CURRENT STATUS AND CONSERVATION OF WILD GOATS IN TUSHETI – THE LAST VIABLE POPULATION IN GEORGIA

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ABSTRACT

We studied wild goats *Capra aegagrus aegagrus* during three years (2009-2011) in Tusheti – north-eastern Georgia. We assessed the status of the population in the study area and identified the most important threats to the population. We used direct observations to assess the number and group composition of wild goats in Tusheti. We also used camera traps to define the species range and collect data on their daily activity during the summer months. We estimate the total Tusheti wild goat population to be about 180 individuals. Our results indicate a positive population trend. Most of the population appears to live in the forests along the main gorges in Tusheti. Unlike large males, females were never observed above the tree line. Older mature males use both the forest and alpine and sub-nival zones where they share habitat with another mountain ungulate, the east Caucasian tur *Capra cylindricornis*. During the summer months most wild goats appear to be active during specific periods of the day: from 05.00 hrs to 12.00 and from 15.00 hrs. to 23.00 hrs. The largest group observed in Tusheti had 11 individuals and the average group size was 4.6 individuals. Poaching remains the main threat to the wild goats in Georgia. The establishment of protected areas in Tusheti has played a positive role. However, the current population numbers are probably well below the carrying capacity of the remaining suitable habitat in Tusheti.

KEYWORDS

Conservation, Georgia, group composition, population number, status, the Caucasus, Tusheti, wild goat.

INTRODUCTION

The wild goat (*Capra aegagrus*) is found in many countries and regions such as Turkey, the Caucasus (Armenia, Azerbaijan, north-eastern Georgia, and southern Russia), Iran, Iraq, Turkmenistan, southern Pakistan and central Afghanistan (Weinberg et al., 2011). Wild goat numbers are apparently declining in many parts of its range due to poaching and habitat loss, and the world status of the species is Vulnerable (Weinberg et al., 2011). This is true for the Caucasus, where wild goat numbers are much reduced (Mallon et al., 2007).

There are several isolated wild goat (*Capra aegagrus aegagrus*) populations in the Caucasus. The range of the Greater Caucasus population stretches from the Argun River basin in Chechnya and Ingushetia to the Djurmut River in Dagestan (Mallon et al., 2007; Weinberg et al., 2011). Part of this population lives in Georgia, namely in Tusheti and Khevsureti

(Arabuli, 1985; NACRES, 1996; Mallon et al., 2007; Akhmedov et al., 2009; Gavashelishvili, 2009). This population is entirely confined to the northern slopes of the Greater Caucasus mountain range. In Azerbaijan, the main population is found in Nakhchivan's Zangezur ridge (Talibov et al., 2009). A smaller population also exists on Kyapa Mountain close to the Murovdagh range (Talibov et al., 2009). According to some reports, an isolated wild goat population still remains on the southern slopes of the Greater Caucasus - at the sources of the Gerdymanchai river, Azerbaijan (Weinberg et al., 2011). However, some authors believe that this population is now extinct (Talibov et al., 2009). In Armenia, wild goats are found in areas south and east of lake Sevan (Mallon et al., 2007; Khorozyan et al., 2009; Weinberg et al., 2011). The wild goat range in Armenia has not changed much compared to its historical distribution (Khorozyan et al. 2009).

In Georgia, the historical range of the wild goat covered not only the Tusheti and Khevsureti mountains on the northern slopes of the Greater Caucasus but also parts of the Lesser Caucasus (Fig. 1). On the Lesser Caucasus, wild goats were found in Adjara Mountains as well as on the Meskheti ridge up to the town Borjomi (Radde, 1899; Dinnik, 1914; Pfitzenmaier in Geptner, 1961; Vereshchagin, 1959). The species disappeared from the Borjomi area at the beginning of 20th century (Geptner, 1961). According to Janashvili (1977), however, small groups still remained there until 1970s. In early 1980s, 65 individuals were counted in the eastern part of Adjara mountains – Arsiani ridge (Arabuli, 1985). This was the last account of the species from the Lesser Caucasus. In 2002 and 2006-2007, no sign of wild goat presence was detected during brief surveys conducted on the Lesser Caucasus (NACRES unpublished data; Gavashelishvili, 2009).

At present wild goats only remain in Georgia in the northern part of the Greater Caucasus, in the mountains of Tusheti and northern Khevsureti (Fig. 1). The Tusheti population was estimated at about 100 individuals in 2004 (NACRES, 2004). Based on preliminary results in 2012 there were about 20 individuals in Khevsureti - in the Georgian-Russian border area (NACRES, unpublished data). Most wild goats do not seem to permanently reside in Khevsureti but often move into Chechnya, Russian Federation.

The wild goat has been a protected species in Georgia since 1982. It was included in the Georgian Red Data Book as *species with a shrinking range and decreasing numbers* (Kacharava et al., 1982). As of 2006, it is included in the Red List of Georgia as *Critically Endangered* (corresponds to IUCN category CR).

We studied wild goats in Tusheti during three consecutive years: 2009, 2010 and 2011. Our objective was to obtain data on population numbers, distribution and current threats to the population to determine its status and then to propose adequate conservation measures to save the species in Georgia.

STUDY AREA

Tusheti is a high mountain region in the northeast of Georgia and one of the only two Georgian provinces situated north of the main watershed of the Greater Caucasus (Fig. 2). Geographically Tusheti consists of northern slopes of the main range of the Greater Caucasus, southern slopes of the Pirikita Range (a northern side-range of the Greater Caucasus), and the Tusheti depression located between the two ranges. To the south and to the west Tusheti borders on the Kakheti and Khevsureti provinces of Georgia. To the north it is bordered by Chechnya and Ingushetia, and to the east by Dagestan of the Russian Federation. Three categories of protected areas cover the whole of Tusheti: state nature reserve (12,672.2 ha; IUCN category I), national park (69,515 ha; IUCN category II) and protected landscape (31,518 ha, IUCN category V).

The elevation ranges from 1,400 to 4,500 m above sea level. Surrounded by high mountains, Tusheti is characterised by relatively dry and calm weather, long, cold winters and short summers. The mean annual temperature is 3.5 °C and the mean annual precipitation is 748 mm. A substantial part of the annual precipitation (527 mm.) falls during the warm period of the year (Chikovani at al., 1990).

Caucasian pine (*Pinus kochiana*) forest is the dominant forest type and is found up to 2,000 m. Birch forest is distributed from 1700 m. to 2400 m. (NACRES, 2004). At higher altitudes there are alpine meadows (2,400 - 3,000 m.) and subnival areas (3,000-3,600 m.) (Nakhutsrishvili, 2000). Our study was mostly focused on the forested part of Tusheti. Pine forests with steep, cliffy slopes such as found in lower Pirikita Alazani and Tusheti Alazani river gorges are perfect habitat for wild goats.

Among ungulates there are also eastern tur (*Capra cylindricornis*), chamois (*Rupicapra rupicapra*), roe deer (*Capreolus capreolus*) and in small numbers red deer (*Cervus elaphus*) and wild boar (*Sus scrofa*). Large carnivores include wolf (*Canis lupus*), lynx (*Lynx lynx*) and brown bear (*Ursus arctos*). The presence of the Caucasian leopard (*Panthera pardus saxicolor*) has not been confirmed in recent years but is thought to be still present in Tusheti as well as in neighbouring Khevsureti.

Much of Tusheti (about 80%) is pastures which are extensively used by transhumant Tush sheep farmers for sheep grazing during the summer season (May to October). A total of 40 villages are also used largely for summer residence by the Tush (they all have permanent homes elsewhere in the lowlands). When the main access road closes during the winter season (November to April), Tusheti becomes almost entirely deserted except for the border police and 10-20 Tush permanently residing there. Tourism is confined to the summer months and tourist numbers have steadily increased over the past few years.

METHODS

Wild goat range

We interviewed local people (park rangers, hunters and shepherds) and used Arc GIS 9.3.1 and the Tusheti land cover map 2011 (prepared by Ltd GIS-lab for NACRES) to create a primary map of wild goat distribution in Tusheti.

We used camera traps with heat-in-motion sensor (Cuddeback, model: Capture, and Cam Trakker film cameras) and direct observations to improve the accuracy of the primary distribution map. Camera traps were placed throughout the preliminarily determined wild goat range at various elevations from 1,800 to 3,200 m. Because prior information suggested that wild goats preferred forested slopes of the study area, most of our camera traps were placed on narrow forest trails apparently actively used by large mammals. Camera traps were placed 50 cm above the ground. The study involved 10 camera traps in 2009 and 16 in 2010. Wild goat sighting and signs (tracks and droppings) were recorded and mapped using a GPS. The primary range map was then revised.

Daily activity and movement

Wild goat daily activity and movement patterns during the summer months were studied using camera trap data. All images were classified by time of recording in one hour class intervals. A picture taken at a particular time of the day was considered one sample regardless of the number of individuals on the picture. Since most of the camera traps were placed on the forest trails presumably between wild goat feeding and/or salt lick sites on the one hand and resting areas on the other, the frequency of occurrence of wild goats in the camera trap pictures was considered indicative of the activity and movement of wild goats.

Population numbers and group composition

Direct observations were conducted to estimate wild goat population numbers and to study their group composition. Standardized observations were conducted from observation points located 3-4 km apart along one side of the sampled section of a gorge. All observations within a sampled section were completed in 2-3 days to minimize the chance of counting the same individuals more than once. From each of the observation points, wild goats were counted on the opposite slopes of the gorge. Observations were conducted twice a day, in the morning (during 6:00-9:00 hrs.) and in the evening (during 17:00-20:30 hrs) during which times wild goats came out into forest openings for feeding. The visibility was affected by weather conditions. Thus, the counts were carried out in almost the same weather conditions allowing a clear view of the opposite slopes. We assumed that during a 2-3 day observation session we were able to record practically all individuals present within our view of the opposite slope. The rivers were rather high during the summer months. So we assumed that each side of the river was used by different wild goat groups. Therefore, to calculate the density for a sampled section, we used only the total area of the slopes of the gorge on which individuals was counted (i.e. slopes opposite to the observation points). An average density was then calculated and extrapolated over the verified wild goat range.

We used 10x-12x binoculars and 60x telescopes in wild goat observation sessions. At least two observers participated in each session recording and verifying with each other the total number of individuals, group size, sex and approximate age of each individual. A wild goat was regarded as the member of a particular group if it was no further than 50 m. from the group and was moving roughly in the same direction (Gundogdu & Ogurlu, 2009). Due to the relatively long observation distance (up to 1 km) sex determination of young individuals (≤1 year) was not possible. The highest recorded number of wild goats (>1 year old) from each observation point was used for population assessment.

RESULTS

We collected field data in summer and early autumn of three consecutive years: 2009, 2010 and 2011. The 2009 survey data allowed us to outline a draft (primary) wild goat range map in Tusheti, which was revised and finalised in subsequent years (Fig. 2). The total area of the wild goat range in Tusheti was calculated as 121 km^2. Much of the range was found to be located in the north-eastern parts of Tusheti and to have two types of habitat: forest and non-forest i.e. alpine and subnival areas. The total area of the forested part of the range was 62.9 km^2 and the non-forest part was 58.1 km^2. Females with young as well as young males were mostly detected in the forested part. Females with young were almost never observed outside the forest. They only moved within a vertical range of 1,400-2,400 m.

During the summer months we observed solitary adult males as well as all-male groups in non-forest areas (alpine and subnival zones) in the vertical range of 2,500 to 3,200 m. No adult males were sighted in the forest openings. However, the camera traps did detect solitary males in the subalpine forest at 2,200 m.

Direct observations were conducted in July of 2010 and 2011. We were able to distinguish three main types of wild goat groups in Tusheti similar to those described in Dagestan by Weinberg (1999): (1) females with yearlings and young individuals (<2 year old); (2) young mature males (2-4 years old) and (3) breeding males (>4). These were most frequently observed group types. But we occasionally also observed mixed groups such as: (i) young mature males and females and (ii) young mature males and adult breeding males. Since wild goat group composition is believed to change very quickly (Edge and Olson-Edge, 1990), we only considered the three most frequently encountered group types mentioned above.

The results of wild goat group composition survey are summarized in Table 1.

Over the 20-day intensive wild goat counts conducted in July 2010 from 4 observation points, we counted a total of 20 adult individuals in 4 separate groups. Three wild goat groups, with 14 adult individuals in total, lived in a forested area. The sampled forest area was located on the western slopes of the Pirikita Alazani river gorge and its northern tributary, the Chigho river gorge. The sampled area had distinct boundaries such as alpine meadows, a fast flowing

river and an area with a road and intense human presence. The total size of the sampled area was 5.77 km^2. Hence, the density in the sampled section of the forested habitat was 2.42 individuals per sq. km. Extrapolating this density over the rest of the forested part of the wild goat range (62.9 km^2) we estimate that *c.* 150 individuals may live in that part of the range.

The only wild goat group which we recorded in 2010 in the non-forest habitats (alpine and sub-nival zones), namely in the upper parts of the Chigo gorge, consisted of 6 mature males. Our camera traps also captured possibly the same group of mature males in alpine and sub-nival areas of that gorge in 2009. Since no females were observed or otherwise recorded above the tree line, we assume that during the summer some mature males live in alpine and sub-nival zones sharing habitat with the east Caucasian turs (*Capra cylindricornis*). It cannot be ruled out that those groups use forested areas too. However, based on our data we believe that some mature males remain in high altitudes, above tree line during the summer months and that such individuals should be calculated separately and included in overall population estimate.

The total size of the alpine and sub-nival areas of the Chigho gorge is 12.1 km^2. Thus, the density for this sampled section was 0.49 males per 1 km^2. The non-forest part of the wild goat range is neraly homogeneous. Therefore the calculated density was assumed to be a representative of the actual wild goat density in the non-forest habitats. Consequently a total of *c.* 30 male individuals may live in the non-forest part of the range. Adding the numbers for the two parts of the range, the total Tusheti wild goat population can be estimated at 180 individuals.

During July and August of 2009-2010, the camera traps operated for a total of 799 trap/days and took 186 wild goat images. Based on the time of recording, wild goats showed two distinct periods of the day with increased activity (moving to or from feeding/salt lick sites): in the morning from 05.00 hrs to 12.00 hrs with a peak activity during 6:00 – 7.00 hrs. and then from 15.00 hrs. to 23.00 hrs with peak activity during 16:00-17:00 hrs. (Fig. 1). No wild goat movement was detected in the period from 12.00 hrs. to 15.00 hrs and from 23.00 hrs. to 05.00 hrs with the exception of extremely low activity during 02.00-03.00 hrs. Both of the "active" periods began rather abruptly (especially the morning period) and died out gradually within 7-8 hours.

DISCUSSION

Current distribution and connectivity to neighbouring populations

Our assessment of the current wild goat range in Tusheti is entirely based on the data we collected during summer and early autumn. Hence the distribution described above only refers to the situation in the "summer season" while no information is available for the "winter season" (from late October through April), during which time Tusheti becomes

inaccessible and almost completely free of human presence. During the winter season, wild goats may expand their range, as much as physical conditions permit, to occupy more of the available suitable habitats. The dramatic increase in human presence in the "summer season" (the Tush return to their summer villages, sheep farms occupy much of the meadows, tourists are all over Tusheti and certain levels of poaching are present) is likely to significantly limit the portion of the habitat used by the wild goats during that period.

No scientific information is available about the past distribution of wild goats in Tusheti. According to a local hunter (Temur Akimidze, personal communication) until 30 years ago wild goats were also found in western parts of Tusheti - in upper parts of the Pirikita Alazani river gorge to mount Makratela (northwest of Tusheti) as well as in upper parts of the Tusheti Alazani river gorge (toward the southwest). Local hunters believe that wild goats have always been fewer in those areas as compared to the eastern parts of Tusheti i.e. closer to Dagestan.

There have been no major changes in the human presence patterns in Tusheti over the last decades. With declining sheep numbers and increasing transportation costs it may even have declined, especially since the break-up of the Soviet Union in the beginning of 1990s. But there were periods of especially high poaching during 1990's and it appears that some level of illegal hunting still continues. Therefore illegal hunting as a direct impact and as a factor causing range fragmentation may explain the shrinking of the wild goat range in Tusheti over the last 30 years.

The wild goat population of Tusheti has survived only in eastern parts of its historical range apparently thanks to steep, rocky and forested terrain and perhaps more importantly thanks to its connection to the Dagestan population. In fact, the Tusheti population may be considered as part of the larger (and apparently healthier) Dagestan population (Weinberg, 1999; Mallon et al., 2007; Weinberg et al., 2011). It is well connected to the Dagestan population through the Andis Koysu basin (this is the name of the Tusheti Alazani river across the Dagestani border) through uninterrupted pine forest habitats (Fig. 3). But the Tusheti population may also be connected to the Chechnya population to the north across high altitude alpine and subnival areas. This may be primarily if not solely by means of mature males, which would have no difficulty moving to and from the Charo Argun basin (Khulandoy valley) in Chechnya. This movement of mature males may become more intensive during the breeding period. While the connection to the Chechnya population seems fairly feasible, the role of the Dagestan population in the maintenance of the Tusheti wild goat population is probably more critical.

Group size and composition

According to our data, the average group size (GS) in Tusheti is 4.6 individuals (N=19; GS_{min}=2; GS_{max}=11). A significantly larger average group size has been reported from neighbouring Dagestan where the group size was found to be within the range of 7 to 25 (Akhmedov et al., 2009).

It has been shown that the average group size in wild goats tends to be larger when density is high (Edge & Olson-Edge, 1990). However, some researchers also suggest that wild goat group size is related to current hunting pressures. Small group size may be an advantage against hunting as small groups are more difficult to spot (Bakhtiev, 1989; Weinberg, 1999). In our study area, it is difficult to assess the relative importance of density in determining the group size independently from that of hunting pressure, since the reduced density appears to be a result of continuing poaching.

In our data the female to kid ratio was 1:0.6. Almost the same ratio was recorded in Dagestan: 0.7 kid per female in the Andis Koysu population in May 1995 (Weinberg, 1999). However, in 1990, a ratio twice high (1:1.5) was recorded in the same population close to the Georgian border (Weinberg, 1999). This is probably the highest ratio ever recorded in the Caucasus. It may be indicative of the high recovery potential of the Andis Koysu population, and hence of the Tusheti wild goat population.

The female to kid ratio may be influenced by weather (Ekvtimishvili, 1954; Edge and Olson-Edge, 1990). However, high hunting pressure has also been proposed to account for a low female-to-kid ratio. The ratio 1:0.4 was recorded in Kachkar Mountains, in north-eastern Turkey (Diker et al., 2009), which is significantly lower than that found in western Turkey (1:0.9; Gundogdu & Ogurlu, 2009). This has been explained by the fact that within the eastern Turkey population hunting eliminated large breeding males giving way to younger males, which were less experienced or less preferred by the females (Diker et al., 2009). Facilitation of the involvement of young males in breeding due to selective hunting of large males has also been described in Chechnya (Bakhtiev, 1989). The Georgian (Tusheti) population has long been under illegal hunting pressure as well and large males are the primary targets. However the relatively high female-to-kid ratio in this population (1:0.6) may indicate that illegal hunting is currently not as devastating as in north-eastern Turkey.

Daily activity

Our cameras recorded wild goats as they moved between their resting areas and grazing and natural salt lick sites. During the summer months in Tusheti, most wild goats are apparently active (actively move, feed, lick on natural saltlicks) during specific periods of the day: from 05.00 hrs to 12.00 and then from 15.00 hrs. to 23.00 hrs. During the hottest part of the day (from 12.00 hrs to 15.00 hrs) and also during the night (from 00.00 hrs. to 05.00) they seem to mostly remain in their resting areas in the forest. Almost the same activity pattern has been reported by Dal (1951) for the Urts Ridge, Armenia.

Hunting can have a huge impact on wild goat activity (Gasparian, 1974; Arabuli, 1985). Gasparian (1964, 1974) suggests that due to high disturbance, large breeding males tend to feed during the night. While our cameras in Tusheti recorded large breeding males in the forested habitat both during the day and during the night, we never actually observed them feeding at large forest openings, at which females and young males were regularly seen. It appears that large males living in the forest avoid open areas during the day and only leave

the forest at night. More studies are needed to understand the daily movement patterns of large mature males during non-breeding times.

Population numbers

Arabuli's (1991) estimate of the Tusheti wild goat population by the end of 1980s was 200 individuals. By 2004 the population declined to only 100 individuals (NACRES, 2004). Political instability, economic crisis and little control of poaching in 1990-1997 had a devastating effect on all biodiversity and especially on large mammals throughout Georgia (Badridze et al., 2000). In subsequent years, the overall situation was more or less normalised, and in 2003 whole of Tusheti became a protected area. All of this has had a positive effect. However, even if reduced, illegal shooting has never completely stopped in Tusheti. Nevertheless our newest result - 180 individuals probably indicates a growing trend in the Tusheti wild goat population.

Implications for wild goat conservation in Georgia

Uncontrolled hunting has been the main reason for wild goat population decline in Georgia as well as in all of the Caucasus (Dinnik, 1914; Dal, 1951; Vereshchagin, 1959; Gasparian, 1974; Kacharava at al., 1982; Bakhtiev, 1989; Weinberg, 1999; Arabuli 2000, 1985; Akhmedov et al., 2009; Diker et al., 2009; Gundogdu & Ogurlu, 2009). In recent history, the first major decline of wild goats and other mountain ungulates coincided with long-range shot guns becoming widely available to the local hunters in the 1950s (Vereshchagin, 1959; Arabuli, 2000). Illegal hunting continued in Georgia even after the wild goat officially became a protected species and all of its Tusheti range was included in a protected area.

Some researchers argue that habitat destruction and farming development are key reasons for the decrease of wild goat numbers in the Caucasus (Dal, 1951; Borodin et al, 1984; Bakhtiev, 1989; Kokhodze, 1991). Habitat destruction is unlikely to be an important factor for Georgia, since well-preserved wild goat habitats are still available not only in Tusheti but also in neighbouring Khevsureti and other parts of the historical range of wild goat, and currently only a fraction of the available habitats are occupied by wild goats. While logging, exclusively for local consumption, could have been a serous disturbance, it has never been too extensive in Tusheti, especially in steep rocky areas. Sheep farming on the other hand is extensive in Tusheti. Competition for pastures as well as other direct forms of interaction may have been important. Indeed, there have been reports of sheepdogs chasing/hunting wild goats (Dal, 1951; Gasparian, 1974; Borodin et al, 1984; Bakhtiev, 1989; Kokhodze 1991). We neither observed nor heard of sheepdogs chasing the wild goats in our study area. This may be explained by the low density of wild goats and the that fact the largest proportion of the population (more than 80%) is now confined to the forested part of the range during the summer months when sheep are present in Tusheti. Therefore any significant levels of direct interactions with sheep (and therefore sheepdogs) or competition for pastures is highly unlikely.

The Tusheti wild goat population's connection to its larger counterpart in Dagestan likely played a key role in its survival during the period in the early 1990s when uncontrolled hunting levels were extremely high. In contrast, the Khevsureti population, which was largely unsupported by the close but dramatically declining Chechnya population, was exterminated by hunters in the same p[period. At present, despite some signs of wild goats coming from across the border, the future of wild goats in Khevsureti still seems extremely uncertain as poaching remains high in that region.

While better law enforcement and establishment of new protected areas in Khevsureti is likely to facilitate the recovery of the local wild goat population, presently only Tusheti has a promising wild goat population. In fact, the Tusheti wild goat population is the only more or less viable wild goat population in Georgia with both a vital connection to the core Dagestan population and a positive growth trend over the last few years.

Nevertheless, poaching is apparently still commonplace in Tusheti. More effective hunting control is needed to maintain the current positive trend of the population. The Tusheti population's growth potential is likely to be high. According to Weinberg (1999) the wild goat density in the forest habitat of Dagestan in the past was 13 individuals per sq. km - 5 times more than we estimate for Tusheti. Since much of the pine forest in Tusheti can be still considered suitable wild goat habitat, we speculate that these forests could support as many as 900 individuals. While ensuring the growth of the Tusheti population is probably the highest priority, the recovery of the Khevsureti population is also very important for the long term future of wild goats in Georgia.

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LITERATURE CITED

Akhmedov, E.G., Yarovenko, Y.A., Nasrullaev, N.I., Babaev, E.A. & Akhmedov S.G. (2009) Conservation of the bezoar goat in the eastern Caucasus. Book - Status and Protection of Globally Threatened Species in the Caucasus. Tbilisi: CEPF, WWF. Contour Ltd., pp. 26-32.

Arabuli, A. (1985) Bezoar goat. In book - Humans why do you persecute me?! "Sabchota Sakartvelo" Publisher, pp 77-88. Tbilisi, Georgia. [in Georgian]

Arabuli, A. (1991) Nature should be cared. Politics journal, issue 9-10, pp 49-52, Tbilisi Georgia. [in Georgian]

Arabuli, A. (2000) Bezoar goat. In book - Some epizodes from ungulate's lifes. "Pirveli stamba" publisher, pp 54-57, Tbilisi, Georgia.[in Georgian]

Badridze, I.K., Gurielidze, Z.V., Butkhusi L.T, Todua, G.G., Lortkipanidze B.L., Khutsishvili I.G. & Darchiashvili G.G. (2000) The Carnivores, ungulates and marine mammals of Georgia: current Trends and their conservation status. In Proceedings of the Institute of Zoology. Vol. XX. Publisher "Metsniereba", Tbilisi, Georgia. pp 260-264 [in Russian, summary in English]

Batkhiev, A. M. (1989) The bezoar goat in mountain of Chechen-Ingushetia (distribution analyses). *Nature and Economy of Chechen-Ingush ASSR*, pp. 103-109. Chechen-Ingush State Publishers, Grozny, Russia. [in Russian]

Borodin, A. M. (ed.). (1984) *USSR Red Data Book*. Lesnaya Promyshlennost, Moscow, Russia. pp 76-77. [in Russian]

Chikovani, T.G., Vronskiï, N.V., Gigauri, G.N. & Ichuaidze, G. K. (1990) Akhmeti reserve. In the Caucasian reserves. pp 206-210, Misl Publisher, Moscow, Russia. [in Russian]

Dal, S.K. (1951) Data on biology, distribution, abundance and quantity ratios of bezoar goat herds on Urts ridge. Izvestiya AN ArmSSR, biologicheskie I selskokhoziaistvennye nauki 4(1), pp 33-39. [in Russian]

Diker, H., Diker, E., Ozalp, M., Avcioglu, B & Kalem, S. (2009) The status of bezoar goat (*Capra aegagrus*) in the Kachkar Mountains, Turkey. Book - Status and Protection of Globally Threatened Species in the Caucasus. Tbilisi: CEPF, WWF. Contour Ltd., pp. 32-37.

Dinnik, N. I. (1914) Animals of the Caucasus, cetacea, ungulates and predators. Part I. Tipografiya K. P. Kozlovskogo, pp. 162-168, Tiflis [Tbilisi] Georgia. [in Russian]

Edge W. D. & Olson-Edge S. L. (1990) Population characteristics and group composition of Capra aegagrus in Kirthar national park, Pakistan. Journal of Mammalogy 71: 156-160.

Ekvtimishvili, Z. (1954) Materials for study of wild goat (Capra aegagrus Erxl.) reproduction. In Proceedings of the Institute of Zoology of Georgian SSR. Vol. XIII. Tbilisi, Georgia. pp 93-97 [in Georgian, summary in Russian]

Gasparian, K. M. (1964) Diet of bezoar goat CAPRA AEGAGRUS Erxl. on the Urts ridge. Academy of Science of Armenian SSR. Zoological Papers. Volume XVI I. #2, 85-100. [in Russian]

Gasparian, K. M. (1974) Bezoar goat Ecology. Academy of Science of Armenian SSR. Institue of Zoology. Zoological Papers. Volume XVI. 78-106. [in Russian]

Gavashelishvili, A. (2009) GIS-based habitat modeling of mountain ungulates in the Caucasus hotspots. Book - Status and Protection of Globally Threatened Species in the Caucasus. Tbilisi: CEPF, WWF. Contour Ltd., pp. 74-83.

Geptner, V.G., Nasimovich, A.A. & Bannikov A.G. (1961) Beard or bezoar goat CAPRA (CAPRA) AEGAGRUS Erxleben, 1777. Book – Mammals of Soviet Union. Volume III, (Rv. V.G. Geptner and N. P. Naumov) Visshaya Shkola publisher, pp 523-534, Moscow, Russia [in Russian]

Gundogdu, E. & Ogurlu, I. (2009) The distribution of wild goat *Capra aegagrus* Erxleben 1877 and population characteristics in Isparta, Turkey. Journal of Animal and Veterinary Advances, Volume 8, issue 11, 2318-2324.

Janashvili, A. (1963) Animals of Georgia. Volume III. Publisher Izdatelstvo Akademiï Nauk Gruzinskoï SSR, pp 172-174. Tbilisi. Georgia. [in Georgian]

Janashvili, A. (1977) Bezoar goat. Book – Ungulates of Georgia, Sabchota sakartvelo publisher, pp 26-31, Tbilisi, Georgia. [in Georgian]

Kacharava, V., Ketskhoveli, N., Maruashvili, L. & Kurashvili, B. (1982) Red data book of Georgian SSR. Rare and endangerred species of animals and plants. Published by "Sapchota sakartvelo" pp 13-14. Tbilisi, Georgia. [in Georgian]

Khorozyan, I.G., Weinberg, P.I. & Malkhasyan A.G. (2009) Conservation strategy for Armenian mouflon (*Ovis [orientalis] gmelini Blyth*) and the bezoar goat (*Capra aegagrus* Erxleben) in Armenia. Book - Status and Protection of Globally Threatened Species in the Caucasus. pp. 32-37, Tbilisi: CEPF, WWF. Contour Ltd.

Kokhodze, T. (1991) Bezoar goat (*Capra aegagrus* L.). Book – Influence of human activity on distribution of main game species of Georgia, pp 102-104, Tbilisi, Georgia. [in Russian]

Kuliev, S.M. (2000) Artiodactila. In Aniamals of Azerbaijan. Volume III, Vertebrate. pp (eds S.M. Kuliev & I.K. Rakhmatuliana). 607-610, Elm Publisher, Baku, Azerbaijan. [in Russian]

Mallon, D., Weinberg, P. & Kopaliani N. (2007) Status of the pray species of the leopard in the Caucasus. Cat News, special issu #2, 22-28.

NACRES (1996) Large Mammals. Georgian Biodiversity Country Study Report. United Nations Environmental Programme, Ministry of Environment of Georgia and Noah's Ark Centre for the Recovery of Endangered Species (NACRES), pp. 83-92., Tbilisi, Georgia. [in Georgian and English]

NACRES (2004) Georgia protected area development project, Component 2 – Final report, Tusheti. NACRES, Tbilisi [in Georgian and English]

Nakhutsrishvili, G. (2000) Georgia's Basic Biomes. Biological and Landscape Diversity – Proceedings of the First National Conference (Eds Broutchashvili, N., Kushlin, A. & Zazanashvili N.), Tbilisi, Georgia pp 43-68 [in Georgian and English]

Nasrulaev, I.I. (2007) Breeding of bezoar goat in Dagestan. Fauna of Russia and adjacent territories. VII Teriological society workshop. Page 324. Pablisher Tovarishchestvo hauchnykh izdaniï. Moscow. [in Russian]

Radde, G.I. (1899) Museum Caucasicum. Volume 1. Tipografiya Kantselyariı̈ Glavnonachal'stvuyushchago grazhdanskoyu chastiyu na Kavkaze, Tbilisi, Georgia. Page 75 (in Russian and in German.)

Schaller, G.B. & Laurie, A. (1973) Courtship behavior of the wild goat. Zeitschrift für Säugetierkunde 39, 115-127.

Vereshchagin, N. K. (1959) Mlekopitayushchie Kavkaza [Mammals of the Caucasus]. Akademii Nauk USSR, pp 370-37, Moscow – Leningrad, Russia. 3 (in Russian.)

Weinberg, P., Jdeidi, T., Masseti, M., Nader, I., de Smet, K. & Cuzin, F. (2008) *Capra aegagrus*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 26 April 2012.

Weinberg, P.I. (1999) Population status and some biology of bezoar goat (*Capra aegagrus* Erxleben) in Dagestan. Publisher Obshestva ispytateleï prirody, otdel biologiï, Volume 104, pp 12-21, Moscow, Russia (in Russian).

Zakariev A. Y. (1982) Bezoar goat ecology. In Mammals of USSR. pp 202-203. Moscow. [in Russian].

BIOGRAPHICAL SKETCHES

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Fig. 1. Historical range of wild goats (*Capra aegagrus*) in Georgia.

Fig. 2 Wild goat population range in Georgia and adjacent territories. Wild goat ranges in Dagestan and in Chechnya are based on Weinberg (1999) and Akhmedov et al. (2009), and Bakhtiev's (1999) respectively. The insert indicates the approximate location of the main map in north-east Georgia

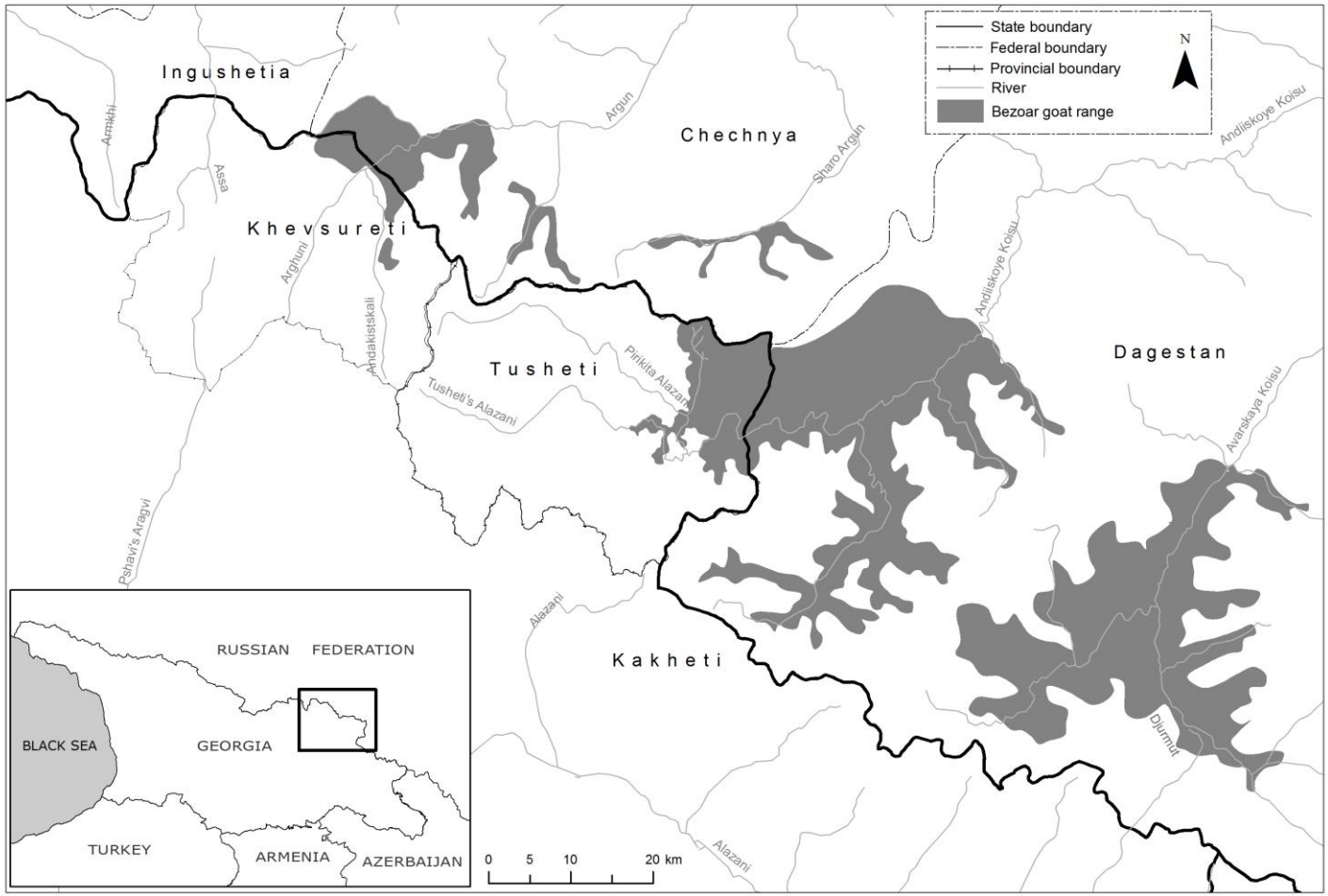

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Fig. 4. Daily activity of wild goats in Tusheti based on camera trap data collected in July-August of 2009 and 2010

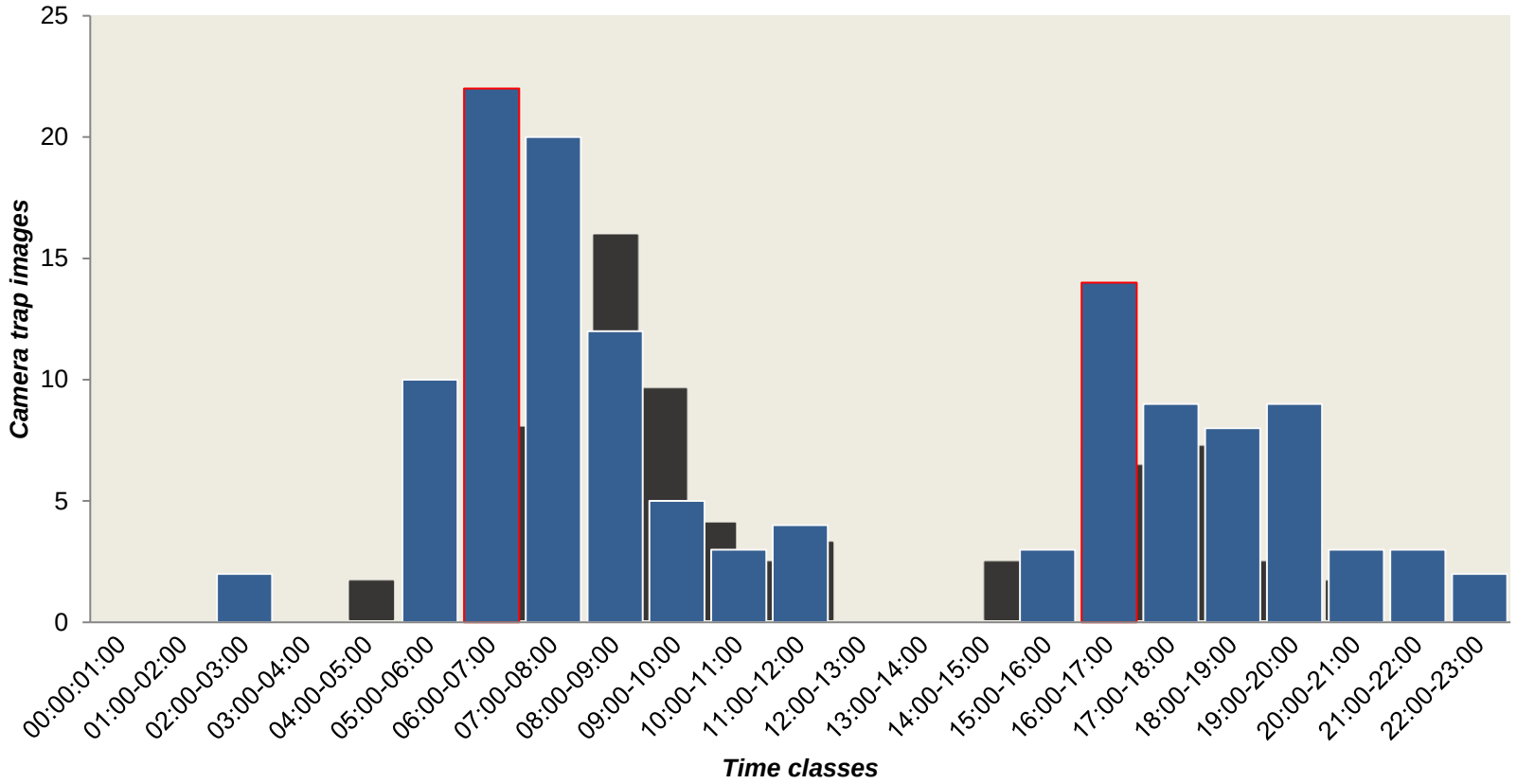

TABLE 1 Wild goat group composition based on the observation data in July 2010 and July 2011, Tusheti.

#	Group category	Number of adult individuals	Number of kids	Average group size (all categories)	Average male group size	Average female group size	Female – kid proportion
1	Females	2	0	4.6	5.2	4.1	1 : 0.6
2	Female with kids	5	3				
3	Female with kids	5	2				
4	Females	2	0				
5	Females	2	0				
6	Females with kids	4	7				
7	Females with kids	7	6				
8	Adult breeding males	6	0				
9	Adult breeding males and young mature males	11	0				
10	Young mature males	2	0				
11	Adult breeding males	4	0				
12	Female with kid and young mature males	2	1				
13	Females and young mature males	6	0				
14	Females with kids	4	3				
15	Females with kids	5	2				
16	Young mature males	3	0				
17	Females with kids and young mature males	9	3				
18	Females with kids	3	3				
19	Females with kids	5	2				