

REINTRODUCTION OF BALKAN CHAMOIS (*Rupicapra rupicapra balcanica* BOLKAY, 1925) IN VITOSHA NATURE PARK

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ABSTRACT

In 2002 a program for reintroduction of Balkan chamois (*Rupicapra rupicapra balcanica* Bolkay, 1925) started in Vitosha Nature Park. At the beginning, an acclimatisation enclosure was constructed covering about 0.3 km² suitable habitats at 1,450-1,600 m a.s.l. Capturing of chamois started in 2003 and various techniques have been used. Between 2003 and 2009 altogether 27 chamois have been transported to acclimatisation enclosure from four different localities in the Rodopi Mountains. Altogether 33 kids have been registered born in Vitosha NP. In 2006 first 9 chamois were released in the wild followed by a group of 6 animals in 2008 and 3 in 2009 in total 18 chamois. We have registered 21-25 cases of mortality due to: diseases 1 (4.5%), feral dogs/wolf 9 (40%), antagonistic behaviour 1 (4.5%), falling from a rock 1 (4.5%), unknown reasons 9-13 (43%-50%). Average of about 15% a year but high mortality in the enclosure 14 cases 8 (57%) of them are caused by feral dogs. In order to minimize the risk of illegal hunting the following actions have been undertaken: meetings with local communities (especially hunters) around the border of the park; direct involvement of students, volunteers and local hunters in reintroduction; publication of articles and interviews in the media; regular monitoring of the released animals and those in the enclosure. Monitoring of the herd released in the wild (outside of the enclosure) has been carried out since 2007. One GPS-GSM collar has been used as well as VHF transmitters and direct observations. In the beginning of 2010 the number of chamois in the wild is 16-19 and 13 animals are still kept in the enclosure. The number of chamois in the park by the end of 2009 is 28-32.

Key words: Capturing, Balkan chamois, Conservation, Reintroduction, *Rupicapra r. balcanica*.

RESUMEN

*Reintroducción del rebeco de los Balcanes (Rupicapra r. balcanica Bolkay, 1925)
en el Parque Natural de Vitosha*

En 2002, se inició un proyecto para la reintroducción del rebeco de los Balcanes en el Parque Natural de Vitosha. Al principio del proyecto, se construyó un cercado de aclimatación

que abarcaba unos 0,3 km² de hábitat apropiado a una altitud de 1.450-1.600 msnm. La captura de rebecos comenzó en 2003. Hasta 2009 un total de 27 rebecos han sido transportados a las montañas de Vitosha entre 2004 y 2009. Se ha documentado el nacimiento de 33 crías. Se registraron entre 21 y 25 casos de mortalidad (1 por enfermedad, 9 por perros asilvestrados/lobos (40,1%), 1 por conducta agresiva (4,5%) y 9-12 por causas desconocidas (42,9%-50%). La mortalidad media anual ha sido de aproximadamente un 15%, aunque se produjo una elevada mortalidad en el cercado: 14 casos, de los cuales 8 (57,1%) fueron provocados por perros asilvestrados. Para minimizar el riesgo de caza furtiva, se han realizado las siguientes actuaciones: Reuniones con la población local (sobre todo los cazadores) en el entorno del parque; implicación directa de estudiantes, voluntarios y cazadores locales en la reintroducción; publicación de entrevistas en los medios de comunicación; seguimiento frecuente de los animales liberados y los animales del cercado. El seguimiento de los rebecos liberados en el medio silvestre no sólo proporciona datos sobre la mortalidad, el índice de productividad, la influencia de las actividades humanas, etc. Además, la presencia frecuente es la mejor herramienta de prevención contra la caza furtiva. El seguimiento de los animales liberados se viene realizando desde 2007. Se ha utilizado un collar GPS-GSM y trans-misores VHF. A comienzos de 2010, el número de rebecos en libertad es de entre 16 y 19, y unos 13 animales se encuentran en el cercado. El número de rebecos en el parque a final de 2009 era de 28-32.

Palabras clave: Rebeco de los Balcanes, reintroducción, participación de la comunidad, *Rupicapra*, radiotelemetría.

INTRODUCTION

Chamois (*Rupicapra rupicapra* L.) is included in Annex III of Bern Convention. The Balkan subspecies (*Rupicapra r. balcanica* Bolckay, 1925) is included in Annex II and Annex IV (strictly protected) of Directive 92/43/EEC of EU for the Conservation of Natural Habitats and Wild Flora and Fauna as well as Annex III (strictly protected) of Biological Diversity Act in Bulgaria. The Chamois is included in Bulgarian Red Data Book as an endangered species.

Even though protected under certain conditions, some harvesting is allowed as exclusions mentioned in Article 48 of Biodiversity Act. The legal hunting takes place only in subpopulation with proofed stable or rising population numbers in the region of Rodopi Mountains. Hunting in the rest of the country (Rila, Pirin and Central Balkan National Parks) is prohibited. According to the Management plan of Vitosha Nature Park chamois is protected and hunting is prohibited.

The Balkan subspecies occurs in several isolated localities in the mountains of the Balkan Peninsula (Shackelton *et al.* 1997). In Bulgaria, chamois is found in four relatively separated localities - Rila Mountain, Pirin Mountain, Stara Planina Mountains, mainly within the borders of the three National Parks (Rila NP, Pirin NP and Central Balkan NP) and in the Rodopi Mountains (Valchev *at al.* 2006). The subspecies is endangered in most of its natural habitats.

Except the Rodopi's subpopulation, there is a decline in the numbers of chamois in Bulgaria in the recent 20 years. The major threat for the Balkan chamois everywhere in Bulgaria is overhunting (mainly illegal). As a result, a lot of the habitats are characterized by very low density and many suitable habitats still remain unoccupied, which creates additional fragmentation. The low numbers of the animals in the isolated locations leads to depletion of the genetic pool. Additional negative factors are huge scale construction works (hydro-power plants, dam lakes, tourist infrastructure and centres - ski slopes, lifts, etc.), disturbance by tourists and livestock grazing (Valchev *at al.* 2006). The support of existing chamois population and restoration of its former range is of importance for the mountain ecosystems and preservation of large birds of prey (vultures and eagles) but also the prerequisite for the recovery of extinct species in Bulgaria like eurasian lynx (*Lynx lynx*) and bearded vulture (*Gypaetus barbatus*).

It is not clear when exactly the chamois got extinct in Vitosha Mountain but in the recent 100 years there are few reports for solitary individuals or small group/s most likely coming from neighbouring Rila Mountain (Petrov (Петров) 1965). After analyses including importance and conservation status of species in Vitosha Nature Park Balkan chamois appear to be one of the most important species of the protected area. Due to this a feasibility study has been carried out. It was estimated that over 80 km² are suitable for chamois in Vitosha and around 50 km² provide the best quality and lack of disturbance (Figure 1). As a result the reintroduction project started. The partners of the projects are Vitosha Nature Park Directorate, Balkani Wildlife Society and State Hunting Enterprise Vitoshko-Studena, which territory overlaps with that of the Nature Park. Because of the low numbers and density of chamois populations in Bulgaria there was

no possibility (permission) for translocation of more than 5-6 chamois per year. Due to this there was a need of an acclimatisation enclosure where the chamois were kept while there is a larger group before releasing them, to make sure they have better chances of surviving in the wild. The chamois for reintroduction were brought from the Rodopi Mountains due to the following reasons: 1) the habitats and conditions in the Rodopi are similar to those in Vitosha NP; 2) there is the highest chamois density in the country which make the capturing easier and the harming of the donor populations minimal; 3) the subpopulation in the Rodopi Mountains is not within a protected area.

Monitoring of the chamois in the Park has been undertaken since the first animals were brought to Vitosha Nature Park in 2003.

Poaching is a considerable potential threat for the reintroduction. An effective way to prevent poaching of chamois is community involvement (Roucher 1999). Working with local communities and hunting societies has started since the beginning of the project. Local hunters have also been involved in many activities including transportation (even carrying) of the animals regular maintenance and guarding of the acclimatisation enclosure, etc.

In order to decrease the mortality caused by large carnivores, poaching and to make sure that the animals will form herd(s) and will not roam out of the park (where the risk of poaching is higher) chamois had been kept in the acclimatization enclosure.

STUDY AREA

Vitosha Nature Park (42°23'N 23°20'E) is the oldest park in Bulgaria and on the Balkan Peninsula designated in 1934. It is situated close to Sofia, the capital of Bulgaria, and covers an area of 271 km². Vitosha is a cupola like mountain and the altitude of the park is between 800 and 2,290 meters above sea level. More than 60% of the park territory is a forested area and could be divided in three main zones - deciduous forest, coniferous forest and subalpine zone. The biodiversity of the Vitosha Nature Park is significantly preserved. Even so closed to the largest city in Bulgaria large mammals such as brown bear (*Ursus arctos*, L.), wolf (*Canis lupus*), otter (*Lutra lutra*), red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*,

L.) and wild boar (*Sus scrofa*) are found in the park. Also the park territory is inhabited by more than 200 bird species, 120 of which nest there.

The habitats of chamois are mostly situated within the treeless south slopes in the highest parts of the mountain around the rock complexes (cliffs, moraines (rocky rivers), etc.). They cover mostly Alpine and Boreal heaths, characterized by the presence of *Vaccinium myrtillus*, *Vaccinium vitis-idaea*, *Juniper sp*, *Festuca valida etc.*, patchy spruce (*Picea abies*) and spruce-beech (*Fagus sylvatica*)-aspen (*Populus tremula*) forests, single *Salix caprea* trees and peat bogs.

Being close to Sofia, Vitosha is one of the most visited parks in Bulgaria, but almost 98% of the tourists visit the areas around two tourist centres in the north part of the mountain so the south slopes remain relatively undisturbed.



Figure 1. Chamois habitats within the Vitosha NP.

Chamois for the reintroduction have been captured in different localities in the Rodopi Mountains. Mostly in gorges and other rocky complexes below the tree line in forested areas with mixed forests. Trap lines were set within the following sites: Devin river valley (41°45'N 24°20'E) altitude 900 to 1,300 m a.s.l. and with density of around 9-11/km² (Valchev *et al.* 2006), Gerzovitsa (41°35'N 24°38'E), altitude 1,150 to 1,350 m a.s.l. and with density 4-5/km², Mursalitsa (41°37'N 24°29'E) altitude 1,400 to 1,650 m a.s.l. and with density of 7-8/km² and

Chepino (Lepanica) (41°57'N 23°59'E) altitude 1,150 to 1,350 m a.s.l. and with density of 4-5/km² (Valchev *et al.* 2006).

MATERIAL AND METHODS

Chamois capture methods

Live capture of chamois is challenging because of its habitat, characterized by rocky terrains and steep slopes, social structure and behaviour, especially in the Rodopi Mountains where the species is hunted and in most localities the density is lower than the carrying capacity of the habitat.

In order to capture chamois for translocation various techniques have been used: 1) rifles with tranquilising darts; 2) specially prepared vertical nets and 3) leg-holding snares (Struch & Baumann 2000, Willisich & Ingold 2007).

1. We used Tellinject GUT 50 rifle with 3 ml syringes. Chamois were immobilized with chemical restraint based on a mixture of xylazine and tiletamine/zolazepam (1 dose for female and kids contains: 50 mg of xylazine, 50 mg of tiletamine, and 50 mg of zolazepam and for male 75 mg of xylazine, 75 mg of tiletamine, and 75 mg of zolazepam).
2. Drive nets have been used for capturing chamois and small to medium size ungulates (Berducou 1993, Meneguz *et al.* 1997). A special vertical net was elaborated for chamois capture. It was a net made of fishing line with diameter 1 mm in order to be less visible for the animals. The height of the net is 2,5 m and the length is over 50 m. Additional 200 m, 2 m height of fishing net (caprolactam fibre) was used. For proper fixing of the net it was strengthened with two ropes on the top and the bottom end. The bottom rope is fixed to the ground and the top is just hung on nails perpendicular to the poles supporting the net. The nails are nailed from the opposite site of expected direction of chamois in order to fall down behind the animal when it hits the net. The nets were usually set couple of hundred of metres away from a herd in a suitable place. Two persons are hidden near the ends of the net in order to react quickly if an animal is caught. Then few people move towards the herd trying to drive the chamois into the net.

3. The leg holding snare system was adapted especially for chamois. It consists of rope snares, metal sprigs fixed on trees and cord trigger. The snares are set in groups and equipped with alarm system. They are usually settled in groups of 15 to 30 together in trap lines. When a chamois activates the cord trigger the snares which are pulled up by the metal spring and captures animal's leg. The cable of the alarm system connecting the trap line and the base camp that is situated several hundred meters away (up to 1 km). There is an alarm signal when a spring is triggered and a snare is activated. In that way it is possible for the team to react within several minutes after an animal is captured, which decreases the risk of injury. The trap lines have been set in autumn-winter period from November to the end of February. Due to requirements of National legislation and to avoid disturbance during breeding period.

Drop nets (Jullien *et al.* 2001) have also been tried in the enclosure with no success.

Transportation of the animals

The animals were transported in a special wooden boxes corresponding to the size of the chamois (130/70/50 cm). Each box is constructed in a way that all the inside surfaces are flat to minimize the chance for traumas. The transportation time varied between 4 and 23 hours depending on the distance, accessibility, road condition etc. In order to reduce the stress during transportation a relaxant was used (Neurotrank used applied in 1ml (which contains: 10 mg acepromazine maleate) per 10 kg of body weight).

The transportation of the animals from the Rodopi to Vitosha was done in most cases with not specialized vehicles for transportation of wild animals. For the transportation in the last 6-7 km to acclimatization enclosure on Vitosha are used either a 4-wheel-drive vehicles or snowmobile in the winter months depending on the snow condition. In 2 cases the animals were carried on a canvas because of high snow cover and snow drifts the area was not accessible by motorized transport.

Veterinary care

Each caught chamois passed a veterinary exam where the general condition of the animal is examined and some preventive medicines applied. Preventive anti stress and anti bacterial therapy is done with Oxytetracycline L.A. 20%, Catozal, Ivermectine and Injectivit. The disinfectant Izosan-G is applied as well. A blood sample from each animal was tested for brucellosis, leptospirosis, Q-fever, internal parasites, etc.

Acclimatisation enclosure

The acclimatisation enclosure was constructed on the territory of Vitosha Nature Park at altitude 1,450-1,600 m a.s.l. The total length of the fence is 2,253 m and additionally 150 m for the quarantine enclosure. The fence is 3 m high; diameter of the rhomboids is 60x60 mm. The fence is fixed on metal pylons (stabilized by concrete) and trees. The total fenced area covers about 30 hectares. Within the enclosure there are well-defined southern and north-western slopes offering proper condition during the different seasons. About 50% of the territory is covered with subalpine grass communities with rocks and *Juniperus sibirica*, 25% are dominated by *Corylus avellana* communities and scattered *Picea abies* and the rest 25% is forest dominated by *Fagus sylvatica* and *Populus tremula*.

The completeness of the enclosure has been regularly checked in order to prevent large carnivores such as wolf and feral dog to enter into it.

In the beginning additional feeding for the chamois in the enclosure was provided in the winter months. For the first two years it became clear that the animals did not use any of the provided supplementary feeding such as hay, lucern (*Medicago sativa*), tree branches, maize and grain. The abundance of natural food within the enclosure is the most likely reason for chamois not to change their diet and to refuse to take advantage of the supplementary feeding. Due to this in 2006 supplying of the enclosure was ceased.

Monitoring

Regular monitoring of the chamois both in and out of the enclosure have been conducted by experts from Vitosha Nature Park, Balkani Wildlife Society, volunteers and guards of the enclosure. Observations were carried out with

binoculars (Olympus 10x50, Olympus 8-16x40 DPS I, Olympus 10x42 EXWP I) and field scope (Nikon ED-82A) from distance in order not to disturb the animals. Observations of the enclosure were conducted mainly from 3 stationary points located between 120 and 200 m away from the fence. Out of the enclosure the chamois were monitored by regularly covering of fixed transects and/or found by GPS-GSM data and with the help of VHF signal of transmitters.

One Vectronic Aerospace GPS-GSM collar has been used as well as 6 VHF transmitters (three collars Telonics, 1 AVM Telemetry, 3 Andreas Wagener Telemetrieanlagen HF-NF Technik) for better tracking of the animals out of the enclosure. These devices proved to be very useful especially after the releasing of the pilot herd out of the enclosure in the wild. All chamois delivered from the Rodopis are tagged with ear tags of different colours. The monitoring gives valuable information regarding chamois number, birth and death rates, sex and age structure of the population. The reasons of mortality have been defined on base of found carcasses or remains of chamois. Two of the animals have been taken to necropsy in the National Research Station of Wildlife Management, Biology and Pathology. Regular counts of the ear-tagged animals and offspring have also been used to assess the mortality.

Poaching prevention

Local hunters have been involved and regularly informed about the development of the project. They participated in many activities preparation and maintenance of the enclosure, transportation of animals etc. Between 2 and 3 people have been responsible for guarding and maintenance of the enclosure and one of them has always been a local hunter. Regular presence of the monitoring team is also an effective poaching prevention.

RESULTS

Methods of capture - success rate, positive and negative sides

Mainly three methods have been used for capturing chamois for the reintroduction. These are: 1) anaesthetizing rifle; 2) vertical net; 3) leg-holding snares.

More detailed information and analyses about capture success regarding the reintroduction are the topic of another paper (under preparation). Here we will present only general information.

In the attempts for immobilising with anaesthetizing rifle over 90 person days (average 2.2 persons involved – table 1) and over 25 syringes were launched in order to immobilize chamois. In most cases the animals were missed.

TABLE 1
Efforts per captured chamois using anesthetizing rifle 2004-2006.

Capturing days	person days	Captured individuals			person days per capture
		male	female	total	
41	90	2	1	3	30

In some cases it was not possible to judge whether the animal was hit by a syringe or not. In 3 separate cases though the chamois was hit the syringes they were not found tranquilized and symptoms of anaesthesia were not registered. In several cases when there was successful darting but the medicament was not properly injected. Altogether 3 chamois have been immobilised 2 males and 1 female. So for one captured chamois average over 30 person days were needed. There was one mortality case registered. A three years old male was darted between the ribs and even the quick respond of the veterinarian and the antidote applied it died.

The vertical nets were used during 8 capturing session and over 80 person days with no success.

Trap lines of leg holding snares have been set for 515 trapping days between 2004 and 2009. At different times and locations the lines contained between 18 and 55 snares. The average number of snares set per day for the whole period is 37.

Altogether 53 chamois have been captured (Table 2). Males got captured approximately two times more often than females (Figure 2).

TABLE 2
Efforts per captured chamois using trap lines of leg holding snares 2004-2009.

Trapping days	Snare/days	Person days	Captured individuals			Person days per capture	Snare/day per capture
			male	female	total		
515	19 055	918	34	19	53	16,4	359,5

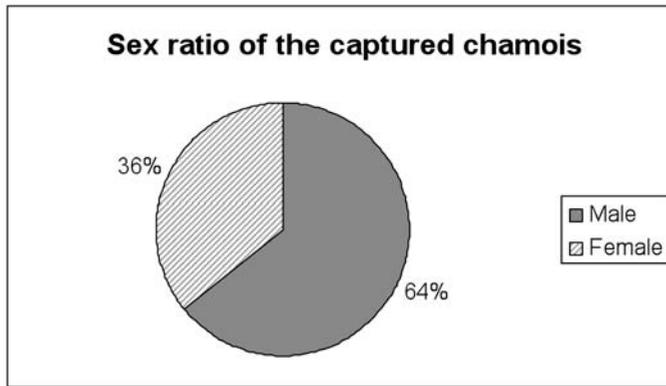


Figure 2 . Sex ratio of the captured with leg-holding snares male and female chamois

Even though the trap lines were usually set in rocky areas inhabited mainly chamois this method is not selective and other mammals have also been captured. Three roe deer, one red deer and one badger (*Meles meles*) have been captured. The snares were gnawed or torn 19 times: 4 of them by wild boar, 2 by red fox (*Vulpes vulpes*), 2 by stray dogs (*Canis familiaris*) and 11 cases the species was not defined. The specimens of other species that have been captured are 13% of all captured animals.

During the trapping there were two mortality cases of chamois both due to technical failure in the alarm system. In one of the cases also the animal that was caught for the hind leg and hung head down from a rock (1.7 m high) near the tree for which the snare was fixed.

TABLE 3
Comparison of different capturing methods.

Method	person-days	captured chamois	Person-days/ chamois	mortality	
				number	percentage
Immobilising	90	3	30	1	33%
Driving net	80	0	>80	0	0%
Leg holding snares	918	53	16,4	2	3%

During the trapping sessions 64% (Figure 2) of all captured chamois were males (ratio ♂: ♀ 1:0.56).

Monitoring

Regular monitoring of the chamois both in and out of the enclosure have been conducted by experts from Vitosha Nature Park, Balkani Wildlife Society, volunteers and the guards of the acclimatisation enclosure. The monitoring gives valuable information regarding chamois number, birth and death rates, sex and age structure of the population. One of the most important goals of the observations was to define the habitats preferred by chamois out of the enclosure. For the years 2007 and 2008 the herd in the wild kept close to the acclimatisation enclosure (Figure 3). In 2009 with the rising number of animals out of the enclosure the chamois spread on a bigger territory. Only for 2008 more 150 field days were spent in monitoring of the chamois in Vitosha NP. For 2009 the field days were over 100.

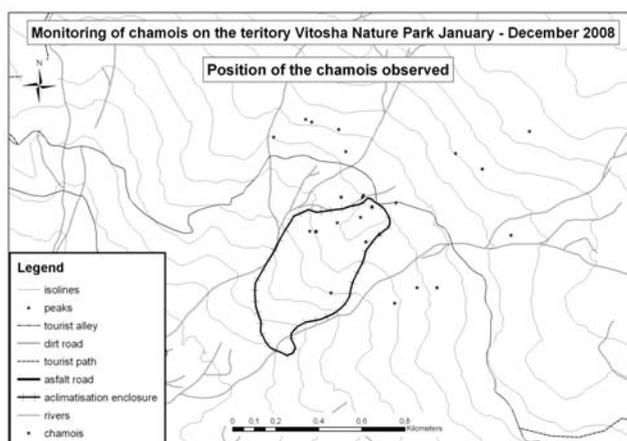


Figure 3. Monitoring of chamois in Vitosha NP-2009.

Transportation

Altogether 27 chamois have been transported to Vitosha NP. In one case the transportation lasted for 23 hours due to the bad weather condition and technical problems with the vehicles and as a result it ended with the only case of mortality during transportation. Mature male chamois died few hours after it was transported.

Dynamics of chamois numbers in Vitosha NP

Due to the small population of Balkan chamois in Bulgaria and neighbouring countries as well as limits in the budget there was no possibility to transport more than 7 animals per capturing season (from September to March). The first animals (a female and a male chamois) were brought to Vitosha NP in February and March 2003. In April 2003 was registered the first kid born on the territory of the Park.

Between 2003 and 2009 altogether 27 chamois have been transported to Vitosha NP. In total the births of 33 chamois kids have been registered in Vitosha (Table 4).

TABLE 4
Reproductive and survival rate of chamois offspring in Vitosha NP.

YEAR	Number of newborn			Survived the first winter	Survival rate
	in the enclosure	in the wild	total		
2003	1		1	1	100%
2004	2		2	2	100%
2005	4	2	6	2	50%
2006	4	2	6	2	50%
2007	3	2	5	3	60%
2008	4	2	6	4	67%
2009	4	3	7	6	64%
Total	22	11	33	20	61%

*- The number of survived first winter for 2009 will be known in summer 2010.

Winter survival rate of the offspring is estimated as the number yearlings (one year old) chamois in the summer is divided by the number of chamois kids that were born during the previous year.

We have registered 21-24 cases of mortality as follow:

1) disease 1(4,, feral dogs/wolf 9 (40,9%); 2) antagonistic behaviour 1 (4,5%), 3) unknown reasons 9-12 (42,9%-50%) average of about 15% a year but high mortality in the enclosure 14 cases 8 (57,1 %) of them are caused by feral dogs (entered the enclosure after snow drifts).

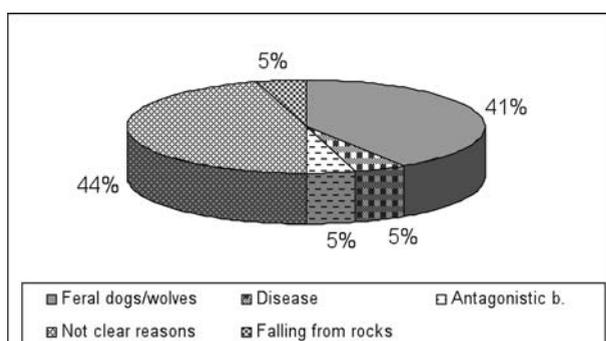


Figure 4. Causes of Mortality of chamois in Vitosha NP

The first herd of nine chamois was released in the wild in the park in the winter (November and December) of 2006. In 2008 another group of 6 animals were driven in the wild and 3 chamois in 2009. At the end of 2009 the total number of animals released in the wild in the Park is 18 individuals.

The regular transportation of chamois from the Rodopi compensated the mortality and as a result there is a steady annual growth in population size of average 32% between 2005 and 2009 (Figure 5). As a result of the reintroduction project a small chamois population is now dwelling on the territory of Vitosha Nature Park. Around 16-19 individuals are living in the wild in the park as other 13 animals are still kept in the acclimatisation enclosure. The total number of chamois is 28-32 specimens. Even small and vulnerable the existing population has a good chance of rising in numbers and stabilising.

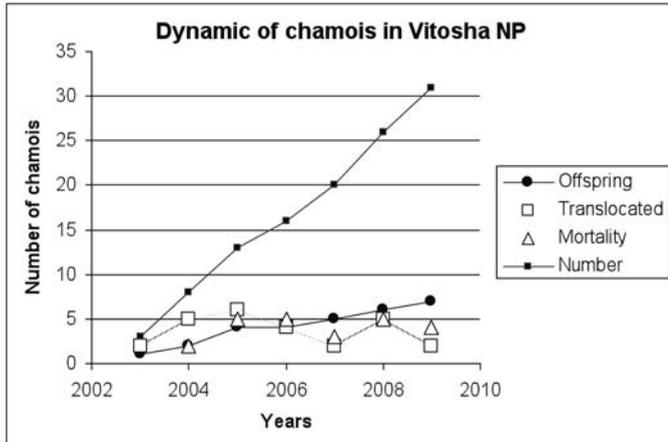


Figure 5 Dynamic of chamois in Vitosha NP.

Poaching prevention

In order to minimize the risk of illegal hunting the following actions have been undertaken:

Three meetings were organised with local communities (especially hunters) around the border of the park in 2007 and 2008. Direct involvement of students, volunteers and local hunters in reintroduction was a vital part of our activities. Volunteers helped the experts in performing most of the monitoring activities. In order to minimize the risk of illegal hunting, permanent guarding of the acclimatization enclosure and neighbouring area has been provided.

DISCUSSION

Capturing. The rough terrain of the chamois' habitats and the limited flight distance of the syringes used for anaesthetizing, rarely allow the use of dart guns for capturing chamois. This is especially true for the region of Rodopi Mountains in Bulgaria where the chamois population is a hunted one and the animals are aware of the threat caused by human with a gun. The situation is the same in other hunted populations (Hamr 1988). The rifle is effective at distance not bigger than 20-30 m while chamois especially in herds are very difficult to be approached to a suitable operational distance for providing proper shot. It takes about 5-12 minutes until the effect of the immobilizing is fully achieved after the

injection. Within that period the animal could run far away, hide under a closed forest cover where is difficult to be traced. When the air temperature is below 0°C the medicament freezes in the needle of the syringes and the method cannot be applied. Due to the above mentioned requires a lot of person-days are needed for capturing a single chamois. Furthermore there is relatively high risk of mortality and traumas. The precise trajectory of the flying syringe can never be predicted. It can be easily changed by the wind and instead of targeted zone to hit a more vulnerable zone and to cause traumas or even death. As a conclusion immobilizing proved to be not very suitable for capturing chamois in the wild, especially in hunted populations. The advantage of this method is that it is selective and suitable for capturing particular or injured animal, or a chamois in an enclosure.

Driving vertical nets also proved to be not very suitable for chamois capturing in our practise. Chamois habitats are usually rocky areas with shallow soils where it is hard to fix the poles supporting the net, during the setting of the net there is unavoidable human presence and noise and it is difficult to drive chamois in that direction afterwards. In case the net is set during the previous day there is no guaranty that there will be any chamois close to the location during the session. A big number of people are needed in order to drive the animals into the net. At least 8 experience drivers are needed to drive the chamois in a certain direction.

Leg holding snares. Trap line of leg holding snares tuned out to be the most effective method of the three that have been used (Table 3). The basic advantage of this method is that it is effective in forest areas like in the Rodopi Mountains. The main disadvantage is that the snares are not selective. But if the trap line is set properly rarely other species are captured..

In the case when a predator or a wild boar was caught they usually gnawed the rope of the snare very quickly and released themselves. If an animal stronger than chamois (red deer or wild boar) is caught it straightens the spring off and releases the snare (at least 6 cases were recorded). When the snare is freed it loses itself and it is usually found few metres away. In three cases less than one year old wild boars did not manage to escape and were released by the team.

In the trap lines more often male chamois have been captured (Figure 2), even though the sex ratio was in favour of females in the Rodopi Mountains where the selective trophy hunting was practiced until 2007 and mainly mature males were harvested. As a result females predominate and the average sex ratio ♂:♀ is 1:1.24 (Valchev *et al.* 2006). One of the possible explanations for more male snared could be that almost half of the capture period (September-February) covers the whole rut season during which the males are less cautious and much more active than the females and wander around in search of females and defence of rutting territory. They might be more curious as well to the new devices in their areas so pay more attention to them and get more often caught. The exact reasons for this are still not clear and there is a need of additional research.

The recorded mortality for this method was relatively low (Table 3) and was due mainly to technical problems with the alarm system and because at the beginning some of the snares were set close to a high vertical rock - precondition for accidents. In order to reduce the mortality rate and traumas during capturing wild chamois with leg holding snares the following should be observed:

- 1) Snares should be set at least 6 meters away of vertical rocks (higher than 0.50 m).
- 2) The team should be able to get to any of the snares for less than 15 minutes after it is triggered (after the alarm is on).
- 3) If there is no possibility to have people close to the trap line during the night it is necessary to equip the snares with radio or GSM-module alarm which can be received by the operators of the trap line at any distance of the snares. Generally capturing during the night is an exception (4% of all captured animals) but if there is no possibility for the team members to spend the dark hours close by the snares and they retreat at a distance this could be a useful way for fast reaction in case of caught animal.
- 4) Technical details to be arranged properly and tested in order to avoid failures.
- 5) If the alarm is not activated during the whole day the device should be checked before the team leaves for overnight or at dusk. Sometimes connection or battery failures could result in not registering a caught animal.

As a conclusion can be said that in our practice the trap lines of leg holding snares tuned out to be the most efficient of all methods for capturing we used. It is necessary to keep in mind that in order to achieve maximum effectiveness and minimum mortality/injuries of chamois there are a number of conditions that should be followed.

Dynamics of chamois numbers in Vitosha NP

Even though there are some advantages breeding in an enclosure has also few disadvantages like mortality caused by antagonistic behaviour (1 case registered), possibilities of stray dogs (wolf) entering the enclosure and harming the chamois population (4 mortality cases). Once dogs (wolves) enter the fenced area the chamois are like in a trap inside the fenced area which increases significantly the chance of success of the carnivores and increases mortality. In order to decrease this mortality, the enclosure should be regularly checked in order to prevent possibility of wolves or dogs to enter the fenced area through holes dug by badgers or foxes. Location with possible snow drifts should be avoided for building enclosures. Also additional plastic or textile nets can be used to increase the height of fence in case of snow drifts. Nevertheless this mortality is compensated by the high survival rate of the offspring (table 4) and the annual delivery of chamois and the average growth is over 30% (Figure 5). After the releasing in the wild and forming of the first herds the animals kept close to the enclosure (Figure 3) where it is safer. This is due to the animals' habit of occupying certain area which in our case is better for monitoring and chamois safety.

Monitoring

Using of GPS-GSM collar and VHF transmitters was an useful way of monitoring the chamois out in the wild on park territory after their release from the enclosure.

Executing regular monitoring of the chamois with the help of volunteers not only provided valuable data regarding population size, structure and habitats but also work as a tool in project popularization, gaining support from local communities and poaching prevention.

Poaching

Involvement of local community (mainly hunters who possess the biggest threat), in activities as maintenance and guarding of the enclosure and adjacent area, regular monitoring no cases of poaching have been registered during the implementation of the present project. Working with locals and especially hunters proved to be a real success so far.

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