ISSN 1027-2992

Special Issue

N° 13 | Spring 2019

CAT NEWS

Pallas's cat Status Review & Conservation Strategy

SPECIES SURVIVAL COMMISSION

CAT SPECIALIST GROUP

CATnews is the newsletter of the Cat Specialist Group, a component of the Species Survival Commission SSC of the International Union for Conservation of Nature (IUCN). It is published twice a year, and is available to members and the Friends of the Cat Group.

For joining the Friends of the Cat Group please contact Christine Breitenmoser at ch.breitenmoser@kora.ch

Original contributions and short notes about wild cats are welcome
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This **Special Issue of CATnews** has been produced with support from the Taiwan Council of Agriculture's Forestry Bureau, Fondation Segré, AZA Felid TAG and Zoo Leipzig.

Design: barbara surber, werk'sdesign gmbh
Layout: Tabea Lanz and Christine Breitenmoser
Print: Stämpfli AG, Bern, Switzerland

ISSN 1027-2992 **©** IUCN SSC Cat Specialist Group

Editors: Christine & Urs Breitenmoser
Co-chairs IUCN/SSC
Cat Specialist Group
KORA, Thunstrasse 31, 3074 Muri, Switzerland
Tel ++41(31) 951 90 20
Fax ++41(31) 951 90 40
<urs.breitenmoser@vetsuisse.unibe.ch>
<ch.breitenmoser@kora.ch>

Associate Editors: Tabea Lanz

Cover Photo: Camera trap picture of manul in the Kotbas Hills, Kazakhstan, 20. July 2016 (Photo A. Barashkova, I Smelansky, Sibecocenter)

TASHI DHENDUP[1,2*], BIKRAM SHRESTHA[3,4], NEERAJ MAHAR[5], SHEKHAR KOLIPAKA[6], GANGA RAM REGMI[7] AND RODNEY JACKSON[8]

Distribution and status of the manul in the Himalayas and China

In this article, we used published and grey literature and expert observations to review the distribution and conservation status of the Near Threatened Pallas's cat or manul *Otocolobus manul* in Bhutan, China, India, and Nepal. The species appears widespread in China; however, distribution in the Himalayas is patchy and not clearly understood. Recent sightings and camera trap records from north Sikkim in India and Bhutan extend the species range to the east of the Himalayas and suggest a wider distribution than previously thought. Nevertheless, the population size and trend in the region remain unknown. The Pallas's cat is likely to be threatened by habitat degradation and fragmentation from traditional pastoralism, unregulated tourism, infrastructural developments such as roads and petrochemical industry, and also by poaching (including their prey). Climate change is also an emerging threat to the species although the potential impacts remain uncertain. Moreover, the species remains one of the lesser known wild cats, and in-place research and monitoring are highly lacking. There is a strong need for active conservation actions and dedicated studies on their presence and distribution followed by a more detailed investigation of their ecology and the impact of ongoing anthropogenic activities.

Pallas's cat is known to occur widespread in China (Nowell & Jackson 1996, Jutzeler et al. 2010). However, their distribution in the Trans-Himalayan regions of India to Nepal and Bhutan in the eastern Himalayas is fragmented and also represent the southern limit of the species range. Records in this range are mostly recent and sparse, and information on Pallas's cats is currently restricted to ad-hoc presence records (mainly from snow leopard surveys) and incidental sightings (e.g. Thinley 2013, Shrestha et al. 2014). There are many studies on the ecology of its primary prey, pika *Ochotona* spp., as well as on high altitude rangeland ecology, especially in China (e.g. Smith et al. 1986, Smith et al. 1990, Smith & Wang 1991, Smith & Foggin 1999, Lai & Smith 2003, Hogan 2010, Guo et al. 2012) but very few on Pallas's cat. It is evident that the species is rare, occurs at low density and is highly vulnerable to disturbances from rangeland habitat degradation and destruction (Ross et al. 2016). Therefore, given the dearth of information on Pallas's cat, there is a strong need to take stock of what is known about the species. This will improve our understanding of Pallas's cat status in the region and help guide conservation interventions. In this article, we review the distribution and conservation status of Pallas's cat in Bhutan, China, India and Nepal.

Methods

Information for this assessment was accrued from published and grey literature, expert observations and through a standardised questionnaire survey developed by the IUCN SSC Cat Specialist Group which was completed by Pallas's cat experts from Bhutan, India, and Nepal. We reached out to researchers in China but unfortunately could not find anyone actively involved with the species. Therefore, the status of Pallas's cat from China was solely based on literature review and information acquired from traceable sources such as the IUCN Cat Specialist Group, Pallas's Cat Working Group (http://www.wild-cat.org/manul/pallas-cat/#), iNaturalist (https://www.inaturalist.org) and other information outlets including blogs and news. Some of the records had only locality references, so we had to obtain approximate GPS coordinates from Google Earth to map the species distribution and calculating the Area of Occupancy AOO. The distribution points were also categorised as historical (< 2000) and contemporary (≥ 2000) and wherever possible into "confirmed" (C1), "probable" (C2) and "possible" (C3) records according to the SCALP criteria (Molinari-Jobin et al. 2012). Only contemporary data inclusive of C1, C2 and C3 records was used to calculate AOO (Table 1). However, due to the low number of recent records, the estimated AOO was unrealistically small. Therefore, we have also included estimates of the extant and possibly extant range of the Pallas's cat in the region from the range-wide data of the most recent IUCN Red List Assessment (Ross et al. 2016; Fig. 1) which includes expert opinions. The AOO was estimated using Geospatial Conservation Assessment Tool, also known as GeoCAT (Bachman et al. 2011), an online open-source, browser-based tool used in IUCN Red List Assessments. To calculate the AOO, we applied a 5 x 5 km^2 grid based on the average home range size of female Pallas's cats in Mongolia, which is around 25 km^2 (Ross et al. 2016).

Distribution

We gathered a total of 358 locality records in the current assessment out of which we could confirm only 35 as C1, one as C2 and two as C3. The rest were too coarse to correctly categorise and so were grouped together as records of unknown category. Most of these are historical data prior to the year 2002. Nevertheless, China is un-doubtedly the stronghold of the species in the region with 334 location points. Bhutan has the least with only three records. Unlike China where the distribution is widespread, distribution in the Himalayas is discontinuous relatively restricted to one or two locations in each country, which appear highly isolated from each other. We were also able to accrue a decent amount of historical data from China, but we could find

Table 1. Number of historical (year < 2000) and contemporary (year ≥ 2000) records of Pallas's cats, Area of Occupancy, and extant and possibly extant areas in each country in the study region.

Country	Historic records	Contemporary records	AOO (km^2)	Extant (km^2)	Possibly extant (km^2)	Total (km^2)
Bhutan	NA	3	75	7,619	0	7,619
China	255	80	1,825	932,609	991,172	1,923,781
India	2	8	200	20,861	8,053	28,914
Nepal	1	10	125	8,965	1	8,966

very few from India and Nepal and none from Bhutan (Table 1). Pallas's cat continues to be reported in the region except for Bhutan where the species has not been recorded since 2012. The AOO estimates for each country in the region were produced from 100 contemporary records (> 2000) resulting in an unrealistically small estimated AOO of 2,225 km² for the region. However, the approximate extant and possibly extant areas of the species in the countries of the region sum up to 970,054 km² and 999,226 km² respectively.

Bhutan

Pallas's cat is the least known and the rarest of the wild cat species found in Bhutan. The Mammals of Bhutan guidebook published in 2004, predicted the distribution of the species at elevations between 2,800 to 4,000 m (Wangchuk et al. 2004). However, the first photographic evidence (i.e. C1) was obtained only in 2012 during a snow leopard *Panthera uncia* survey in central Bhutan when a Pallas's cat was camera trapped at two different sites in the north-western part of Wangchuck Centennial National Park (WWF 2012). A couple of months later in the same year, a similar snow leopard survey in western Bhutan photographed a Pallas's cat in Jigme Dorji National Park at 4,122 m (Thinley 2013). However, camera trapping surveys in the following years, including a nationwide high-elevation tiger *Panthera tigris* survey in 2014 and a nationwide snow leopard survey in 2015 failed to gather any additional Pallas's cat records.

China

China has approximately 50% of the presumed global distribution range of Pallas's cat (Jutzeler et al. 2010, Ross et al. 2016). They can be found in northern, western and central China, in the Altai Mountains (Ross et al. 2016), and on the Qinghai-Tibetan Plateau (Mallon 2002). There are also reports from Gansu, Hebei and western Sichuan provinces (Mallon 2002). The species is also reported to be present in at least 25 Chinese Nature Reserves (Jutzeler et al. 2010), including Xuelingyunshan, Tuomuerfeng, Luoshan, Baijitan, Qinghaihuniaodao, Wanglang, Wolong, Zhumulangmafeng, Kalamailishan, Qitaihuangmobanhuangmo, Aerjinshan, Ganjiahu (Xinjiang), and Luobupoyeluotuo protected areas (China Species Information Service 2008). The Pallas's cat was also previously reported from the east in Jilin Province and the areas around Manchouli (Banjie 1984). The species has also been sighted in the Arjin Mountains Nature Reserve in Xinjiang (Butler et al. 1987) and Gertse County in Ngari Prefecture of the Tibetan Autonomous Region (Fox & Dorji 2007).

Published records after 2010 have come from the Tibetan Plateau north of Rouergai in Sichuan Province. Sightings were made in 2011, 2012 (Webb et al. 2014) and then in 2015 and 2016 (Webb et al. 2016). Sightings by tourists and wildlife-watching tourism operators with photographic evidence have also been reported from other parts of the country: an adult with two kittens near the Qinghai Lake in Qinghai (Townshend 2016), an adult with four kittens in the Bayan Bulag Grassland, Xinjiang (New China TV, 2018), Bortala Mongol Autonomous Prefecture of the Xinjiang Uyghur Autonomous Region (People Daily China 2017), Sanjiangyuan in the Yushu Prefecture in Qinghai (Townshend 2017), Ngawa Tibetan and Qiang Autonomous Prefecture of northwestern Sichuan (Faucher 2018), and in the Hainan Tibetan Autonomous Prefecture of northeastern Qinghai Province in Western China (Hoit 2014).

India

The presence of Pallas's cat in Ladakh was mentioned in the Indian literature since the early 1970s (Prater & Barruel 1971). To date, the species has only been confirmed from the Trans-Himalayan landscapes of Ladakh and Sikkim, where its occurrence is nominal (Mallon 1991, Pfister 2004, Chanchani 2008, Mahar et al. 2017). In Ladakh, the species has been reported from Hanle, Staklung

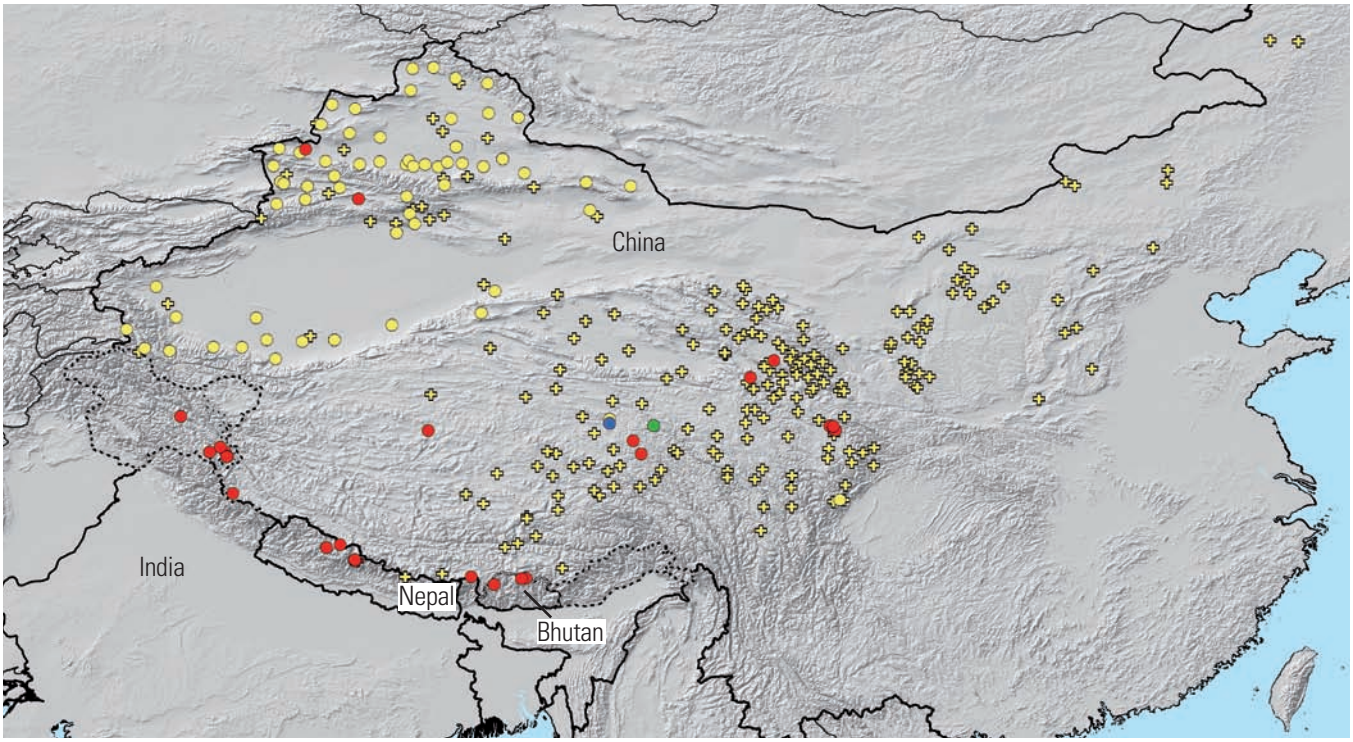

Fig. 1. Geographic distribution of the Pallas's cat in the study region, mapped according to historical (< year 2000; crosses) and contemporary (≥ 2000; circles) occurrence records. Red = confirmed (C1); Blue = probable (C2); Green = possible (C3); yellow = records where categorisation was not possible.

and Lal Pahari areas of Changthang Wildlife Sanctuary and, in Rupshu (Mallon 1991, Pfister 2004, Mahar et al. 2017), at altitudinal ranges between 3,000 and 4,800 m (Pfister 2004). In Sikkim, the first occurrence record consists of a single sighting at Tso Lhamo Plateau at an elevation of 5,073 m, the then highest altitudinal record of the Pallas's cat (Chanchani 2008). Photographs of the species taken by tourists and nature photographers from the area continue to appear in the social media. Negi (1998) described the species occurrence in Spiti area of Himachal Pradesh, but this has not yet been confirmed.

Fig. 2. Pallas's cat photographed near Staklung in Changtang Wildlife Sanctuary, Ladakh, India, 14 May 2015 (Photo N. Mahar).

Nepal

The first evidence of Pallas's cat presence in Nepal occurred in 2012 during a snow leopard survey using camera traps in the Marsyangdi valley of Manang district, located within the Annapurna Conservation Area ACA (Shresthra et al. 2014) at Thorkya (4,200 m) and Aangumie Lapche (4,650 m). A camera trapping survey on Pallas's cat in 2014–2015 in the same area detected the species at six different locations at elevations ranging from 3,988 m to 5,073 m, confirming the importance of ACA for Pallas's cats (Regmi et al. 2016). A photograph of a Pallas's cat pelt from Nyesyang valley in 1987 likely confirms the species' historical presence in Manang district (Lama et al. 2016). Recently, a second record for Pallas's cat in Nepal was documented at 5,539 m in the north-eastern part of Tinkyu village of upper Dolpa, some 90 km northwest of Manang (Werhahn et al. 2018). This is the highest elevation record for Pallas's cat across its range. The evidence included a faecal sample verified through faecal DNA analysis. In 2017, a camera trap photo-captured the Pallas's cat in Phoksundo Village Development Committee of Dolpa district (G. Khanal, pers. comm.).

Habitat

A Pallas's cat habitat consists of rocky areas, grassland, shrubland, hills, low mountains, and cold montane deserts and is generally characterised by low rainfall and, low humidity and a substantial variation in temperature (Ross et al. 2016). The habitat of the species is very similar across the Himalayan and China's Tibet-Quinghai Plateau and fringes (Fig. 2 & 3). Bhutan is located within the warmer south-facing slopes of the Himalayas, and the cat's habitat is comprised of rolling hills dominated by glacial out-wash and alpine steppe vegetation (WWF 2012).

In Nepal, the upper Manang valley has a dry and cold climate, falling in the rain-shadow of the Annapurna Mountain Range. It is a transition zone between the moist southern Himalayan slopes and the high alpine desert of Tibet. The upper watershed of Marsyangdi River, the largest river in Manang district (1,950 km^2), consists primarily of alpine grasslands (4,500 m to 5,000 m) and subalpine scrublands (4,000 m to 4,500 m; Shrestha et al. 2014). However, the Pallas's cat occurs in very broken and rocky areas consisting of mostly rolling hill slopes and very little cliffs. In Dolpo, the species was also recorded in very rocky hill slopes within montane grassland steppe.

In the Trans-Himalayan region of India, the Pallas's cat lives in extreme conditions where the temperatures fall to -30° C in winter (Bagchi et al. 2012) and sites dominated by sparse vegetation and barren sloping land with <100 mm annual rainfall (Hartmann 1983). In central Ladakh, the mid-winter snow depths at 4,000 m elevation can be less than 10 cm (Fox et al. 1991). Usually, the species occupies empty burrows of marmots and foxes in proximity to prey species like pika *Ochotona* spp. and Himalayan marmot *Marmota himalayana* habitats. It prefers south-facing slopes, especially rocky terrain with crevices, open rock-strewn terrain and mountain steppe areas (Menon 2014). Vegetation of the Tso Lhamo plateau in Sikkim is dominated by grasses (*Stipa orientalis*, *Elymus nutans*) and forbs; at the edges of the range, this is replaced by Juniperus- and Rhododendron-dominated communities of the alpine zone of the Himalayas (Chanchani 2008). Typical habitat for Pallas's cat in China consists of flat and rolling steppes with open grassland. They can occur in deserts, semi-deserts and dry steppe areas (Bangjie 1984). *Kobresia pygmaea* and *Carex* spp. are the two most dominant forms of vegetation cover in the alpine meadows of the Tibetan Plateau (Badingqiuying 2008). The record from north-eastern Gertse County in the Tibetan region reported a desert steppe habitat at 5,050 m dominated by *Stipa* spp. and various forbs (Fox & Dorji 2007). Observations from Tibet however also come from heavily disturbed habitats such as old quarries, proximity to human habitation and vehicle traffic and heavily grazed areas at 3,500 m (Webb et al. 2016).

Prey

Pallas's cats are specialist feeders. Range-wide pikas are their most important prey (Ross et al. 2010). They were also reported to prey on a wide variety of small mammals, insects, birds, reptiles and carrion but in fewer proportions (Chapter 3). In Bhutan, potential prey species include Royle's pika *O. roylei*, large-eared pika *O. macrotis*, voles, Himalayan marmot and numerous high-altitude bird species like the blood pheasant *Ithaginis cruentus* and several species of partridges. In the region of Manang in Nepal, prey species can include Royle's pika and the Sikkim vole *Alticola sikkimensis* (Shrestra et al. 2014). A single, genetically-identified Pallas's scat collected in Dolpo (Nepal) revealed pika *Ochotona* sp. and woolly hare *Lepus oiostolus* hairs, and traces of vegetation and debris (Werhahn et al. 2018). Also,

in China, Pallas's cats are known to feed predominantly on colonial pikas, small rodents such as voles, birds, hares, and marmots (Wozencraft 2008). In the Trans-Himalayan region of India, potential key prey species also include pikas, voles *Alticola* spp., Himalayan marmot and the woolly hare. Many bird species such as chukar *Alectoris chukar*, Tibetan snowcock *Tetraogallus tibetanus* and Tibetan partridge *Perdix hodgsoniae* that occur in this landscape use marmot burrows and could thus be possible diet items for this cat. The Pallas's cats in the Tibetan region of Rouergai area mostly survive on the vast colonies of the plateau pika (or black-lipped pika) *O. curzoniae*, as well as the Himalayan marmot (Webb et al. 2016).

Threats

Pallas's cats are dietary and habitat specialists, occupying larger home ranges than other small wild cat species (Ross et al. 2012). In open alpine grasslands, they appear to show significant dependence for shelters such as burrows made by marmots and other animals. They are also highly vulnerable to mortality and displacement resulting from pastoralist activities. These factors may even increase the vulnerability to natural predation by e.g. eagles and foxes (Ross 2009). However, a comprehensive understanding of threats across the region is lacking (Chapter 8). Habitat degradation and disturbance are widely reported to be ubiquitous throughout the distribution range of the Pallas's cat in this region: its habitat is mostly used for seasonal grazing by domestic animals such as yaks, horses, cattle, goats, and sheep, along with herding and feral dogs, with grazing intensities varying among sites and countries. The alpine meadows of the Himalayas and China are visited by hundreds of people during late spring or summer collecting the Chinese caterpillar *Cordyceps* spp. This is accompanied by littering of the environment, chopping off rhododendron shrubs for fuelwood and disturbing or trapping wildlife (Wangchuk et al. 2013).

In Nepal, there is evidence that around 20 years ago people from Manang used to sell the pelts of the Pallas's cat, leopard cat *Prionailurus bengalensis* and snow leopard along with red fox *Vulpes vulpes* and golden jackal *Canis aureus* (Lama et al. 2016). Local people also catch small mammals like pikas for consumption. Although hunting is prohibited, current trade and local use of wildlife species from these parts of Nepal are not clear. In Dolpa, stone trap and steel-jaw traps are or have been widely used by local people to kill large carnivores like snow leopards and wolves in retaliation for livestock depredation, which may adversely impact non-targeted animals like Pallas's cat (Lama et al. 2017). Recently, road construction reached remote settlements in Mustang and Manang Districts, accelerating habitat fragmentation and human disturbances within the Pallas's cat habitat.

The major threats to wildlife in the high altitudes of the Indian Himalaya include unregulated tourism, development activities, livestock grazing and disturbance (Fox et al. 1994, Bhatnagar et al. 2006, Geneletti & Dawa 2009, Humbert-Droz 2017), factors that are known or suspected to have a negative impact on the Pallas's cat (Chapter 8). Although wildlife hunting is prohibited, the presence of workers in Ladakh for development projects such as road construction might affect this cat negatively. There are several anecdotal records of outsiders hunting and consuming marmots and other herbivores. Pastoralism in Ladakh is an age-old practice; intensive livestock grazing and the presence of livestock guard dogs may have an impact on Pallas's cat, however, requires further investigation. For example, a Pallas's cat sighted in Hanle lacked its tail, presumably from having been attacked by dogs (P. Raina, pers. comm.).

Poaching and, before legal protection, hunting was thought to constitute main threat to Pallas's cat in China and law enforcement was considered to be weak (Sunquist & Sunquist 2002, Brown et al. 2003, Murdoch et al. 2006). The population was believed to have declined, and it was suggested that Pallas's cat was extirpated from the easternmost part of its range in China due to hunting (Nowell & Jackson 1996, Mallon 2002). Their main prey base, namely pika, were or still are routinely poisoned as vectors of bubonic plague (Nowell & Jackson 1996, Smith et al. 1990, Mallon 2002, Badingqiuying et al. 2016) and because they are also believed to cause damage to the grassland ecosystem and compete with livestock (Wilson & Smith 2015, Wu & Wang 2017). Recent studies in the southern Qinghai region show that the poisoning campaign is reducing carnivore abundance, possibly through prey depletion and secondary poisoning and could affect Pallas's cats (Badingqiuying et al. 2016).

Climate change is also expected to affect the species, but the consequences remain uncertain. Soon, climate change is predicted to affect the fragile mountain ecosystem of the Himalayas and the grasslands in the high steppes of China with adverse effects on biodiversity (Xu et al. 2009, Luo et al. 2015). This may alter the ecosystem functioning and adversely affect the availability of prey, and alter disease prevalence and the phenology of the species (Daszak et al. 2001, Ross 2009, Qu et al. 2016).

Fig. 3. A Pallas's cat camera trapped in Annapurna Conservation Area, Nepal (Photo Tashi R. Ghale / Global Primate Network Nepal).

Future Research and Conservation

Listed as Near Threatened on the IUCN Red List, Pallas's cats are experiencing a global decline in their population size (Ross et al. 2016). The species is included in Appendix II

of CITES and is legally protected in the region. In India, it is a Schedule I species under the Indian Wildlife Protection Act, 1972 (Anon 1992) and Jammu and Kashmir Wildlife Protection Act, 1978. In China, it is a Class II species on the national list "Protected Animal of National Importance in China." In Nepal and Bhutan, although there is no special protection, it is illegal to hunt the Pallas's cat or sell its pelt. However, monitoring of illegal activities is relatively weak across most of the region.

There is a strong need for dedicated studies looking at the distribution, ecology, and threats of the Pallas's cat and to prescribe well-targeted conservation actions in all range countries. Conservation plan and systematic monitoring schemes are currently lacking, and direct or indirect effects of over-grazing through livestock, predation by dogs and human use of prey species need to be assessed. Education and information represent another priority. Compliance, law enforcement, and legislation need to be strengthened at the national level, and the scale of illegal trade of Pallas's cat pelts should be studied and assessed, best in a transboundary collaborative approach of the range countries.

Acknowledgments

We thank David Barclay from the Pallas's Cat International Conservation Alliance, and Urs Breitenmoser and Tabea Lanz from the IUCN Cat Specialist Group for their support rendered to us during the preparation of this assessment. We also thank Richard Webb, Gopal Khanal, Pankaj Raina, Ranjana Pal and Tsewang Namgail for sharing locality points of Pallas's cat. Due thanks also go to Lingyun Xiao, Kubanych Jumabay and Gao Yufang for helping us reach out to researchers in China. We also acknowledge the reviewer with valuable comments which helped improve the manuscript.

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[1] Ugyen Wangchuck Institute for Conservation and Environmental Research, Department of Forest and Park Services, Bumthang 32001, Bhutan
*<tashid@uwice.gov.bt>

[2] Wildlife Biology Program, University of Montana, Missoula, Montana, USA

[3] Institute of Environmental Studies, Charles University, Prague, Czech Republic

[4] Department of Biodiversity Research, Global Change Research Institute CAS, Brno, Czech Republic

[5] Wildlife Institute of India, Dehradun, Uttarakhand, India

[6] Institute of Cultural Anthropology and Development Sociology, Leiden University, The Netherlands

[7] Global Primate Network Nepal, GPO Box 26288, Kathmandu, Nepal

[8] Snow Leopard Conservancy, 75 Boyes Blvd, Sonoma CA 95476, USA