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The Persian Leopard





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Cover Photo: Persian Leopard in Kazakhstan © USNR/CADI/ACBK, camera trap picture taken 1 January 2020, photo was provided by Tatjana Rosen

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Status of Persian leopards in northern Iran and Central Asia

The Persian leopard *Panthera pardus tulliana* is an endangered large felid living in mountainous landscapes of the Caucasus, Southwest Asia and parts of Central Asia. In this paper, we review available literature to update our information on the status, population, ecology, threats, and management recommendations in regard to this big cat in the region. Most of the Alborz and Kopetdag Ecoregions harbour the largest population of Persian leopard with some protected areas having the highest densities of these carnivores. A total of 348 to 440 leopards are guessed to exist in the region, making it one of the largest continuous leopard hotspots across Asia. Almost 80% of the population exists in Iran, followed by Turkmenistan which holds the second largest Persian leopard population, while the leopard population in Kazakhstan mainly depends on transboundary transient individuals from Turkmenistan. Habitat types vary from Irano-Turanian landscapes to highland scrublands and Hyrcanian temperate forests, with urial *Ovis vignei*, bezoar goat *Capra aegagrus* and wild pig *Sus scrofa* being the main prey of leopard. Resident males occupy a mean home range of 103.4 ± SE 51.8 km² which is larger than the ones observed in other studies of male Asian leopards. Persian leopards occur continuously across the Alborz and Kopetdag mountains ranges, and face multiple anthropogenic threats such as: (i) inadequate livestock grazing or husbandry practices; (ii) illegal killing of leopards; (iii) and wild prey depletion. Livestock grazing is commonplace in the range countries, particularly inside protected areas. Conflict mitigation measures in Iran, and generally in the range countries, should be implemented at least in the areas with high leopard mortality provoked by livestock losses. Also, given the occasional occurrence of problem individuals responsible for a disproportionate impact on human interests, particularly in northeastern Iran, we suggest to apply selective management which would target on specific individuals and become effective for conflict mitigation.

The Persian leopard is an endangered large felid living in mountainous landscapes of the Caucasus, Southwest Asia and parts of Central Asia (Jacobson et al. 2016). In northern Iran including Alborz and Kopetdag mountain ranges, and Central Asia, this subspecies faces different situations. While high densities of leopards exist in parts of Iran (Farhadinia et al. 2019, Hamidi et al. 2014),

the leopard exist at low densities in Turkmenistan (Kaczensky et al. 2019) and the leopard population in Kazakhstan is dependent on transboundary movements (Kaczensky et al. 2019). In this paper, we review available literature to provide a background on the Persian leopard status, population, and ecology in the region. We then provide a detailed profile of key threats and conservation re-

commendations that potentially may secure the leopard viability in northern Iran and Central Asia.

Methods

To describe the occurrence and population status of the Persian leopard in northern Iran (Alborz and Kopetdag mountain ranges) and Central Asian countries (Turkmenistan and Kazakhstan), we relied on multiple data sources such as opportunistic camera-trapping records and direct sightings collected between 2000 and 2021. Records in the database were attributed to two categories of reliability, namely “confirmed” (C1) and “probable” (C2) observations. Confirmation of presence (C1) was based on available photos or movies, or leopard carcasses or other remains of the species that were verified by reliable experts whereas observations by trained persons (e.g., field biologists, skilled rangers, experienced hunters, and taxidermists) were assigned to C2. This resulted in a final dataset of 589 locations from 3 range countries (Table 1). We guesstimated country-specific leopard population sizes using ranger-based (unpublished data of the Iranian Department of Environment 2021) and expert opinion (Turkmenistan and Kazakhstan) data across the study area. We also measured the proportions of different mortality types (human-induced threats and natural mortality) of leopards from 2000 to 2021 in northern Iran (unpublished data of the Iranian Department of Environment 2021). Finally, we propose several management actions to boost the existing leopard conservation efforts.

Distribution

Persian leopards occur in 602,000 km² of mountainous landscapes of Southwest and Central Asia, as well as the Caucasus, which cover 16% of their historic range in this region (Jacobson et al. 2016; Fig. 1). Over 75% of the extant range of Persian leopards lies within Iran (Jacobson et al. 2016). Nonetheless, recent habitat modelling showed that the continuous suitable habitat for Persian leopards in Iran is extended over 316,984 km² (Ahmadi et al. 2020), suggesting that the extant distribution area of Persian leopards can be smaller across its range than expected (Ashrafzadeh et al. 2020). Importantly, a high percentage of suitable habitats is still located outside the existing network of protected areas; for example, only 24% of suitable leopard habitats are managed as protected areas on the Iranian side of the Ko-

Table 1. Number of Persian leopard records collected between 2000 and 2021 in northern Iran (Alborz and Kopetdag mountain ranges) and Central Asian countries (Turkmenistan and Kazakhstan). C1 = confirmed and C2 = probable.

Region/Country	C1	C2
northern Iran (Alborz and Kopetdag mountain ranges)	278	263
Turkmenistan	38	0
Kazakhstan	10	0
Total	326	263

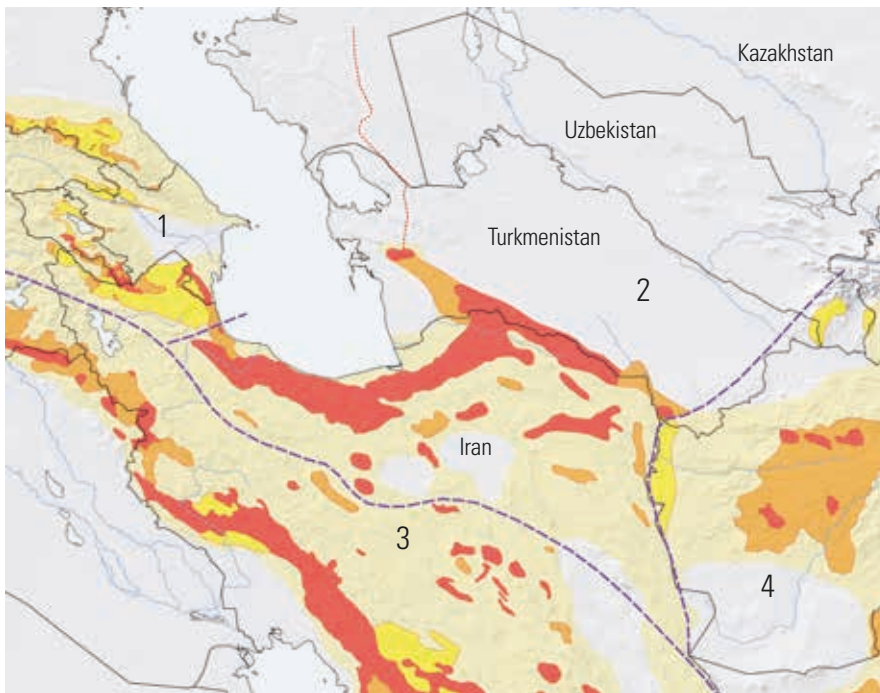


Fig. 1. Distribution of leopard in northern Iran and Central Asia (2). Red = extant, orange = possibly extant, dark yellow = possibly extinct, light yellow = extinct, violet lines = regional division. 1 = Caucasus Ecoregion, 2 = Alborz-Kopetdag, 3 = Zagros, 4 = eastern range. Map courtesy to Peter Gemgross, based on Farhadinia et al. (2022).

petdag Ecoregion (Hosseini et al. 2019). Just recently in 2022, a female leopard with her two cubs was sighted and filmed in the Ghazanghayeh No Hunting Area in north-eastern Iran, next to the Iran-Turkmenistan border (V. Kheirabadi & M. Soofi pers. comms.).

The second largest range for Persian leopard is found in Turkmenistan (Lukarevsky 2001), mostly in the borderline areas along the Kopetdag and Sunt Hasardag mountain ranges between Turkmenistan and Iran (Farhadinia et al. 2021). Leopards have also been recorded in Badkhyz State Nature Reserve on the border with Iran and Afghanistan (Kaczensky et al. 2019). A small breeding population was recently (2020) confirmed by camera-traps in the Uly Balkan range north of the Kopetdag and by local herders' sightings reported from the Kichi Balkan lying between the Uly Balkan and the Kopetdag. Furthermore, leopards have been reported along the Garabogaz-gol depression on the Turkmen side using the Ustyurt Plateau as a corridor. In 1989, leopard tracks were spotted in the Kulansai Gorge at Garabogaz-gol (Lukarevsky 2001). In 2020, a leopard was sighted near the settlement of Arsary Baba on the edge of the Garabogaz-gol basin (ca. 120 km north-east of the Uly Balkan range). Since the Ustyurt Plateau stretches far into Kazakhstan and Uzbekistan, it is most likely that leopards had been historically dispersing into Kazakhstan,

and until recently continue to do so. For example, in the autumn of 2018 a young male Persian leopard was recorded by camera-traps in Ustyurt Nature Reserve UNR of Kazakhstan for the first time (Pestov et al. 2019). The distance from UNR in Kazakhstan to Arsary Baba in Turkmenistan as the nearest confirmed leopard range is about 170 km. After multiple detections (Fig. 2) during different seasons, this leopard was found dead about 370 km north-east of UNR (Mangystau region, Kazakhstan). Prior to 2018, the leopard presence in Mangystau was recorded in 2007 and 2015 when leopards were trapped and killed by shepherds. A dead leopard was also recorded in 2000 on the banks of the Talas River near the town Toguskem, in the Mujunkum desert in eastern Kazakhstan. In addition, during interviews with members of local communities in the region we obtained anecdotal reports and images of several leopard encounters in Mangystau region in Kazakhstan over the past fifty years.

Population abundance and density

The Persian leopard population size in Iran is guesstimated to be about 550–850 individuals (Kiabi et al. 2002), making it the main stronghold for leopard populations in the region. The Alborz and Kopetdag Ecoregions harbour the largest population of Persian leopard with some protected areas having

the highest densities of these carnivores. Based on the guesstimates provided in Table 2, a total of 348 to 440 leopards are believed to exist in the region, making it one of the largest continuous leopard hotspots across Asia (Jacobson et al. 2016). Almost 80% of the region's leopards (288 to 355 individuals) exist in Iran (Table 2).

The density of leopards in northeastern Iran was reported to vary between 2.63 and 8.86 individuals/100 km² (Farhadinia et al. 2019, Hamidi et al. 2014). With 30 and 20 adult individuals detected during camera trapping surveys in Tandoureh and Golestan National Parks, respectively, these two reserves hold the largest populations of Persian leopards in west and central Asia (Table 3). Along Alborz range, opportunistic camera trapping efforts as well as DNA fingerprinting have detected small populations of leopards along Alborz mountains, northern Iran (Table 3)

In the early 2000s, it was guesstimated that approximately 80–100 Persian leopard may still be found in Turkmenistan, with the highest densities recorded in the Kopetdag range along the southern boundary of the country (Lukarevsky 2001, Red Book of Turkmenistan 2011). Opportunistic camera-trapping and observations over the past decade did not provide sufficient information to make reliable estimates of Persian leopard numbers, but these together with the information from adjacent Iran suggest that the Kopetdag and its extension into the Sunt Hasardag in the north and Badkhyz in the southeast remains the most important stronghold of the leopard in Turkmenistan. Recent records also highlight the importance of the Uly and Kichi Balkan ranges for the expansion of the leopard distribution further north to the Ustyurt Plateau (T. Rosen, pers. obs.).

The Persian leopard had never been considered an extant species in Kazakhstan, despite the existence of sightings and reports since the 1970s. The first recent occurrence of Persian leopard in Kazakhstan was documented by camera-traps in 2018, but then this individual died in 2021. The occurrence of leopard in UNR and the earlier sightings on the Ustyurt Plateau in Turkmenistan suggest a good chance for recolonization from Turkmenistan if its population increases. To facilitate dispersals of sub-adult leopards from Turkmenistan to Kazakhstan and Uzbekistan, a careful analysis of the risks associated with barriers to movements, such as the international border fences (Pestov et al.



Fig. 2. Different habitat types of leopard in northern Iran and central Asia: Top from left: the highlands of the Hyrcanian relic temperate forests and rugged mountains in Kiasar National Park, northern Iran (Photo H. Tizrouyan & K. Ateni); Ustyurt plateau, Kazakhstan (Photo USNR/ACBK/CADI); middle from left: the Hyrcanian relic temperate forests in Kiasar National Park, northern Iran (Photo H. Tizrouyan & M. Abbaszadeh) and the steppe mountains of Tandoureh National Park, Iran-Turkmenistan border (Photo Future4Leopards Foundation), bottom from left: Kopetdag mountains in Turkmenistan (Photo Team Bars Turkmenistan) and Turan Biosphere Reserve, southern Alborz (Photo Iranian Cheetah Society/DoE/Stichting SPOTS).

2019) should be done. Also, protection efforts need to be strengthened to increase the prey base and to safeguard leopards within and beyond protected areas.

Habitat and ecology

Persian leopards occur in a variety of habitat types (Fig. 2), from Irano-Turanian arid landscapes to highland scrublands and the Hyrcanian temperate forests of Iran. Leopard habitat distribution often overlaps with the ranges of main wild prey species such as urial *Ovis vignei* and bezoar goat *Capra aegagrus* (Hosseini et al. 2019). Also, leopards

in Iran can range across a wide continuum of altitudes, from the sea level in lowlands of Mazandaran Province up to nearly 4,000 m on the Alborz peaks. Vegetation of the areas where leopards were recorded in UNR (Kazakhstan), Badkhyz and Uly Balkan (Turkmenistan) is typical for cold desert ecosystems and includes the sub-shrubs (*Anabasis eriopoda*, *A. brachiata* and *Nanophyton erinaceum*); abrasive plants *Atraphaxis replicata*, dwarf shrubs *Convolvulus fruticosus*, drift plants *Limonium suffruticosum*, pockholt plant species *Zygophyllum ovigerum*, tamarisk plants *Tamarix* spp., wormwood *Artemi-*

sia spp. shrubs, and pistachio *Pistacia vera* woodlands. Vegetation of the Kopetdag range is dominated by junipers *Juniperus* spp., woodlands, bulbous bluegrass *Poa bulbosa*, and desert sedge *Cyperaceae*.

The studies of the Persian leopard diet in northern Iran are based on the analyses of faecal samples (Farhadinia et al. 2014, Ghoddousi et al. 2016, Sharbafi et al. 2016, Taghdisi et al. 2013) and the kills of radio-collared leopards (Farhadinia et al. 2018). All show a consistent dominance of wild ungulates in the diet, estimated to constitute 80–95% of the consumed biomass. The key

Table 2. Baseline information on the guesstimated population size of Persian leopards in Alborz and Kopetdag Ecoregions based on expert opinions.

Country and province	Population guesstimate	Reference
Iran, Razavi Khorasan	100	Iranian Department of Environment, unpublished report 2020
Iran, North Khorasan	35-45	Iranian Department of Environment, unpublished report 2020
Iran, South Khorasan	3-5	Iranian Department of Environment, unpublished report 2019
Iran, Semnan	40-60	Iranian Department of Environment, unpublished report 2020
Iran, Mazandaran	80-100	Iranian Department of Environment, unpublished report 2019
Iran, Alborz	20-25	Iranian Department of Environment, unpublished report 2020
Iran, Tehran	10-20	Iranian Department of Environment, unpublished report 2019
Turkmenistan	60-80	Team Bars Turkmenistan, 2021
Kazakhstan	0-5	Red Book of Endangered Species, Kazakhstan 2021
Total	348-440	

wild prey species for leopards across the Kopetdag Ecoregion (Iran, Turkmenistan and the adjacent areas of the Ustyurt Plateau in Kazakhstan) are urial, bezoar goat, wild pig *Sus scrofa* and goitered gazelle *Gazella subgutturosa* (Kaczensky et al. 2019), while red deer *Cervus elaphus* and roe deer *Capreolus capreolus* make only a contribution to the leopard diet in temperate forests of the Alborz range (Ghoddousi et al. 2016, Sharbafi et al. 2016). Despite this diversity of prey resources, livestock depredation by leopards is common across the region, targeting mainly cattle in forest areas of the Alborz range (Babgir et al. 2017, Ghoddousi et al. 2016) and smaller stock such as sheep and goats in steppe landscapes (Farhadinia et al. 2018). Dogs have also been widely taken by leopards across the region, with some individuals specialising in killing and consuming dogs (Farhadinia et al. 2018).

As Persian leopard is a wide-ranging predator, resident males occupy a mean home range of $103.4 \pm SE 51.8 \text{ km}^2$ which is larger than the ones observed in other studies of male Asian leopards (Farhadinia et al. 2018). Larger home range size of leopards is negatively correlated with landscape productivity (Snider et al. 2021). A satellite telemetry-based study also revealed that a young male leopard, possibly a dispersing individual, moved 82 km from Iran to Turkmenistan (Farhadinia et al. 2018). Compared to other sympatric carnivores in the Alborz and Kopetdag, leopards respond differently from wolves *Canis lupus* to land use patterns, with higher occupancy of human-free areas such as national parks, whereas wolves tend to occur more in communal lands (Mohammadi et al. 2021). Given the high occurrence of brown

bears *Ursus arctos* and Persian leopards along the Alborz range, future studies are encouraged to investigate possible intra-guild interactions between these two species.

Threats

Persian leopard populations face multiple anthropogenic threats that continue to contribute to population declines and range contraction across the range countries (Lukarevsky 2001, Soofi et al. 2019). These threats mainly include, but are not limited to: (i) inadequate livestock grazing or husbandry practices, (ii) illegal killing of leopards, (iii) and wild prey depletion. Below we describe these threats separately for each country.

Iran

Livestock grazing practices are commonplace in Iran, even inside protected areas (Khorozyan et al. 2020, Soofi et al. 2018). A recent study by Soofi et al. (2018) in the Hyrcanian forests of northern Iran identified that the occurrence of Persian leopard and its wild prey was very fragmented and negatively affected by livestock presence across different seasons. The second threat that impacts the persistence of leopards is wild prey poaching. Leopards need large tracts of quality prey-rich habitats to survive, so when prey abundance is low they inevitably have to move widely, clash with people, and occasionally die from poaching and collisions on roads and railways (Naderi et al. 2018). As a common consequence of prey scarcity, leopards have to hunt livestock and often being killed in retribution or to prevent further attacks on livestock (Babgir et al. 2017, Farhadinia et al. 2018, Soofi et al. 2019, Khorozyan et al. 2020). Losses from livestock de-

predation by leopards are particularly large and financially detrimental for small-scale households and near protected areas (Khorozyan et al. 2020). In response to this damage, pastoralists tend to kill leopards illegally by trapping, poisoning or shooting (Khorozyan et al. 2020).

Over the past 21 years (2000–2021; unpublished data of the Iranian Department of Environment), 158 individual leopards were reported to be killed along the Alborz range in northeastern Iran ($n = 74$ for illegal killing, 34 for unknown, 27 for vehicle collisions, and 23 for natural causes). A recent study reports that 54% of the leopard mortalities were related to livestock depredation across Iran (Soofi et al. 2022). This result suggests a dire need for the development and application of practical and effective conflict mitigation measures along with anti-poaching and prey recovery initiatives. Support to livestock protection should address the ecology of leopards (Farhadinia et al. 2018, Khorozyan et al. 2020), as well as livestock grazing patterns and landscape structure (Ghoddousi et al. 2016, Soofi et al. 2019).

Turkmenistan and Kazakhstan

In Turkmenistan and Kazakhstan leopards were reported to be trapped and killed. The possible reasons for leopard killings are preventive protection of livestock from predator attacks and retaliatory persecution in response to actual attacks and livestock losses. Furthermore, there is evidence of high poaching pressure on the leopard's wild prey, namely urial sheep, goitered gazelle and bezoar goat, which results in decreasing wild prey densities and may increase leopard depredation on livestock.

While border security zones provide some degree of protection to leopards and other wildlife, poaching of wild prey remains a significant threat especially in Badkhyz, Uly Balkan, and the Ustyurt Plateau in Turkmenistan, where some of the authors found the first-hand evidence of poaching of goitered gazelles and bezoar goats (Kaczensky et al. 2019). Another significant threat is the presence of border fences, especially those on the borders between Iran, Turkmenistan, Afghanistan, Kazakhstan, and Uzbekistan (Farhadinia et al. 2021), which can severely limit movements of leopards and its wild prey. The border fences between Kazakhstan and Turkmenistan, Iran and Turkmenistan as well as Turkmenistan and Uzbekistan consist of two parallel rows of multi-strand barbed wire fences that make crossing impossible for ungulates and extremely challenging for leopards. For example, a collared leopard dispersing from Iran could not pass the border fence along the Turkmenistan border (Farhadinia et al. 2021). The border between Turkmenistan and Iran is one row of equally impassable multi-strand barbed wire fence.

Conservation and management

Conflict mitigation measures in Iran and other range countries should be implemented at least in the areas with high leopard mortality provoked by livestock losses, for example, in parts of Mazandaran Province in northern Iran. These measures can be implemented within community-based approaches and include (1) training and support of local herders to livestock protection techniques (e.g. protective collars for cattle, predator-proof corrals); (2) compensation payment schemes; and (3) provision, handling, training and care

of livestock guarding dogs. Livestock guarding dogs have been commonly used by herders to protect their livestock from predators, but they also can provoke predator attacks, threaten other people, livestock and wildlife, and transmit diseases (Khorozyan et al. 2017). Thus, it is important to educate and raise the awareness of pastoralists in order to help them guide their livestock husbandry practices properly and in environmentally and socially friendly ways. For example, training of guarding dogs can reduce negative impacts on wildlife (Leib et al. 2021) so that they are trained only to effectively deter predators, such as leopards (Khorozyan et al. 2017, 2020). Pastoralists hold official permits with specified sizes of their pastures and grazing periods (2–3 months), but often over-use pasture lands and penetrate deep into the core zones located beyond their land allotments and, when patrolling is insufficient, often inside protected areas (Soofi et al. 2018). Such large-scale and extended grazing activities make livestock vulnerable to depredation by carnivores. Thus, the above-mentioned conflict mitigation measures are essential to promote coexistence between herders and leopards in shared landscapes. Given the occasional occurrence of problem individuals, which can be responsible for a disproportionately high impact on livestock, we also suggest to apply selective management which would target specific livestock-killing individuals and ensure the effectiveness of conflict mitigation (Swan et al. 2017). For example, translocation of live-captured individuals to low-density and remote areas should be considered the only alternative to shooting problem leopards (Farhadinia et al. 2015). Vehicle collisions also contributes

to leopards mortality in Iran, but these collisions were mainly common in the Golestan National Park in northeastern Alborz, where the Asiatic road crosses the park connecting Tehran to Mashhad (Soofi et al. 2022). Hence, it is of high priority for building wildlife overpass bridges in the park to reduce the risk of collisions. In addition, speed limit enforcement signs can also be implemented along the road to effectively reduce not only vehicle collisions with leopards but also other wildlife species which are frequently being killed on the road (Naderi et al. 2018).

In Turkmenistan, all protected areas require greater funding support. In the case of Badkhyz and Kopetdag state nature reserves, since these reserves largely fall in the border security zone, rangers and scientific staff should be given access to the exclusion zone for monitoring of leopards and other wildlife. The proposed establishment of Uly Balkan Reserve is an important step for leopard conservation, which should be followed up by designation of a wildlife corridor stretching from Uly Balkan to protected areas on the Ustyurt Plateau in Turkmenistan and in adjacent areas of Kazakhstan and Uzbekistan.

In Kazakhstan, in the wake of the rediscovery of the Persian leopard, a scientific justification led to the inclusion of the Persian leopard in the Red Data Book of Kazakhstan and the preparation of the National Action Plan. While leopard was included in the Red Data Book in 2021, integration of the Action Plan into Kazakhstan’s legislation is still pending and debatable given the death of the only known individual. UNR is largely under-funded, and its personnel’s motivation is low. In addition, most of the camera-traps placed to monitor leopards were stolen, making wildlife moni-

Table 3. Population densities of Persian leopards in Iran within the Alborz and Kopetdag Ecoregions estimated from camera-trapping. Abbreviations: NA – not available, non-SECR - spatially non-explicit, i.e., conventional, capture-recapture method, SECR - spatially explicit capture-recapture method.

Area	Province	Year	# adult animals	Density (ind./100 km ²)	Method	Reference
Tandoureh National Park	Razavi Khorasan	2016	30	5.57	Photographic secr	Farhadinia et al. (2019)
Sarigol National Park	North Khorasan	2015	10	8.86	Photographic secr	Farhadinia et al. (2019)
Salouk National Park	North Khorasan	2015	11	3.10	Photographic secr	Farhadinia et al. (2019)
Golestan National Park	Golestan Province	2011	20	2.63	Photographic non-secr	Hamidi et al. (2014)
North Alborz PA	Mazandaran Province	2018	7	NA	Opportunistic camera trapping	Salmanpour & Tizrouyan, Unpublished report (2021)
Kiasar National Park	Mazandaran Province	2018	10	NA	Opportunistic camera trapping	Salmanpour & Tizrouyan, Aradni and Ateni, Unpublished report (2021)
Parvar PA	Semnan Province	2013-2015	7	NA	DNA fingerprinting	Ardani et al. (2019)



Fig. 3. Persian leopard on a bezoar goat kill in Central Alborz Protected Area, northern Iran (camera trap set up by A. Rahbarizadeh).

tor-ing even more challenging. Large resources are required to support and motivate park rangers and other staff members, which could translate into better protection on the ground. Establishment of the proposed South Ustyurt State Nature Reserve in Kazakhstan, which covers the key habitats for urials and goitered gazelles, may provide a refuge for leopards in the future. In the broader scale, the establishment of protected areas on the Ustyurt Plateau will also require coordinated actions between the conservation authorities of Turkmenistan, Kazakhstan, and Uzbekistan to allow for wildlife movements across borders (Linnell et al. 2016, Pestov et al. 2019). Such transboundary cooperation is also essential for Turkmenistan, Iran, and Afghanistan. We conclude that Persian leopards occur continuously across the Alborz (Fig. 3) and Kopetdag mountains ranges (Fig. 4). These landscapes contain the areas with the highest densities, especially inside Iranian protected areas. However, leopards have been reported to be killed across the region by shooting, poisoning and trapping, mostly in relation to livestock depredation, which adds to natural mortality. Considering that human developments in the shared landscape are inevitable, it is of paramount importance to promote coexistence between people and leopards to ensure the survival of the leopard population. We suggest the following activities to improve and promote leopard conservation in the region: (a) to educate and train pastoralists within community-based initiatives to livestock protection techniques in order to help them apply good livestock grazing practices; (b) to focus on managing problem leopards; (c) to monitor leopards and their prey effectively; (d) establishment of

new protected areas and (e) capacity building and awareness-raising in local communities and staffs of protected areas in conflict management and conservation initiatives.

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Fig. 4. Persian leopard on a wild pig kill in Tandoureh National Park, Kopetdag mountains, Iran-Turkmenistan border (Photo H. Eslahi).