we are tidying and organising base camp, ready for our departure tomorrow back to Bratislava. The two weeks seem to have flown by and we have packed loads in. I feel it's been a very successful and enjoyable slot - I'll be sorry to see this team go. but look forward to two more action packed weeks to come.

29 - 30 August

The second slot is now in full swing. Having dropped the first team in Bratislava, I had a lazy day around town before meeting the next team - some of them in the evening for a pre-expedition feast in the city centre - and the whole team bright and early Sunday morning. They were piled unceremoniously into the Land Rover and Slavo's car and whisked back to base camp where the bombardment of information began. Safety procedures and an outline of the science work, as well as an overview of the expedition equipment were all crammed into the first day. The next morning we began with compasses, GPS, map reading as well as some more practical scientific information about how to fill in data sheets and collect samples.

Of course none of this could really begin to sink in until we got out in the field, so in the afternoon we headed out into the forest to put all the hard learnt theory into practice. The team were rewarded with their first bear scats and a collection of red deer tracks and scats. The training is progressing well, tomorrow the team will get a few hours alone in pairs to try out their new-found skills - then the science begins for real.

31 August - 1 September (white rabbits, white rabbits)

The team's first day proper in the field was celebrated with some pretty grotty weather with rain all morning, heavy at times. Therefore we spent just a few hours out in the field - first together as a whole group for a final recap of techniques and then off in smaller groups. In spite of the inclement weather, a number of samples were collected but all the groups were back at base camp by mid afternoon. Undeterred the team moved on to animal study of a different kind - balloon animals to be precise - the explanation being that it was Claire's 18th birthday. I still feel that the enormous bear scat she got to pick up in the morning was celebration enough - after all how many people can say they picked up a bear poo on their 18th. However, the team felt further celebration was in order and there was cake and balloon chamois, wolves and bears to study. The highlight was undoubtedly Petra's determined effort of a three balloon challenge - three balloons, one inside the other. When she was eventually successful Alex was left only with a disbelieving face and, shaking his head, he went off to consider the marvels of the universe and reassess his overall understanding of it. After dinner and yet another birthday dessert we all headed to the bar to toast Claire's health and, for reasons I can't remember - to discuss Morris dancing at great length. The following day saw the return of better weather and thus to normal scientific collection. Large areas of the south side of the main ridge were surveyed picking off a number of the last remaining side ridges. As well as good scat collections, the wet weather improved tracking possibilities and wolf, bear and possibly lynx prints were all recorded. There were also a couple of pine martin sightings. All goes well and, if the weather holds, the main ridge and chamois observation may beckon tomorrow.

2 - 4 September

The forecast promised fine weather for the next few days, so we decided on a three day stint up on the main ridge to concentrate on chamois observation. Four of the team travelled round to the north side of the ridge and used the cable car access to reach the hut at Chopok whilst the rest came with me in the Land Rover up to the hut on the western end of the ridge. Both teams reached their bases by midday and headed out for afternoon walks or observations. On the west side no chamois were seen, but a number of predator signs were recorded again suggesting that this section of the ridge is used regularly by wolves. On the east edge a number of chamois sightings were made and observations recorded - late afternoon and evening seems to be proving very successful especially on the east end where, as the tourists begin to disappear into the huts or head home, the chamois move up onto the main ridge. They are again observed early in the mornings before heading down into the cliffs on the north side.

The team with me in the west, encouraged by the predator sign, decided to try a night observation and so, fortified by much needed lentil soup at the hut, we spent about three hours heading up, watching the ridge and heading back down to bed. No animals were seen, but everyone enjoyed the opportunity to have a go with the night sight equipment as well as it being a beautiful moonlit night and a great time to be out in the mountains. Anyway I think we got as much sleep as the team in the other hut who had horror stories of late night guitar action in their hut!

The next day was to be our main observation day and so, split into pairs, we spread out across the entire ridge. Most of my team decided to cross the ridge and spend the night at the Chopok hut which gave me the chance to see the eastern end of the ridge for the first time. The ridge towards the main peaks of Chopok and Dumbier in the east becomes rockier and more mountainous and dramatic, which made the crossing of the ridge a very enjoyable walk. Along the way we took up various observation posts and scanned the cliffs for chamois activity. A number of groups were observed as well as one team hearing wolf howls down in the valley, and all the teams seeing a huge golden eagle flying along the ridge. This was a personal highlight for me; read as you might of the size of golden eagles it doesn't prepare you for the thing flying just 20m over your head - these are colossal birds! It was especially interesting as Anya and I were able to observe a chamois seeing the eagle and nervously and hurriedly crossing the slope beneath it to take shelter in the cliffs. This was our first chance to see interaction between chamois and other animals and was of great interest to Slavo, as one of the foci of his science work.

All the teams were at Chopok after a full eight or nine hours on the mountainside for a much needed meal. We just about mustered the energy for the ten minute climb up to the summit of Chopok to watch the sun setting before forcing ourselves across the 9 o'clock boundary of respectability before tumbling gratefully into bed. The following day we split again and took various routes back across the ridge, or down various side ridges to the north and south back to base. Another long day for most people with some more successful chamois observation - Slavo actually saying it was his best day yet, observing a number of chamois at close quarters. Back now to civilisation, showers and a day off to hopefully enjoy the continued sunshine and do some much needed laundry.

5 - 9 September

The day off raced by as days off always do, but people were refreshed, clean and ready to go again the next day - which was just as well because the fine weather continued to hold and so we headed again back up to the main ridge. This time the whole team concentrated on the western end of the ridge where previously we had seen very few chamois. Our theory was that this end of the ridge had only been observed so far by teams who were on their way to other areas - so the whole team headed up to the western hut for some extended observation sessions. Sure enough (though a number of teams spent three to four hours watching very empty valleys) we were rewarded by sighting a group of thirteen, which were observed throughout the afternoon as well as a lone male. Even the groups who had seen nothing were at least able to enjoy a spectacular sunset before heading back for the now legendary hut bean soup.

The next day four of the team made the crossing to Chopok for observations there whilst the remainder of the team again concentrated on extended observation of the western area. Again good chamois observations were recorded and we began to build up a good picture of the main groups along the whole length of the ridge. We also saw golden eagles again and a number of other raptors.

The sun rose the next day to, well barely any effect actually, as the ridge had misted in heavily overnight. About half of the team decided to brave the conditions and walk down anyway whilst the others opted for the Land Rover or chair lift. Walking, however, turned out to be a good gamble as only a few hundred metres of descent and the seemingly impenetrable mist gave way to sunshine and very pleasant walking conditions. Though only

covering the tops of the ridge, the fog seems to have heralded a change in the weather. Today, our last day of the expedition seems almost autumnal with a strong and bitterly cold wind chilling everyone despite bright skies and sunshine. We've had a final day of collecting scats and prints in the forest zone before getting wholeheartedly stuck into packing base camp neatly into the back of the Land Rover. For the team I know the two weeks have raced by and for me I can barely believe I left England over five weeks ago. It has been an excellent expedition with some very good results – thank you to everyone who made it happen. Too many to mention, but you know who you are. We look forward to future years working with Slavo out in Slovakia, to more chamois observation and most importantly to more little brown envelopes of scat...

STOP PRESS - OK I have been caught out - I was back before two of the other teams. The last teams have just come into the room where I had proudly put the finishing touches to the diary, assuming that nothing else diary-worthy would happen - how wrong could I be - some huge bear prints - 30 cm long would have been almost worth the stop press in their own right but it barely justifies mention when John reported seeing not one, but TWO bears - a mother and baby rustling off into the bushes. It is hardly worth saying that everyone was incredibly jealous - but no one so much so as Nadine - his partner on today's walk who at the key moment of the bear sighting was further back down the trail answering the call of nature - never before has a call of nature so interfered with a sighting of nature - the irony was not lost on her.