

## Small cats in Nepal: Conservation status of felinae sub-family in the country

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### Abstract

Twelve species of wild felids representing six lineages are found in Nepal, of which four are from Panthera lineages. Remaining eight species from non-panthera lineages is represented as poorly studied groups with limited information available for Nepal hindering effective conservation intervention. Thus, this review paper aimed to identify the status focusing on the distribution and threats of the cat species using review based approach. Among the small cats, jungle cat has the largest distribution range in Nepal, while occurrence of marbled cat has been verified recently from eastern Nepal. Fishing cats are recorded throughout low-lands of Nepal, while rusty spotted cats are recorded from western low-lands of Nepal and Asiatic golden cat have been documented from Mid-hills regions. Two species of small cat, i.e. Eurasian Lynx and Leopard Cat are protected by Nepalese law. Though there is a fair amount of information to make prediction about the distribution range, population level data are largely unavailable. Therefore, an explorative study on distribution followed by population level ecology in Nepal is essential.

**Keywords:** Asiatic golden cat, Mammals, Protected species, Threats, Wild felids

### Introduction

#### Status of the felids

Felids, member of the wild cat family, are only obligatory carnivores with their dietary requirements fulfilled purely by flesh. Recent revision on the taxonomy of felids initiated by IUCN cat specialist group proposed 2 sub-families, 8 lineages, 14 genera, 41 species, 77 sub-species (Kitchener et al., 2017), but the number of species and sub-species is debatable. Among the two sub-families described, sub-family Pantherinae represents the larger members of the family, while the Felinae represents the smaller members of true flesh eaters.

Medium and small body sized predators in the ecosystem, often cited as meso-predators, play significant role in ecosystem through regulation of small prey species (Prugh et al., 2009). These species are yet to receive adequate conservation attention from concerned stakeholders including academia, conservationist and governments (Brodie, 2009). The case is even worse in the country like Nepal, where the funds for research and conservation are limited. However, some of the species are getting concern for the conservation.

#### Small cats in Nepal

Nepal is the second richest country in the world for felid

diversity (India, n = 15) with 12 species reported so far from the country (Dickman et al., 2015; Lamichhane et al., 2016). These represent four big cat species namely Tiger (*Panthera tigris*), Common Leopard (*Panthera pardus*), Snow Leopard (*Panthera uncia*) and Clouded leopard (*Neofelis nebulosa*) and eight small cat species (from felinae sub-family) namely Eurassian lynx (*Lynx lynx*), Asiatic Golden Cat (*Catopuma temminckii*), Marbled Cat (*Pardofelis marmorata*), Fishing Cat (*Prionailurus viverrinus*), Pallas's cat (*Otocolobus manul*), Jungle Cat (*Felis chaus*), Leopard Cat (*Prionailurus bengalensis*) and Rusty Spotted Cat (*Prionailurus rubiginosus*). Despite this feline richness, research priority is highly skewed towards big cats, particularly, in two charismatic species, tiger and snow leopard. Limited studies have been carried out to understand ecology of common leopard, while there is lax information for the rest. The lax information hindered the ability to devise effective conservation intervention for small cats (Sutherland et al., 2004). State sponsored periodic monitoring of tiger and their prey base are carried out in the interval of two to four years (Dhakal et al., 2014; DNPWC & DFSC, 2018). However, population status of common leopard is not yet estimated and small cats are not even within the frame.

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Small cats are crucial in maintaining the population of rodents and birds. Their occasional interactions with livestock could be the concern to farmers as well as local inhabitants (Nowell et al., 1996). In this regard, quantifying threats and conflicts are also the major issues for the conservation of small cats. But, the attention from the concerned stakeholders are yet to be received. Small cats are just primarily form the accidental capture in studies designed for other species (Appel et al. 2013; Lamichhane et al. 2014; Lamichhane et al. 2016; Yadav et al. 2018) such as camera trap image during the national tiger census (Lamichhane et al. 2014; Poudel et al. 2019; Yadav et al. 2018) gives primary source of information in Terai region, Nepal. However, study designed to capture the apex predator could not be suitable for capturing the smaller member of the family. The smaller patches of forested habitats which are not used by the top predators, but work as ample habitat for small cats are rarely explored in those surveys. This might provide some plausible explanation of the low capture of small felids that use data from large cat surveys.

Besides, early 90s and at the beginning of 20th century, when digital cameras were not available, only the negatives with images of tiger were printed and other animals used to be neglected to minimize the printing cost (Pers. Comm. Naresh Subedi and Yadav Ghimire, 2015). Due to these biases in camera trap locations and level of emphasis, information on the small cats are inadequate.

The scenario is in transition toward the change, with some focus of researchers and conservationists being tilted towards the small cats as well, which rose the volume of field based literature (Ghimirey et al., 2012; Lamichhane et al., 2016; Mishra, Basnet, Amin, & Lamichhane, 2018). Still the big cats receive much attention and well-developed infrastructure supporting their conservation efforts (Heard et al., 2014).

Therefore, this article aims to document the distribution status and threats of eight species of cats representing the non panthera lineages, primarily through the literature review, which could be

imperative to line-up the conservation efforts. Previous studies conducted by conservation organizations and researchers have been primarily used as source of information. Although, the conservation challenges are different with the species, some generalization can be made about the threats and conservation due to similarities in their habit and habitat.

### Review and Synthesis

Eight species of small cats representing four lineages and six genus have been recorded so far in Nepal ( Fiona Sunquist et al., 2014; Lamichhane et al., 2016) (Table 1). Species specific distribution, threats and conservation status to the species are described briefly below:

#### Jungle cat (*Felis chaus*: Schreber, 1777)

Jungle cats are considered as the most common species of felids in Nepal (Jnawali et al., 2011). They are highly adaptable to the diverse habitat conditions ranging from forests and grasslands to high human interferences area (Nowell et al., 1996). In Nepal, it ranges up to 4,000 m altitude and occurs within all of the protected areas (Jnawali et al., 2011). The confirmation about the presence of species is not yet made for many locations both inside and outside protected areas. Till date, out of 20 protected areas in Nepal, published literature on the presence of species is available only for Makalu Barun National Park, Chitwan National Park and Koshi Tappu Wildlife Reserves (Ghimirey et al., 2012). Outside the protected areas, they have been recorded from Jagadishpur Reservoir and Ghodaghodi Lake area and urban areas of Kathmandu Valley (Basnet et al., 2017; Dahal et al., 2014). Owing to their wide range of distribution, both at national and global level, they are enlisted as least concern (LC) species (Grey et al., 2016). Adaptability of jungle cat to the wide range of anthropogenic interferences have intensified the interaction of species with humans and feral dogs, which could drive species towards the extinction (Basnet et al., 2017; Nowell & Jackson, 1996). They are enlisted on Appendix II of CITES (UNEP-WCMC (Comps.) et al., 2014).

**Table 1:** Small wild cats of Nepal

Lineages	Common name	Species	Sub-species
<b>Domestic Cat lineages</b>	Jungle cat	<i>Felis chaus</i>	F.c. affinis
<b>Leopard Cat lineage</b>	Pallas's cat	<i>Otocolobus manul</i>	O. m. nigrippectus (Hodgson, 1842)
	Rusty spotted cat	<i>Prionailurus rubiginosus</i>	P. r. rubiginosus
	Fishing cat	<i>Prionailurus viverrinus</i>	P.v. viverrinus
	Leopard cat	<i>Prionailurus bengalensis</i>	P. b. horsfieldii
<b>Bay Cat lineage</b>	Marbled cat	<i>Pardofelis marmorata</i>	P. m. longicaudata
	Asiatic golden cat	<i>Catopuma temminckii</i>	C. t. moormensis
<b>Lynx lineage</b>	Lynx	<i>Lynx lynx</i>	L. l. isabellinus

**Pallas cat (*Ocolobous manuel*, Pallas, 1776)**

Pallas cat, a small cat, is known to occur throughout northern and central Asia inhabiting wide variety of habitats. Despite having its extensive range, little is known about the species ecology, behavior and conservation status (Nowell et al., 1996; Shrestha et al., 2014). The species was recorded in 2013, although the evidences of historic presence of cat were recorded later on (Lama et al., 2016; Shrestha et al., 2014). In Nepal, after identification as the eleventh species of cats in 2013, it has been gaining attention from the researchers. Recently, the species has been recorded from Dolpa district as well confirming the presence from two additional districts (Dolpa and Manang) of Nepal (Werhahn et al., 2018). There is high probability of recording this elusive species from other Himalayan districts of Nepal, which needs further confirmation. Although, more information about the species is very rudimentary in case of Nepal, globally they are enlisted as Near Threatened (NT) species in IUCN Red List due to its decreasing population trend and increasing threats from hunting and habitat loss (Ross et al., 2008), unregulated tourism, unscientific construction activities. They are considered to be data deficient species owing to lack of ample information about this species in Nepal (Amin et al., 2018).

**Rusty spotted cat (*Prionailurus rubiginosus*)**

Rusty spotted cat is the newest member of the felids recorded and represents the smallest among the wild cats of Nepal. The species has been recorded from Sukhlaphanta National Park and Bardia National Park (Lamichhane et al., 2016). Rusty spotted cat is listed as Near Threatened (NT) species globally, while they are considered to be Data Deficient (DD) for Nepal owing to limited information regarding the threats (Amin et al., 2018).

**Fishing cat (*Prionailurus viverrinus*: Bennett, 1833)**

Fishing cats are strongly associated with wetlands. They are typically found in swamps and marshy areas, oxbow lakes, reed beds, tidal creeks and mangrove areas. They are more scarce around smaller and fast-moving water courses (Nowell et al., 1996). They have been recorded at elevations up to 1,525 m in the Indian Himalayas (Prater, 1971). Although, fishing cats are widely distributed through a variety of habitat types, their occurrence tends to be highly localized. In Nepal, presence of fishing cat have been verified from five protected areas of low land namely Koshi Tappu Wildlife Reserve, Parsa National Park, Chitwan National Park, Bardia National Park and Sukhlaphanta National Park (Dahal & Dahal, 2011; Mishra et al., 2018; Poudel et al., 2019; Taylor et al., 2016; Yadav et al., 2018). Their presence has been confirmed from areas outside protected area as well. Fishing cats were camera trapped in Ghodaghodi Lake of Kailali and Jagadishpur Reservoir of Kapilvastu (Dahal et al., 2014).

Study on fishing cat was found to be increasing and advance methods like satellite telemetry has been used to monitor this

felid and its distribution was found to be present in western Terai region. The status of Fishing cats were updated to vulnerable from endangered in IUCN Red list back in 2016 as the distribution range and population status was expanded with increase in survey efforts (Mukherjee et al., 2016). Despite this, the species is threatened to extinction due to fragmentation and degradation of habitat, illegal hunting and lack of connectivity between population (Appel et al., 2015). In addition, retaliatory killing have emerged as a potential threats to the survival of fishing cat in Nepal. Acknowledging the status of fishing cat in the country, they are enlisted as endangered species in national Red List series (Amin et al., 2018; Jnawali et al., 2011).

**Leopard cat (*Prionailurus bengalensis*: Kerr, 1792)**

The diet of leopard cat includes young ungulates chickens, jungle fowl and rodents (Heptner & Sludskii, 1972; Jnawali et al., 2011). The population of leopard cat from Nepal is listed in CITES (UNEP-WCMC (Comps.) et al., 2014; Wilson et al., 2005). In Nepal, this species is reported to occur within the protected areas of Annapurna Conservation Area, Bardia National Park, Chitwan National Park, Dhorpatan Hunting Reserve, Kanchenjunga Conservation Area, Khaptad National Park, Langtang National Park, Manaslu Conservation Area, Parsa National Park, Shuklaphanta National Park and Mid-hill districts namely Bajhang, Doti, Ilam, Kanchanpur, Panchthar and Ramechhap (Appel et al., 2012; Ghimirey & Ghimire, 2010; Ghimirey et al., 2012; Jnawali et al., 2011; Lamichhane et al., 2014). The most serious threats to the leopard cats are due to poaching and killing by local villagers who perceive them as a species that harm their livestock and crops (Ghimirey et al., 2010). It is listed as the Least Concern (LC) species globally in IUCN Red List (Ross et al., 2015).

**Marbled cat (*Pardofelis marmorata*: Martin, 1837)**

Marbled cat is one of the least studied species of small cat in Nepal which was first reported from Nawalparasi district, on the basis of pelt. In subsequent studies, no second record of species has been found creating a circumstances of doubting the presence (Dahal et al., 2017). However, the presence of marble cat in Eastern Sikkim may have possibility to have its presence in Eastern Nepal (Biswas, Das & Mukhopadhyay 1999) which needs further exploration. Due to lack of ample information, it would be too early to make claim about species specific threats, but deforestation and forest degradation could have threatened the existence of this globally threatened and nationally data deficient species (Amin et al., 2018; Ross et al., 2016). Besides, the species is also listed in Appendix I of CITES highlighting the threats from international illegal trade for survival of species. The potential sites for exploration are Chure and Mid-hill forests of eastern Nepal including Triyuga forest, Dharan forest among others.

**Asiatic golden cat (*Catapuma timmincki*, Vigros and Horsfield, 1827)**

Asiatic golden cat (*Catapuma timmincki*) is poorly studied felid species in Nepal (Ghimirey et al., 2009) and throughout the world. Thus, there is less ecological and behavioral information about them (Sunquist & Sunquist, 2002; Sunquist & Sunquist, 2014). However, the species is gaining some form of attention recently, as a result the information is being gathered through purposive study or through analysis by-catch during other studies (Bashir et al., 2011; Kawanishi & Sunquist, 2008; Lyngdoh, Selvan, Gobi, Habib, & Hazarika, 2011). In case of Nepal, there are two incidences of being photographed in camera trap to be known (Ghimirey et al., 2009; Rai et al., 2018). These species are intermediately associated with the forested habitat (Nowell & Jackson, 1996) and have been spotted in four morph types, i.e. golden, spotted, grey and black colored (Bashir et al., 2011; Ghimirey et al., 2009; Vernes et al., 2015). They are about to be threatened worldwide (McCarthy et al., 2015), while it is data deficient in case of Nepal, though believed to occur all the way through the Mid-hill region of the country (Jnawali et al., 2011). Although the sample was collected by Hodgson from Nepal, there is no information about the location of the collected sample. Habitat fragmentation induced from the deforestation and forest degradation are considered as the primary threats to the species (McCarthy et al., 2015; Nowell & Jackson, 1996).

The species is assessed as Near Threatened species with estimation of 20 to 30% decline in population throughout its range (McCarthy et al., 2015). The record of the species from Sikkim, India in the border of Nepal makes the site with highest potential for Asiatic golden cat presence. Along with this, in diet analysis of tiger, the fur was recorded in one of scat in Chitwan National Park back in late 80s which could be possible site for exploration. Nepal is believed to be the westernmost range of the Asiatic golden cat since hunters had caught a male individual in a dense forest in the Mid-hills in 1829 and that was brought alive to the British Resident Brian H. Hodgson (Hodgson 1831). The major threats for Asiatic golden cat are habitat destruction and fragmentation as a result of deforestation. They are also hunted for their pelts and bone (Nowell et al., 1996). Thus, the species is listed on Appendix I of CITES (UNEP-WCMC, 2014). These threats have compelled them to be listed in NT category of IUCN Red List of vulnerable species.

**Eurasian lynx (*Lynx lynx*)**

Lynx occur sporadically throughout the Tibetan plateau and are found throughout the rocky hills and mountains of the Central Asian desert regions (Nowell et al., 1996). Although, a large portion of the lynx's range is in Asia, status, feeding ecology and trend in many countries are poorly understood due to insufficient data (Breitenmoser et al., 2015). There is proof of lynx presence in Nepal (Fox, 1985; Jnawali et al., 2011) which was confirmed by its record from Dhaulagiri region, Mustang and Manag Districts (Kusi et al., 2018).

It has been included on CITES Appendix II and protected under the Bern Convention (Breitenmoser et al., 2015). On the better-forested southern Himalayan slopes, the only record is a sighting in alpine tundra. Lynx in China have been reported to feed on pikas, large rodents and hares (Feng et al., 1986).

**Conservation implications**

Study on cats in Himalayan regions of Nepal are largely unexplored and the species are often shadowed by few species like snow leopards (Kusi et al., 2018). These areas could be the potential sites for the exploration of Pallas's cat and Eurasian lynx. Similar is the case with Mid-hills which has remained unexplored. The patches of forests within the regions could hold the population of small cats including Jungle cat, Asiatic golden cat, Marbled cat and Leopard cat. Recent records of the small cats, including the Asiatic golden cat, from the Mid-mountains focused the researchers and conservationists toward this area. Owing the diversity of small cats from the Sikkim areas, adjacent areas in Nepal are sites that serve as potential habitats for small wild cats. Dharan, Triyuga and other forest patches of eastern lowlands could be the potential sites having great diversity of unidentified carnivore signs during the recent visits (pers. obs. first author). There seems some strong need for dedicated studies looking at the distribution, ecology and threats of the different cat species and also need to prescribe well-targeted conservation actions in all the range countries (Nowell & Jackson, 1996)

Habitat degradation and fragmentation is the prime cause of species depletion, which causes degradation of the habitat of small felids as well. Though, the overall forest coverage have been reported to increase in recent years, increase in the quality of the forest are still questionable. The statement is true for the forests in the Tarai and Churia region where the impact of human have been intensified in recent period.

**Conclusion**

Although, few literatures are available on the small cats in Nepal, the majority of them are designed for larger member of felidae hindering the ability to make claims about their population status in the country. However, several studies and protected area management plans claim about the distribution of species in some areas and most of them are from anecdotal records. Taking reference to the global population trend of small wild cats, it can be assumed that the species are threatened to extinction due to anthropogenic interferences, but there is limitation in the study regarding its potential threats. Despite this, many species are protected due to the umbrella effects of other species.

Furthermore, there is lack of knowledge about presence of species outside protected areas as most of the researchers are focused within protected areas except for some species of cat. Among the eight species of small cat present in Nepal, Asiatic golden cat and Marbled cat are listed on Appendix I of CITES, while rest six are enlisted as Appendix II species indicating the

threats from international illegal trade on their survival. Two species of small cats, i.e. Eurasian lynx and Leopard cat are protected by NPWC Act 1973. As the legal protection seems inadequate for identifying the level of threats in various studies, there is immediate need for national level protection as well as revision on the legal provision. In addition, assessment of the conservation status and management plan of these species is required.

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