Status of the Prey Species of the Leopard in the Caucasus

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The severe economic crisis that followed major political and social changes in 1992 in the former Soviet Union, together with a weakening of formerly effective protection systems resulted in a sharp rise in hunting of wild ungulates and exploitation of natural resources. As a consequence, turs, bezoar goat, wild sheep, chamois, red deer and roe deer have all declined in abundance over the past 15 years, their ranges have been reduced and in many cases are becoming fragmented. In Iran, the decline in ungulate numbers has taken place over a longer timescale, since 1978. The only ungulate species in the ecoregion that has been relatively unaffected is wild boar. The effects on smaller mammalian prey such as porcupines and hares are unknown. The precise extent of species declines is difficult to evaluate in many cases because of inadequacies in baseline data and lack of monitoring programmes. The best populations of ungulates survive in a few protected areas such as the Kavkasky, Khosrov, Kazbegi and Zakataly Reserves and remote areas of Dagestan. The extent to which fragmented and depleted prey populations at an ecoregion-wide scale can support viable leopard populations, and over what time scale, needs urgently to be assessed.

The leopard *Panthera pardus* has the widest distribution of all big cats and a very wide prey spectrum (Nowell & Jackson 1996). Within the Caucasus ecoregion, leopard prey includes an expected mix of large ungulates, medium sized mammals, small mammals, game birds and domestic livestock (Heptner & Sludskij 1972, Gutleb n.d, Khorozyan & Malkhasyan 2002).

For the former Soviet Union, Heptner & Sludskij (1972) said the main prey of Caucasus leopards consists of wild ungulates: bezoar goat *Capra aegagrus*; turs *Capra (ibex) caucasica* and *C. cylindricornis*; wild sheep *Ovis orientalis*; chamois *Rupicapra rupicapra*; red deer *Cervus elaphus*; roe deer *Capreolus capreolus*; and wild boar *Sus scrofa*. Sometimes they prey on European hare *Lepus europaeus*, snowcock *Tetraogallus caucasicus* and *T. caspius*, Caucasian black grouse *Tetrao mlokosiewiczi*, rock partridge *Alectoris chukar*, pheasant *Phasianus colchicus* and crested porcupine *Hystrix indica* (in Talysh). They also take livestock including dogs, poultry, horses, donkeys and cattle.

Gutleb (n.d.) said the main prey of the leopard in Iran is bezoar goat together with wild sheep and wild boar. Foxes, presumably *Vulpes vulpes*, dogs, cows, sheep, and horses are also taken.

In Armenia, bezoar goats make up over 90 % of leopard diet in Khosrov Reserve, with wild boar and hares taken occasionally. Small rodents are also consumed and berries of buckthorn *Frangula* sp. have also been recorded. In southern Armenia wild boar and roe deer are taken more often, and hare and porcupine are taken opportunistically (Khorozyan & Malkhasyan 2002, Khorozyan *et al*. 2005, Lukarevsky *et al*. 2007a).

In Turkmenistan this leopard subspecies has also been recorded preying on goitered gazelle *Gazella subgutturosa*. A number of small mammals and birds and even reptiles that could in theory be taken opportunistically are also present in the ecoregion.

Current Status of Prey Species

The severe economic situation and weakening of protection systems that have affected most of the region since 1992 caused a huge increase in exploitation of natural resources. Habitat destruction, overgrazing, and unregulated hunting of animals and collection of plants are three major and continuing threats to biodiversity in the ecoregion (Krever *et al*. 2001; Zazanashvili *et al*. 2004). Uncontrolled hunting for food or trophies has extirpated large ungulates from many areas. Overall numbers are now much lower than 20 years ago and surviving sub-populations are small and scattered. As a consequence, fragmentation has become an additional negative factor. In Iran, too, mountain ungulate populations have declined drastically, but over a longer time period, since 1978, and have become scarce as a result of poaching and increased use of protected areas by domestic livestock (Ziaie 1997, Kiabi *et al*. 2002).

The only species that may have escaped this onslaught is wild boar. Indeed, Gutleb (n.d.) suggested that a big increase in wild boar numbers in Iran might be a positive factor for the leopard in the region, and Lukarevsky *et al*. (2004) thought that good numbers in Talysh and other parts of the border area ensured a secure prey base for animals transiting from Iran.

Bezoar goat or Persian wild goat *Capra aegagrus aegagrus*. The species occurs in all countries of the ecoregion but numbers are much-reduced from former levels. Bezoar goats live on forested slopes on the northern side of the Greater Caucasus in Dagestan, Chechnya and Ingushetia (RU), Tusheti (GE) and an isolated population on Babadag (AZ; Fig. 3). Earlier reports of the species on the southern slopes of the Greater Caucasus have turned out to be erroneous. The population was estimated at 1,500 in the Greater Caucasus in the late 1980s (Weinberg *et al*. 1997). Highest numbers occur in Dagestan, where numbers in the second half of the 1990s were estimated at 1,500 (Wein-

berg 1999), while Nasrulaev (2003) gave a figure of 2,560 animals. However, Magomedov *et al*. (2001) estimated that between 1998 and 2000, the wild goat population in Dagestan might have shrunk by more than three times. Only about 100 remain in the Tusheti region, Georgia (NACRES n.d).

In the Lesser Caucasus, wild goats inhabit drier open habitats. In the late 1980s numbers were estimated at 2,000-2,500, with over half (1,000-1,250) on the southern part of the Zangezur range (Weinberg *et al*. 1997). Bezoar goat is still quite common in leopard range in Armenia (Fig. 1), especially Khosrov Reserve (Khorozyan *et al*. 2005) and also on the Meghri Ridge.

Bezoar goats are widespread in NW Iran in rocky terrain (Ziaie 1997) and are widely distributed in the mountains of NE Turkey (Kence & Tarhan 1997) though no population estimate is available for either of these countries. Bezoar goats are threatened by increased poaching for meat (Krever *et al*. 2001). They are included in the Red Data Books of Russia, Georgia, Armenia and Azerbaijan. Both the species, *C. aegagrus*, and the subspecies occurring in the ecoregion, *C. a. aegagrus,* were red listed as Vulnerable in 1996 (IUCN 2006).

Bezoar goats occur in Khosrov Reserve, and occasionally in Shikakhogh NR (AM); Ordubad Wildlife Sanctuary in Nakhchyvan and Gay-Gel Reserve (AZ); Tusheti Reserve (GE). They also occur in three protected areas in Iran along the border with Armenia and Azerbaijan: Marakan PA, Arasbaran PA, and Kiamaky WR.

East Caucasian tur *Capra cylindricornis* (Fig. 2) is distributed in the eastern part of the Great Caucasus from the Babadag massif in Azerbaijan to Mt Elbrus. It occurs in Azerbaijan, Georgia and Russia (Fig. 3; Kabardino-Balkaria, North Ossetia, Ingushetia, Chechnya, Dagestan). According to Weinberg *et al*. (1997) the population in the late 1980s had already declined by over 30 % to 18,000-20,000 though Magomedov & Akhmedov (1994) estimated 20,000 in Dagestan alone.

The tur occurs in the following reserves: Lagodekhi (200), Tusheti (700) and Kazbegi (3,000) (GE; NACRES 2006); Kabardino-Balkarian, and North Ossetian (about 800, RU); Zakataly (about 2000, though many of these cross regularly into Russia), Ilisu, and Ismailly (AZ). The large subpopulation (3,000) in Kazbegi NR in the Khevsureti region of Georgia is particularly significant, as a leopard skull was found here in the River Assa gorge in the 1980s (Lortkipanidze *et al*. 2004) and local hunters report that leopards are still present.

Fig. 1. Bezoar goats in Armenia (Photo A. Malkhasyan).

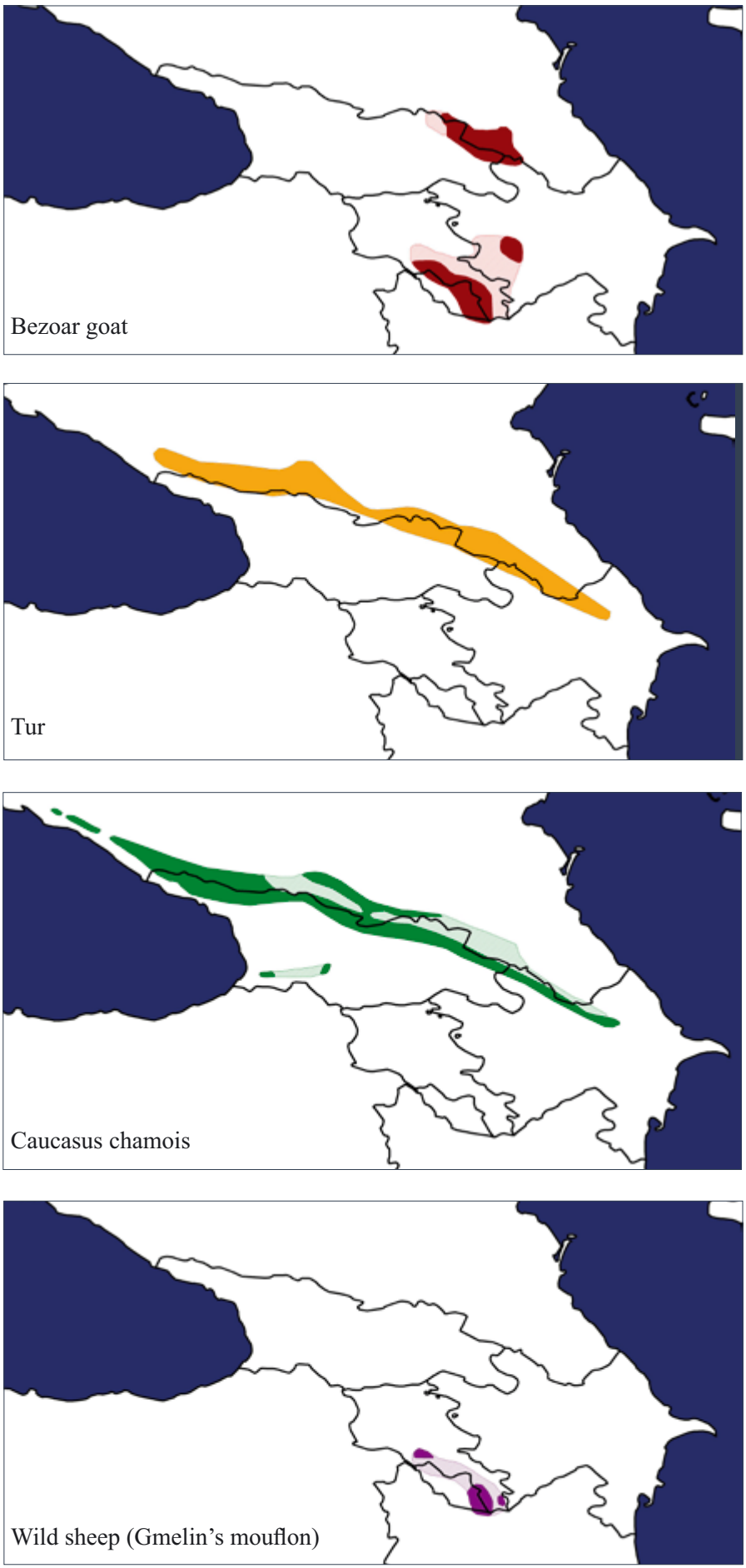
Uncontrolled hunting could pose a long-term threat to their survival and both species of tur have been hunted in the past for meat and trophies. In Georgia, tur-hunting plays a significant role in local culture, in Georgia (Khevsureti for *C. cylindricornis* and Svaneti for *C. caucasica*) and in the whole of the North Caucasus. Turs are legally protected from hunting in Georgia but are subject to trophy hunting elsewhere, though quotas and licensing agreements differ among the range states (Krever *et al*. 2001). Selective hunting has resulted in decreased proportions of males in most populations, even within reserves (Weinberg 2002a). *C. cylindricornis* was red listed in 1996 as Vulnerable (IUCN 2006).

West Caucasian tur *Capra (ibex) caucasica* (Fig. 4) is distributed in the western part of the Greater Caucasus (Russia and Georgia). A small hybrid zone has been reported (Heptner & Sludskij 1972), but tur taxonomy remains uncertain and the relationship between the two taxa is unclear (Weinberg 2002b). Weinberg *et al*. (1997) estimated the total population at 12,000 and Krever *et al*. (2001) at 6,000-10,000. In 1980-1985, the Kavkasky NR alone harboured 5,000-7,000 tur, but by the end of the 1990s only some 2,500 remained (Romashin 2001). Approximately 1,000 occur in the Svaneti region of Georgia (NACRES 2006).

The tur occur in Kavkasky Reserve and Teberdinsky Reserve (RU) and a few along the border with Russia in Ritsa Reserve (GE). Red listed in 1996 as Endangered (IUCN 2006).

Wild sheep (Gmelin's mouflon) *Ovis orientalis gmelinii,* occur in the southern part of the Caucasus region, particularly the Zangezur range, Nakhchyvan,

Fig. 2. East Caucasian Tur in Lagodekhi Reserve, Georgia (Photo B. Lortkipanidze).



and NW Iran. Weinberg *et al*. (1997) said the population in the former Soviet Union probably numbered about 1,000. Current rough estimates are up to 500. In northwest Iran, wild sheep are widely distributed in foothills and rolling steppe and occur in three reserves on the border: Marakan Protected Area, Arasbaran Protected Area, Kiamaky Wildlife Reserve (Ziaie 1997). *O. o. gmelinii* was red listed as Vulnerable in 1996 (IUCN 2006).

Chamois *Rupicapra rupicapra* (Fig. 5). Two subspecies are recorded in the ecoregion. Caucasian chamois *R. r. caucasica* were once widely distributed along the Greater Caucasus, but along the North Caucasus numbers and population densities markedly decline eastwards. Weinberg *et al*. (1997) estimated the population at 15,000 in the early 1990s but numbers have decreased drastically in the last 20 years and are still declining and becoming fragmented. Krever *et al*. (2001) gave an estimate of 4,000–4,500 remaining in the Greater Caucasus (Russia, Azerbaijan and Georgia). Numbers in Lagodekhi NR (GE) fell from c. 350 in 1980 to 60 in 1990 and are still declining (Gurielidze 2004, NACRES 2004). Chamois have disappeared completely from the eastern half of the Lesser Caucasus and barely survive in the western part (Fig. 3); Krever *et al*. (2001) estimated that only c. 25 remain in Borjomi-Karagauli NP, GE.

In Azerbaijan, range and numbers have fallen sharply due to human influence in recent years. The population was estimated at 600–800, and is now restricted to the southern slopes of the Greater Caucasus in the area of Zakataly, Ilisu and Ismailly nature reserves (Gadjiev & Rakhmatulina 2000). Chamois are still quite common in Zakataly NR and current numbers may be 200-300.

Turkish chamois *R. r. asiatica* occur in the mountains of NE Turkey (Kence & Tarhan 1997) but no population estimate is available. Chamois do not occur

Fig. 3. Distribution of the larger prey species of the leopard in the Caucasus accordng to Weinberg *et al.* 1997. Solid areas = confirmed distribution, hatched areas = general distribution. The distribution areas in Iran and Turkey are not shown.

in Iran. The species is not considered to be globally threatened. Caucasian chamois was red listed as Vulnerable, and Turkish chamois as Data Deficient in 1996 (IUCN 2006).

Red Deer *Cervus elaphus*. Red deer were once widespread in the forests of the Greater Caucasus and also occurred in a few pockets in the Transcaucasus but are known to have declined over the past 15 years. Krever *et al*. (2001) reported several thousand in the Greater Caucasus with more than 1,500 in Kavkazsky NR in 1999, and less than 1,000 in protected areas in Azerbaijan, particularly Zakataly NR, and approximately 160 in Lagodekhi NR, Georgia. Numbers in Lagodekhi have declined from a high point of 1,434 in 1990, reached following suppression of wolves (Gurielidze 2004). Firouz (2005) said red deer once ranged through the forests of the northern Alborz but are now eliminated or extremely scarce in the western Caspian region. Red deer was globally red listed as Lower Risk/Least Concern in 1996 (IUCN 2006).

Roe deer *Capreolus capreolus* occur in all countries of the ecoregion and were formerly widespread across the former USSR (Heptner *et al*. 1961). Roe deer remain common all over the North Caucasus mainly in broad-leaved forests, though densities are not high, only up to 10/1000 ha. Roe deer occur widely in Georgia, including Lagodekhi and Tusheti NRs and the population in the mid-1990s was estimated at 3,000 (NACRES 1996). The species is also found in the Karadeniz Mountains of NE Turkey (Baskaya & Bilgili 2004). It was globally red listed as Lower Risk/Least Concern in 1996 (IUCN 2006).

Wild boar *Sus scrofa* (Fig. 6) occurs over almost all the ecoregion except the higher zones of the Greater Caucasus (Lukarevsky *et al.* 2004). They are widespread in coniferous, deciduous and mixed forests, scrub and undergrowth in the subalpine zone up to 2600 m (Heptner *et al.* 1961) and occur in the Karadeniz Mountains of NE Turkey (Baskaya & Bilgili 2004). Gutleb (n.d.) reported a recent big increase in wild boar in Iran. The population in Georgia in the mid-1990s was estimated at 8,000 (NACRES 1996). No other regional population estimates are available. Wild boar was globally red listed in 1996 as Lower Risk/least concern (IUCN 2006).

Fig. 4. West Caucasian tur in Kavkasky Zapovednik in Russia (Photo V. Lukarevsky).

Goitered gazelle *Gazella subgutturosa*. Now almost completely restricted to the Shirvan steppes of Azerbaijan (Shchadilov & Hadjiev 2001), which lies outside the distribution of the leopard. A few small populations are known in other parts of Azerbaijan. A reintroduction to Vashlovani Reserve (GE), where a leopard has been present since 2003, is currently planned (Z. Gurielidze, pers. comm. 2006). Distribution in Iran scarcely reaches the borders of the ecoregion (Hemami & Groves 2001).

Medium and small mammals. Indian porcupine *Hystrix indica* is preyed on occasionally in Talysh (Heptner & Sludskij 1972) and southern Armenia (Khorozyan *et al.* 2005). This species also occurs in northern Iran (Harrington 1977) and Vashlovani NP and Chachuna managed reserve (GE). No information is available on its present status in the ecoregion. It was globally red listed as Lower Risk/Least Concern in 1996 (IUCN 2006). European hare *Lepus europaeus* is also widely distributed throughout the ecoregion but details of population density and status are lacking. It was globally red listed in 1996 as Lower Risk/least concern (IUCN 2006). Red fox *Vulpes vulpes* is recorded across the ecoregion.

Fig. 5. Caucasus chamois in Kavkasky Zapovednik in Russia (Photo V. Lukarevsky).

Fig. 6. Wild boar in the Alazani River region (Photo I. Matcharashvili).

Birds

Caucasian snowcock *Tetraogallus caucasicus* occur in the Greater Caucasus on alpine slopes between the treeline and the snowline (del Hoyo *et al.* 1994). Baziev (1978), estimated their numbers at 200,000, based on counts in Kabardin-Balkaria only, where snowcocks are probably more abundant than anywhere else. BirdLife International (2006a) estimated numbers at 100,000-500,000 and red listed it as Least Concern.

Caspian snowcock *T. caspius* are distributed in the Lesser Caucasus, NW Iran and NE Turkey, where they inhabit steep slopes above the treeline (del Hoyo *et al.* 1994). The population in the Caucasus except for NW Iran, is estimated at 5,000–18,000 and the species is red listed as Least Concern (BirdLife International 2006b). However the Caucasus population may be declining faster than in other parts of the range.

Caucasian black grouse *Tetrao mlokosiewiczi* is resident in the Greater and Lesser Caucasus, NE Turkey and NW Iran. Its stronghold is in the Greater Caucasus. Population estimates here range from 15,000–100,000 in RU; 40,000–50,000 in GE; 1,000–1,500 in TR; 110–200 in IR; 150 in AM and 700–3,000 in AZ (BirdLife International 2006c). In total these figures indicate a global – and ecoregional – population of 57,000-155,000. Habitat consists of alpine and subalpine meadows, scrub, and forest edges at 2,000–3,300 m. Habitat loss and deterioration due to livestock grazing and disturbance by shepherds' dogs are believed to be a major threat and illegal hunting is increasing especially in the Lesser Caucasus; it is red listed as Data Deficient (BirdLife International 2006c).

Chukar [rock] partridge *Alectoris chukar* occurs across the ecoregion in open and scrub habitats and pheasant *Phasianus colchicus* is a widespread resident in plains forests and scrub. Neither species is listed as globally threatened.

Livestock

Livestock is widespread across the ecoregion: sheep, goats, cattle, horses, donkeys and poultry, as well as dogs. No region-wide information on numbers is available. There was a significant decrease in livestock in the former USSR after its collapse, but numbers are now growing again, though still lower than before in the North Caucasus. Numbers are rising quickly in Azerbaijan, but slowly in Armenia. There is therefore a big difference between the Armenian and Nakhchyvan slopes of Zangezur Range. Overgrazing in subalpine and alpine pastures has increased by nearly three times (Krever *et al.* 2001). This has clear negative implications for wild mountain ungulates, chukar and Caucasian black grouse. According to Heptner & Sludskij (1972), leopards rarely prey on livestock in places where wild ungulates are abundant, but elsewhere attacks are frequently reported. No systematic survey work is available that allows an assessment of the importance of depredation or the significance of domestic prey for the survival of the leopard.

Discussion

From the foregoing it can be seen that good populations of ungulates survive in some protected areas such as Kavkasky Reserve (RU), Kazbegi Reserve (GE) and Khosrov Reserve (AM), and elsewhere, but all authorities agree that numbers and range of most species have declined over the last 15 years or longer and are becoming fragmented. However, the extent and trajectory of these declines are usually not known in detail. Baseline information is often 20 years old or more, and some figures are at best 'guesstimates' pieced together from fragmentary evidence or brief surveys in limited areas. Accurate population data are lacking for many areas, as are the details of current trends – for example whether the steep declines that began in 1992 have slowed or stabilised. Given the patchy nature of the available information, it is difficult to infer overall trends across the ecoregion.

From the persistence of small nuclei of leopards in a few places in the Caucasus ecoregion one can conclude that the prey base, whatever the composition, is somehow adequate in those places. This is clearly true for Khosrov Reserve, where the population of bezoar goats is described as 'good' by Khorozyan *et al*. (2005) though not enumerated. The leopard living in Vashlovani Reserve (GE) since 2003 is believed by reserve staff to subsist on wild boar, hares and livestock (pers. comm. 2006). However, the extent to which fragmented and depleted prey populations at an ecoregion-wide scale can support viable leopard populations, and over what time scale, is a very important and so far unanswered question. Khorozyan & Malkhasyan (2002) noted that small rodents and hares appeared to be taken by leopards, but only when moving from one rocky habitat patch to another through sparse forest or plateau grasslands. This is an example of the well-known versatility of this species and facilitates dispersal from core populations in Iran, or movement of animals between existing sub-populations. Whether such small prey items could constitute a significant proportion of the diet on a longer-term basis has also not been established; it is generally stated or assumed that medium and large ungulates are necessary. The potential prey spectrum for the

leopard does vary across the ecoregion and further research using scat analysis to clarify dietary preferences in different localities is needed. Mountain ungulates are notoriously difficult to census and the remoteness and inaccessibility of many parts of the Caucasus ecoregion compound the problems in obtaining accurate population estimates. Nevertheless, all efforts should be made to conduct thorough surveys using rigorous methodologies and robust statistical extrapolations and then to instigate monitoring programmes to track population trends in order to provide a sound basis for future conservation planning.

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