INFLUENCE OF SOME CLIMATIC FACTORS AND PREDATORS ON THE POPULATION SIZE OF TATRA CHAMOIS IN THE TATRA NATIONAL PARK

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Abstract - Effect of weather conditions during the birth season and predators on the population of Tatra chamois (*Rupicapra rupicapra tatrica*) was investigated using a series of population counts from 1950 until 1996. Weather conditions were characterized by 16 variables derived from the daily temperature, precipitation and wind records of the Slovak Hydrometeorological Institute. Among climatic factors, snow conditions proved to affect the population size. No effect of average or extreme temperatures was identified. Stepwise multiple linear regression was used to identify the effects of population density and predators on the abundance of chamois. Both the actual population density and population growth of chamois proved to be affected by the population density in the preceding year, abundance of wolf and wild boar. No effect of the abundance of lynx as a second major predator of chamois was found.

Résumé - **Influence de facteurs naturels sur la population de chamois Tatra (*Rupicapra rupicapra tatrica*) dans le Parc National du Tatra.** Les influences des conditions climatiques pendant la saison de naissance et celles des prédateurs sur les populations de chamois (*Rupicapra rupicapra tatrica*) ont été étudiées à partir de comptages effectués de 1950 jusqu'en 1996. Les conditions climatiques ont été caractérisées par 16 variables, qui sont dérivées des valeurs de températures journalières, de précipitations et de vents enregistrées par l'institut de météorologie slovaque. Parmi les facteurs climatiques, la hauteur et la durée d'enneigement influencent la taille de la population de chamois. Aucun effet des températures moyennes ou extrêmes n'a été enregistré. Une régression linéaire multiple a été utilisée pour isoler les effets de la densité de population et des prédateurs sur l'abondance de chamois. La densité actuelle et la croissance des populations de chamois sont directement dépendante de la densité de la population de l'année précédente, et aussi de l'abondance des loups et des sangliers. Par contre, aucun effet du lynx, autre prédateur important du chamois, n'a été était observé.

Key-words: *Rupicapra rupicapra tatrica*, Birth season, Climate, Predators
Mots clés: *Rupicapra rupicapra tatrica*, Saison de naissance, Climat, Prédateur

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1. Introduction

Chamois is a glacial relict which is indigenous to the Tatra National Park (TANAP), *i.e.* in the Belian, East and West Tatra Mountains. The population in the Tatra Mountains is considered to form an endemic subspecies *Rupicapra rupicapra tatrica* Blahout (1971), which differs from the Alpine chamois by morphological features (Blahout, 1972), as well as by typical habitats: Tatra chamois do not occupy the forest zone, the occurrence is almost exclusively limited to subalpine dwarf-pine stands and alpine meadows, sometimes they even mount to the subnival zone.

During the World War II, the population of chamois was strongly reduced by hunting and poaching. In 1950, only 235 individuals were counted in the Czechoslovak part of the Tatra Mountains. The population recovered quickly from war events and in 1963, the census of chamois reached 944. However, since 1964, the chamois population has been declining (Fig.1). The first rapid decrease occurred within the period from 1964 to 1967, when it dropped to 596 individuals,

i.e. to 63% of the original population (Blahout, 1977). At present, the population is estimated to only 200 chamois, which is less than one quarter of the maximum population size. A similar decrease of population was observed in the Polish part of the National Park (Tatrzanski Park Narodowy, TPN), where only approximately 80 individuals survive today, *i.e.* 31 % of over 260 chamois which used to live there in 1981 (Gasienica-Byrcyn, 1987).

Since 1970, the Research Center of the TANAP has been carrying out studies focussing on potential causes of the decline of the Tatran population of chamois and proposing measures for its conservation. The first studies dealt with anthropic influences, especially disturbing the herds by tourists, high-altitude turism, alpinism, paragliding, glider and helicopter influences (Blahout, 1969, 1977; Chovancová, 1985, 1990). Since 1980s, the aspects of pollution and deterioration of environment due to human economic activities were investigated, with emphasis on the effects heavy metal pollution (Chovancová *et al.,* 1996; Janiga & Chovancová, 1997).

Among the factors causing mortality of chamois, viral, bacterial, and actinomycetal diseases (*e.g.*, Gourreau *et al.,* 1993, Gauthier, 1992) as well as parasites (*e.g.*, Nocture *et al.,* 1998) have frequently been studied. In Slovakia, most attention has been paid to nematodes (Mituch, 1988; Chovancová, 1990; Stefancícová *et al.,* 1999) and human-transmitted bacterial diseases (Speníc *et al.,* 1975). However, importance of pulmonary and gastrointestinal nematodes for the population decline decreased in the last 20 years, probably in association with a lower population density (Chovancová *et al.,* 1997).

Since 1993, field research has been extended by telemetric methods in the investigation of chamois. Wolf as a chamois predator has been studied employing telemetry since 1994. Another important predator proved to be lynx, whereas the predation by eagle and fox proved to be less important (Blahout, 1972; Chudík, 1969; Chovancová, 1990 & 1995). In Tatra Mountains, chamois

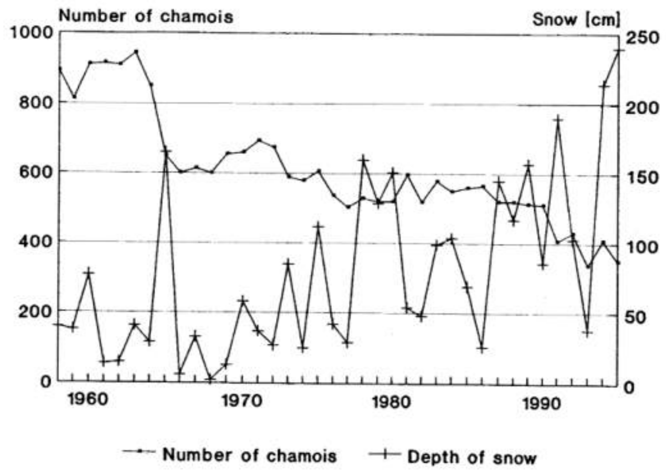

Fig. 1 - Development of the chamois population size and snow conditions over the period 1950 to 1995

does not represent the main food source neither for wolf nor for lynx. Their diet is mainly constituted of red deer, roe deer and wild boar. However, if the population size of main prey is limited due to an intensive hunting, epizooties or other factors, the predation pressure on chamois, as a substitute prey, can increase (Fig. 2).
In the spring 1991, a mass die off newborns occurred due to unfavourable climatic conditions. This event turned our attention to the problem of climatic influences. The Tatra population of chamois lives on the limit of the distribution range of the species, under extreme climatic conditions. Therefore, we adopted a working hypothesis that weather is one of the factors that heavily affect the population dynamics of chamois, especially during the birth season. During the field observations, we documented not only mortality of young individuals or females, but also the fact that the young that survived were mainly female (Chovancová, 1985, 1990). Preliminary analyses have shown that the course of temperatures and the height of snow during the birth season considerably changed within the period of observations. Mainly the height of snow cover in May increased, sometimes reaching a two-meter height in recent years (*see* Fig. 1). The wind and temperature conditions changed as well. Therefore, this study aims at the evaluation of the influences of climate and predators on the chamois population in the Tatra National Park based on available data.

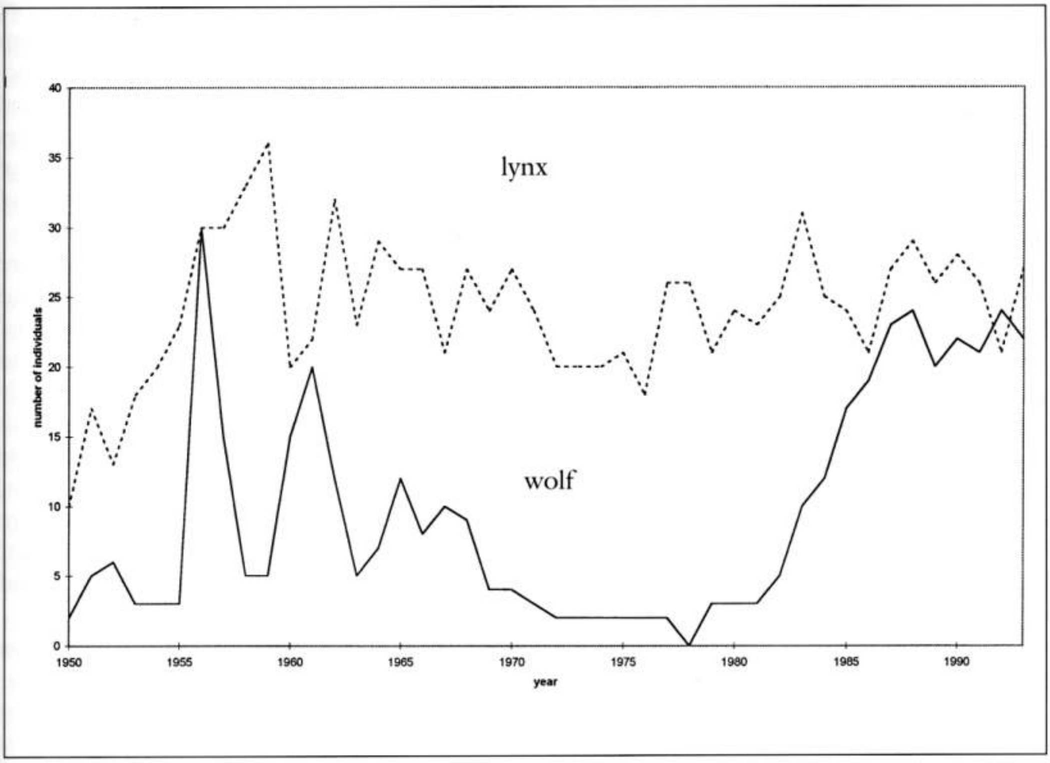

Fig. 2 - Development of the population sizes of main predators of chamois over the period 1950 to 1993

2. Methods

Chamois in the TANAP have been regularly counted every year since 1936. Counting is performed in within two days in October, i.e. during the breeding period, when the animals are gathered together, and a control counting is performed in June. The whole territory of the National Park is divided into counting districts. In each district, a pair of National Park employees records the number of individuals observed, and, when possible, their age, sex, activity, and direction of motion) (Chudíc, 1968). The data from this counting are then compared with the information gathered by National Park staff in the field, given in form of regular mensual reports. Wolf and lynx are counted in the winter on the basis of snow traces (Kovác, 1994).

The chamois population is isolated and confined to alpine environment. Its dynamics depends therefore only on birth rates and death rates, no migration is possible. The range of the population over the past 50 years is more or less constant, so that the population density in each year is directly proportionate to the number of chamois counted (*Nt*) To assess the population dynamics of chamois, depending from chamois population density as well as complex relationships between predators, deer and wild boar as primary prey, and chamois as occassional prey, we used a modified autoregressive model following Forchhammer *et al.* (1998):

$$X_t=\beta_0+(1+\beta_1)X_{t-1}+\Sigma_d\gamma_{t-d}P_{t-d}+\Sigma_d\omega_{t-d}D_{t-d}+\varepsilon_t$$

where X_t is a natural logarithm of chamois abundance in year *t,* X_{t-1} is a *log(e)* abundance of chamois in the previous year, P_{t-d} and D_{t-d} are abundances of predators and their main prey, prespectively, *d* years before the current year *(d 0+0,3)*. Since there were quite many variables, partly collinear, we used a stepwise selection of independent variables to select the significant ones.

In addition, a multiple linear regression model using logged population growth $R_t= ln(N_t/N_{t-1})$ (Post & Stenseth, 1998) as dependent variable was used.

The whole time series starting from 1950 were analyzed using the procedure REG of the statistical package SAS (SAS Institute, 1988).

With respect to the fact that kids are the most sensitive to climatic influences, we evaluated the weather conditions in the birth season (May). We disposed by detailed meteorological data from the archives of the Hydrometeorological Institute, Observation Center Lomnickystít (2,193 m a.s.l.). Considering the fact that the main zone of occurrence of chamois is located around 1,900 m a.s.l., 5.5°C was subtracted from temperature data, and 60 cm from the height of the snow cover. According to meteorologists, these reductions correspond to the difference in altitude between the Observation Center and the zone inhabited by chamois.

From the original meteorological data, we selected or derived data which, to our opinion, could constitute a life hazard for the newborn chamois. We sought to select variables characterizing the precipitation (especially snow) and temperature regimes. In general, the variables are associated either with the duration of adverse conditions, or with the frequency of occurrence of weather extremes.

Among the causes of mortality, which are related to the weather conditions, we selected following ones: undercooling, restricted availability of food due to snow cover, and problems with locomotion. This list is surely not complete, but variables associated with only these factors could be derived from the available meteorological data. For each factor, we selected several variables, which are mutually correlated but describe different aspects of hazard (acronyms of variables used throughout the text are in parentheses).

Probability of undercooling depends on general temperature regime, which was characterized by average minimum night (TMIN) and maximum day temperatures (TMAX), and average daily temperatures (TAVG) in May. However, this risk is also associated with temperature extremes, which

were characterized by absolute temperature minimum (ABSMIN), number of days with an all-day frost (FROST) and number of days with extreme frosts (maximum day temperature below −5°C: EXTRF).
The effect of frost can be enhanced by wind, therefore we calculated the wind chill factor as a minimum product of wind speed and minimum daily temperature (WXT).
Another risk is rain followed by night frost: occurrences of this event in May (RAINF) were also counted.
Availability of food is generally associated with snow cover. This was characterized by the average snow depth (AVSNOW), number of days with fresh snow accumulation over 10 cm (FRESH10), number of days with snow cover over 5 cm (SNOW5) (the sole presence of snow may decrease the availability of food), snow cover over 35 cm (SNOW 35) (this corresponds to the limb length of a chamois young, so that such snow depth can substantially hinder the locomotion), and snow cover over 100 cm (SNOW100) (extremely deep snow, making food practically unavailable). In addition, the maximum length of the period when the ground was continuously covered by fresh or old snow (COSNOW) was assessed.
Occurrence of problems with locomotion was assessed by the number of days with melting snow (MELTS), as well as frozen snow which blocks passage to food and increases the risk of fall (FROZS).
For the analysis of interaction with weather characteristics, we used data starting from 1958, when the chamois population decreased for the first time. The low population number in 1950 was caused by war. Using the data from the entire time series would therefore distort the causal relationships.
With respect to a high number of mutually correlated meteorological characteristics, we tried to identify synthetic meteorological factors that would globally characterize the weather conditions in May. For their identification, we used factor analysis. Principal component analysis was used to extract the factors, whereas the squared multiple correlation coefficients for individual variables were used as prior communality estimates. An orthogonal rotation using the varimax rotation criterion was used for the identification of factors. Factor analysis was performed using the FACTOR procedure.
Because we had no preliminary information on the character of the relationships between the meteorological variables and the numbers of chamois, we used the non-parametric Spearman's rank correlation coefficients, quantifying the closeness of a monotonous (but not necessarily linear) relationship. Pearson's product-moment correlations were calculated as well using the CORR procedure.

3. Results

3.1. Influence of predation and population density on chamois numbers.

As already mentioned above, the numbers of red and roe deer as well as wild boar were included in the evaluation of the relationships between the numbers of chamois and their potential predators, *i.e.* wolf and lynx. We supposed that the increase in the number of predators would affect the chamois population especially if it is preceded by stagnating or decreasing numbers of other animals representing food source for predators.
The population dynamics models are presented in Tab. 1. As expected, abundance of chamois were significantly affected by the population density in the preceding year. The time series of chamois abundance, as well as abundances predators and ungulates except roe deer (Tab. 2) are positively autocorrelated, so that such a result could be expected.
For population growth, the effect of population density is negative, but the regression coefficients are fairly low in their absolute value (even if significantly differing from zero). No delayed density dependence was identified.
Among the predators and their main prey, the same factors proved to be significant in all models: wolf density and wild boar density in the preceding year. Red deer density exhibited

Tab. 1 - Estimated partial correlation coefficients and regression models for the population dynamics models used

Dependent variable	Lag (years)	Model (1)		(2)		(3)	
		r	β	r	β	r	β
Intercept			210.579***		1.5958***		0.42091***
Chamois density	1	0.928	0.817***	0.920	0.7815***	0.367	-0.00035**
Wolf density	1	0.077	2.950*	0.219	0.0040[a]	0.207	0.00433[a]
Boar density	1	0.635	-1.475***	0.684	-0.0028***	0.690	-0.00286***
R2		0.8733			0.8653		0.5263

r = partial correlation coefficient, β = regression coefficient (tested H_0: β = 0)

Models:

(1) $N_t = f(N_{t-1}, \Sigma_d P_{t-d}, \Sigma_d D_{t-d})$

(2) $\ln N_t = f(\ln N_{t-1}, \Sigma_d P_{t-d}, \Sigma_d D_{t-d})$

(3) $\ln(N_t/N_{t-1}) = f(N_{t-1}, \Sigma_d P_{t-d}, \Sigma_d D_{t-d})$

N = chamois density, P = predator density, D = deer (main prey) density, t = year, d = lag

Significance levels: a = P > 0.90, * = P > 0.95, ** = P > 0.99, *** = P > 0.999

Tab. 2- First-order autocorrelations of ungulate and predator time series

Variable	AFC
Chamois	0.77490***
Wolf	0.86177***
Lynx	0.16342ns
Roe deer	0.69457***
Red deer	0.86729***
Wild boar	0.69455***

Tab. 3 - Factor structure derived from factor analysis with varimax rotation

Variable	Factor FAC 1	FAC 2	FAC 3	FAC 4
COSNOW	0.96159	0.14291	-0.12994	-0.03783
SNOW5	0.94978	0.16094	-0.11621	-0.09478
SNOW35	0.93917	0.16538	-0.12608	0.15516
AVSNOW	0.91576	-0.01140	-0.16852	-0.21105
MELTSN	0.90327	-0.03783	-0.04357	-0.21338
SNOW100	-0.84132	-0.01846	-0.19881	-0.28889
WXT	-0.53368	-0.30385	-0.05158	-0.17039
EXTRF	-0.00960	0.82808	-0.27028	0.15706
FROST	-0.00581	0.76274	-0.40278	0.16836
FROZSN	-0.36726	-0.76034	-0.12668	-0.19152
ABSMIN	-0.12202	-0.75799	0.35152	-0.20092
TAVG	-0.19252	-0.34614	0.88764	-0.22023
TMAX	-0.20325	-0.32752	0.88245	-0.20585
TMIN	-0.14615	-0.36820	0.85347	-0.29990
RAINF	0.04037	0.26279	-0.28903	0.70336
FRESH10	0.09238	0.26878	-0.26511	0.59280

significant effects as well, but it proved to be collinear with the delayed chamois abundance, so it had to be excluded from the model. The effect of wolf as a predator is at the limit of significance. Like with chamois number, no effects of predator or ungulate numbers in years earlier than *t-1* were found.

No influence of lynx abundance could be detected. Since it was documented that lynx occassionally kills chamois, we tried to turn the model and investiagte the effects of prey ungulates including chamois on the population dynamics of lynx using the same model as for chamois (multiple linear regression with the logged population growth of lynx as dependent variable and abundances of prey ungulates and lynx in the current year and two previous years as independent variables). Stepwise selection yielded the following model:

R_t (lynx)= 0.433108 - 0.030086 $lynx_{t-1}$+ 0.000764 roe-$deer_{t-2}$

R^2=0.4013, Durbin-Watson D=2.055ns

Chamois population size did not exhibit any significant effect on lynx.

3.2. Effects of weather conditions on chamois population

Factor analysis revealed 4 background factors. The factor structure (correlations of the original variables with the identified factors) is given in Tab. 3.

The highest loadings on factor 1 exhibit the variables, characterizing snow (partially wind) conditions: numbers of days with various snow heights, with continuous snow cover, average snow height, and wind chill factor. Factor 2 is mainly correlated with variables describing frost conditions (numbers of days with an all-day and extreme frosts, absolute temperature minimums, frost with snow cover). Factor 3 is most correlated with variables which characterize the course of average monthly minimum, daily and maximum temperatures. Factor 4 is most correlated with variables which describe fresh precipitation (new snow and rain). The identified factors represent the optimum way to characterize the relationships between the investigated variables and present their synthetic expression.

Correlations between the abundance of chamois and the meteorological characteristics are given in Tab. 4. The groups of variables, which are significantly correlated with the indices of chamois number are identical for both Pearson's and Spearman's correlations. In some cases, rank correlations are higher, what indicates that not all relationships must necessarily be linear. The number of chamois is most closely correlated with the characteristics of snow and/or wind conditions in May (SNOW5, SNOW35, SNOW100, MELTSN, AVSNOW,COSNOW, WXT). In all cases the correlations are negative, i.e. the number of chamois decreases along with the deterioration of weather conditions (increasing height or duration of snow cover in May). There is also a significant correlation with the synthetic expression of snow conditions – factor 1 from the factor analysis. Abnormal snow conditions probably account for the most significant decrease in the chamois population during the whole observation period, which occurred in 1965, when the number of individuals fell from 850 to 650 (*i.e.* by 24%) in a single year. In this year, there was a permanent snow layer in the chamois area throughout the whole month of May. In this month, for 19 days, the snow cover was over 1 m, while the monthly average snow cover was 105.5 cm. Similar factors could explain the reduction of population in 1991 (a 20% drop – extreme wind conditions, snow layer more than 1 m thick all month) and in 1995 (a drop by 15 %; the average snow height was 180.2 cm!). Since 1978, strong winds in May keep recurring, multiplying the effect of low temperatures (wind chill factor). Otherwise, frosts (TMIN, FROST, EXTRF, FROZS) do not exhibit any association with the number of chamois. Frost conditions did not essentially changed during the period 1959 to 1996,

extremely low temperatures occurred even during the chamois population climax.
That is why factor 2 does neither show any correlation with the number of chamois. Average temperatures (TMIN, TAVG, TMAX) or fresh precipitation (FRESH10, RAINF) do not seem to affect the number of chamois as well.
Snow condition in May is obviously not the only factor that caused the decrease of the chamois population. A considerable decrease occurred even in years with relatively favourable May weather conditions (1964, 1972, 1976, 1982). However, we cannot exclude that weather participated in the decrease of the chamois population also in these years, since the winter or June data have not been evaluated.

Tab. 4 - Pearson's (r) and Spearman's (r_S) correlation coefficients between the chamois population size and the observed characteristics of weather conditions in May and/or with the synthetic factors, and first-order autocorrelations

Variable	r	r_S	AFC
ABSMIN	0.03341ns	- 0.12386ns ***	-0.02249ns
TMIN	-0.03341ns	0.02875ns	-0.07392ns
TAVG	-0.03075ns	-0.01846ns	-0.07394ns
TMAX	-0.06093ns	-0.03922ns	-0.09117ns
W_T	0.46581**	0.62138***	0.23294ns
FROST	0.13305ns	0.02343ns	0.01584ns
EXTRF	0.00789ns	-0.12579ns	-0.12231ns
RAINF	0.13610ns	0.12937ns	0.12937ns
FRESH10	-0.26404ns	-0.15006ns	-0.17039ns
SNOW5	-0.52187***	-0.55196***	0.25196ns
SNOW35	-0.45519**	-0.58607***	0.17158ns
SNOW100	-0.46331**	-0.46836**	0.13765ns
FROZSN	-0.18544ns	-0.21681ns	-0.19677ns
MELTSN	-0.47611**	-0.53870***	0.26027ns
AVSNOW	-0.50719**	-0.53708***	0.24707ns
COSNOW	-0.48610**	-0.53358***	0.21797ns
FAC1	-0.59820***	-0.59628***	0.32571ns
FAC2	0.02391ns	0.01963ns	-0.05196ns
FAC3	-0.17205ns	-0.12861ns	0.29489ns
FAC4	-0.01339ns	-0.01504ns	-0.21372ns

4. Discussion

Our results indicate that there is an effect of weather on chamois population, in the birth season, and that chamois population dynamics is affected by population density as well as relationships in a complex system predator-prey. The time series of chamois abundance exhibit obviously some degree of inertia. However, population growth (negative in most years) is only slightly influenced by population density. Apparently the chamois population size is far below the carrying capacity of the environment (since the beginning of 1980s, the population number ranges below 50% of the maximum census), so that the competitive interactions between individuals or spread of diseases and parasites may play a role only on a local scale. Our results are in contrast with the findings of

Capurro *et al.* (1997), who found clear dependences of mortality from density (even if affected by sex and age).

On the other hand, one must be cautious with the interpretation of results based on population change rather than on abundance itself. The precision of the counting method can be estimated to ±5%, what is more than the inter-annual fluctuation in some cases. Therefore, the reliability of increment/decrement estimates is questionable.

The model of chamois-predators-main prey interactions has shown that the population size of ungulates prey affects chamois population (both abundance and population growth) more that the population size of predators themselves. The population size of lynx even did not prove to be a significant factor, even predation of lynx on chamois has been documented in the Tatra Mountains, even much more frequently than that of wolf (Chudìk, 1969). Also our field observations confirm the predation: wolf faeces containing chamois fur and hoofs, chamois hunted by lynx, predators' tracks in the chamois zone, direct observations of the presence of predators over the upper forest limit and in the vicinity of preyed chamois (Chovancová, unpublished results). Wolf predation on chamois has been proven, *e.g.*, by Poulle *et al.* (1998). Also in the other parts of chamois' distribution range, it is known that lynx preyes chamois: for example in Alps, it constitutes the second main prey of lynx after roe deer (Lovari, pers. comm). However, in Alps, habitats of lynx and chamois overlap much more than in the Tatra Mts.

This problem can again be partly associated with the reliability of counting of predators. It is a difficult task, especially for wolf which has a large range and can easily migrate over large distances, since High Tatras are surrounded by densely forested areas. Even if counting was absolutely precise, it would reflect only the census at the period of counting, not an average census over the whole year. For lynx, only data about the whole population in the Tatra National Park are available. However, a part of population (it is difficult to quantify how big part) lives at lower altitudes and never mounts up to the subalpine and alpine zones. More precise data should have been collected on the basis of the knowledge of the predator's lifestyle – the structure of their prey, size and location of home ranges of particular individuals, etc. However, it is possible to collect such data today, but they cannot be completed backwards for the whole time series.

The presented results obviously do not mean that lynx does not contribute to the reduction of the chamois population size. In the Tatra Mountains, chamois does not represent the main prey of lynx. Catching several individuals of chamois cannot be reflected in the survival and the increase of number of lynx. On the contrary, for chamois, this permanent intervention into its population can have important effects, especially if females and young are preferentially preyed, since it does not allow the population recovery.

Within this preliminary analysis, we have not disposed of meteorological data for the whole winter. We focussed on weather conditons in in May, which is the birth season, therefore we expected important effects on chamois population. In general, weather conditions in winter proved to have strong effect on the demography and even on phenotypic variation of ungulates. Deep-snow winters lead to smaller body size and postponed female fecundity of red deer (Post *et al.*, 1997) and increased mortality in several ungulate species (Forchhammer *et al.*, 1998, Post & Stenseth, 1998). Weather in winter can even affect the predator-prey relationship and deep snow in winter increases predation rates (Nelson & Mach, 1986). However, a study by Capurro *et al.* (1997) has not identified any effect of snow cover in winter on the mortality of chamois in Italian Alps.

We have not found any study focussing on the effect of climate specifically during the birth season in chamois, but an influence of weather conditions on the survival of newborns has been proven for other ungulates (Wotschikowsky & Schröder, 1990, Wissel *et al.*, 1999). The selected climatic variables do not represent the whole range of climatic factors, which may cause life hazard for chamois in the alpine environment. For example, the risk of avalanches (a major cause of mortality in High Tatras, *see* Chudìk, 1969) is only partially reflected by the occurrence of fresh snow. However, we were limited by the data provided by the Weather Service.

The climate apparently changed within the observation period towards warmer May, however, much more snowy at the same time. At this stage, it is difficult to predict if this trend is a manifestation of a temporary fluctuation, or if it indicates a long-term climate change.

Several practical measures have been undertaken to stop the decline of the chamois population. A reserve population of Tatra chamois was established in the Low Tatra National Park. From the original 33 individuals introduced within the period 1969–1976, it increased to approximately 110 individuals at present. However, utilization of this reserve for the recovery of the population in the Tatra Mountains is a controversial issue. Alpine chamois was introduced in the nearly located National Park Slovak Paradise, so that the gene-pool of the reserve population may be polluted through introgression. In addition, medicaments against parasites were provided, and the Ministry of Environment approved recently the reduction of predators by trapping of lynx over the upper tree limit.

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