Status of the Leopard in the Caucasus

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There has been a huge decline in the former range of the leopard in the Caucasus, which is estimated to have once covered the whole region, except for steppe areas. More recent surveys, including those conducted by WWF since 2001 and others, based on searches for field signs, camera trapping and questionnaires have clarified the situation to some degree. These surveys have confirmed some surviving nuclei and identified possible sites and promising areas for further survey. The largest populations in the ecoregion survive in Iran, which seems to be a stronghold for the leopard in the region. The current presence of leopards in NE Turkey is not confirmed. Leopards have disappeared from the western part of the Greater Caucasus and are known from very few localities in the east. A few occurrences are known in the Lesser Caucasus, including Khosrov reserve and the mountain ridges along the border between south Armenia and Azerbaijan. Existing sites are fragmented and estimated numbers are very low, even down to a single animal in one case. Tentative estimates indicate not more than 15 leopards in the Greater Caucasus and up to 50 in the Lesser Caucasus and Iran. The viability of these small remnants, and the extent to which they are dependent on immigration from Iran is not known.

Assessing the status and the trend of a population is the obvious first step towards its conservation. In the case of the leopard in the Caucasus, this is however a challenging endeavour. There can be no doubt that the leopard is highly endangered – this was already the verdict of Heptner & Sludskij (1972) for the early 1970s and has been corroborated by all subsequent reviews – but how many leopards are left, where exactly, and whether the nuclei are still viable or not is matter of debate and speculation.

Leopards are elusive animals living at very low densities in remote and often hardly accessible areas. Marginal or non-existing capacity in wildlife management and research in all Caucasian countries are responsible for a shortage of data and limited understanding. Recent reviews of the status of the leopard in the Caucasus suffer from the lack of reliable information and are often based on unconfirmed or anecdotal reports. Many of these observations are impossible to judge and seem to have been included over-enthusiastically into the published reports. In recent years, several field surveys based on traditional field techniques were carried out, mainly on behalf of WWF, and researchers have started to use camera traps and ventured into molecular and chemical methods to generate confirmed leopard presence data. These efforts have produced some spectacular, though mostly anecdotal results. The vast extent of the Caucasian range and the arduous access of remote areas make a systematic survey or a continued monitoring a very difficult task, even without considering the organisational and logistic challenge arising from the fact that six different countries share the eco-region. In this article, we summarise recent reviews, surveys, and field research. As none of the surveys were exhaustive, we present and discuss not only confirmed, but also possible occurrences. In addition, we indicate which areas outside the known or probable present distribution areas of leopards in the Caucasus might be promising for further survey work.

Methods

The main methods used to confirm the presence of leopard in the Caucasus were compiling information from local people and systematic search for field signs (Lukarevsky 2003, Lukarevsky *et al*. 2004a). Such signs are footprints, scrapes, scats and urine marks. Detection of signs depends on the observer's experience, but also on vegetation, substrate, and humidity. Blurred signs of any of the larger carnivores (e.g. brown bear, wolf, hyena) can be confused with leopard, but for distinct cat footprints in the Caucasus, only large Eurasian lynx overlap in size with small leopards. The most distinct sign for the species are the *scrapes* made by the hind paws and about 35 – 50 cm long (Fig. 1). In August and September 2001 a first series of 32 transects with a total length of 419 km were carried out (Lukarevsky *et al*. 2004a) in Armenia (14 routes, 190 km), Georgia (7 routes, 100 km) and Azerbaijan (11 routes, 129 km). A follow-up survey took place in July and August 2003 in Armenia and Azerbaijan (Lu-

Table 1. Leopard field surveys (transects) in the Caucasus done by V. Lukarevsky and co-workers from 2001–2005. Transects: total = number of transects made; pos = number of transects with leopard signs; length = sum of kilometer walked, ridden or driven.

Year	Country	Period	Area	Transects		
				total	pos	length
2001	AM	25.07.–10.08.	Khosrov NR	14	7	190
	AZ	15.08.–06.09.	Talysh, Zangezur	6/7	2/2	129
	GE	15.–23.09.	Assa river, S of Ingushetia	7	0	100
2002	RU	06.–18.08.	Greater Caucaus (Kabardino-Balkariya, Karachaevo-Cherkesiya, Kavkazskiy zapovednik)	14	0	205/500
	AZ	28.05.	Talysh Mountains (excursion)	1	1	15
	AM	22.–23.05.	Hosrov – Meghri (excursion)	1		7
	AM	11.–22.10.	Meghri, Hosrov	7	1	85
2003	AM	17.–29.07.	Nyuvadi, Meghri	8	1	97+
	AZ	02.–15.08.	Talysh, Nakhichevan, Zangezur	8	3	156+
2004	AM	10.–20.08.	Khosrov, Meghri, Shikahoh, Zangezur	9	4	135
	GE	30.07.–06.08.	Greater Caucasus (Tushetiya)	4	2	57
	IR	25. –26.4.	Lisar PA, Arasparan PA, Kiamaki PA, Marokan PA	9	64	106/400
	TR		Ikizdere and Sivirikaya, basin of Choroh (Ĉoroch) river (Kiliçkaya, Cevreli, Yusufeli)	7	0	60
	RU	07.–22.10.	Greater Caucasus (Dagestan)	9	2	103/370
2005	RU	03.–15.07.	Greater Caucasus (Kabardino-Balkariya, Kavkazskiy zapovednik)		0	>200
	AZ	5.–15.05.	Zakatala PA, Ilisu PA, Ahar-Bahar range	7	2	123/250

karevsky 2003), with 8 routes each in Armenia and Azerbaijan, of which 3 in the Talysh Mountains (southeast AZ, bordering IR), and 5 in the Nakhchyvan enclave (Table 1). The fieldwork was done by V. Lukarevsky and a number of local co-workers on behalf of WWF and compiled in several internal reports and summarised in an unpublished draft conservation strategy (Lukarevsky *et al*. 2004b). Additional field surveys were done in Iran (January/February 2004) in the Russian part of Dagestan (November 2004), on the Iori-Mingechaur plateau (May 2005), and in Talysh and Akhar-Bakhar ranges, in Nakhchyvan and in southern Armenia (Meghri ridge; March 2007). In the Russian part of the Caucasus, a questionnaire survey was carried out. Some 4,500 questionnaires were distributed, including 1,000 in Chechnya and Ingushetia. However, only about 80 were returned, and only an insignificant number of respondents passed on information that was previously not available. The results presented here are based, if not stated otherwise, on these reports and the summary. Additional transect surveys were done by Khorozyan *et al*. (2005) in 2004 in Khosrov (94 km) and in Shvanidzor-Nuvadi (95 km) areas of Armenia with the intention to collect leopard scats.

Fig. 1. The typical sign left by leopards are scrapes made by the hind paws (Photo V. Lukarevsky).

During the field surveys, local people were interrogated. Information gathered that way was often included into the reports, but so far never systematically analysed and compiled. There is no comprehensive large-scale survey based on standardised interviews available that would allow assessment of the potential presence of the leopard based on the knowledge of local people. Camera trapping has produced positive results in three places (AM, AZ and GE) so far, but was not applied in a manner allowing a quantitative assessment. Radio telemetry has never been used to study leopards in the Caucasus ecoregion.

Status of the leopard in the Caucasus

Historic distribution

Heptner & Sludskij (1972) have reconstructed the historic distribution of the leopard in the Caucasus (Fig. 1). The range covered the whole of the Greater and Lesser Caucasus except steppe and semi-desert areas. Considering the habitat south of the border of the Soviet Union, the species was probably widespread in the mountains of northern Turkey and Iran. "By the 1950s to the 1960s the range of leopards in the Caucasus had shrunk greatly, the population of the animal became negligible, and actually on the brink of total extinction." By 1950, Heptner and Sludskij (1972) indicate only three remaining nuclei (Fig. 2), with still decreasing tendency: "On the whole, by the middle and end of the 1960s leopards had already practically disappeared or were passing through their last days in the Trans-Caucasus and the Little Caucasus. They still occur, though very rarely, at places where

there are several tributaries from Iran, i.e. on the Zangezur (southeastern AM and southwestern AZ) and persist on the Talysh (AZ)." In the Greater Caucasus, leopards were still met along the southeast slope (triangle RU, GE and AZ – Fig. 2) and "some strays" in the Kuban catchment (northwestern nuclei in Fig. 2). In 1972 the leopard was granted protection in the Soviet Union, and the Caucasus population was listed under Category I in the Soviet Red Data Book and considered immediately threatened with extinction. There is very little published information on the leopard in the Caucasus after 1970 until recent times. Shoemaker (undated) speculated for the early 1990s that there were probably no more than 10 individuals living in the Greater Caucasus. It was debated whether they were a persisting nucleus or immigrants from the south. A vital population however remained in the Lesser Caucasus, in the southern parts of Armenia and Azerbaijan, obviously profiting from animals immigrating from the south. Based on harvest rates, Khorozyan (1999) illustrated an increase and north-expansion of the leopard population in Armenia in the years immediately before its legal protection in 1972. The development of the Iranian source population is however not known.

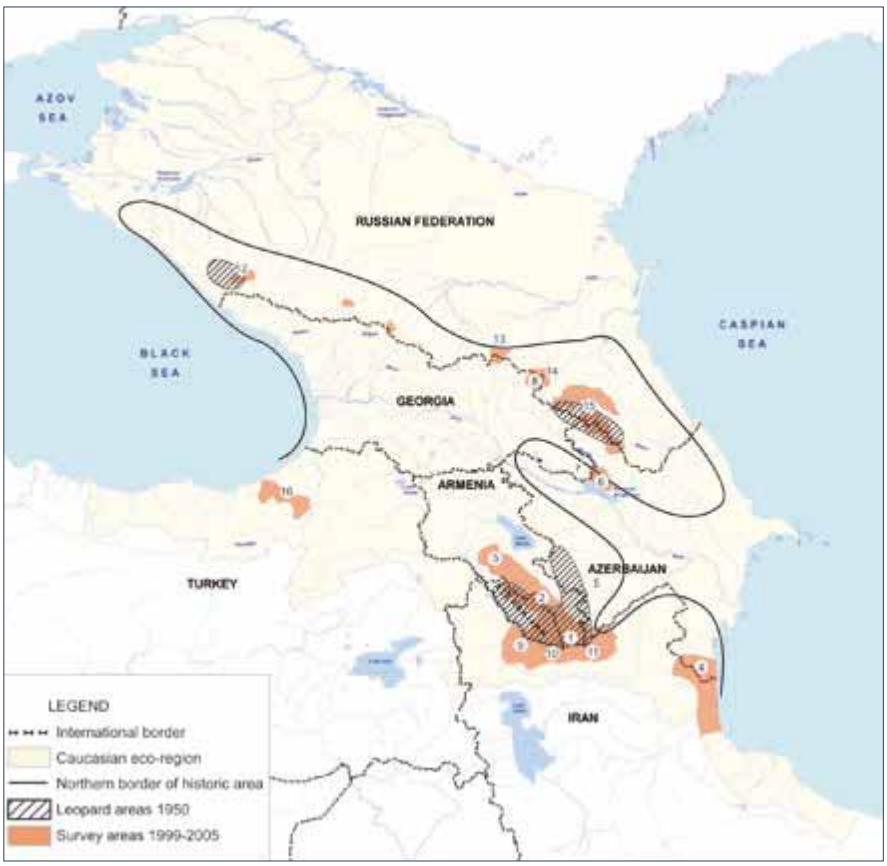

Fig. 2. Historic range of the leopard (areas south of the solid line) and leopard distribution in the Caucasus by 1950 (crosshatched areas) according to Heptner and Sludkij (1992). In orange the survey areas 1999–2005 (results in Fig. 3). Black numbers in white circles: Areas and locations mentioned in the text: 1, Meghri Range; 2, Zangezur Mountains; 3, Khosrov Reserve; 4, Talysh Mountains; 5, Karabakh and Murov-Dagh Mountains; 6, Ilisu Branch Reserve; 7, Vashlovani Reserve; 8, headwaters of Andiyskoye Koysu River (Tushetis Nature Reserve); 9, Marakan Protected Area; 10, Kiyamaki Dagh Reserve; 11, Arasbaran Biosphere Reserve in Qara Dagh; 12, Caucasus State Biosphere Zapovednik; 13, Armkhi and Assa headwaters (Ossetiya and Ingushetiya); 14, Sharoargun and Argun headwaters (Chechenya); 15, Adiskoye Koysu and Avarskoye Koysu headwaters (Dagestan); 16, Ikizdere and Sivirikaya, basin of Choroh (=Ĉoroch) river (Kiliçkaya, Cevreli, Yusufeli).

Armenia (AM)

An important region for the leopard in the Lesser Caucasus is southern Armenia (Fig. 3). The ranges occupied by leopard are the mountains southeast of Yerevan and south of Lake Sevan (Khorozyan & Malkhasayan 2005; Fig. 1). The best-known leopard area are southern Zangezur and Meghri Ranges shared by AM and AZ (1 in Fig. 2) in the southern tip of the country, where the estimation from the field surveys carried out by V. Lukarevsky and colleagues on behalf of WWF was 3–5 individuals (Lukarevsky *et al*. 2004a). The presence of the leopard in this region is also demonstrated by sporadic, but regular attacks on livestock, especially in the lower parts of the mountains. The Meghri occurrence is adjacent to the leopard range in Azerbaijan's Nakhchyvan Republic and in northern Iran. Another permanently occupied area is the Khosrov Reserve (2 in Fig. 2; 2–3 leopards). The Zangezur Ridge (3 in Fig. 2) and adjacent mountains form an ecological corridor and are a significant transit region between existing populations in NW Iran and the south Transcaucasus. Another important corridor between northern AM and the Karabagh Mountains (see also Zimmermann *et al*. 2007) is the Murovdag. These ridges form also the most important connection between the Iranian population and the Greater Caucasus. The large cat persisted in this region because of the proximity to the Iranian source population. The leopard has however been very rare since at least 1945; from 1949 to 1976, only 25 leopard skins were supplied to the Armenian state fur purveyance centres (Khorozyan 1998), so less than one per year. The leopard was granted legal protection in Armenia in 1972. No specific surveys were done until recently, but we can assume that the occurrence persisted at relatively low abundance. The total estimate for the late 1990s was not more than 25 leopards (Khorozyan 1998). More recent reports estimate the total number of leopards in Armenia to be 7–11 individuals (Lukarevsky *et al*. 2004b) and 10–15 leopards (of which 5–8 adults; Khorozyan & Malkhasayan 2005), respectively. Even the lower figure may have been too optimistic, and the number of leopards in southern Armenia in 2001–2003 may have been as low as 3–5 individuals. In the following years, increasing reports and observations indicate higher leopard presence (up to 7 animals).

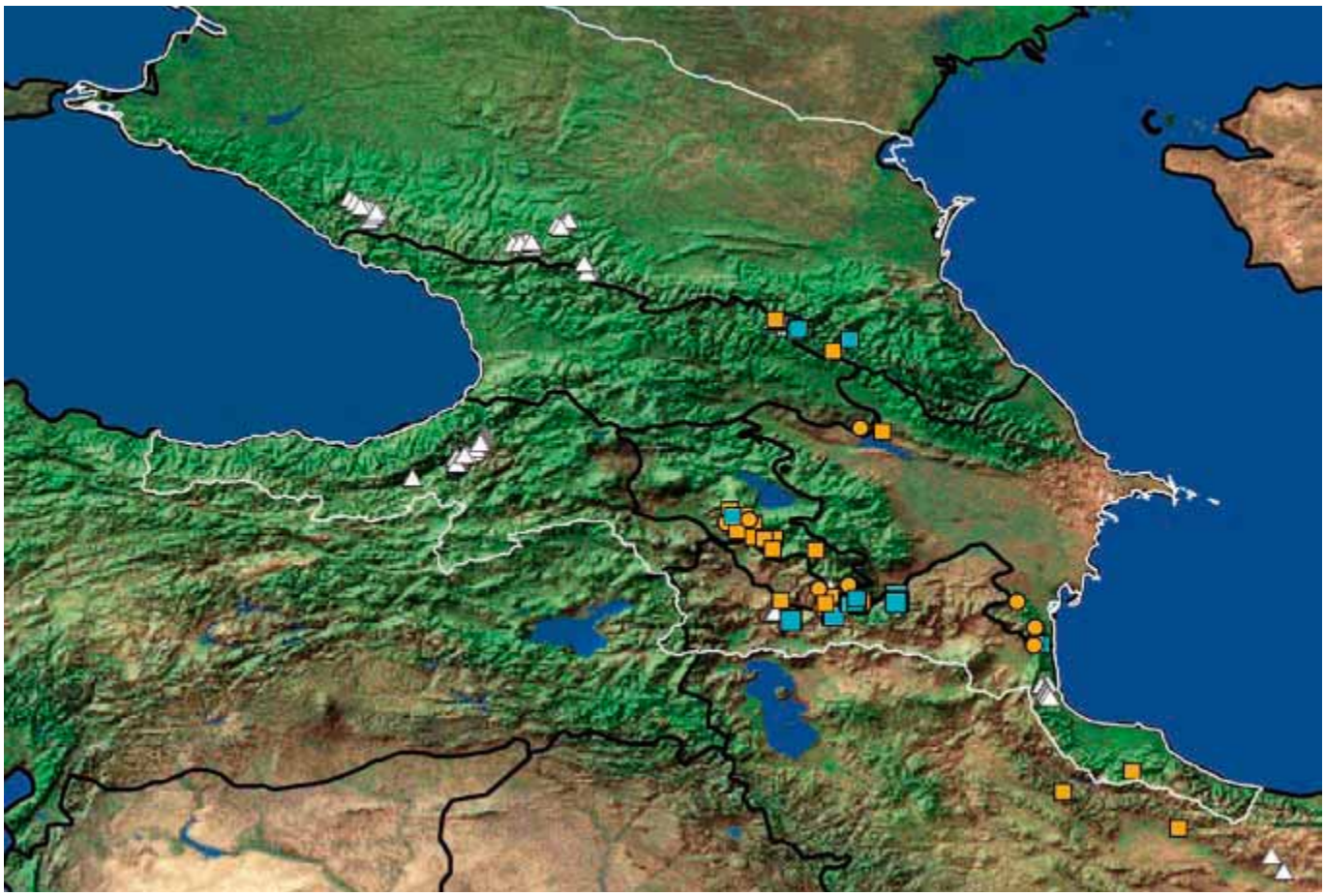

Fig. 3. Recent surveys and distribution of the leopard signs in the Caucasus eco-region. Blue squares indicate the transects with leopard signs carried out by V. Lukarevsy and co-workers on behalf of WWF from 1999–2005, white triangles indicate the locations of negative transects. Orange symbols represent leopard presence indication from the literature or other reports (e.g. questionnaires) since 1990. Dots are the "hard fact" observations (such as dead leopards or camera trap pictures), squares other confirmed records (e.g. tracks).

Fig. 4. Leopard in the Talysh Mountains pictured by an automatic camera in January 2007 (photo E. Askerov).

Azerbaijan (AZ)

Leopard was legally protected in Azerbaijan in 1969, but information about leopards in Azerbaijan remains limited. During the surveys, four separated occurrences were identified: Talysh Mountains (4 in Fig. 2; Fig. 4) in the southern most corner of Azerbaijan. Signs of 3–5 leopard were found here at an altitude of 700–1500 meter. This occurrence is adjacent to the leopard range in the neighbouring ridges of Iran. In south-western Azerbaijan, in the Zangezur range (2 in Fig. 2; Fig. 5) of the Nakhchyvan Autonomous Republic, the distribution of leopard is consistent with its presence in Armenia and in Iran. The abundance seems to be low, probably not more than 3–4 animals. Difficult to assess is the presence of the big cat in the disputed area of Nagorny Karabakh. According to local contacts (Lukarevsky *et al*. 2004b), a leopard occurrence of probably not more than 3–4 animals persists

in the western part of the Karabakh and Murov-Dagh Mountains (5 in Fig. 2). Furthermore, some individual leopards exist in the Ilisu Branch Reserve (6 in Fig. 2) in the Iori-Mingechaur highlands (Fig. 5) of the Akhar-Bakhar ridge in northern Azerbaijan. This occurrence is in the Greater Caucasus and is interesting in regard to its potential connection with adjacent leopard areas in Georgia and Russia. This area needs special investigations, as individuals migrating from the Greater or Lesser Caucasus might occur here. Field surveys in March 2007 have confirmed leopard presence in Meghri mountains and on the Zangezur ridge on the Azerbaijan side (but no sign was found on the Armenian side), in the Negramdag at the border with Iran, in the Iori-Mingechaur and the Akhar-Bakhar ridge.

Fig. 5. Victor Lukarevsky (front) and Elshad Askerov looking for leopard signs in the Turianchai Reserve in the Iori-Mingechaur highlands of the Akhar-Bakhar Range in northern Azerbaijan (Photo E. Askerov).

Georgia (GE)

In April 2004, the NACRES team took a picture of a leopard (Frontispiece) by means of a remote-sensing camera in the Vashlovani State Reserve (7 in Fig. 2) in southeast Georgia (Anonymous 2004). NACRES biologists Bejan Lortkipanidze and Georg Darchiashvili had discovered leopard tracks in the reserve already in winter 2003. The first picture of a leopard from Georgia ever was nevertheless a sensation. The last evidence of a leopard in Georgia was an animal killed in 1952! The picture is also remarkable because it was taken in the Shirakis Vake, a rather arid, low, but rugged ridge of only about 500 meters altitude covered in dense Juniper-Pistacia scrub forest, forming a good, but small and isolated patch of leopard habitat south of the Greater Caucasus. The unexpected presence of a leopard in the Vashlovani Reserve can however not disguise the fact that there is very little evidence for the presence of the species for decades.

The survey has revealed only one more place where leopard signs were detected, along the headwaters of the Andiyskoye Koysu River in Tushetia (Fig. 3; 8 in Fig. 2), at the border with Russia's Dagestan. It is impossible to estimate the number of leopards in Georgia. If there are any resident animals, they must be very few. In 2000, NACRES members saw the skull of a leopard killed in Arkhoti (the upper part of the Assa River basin) in the 1980s (Lortkipanidze *et al*. 2004). A WWF expedition to the area in 2001 did not find clear evidence of leopard presence, although local hunters said that they sometimes saw leopards (Lukarevsky *et al*. 2003). However this expedition was of short duration and survey conditions in Arkhoti are difficult. Leopard presence was recorded farther down the Assa River valley in Ingushetia (RU) in 2002–2005 (see below). Its occurrence in the Georgian part of the Assa Valley is considered to be equally likely. The habitat is suitable – inaccessible slopes, presence of turs, and minimal disturbance as very few people live in this area.

Iran (IR)

According to Firouz (1974) the leopard was widespread in northern Iran and present in most of the protected areas of the region. Close to Armenia and Azerbaijan, the species was found in Lake Orumyieh National Park[1], Marakan Protected Area (9 in Fig. 2) and Kiamaky Wildlife Refuge (10 in Fig. 2). Tajbakhsh (1995) and Ziaie (1996) stated that the leopard was still to be found in most of the Iranian provinces, well preserved in reserves, however persecuted outside the protected areas. Kiabi *et al*. (2002) confirm the wide distribution of the species, with the main distribution area – and probably the only vital population – along the Alborz (Elburz) range south of the Caspian Sea, stretching from Azerbaijan in the west to Turkmenistan in the east. They roughly estimated the Iranian population to be 550–850 leopards, of which 55 % inside protected areas. The highest abundance was in the northwest of the country, adjacent to or within the Caucasus eco-region. This estimation however is based on data collection over 25 years. Newer estimations, based on recent field trips to protected areas in northwest Iran (Lukarevsky *et al*. 2004c) indicate lower numbers than claimed by Kiami *et al*. (2002): Marakan PA, 2–3; Kiamaky Reserve and surroundings, 10–12 individuals; Arasbaran Biosphere Reserve in the Qara Dagh (11 in Fig. 2), 7–9 leopards; Lisar Biosphere Reserve, sporadic. The total estimation for northwest Iran (3,000 km²) was not more than 25 leopards (Lukarevsky *et al*. 2004c). However, Lukarevsky *et al*. (2004a) state that the suitable habitat stretches most often far beyond the protected areas and leopards could well live in between the reserves, if wild prey would be sufficiently available and the leopards could be protected from illegal killing. No recent survey

[1] This is a surprising statement, given the fact that Lake Orumyieh NP is an open salt plain, a habitat that would have more suited the now locally extinct cheetah.

data are available for the Iranian side of the Talysh range (4 in Fig. 2). The mountains south of the border with Azerbaijan to the city of Rasht is an important area for leopard conservation, as it is the potential corridor between the populations in the Lesser Caucasus and the Alborz Mountains.

Russia (RU)

The northern foothills of the Greater Caucasus in the Russian Federation were the northern boundary of the historic distribution of the leopard, which was, by 1950, reduced to two small pockets and at the brink of extinction (Heptner & Sludskij 1972; Fig. 2). In the 1960s, "in the Great Caucasus some leopards are evidently still met with along the southern slope of the eastern section (Azerbaijan and eastern Georgia) and some strays probably live in the Kuban region of the Caucasus and on the southern slope of the western half of this range" (Heptner & Sludskij 1972), hence the authors seem to have considered the leopard virtually extinct in the Russian part of the Caucasus by 1970. However, the great cat persisted also in the north part of the Greater Caucasus in very low numbers. In the mid-1980s, "according to recent estimates, the number of leopards in the northern macroslope of the Greater Caucasus hardly exceeds 10 individuals. They are scattered over the vast space of the Krasnodar and Stavropol Provinces, and of the Kabardin-Balkar, Chechen-Ingush, and Daghestan ASSR" (Bragin 1989). The picture has not much changed until today.

The northwestern most occurrence, in the region of today's Caucasus State Biosphere Reserve[2] (12 in Fig. 2), is obviously extinct; no more signs of presence were discovered in the recent surveys (Fig. 3; Lukarevsky *et al*. 2004b). During the field transects from 2002 – 2005, signs of presence of leopards were still discovered in or reported from three places: In Ingushetia (Assa River valley) and Ossetia (Armkhi River) (13 in Fig. 2) and in Dagestan (Andiskoye Koysu and Avarskoye Koysu headwater systems; 15 in Fig. 2), where Yarovenko (1997) estimated that 10 leopards were living. The questionnaire survey in Chechnya revealed leopard presence along the headwaters of Sharoargun and Argun River (14 in Fig. 2). In spring 2002, a female with two cubs was killed in this region. The cubs were sold to Novosibirsk Zoo. The locations of the positive field transects are shown in Fig. 3. The abundance of leopards in the northern Greater Caucasus is however very low. All together, not more than 10 individuals are believed to live in the Russian part of the range.

Turkey (TR)

North-east Turkey was the western extent of the historic distribution of the Caucasus population of *P. p. saxicolor* (Fig. 2), but its presence in the Turkish part of the Caucasian eco-region has been questioned for at least half a century. Already Kumerloeve (1975) does not list any records of leopard from NE Turkey. In a recent review on the status and distribution of the leopard in Turkey and the Caucasus, Johnson (2003) concluded that population relicts still exist in the mountain ranges of northern Turkey. This assessment was based on only two recent reports, a track found in the snow of the Kackar Mountains (Samli 2003 on www.wildlifeeasy.com cited in Johnson 2003) and two sightings (of which one supposedly documented by pictures; Gulas 2003 on www.cemalgulas.com cited by Johnson 2003). Baskaya & Bilgili (2004) claim to have found leopard tracks at 16 of 46 field trips to the Çapans and Karçal Mountains (Eastern Karadeniz Range) between 1995 and 2001. The authors assumed an almost continuous range of leopards over 250 km from the Ikizdere-Ispir highway to the border with Georgia (where, on the Georgian side, no confirmed leopard occurrence exists). However, this interpretation is based exclusively on the finding of footprints, which are not unproblematic records in an area, where, with the Eurasian lynx, another large cat roams. During our field trip in the Turkish part of the Caucasus eco-region (Ikizdere and Sivirikaya, and Kiliçkaya, Cevreli and Yusufeli in the basin of the rivers Choroh (Çoroch); 16 in Fig. 2; Table 1) in 2003, we were not able to confirm the presence of leopard in north-eastern Turkey (Fig. 3). All droppings/faeces collected as potential leopard scats, including samples from north-eastern Turkey, proved to be lynx (and one dog) in DNA analyses (Can 2004). In spite of several optimistic publications in recent years, there was no hard evidence for the presence of leopard in the Turkish part of the Caucasian eco-system for decades (Can 2004). The habitat in north-eastern and eastern Turkey would however be suitable for the species (Zimmermann *et al*. 2007), and the area remains interesting for further surveys – mainly the regions bordering Armenia and Iran – but more decisive and robust monitoring methods will be needed.

Assessment and conclusions

It is difficult to make a comprehensive assessment of the status of the leopard based on the available publications and recent surveys. The Caucasus eco-region is a vast, very diverse and politically complicated area, and many of the places where leopards may still exist are extremely remote. No exhaustive survey was done so far; even the recent field trips had to concentrate on certain promising areas because of practical limitations. The published evidence seems partly over-optimistic, based on observations that were not confirmed as leopard signs, but on the other hand, once in a while a leopard is discovered in an area where it would not have been expected, like the photo-trap picture in 2004 from Georgia. However, there can be no doubt that the leopard in the Caucasus is critically endangered. The recent surveys on behalf of WWF (Fig. 3; Table 1) have confirmed the presence of the species in several locations scattered over the whole range, but the estimated numbers are very low, probably less then 15 for the Greater Caucasus and maybe up to 50 leopards for the Lesser Caucasus, including the cats in Iran, which seem to be the stronghold of the whole population. Even if the estimates are rather conservative or the odd leopard may have been missed, it is unlikely that important occurrences of the species are unknown. During the brief visits in Armenia and Azerbaijan in March 2007, less signs were found than in previous years, and new rumors on poaching confirm that the leopard is still under big pressure.

[2] The reintroduction of leopard into the Caucasus State Biosphere Zapovednik is presently discussed among Russian GOs, NGOs, and scientists.

The leopard is a long living and elusive animal, which can go undetected for some years in remote areas. However, over time, a species does not survive as individuals, but as a population with reproduction and mortality, and leaves an imprint in its environment. The presence of a population of large carnivores is normally well known to local people and should be particularly obvious in areas with good snow cover in winter, as in the Greater Caucasus. The absence of a species cannot be proven. However, if over an adequate period of monitoring, taking into account the lifespan and turnover of the leopard, no undisputable positive sign of presence confirms its presence, we can assume it is locally extinct. This is for instance the case in Turkey, where the last known leopard was killed in 1974 (which might even have been an escaped animal; Can 2004), but also for other regions in the Caucasus. Nevertheless, some areas in the eco-region remain to be surveyed, because there is a certain chance that leopards may have survived undetected because no adequate monitoring was established.

The absence of a consistent monitoring makes it also difficult to assess the trend of the population. The general belief is that the population is declining, but there is no evidence for this assumption. Heptner & Sludskij (1972) were very pessimistic regarding the survival of the leopard in the late 1960s, fearing its fast eradication in the Caucasus. If their assessment was correct, the leopard population has not continuously declined over the past 40 years, but at least temporarily recovered. The Kuban occurrence (number 12 in Fig. 2) went extinct, but the leopard has persisted in the eastern part of the Russian Caucasus. The situation stabilised in the Lesser Caucasus, but worsened again in the period after the disintegration of the Soviet Union. The Bezoar goat, the leopard's main prey, declined during the 1990s.

There can be no doubt that immigration from Iran was an important factor for the persistence of the Caucasus population, and probably not only in the Lesser Caucasus – where the connection between the occurrences in Azerbaijan, Armenia, and Iran is obvious – but also for the Greater Caucasus. We can assume that the species would indeed be extinct without sporadic immigrants from the south. As a matter of fact, the leopard has survived in both parts of the Caucasus even though it was considered "at the brink of extinction" already 50 years ago. This gives us at least some hope that conservation actions – if they start now – may not come too late, even though the population is at a dangerously low level and fragmented. The immediate needs or strategic goals are obvious: (1) stabilise the present occurrences, (2) secure the corridors to the Iranian populations (mainly in the Alborz range, which potentially connects the Caucasus population with the Central Asian populations), and (3) start to expand the present range of the leopard in the Caucasus in order to re-establish a viable metapopulation. One prerequisite for all conservation activities is however to complete the basic surveys in areas where leopards still might exist, and then to establish an efficient monitoring system, allowing us to assess the status and the trend of the leopard population and to control the effectiveness of conservation measures.

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