

# Distribution and illegal killing of the Endangered Indian pangolin *Manis crassicaudata* on the Potohar Plateau, Pakistan

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**Abstract** The Endangered Indian pangolin *Manis crassicaudata*, a burrowing, armoured mammal, plays an important role in the food web by consuming insects and termites. In Pakistan the species' range includes the 22,000 km<sup>2</sup> Potohar Plateau, where it is under pressure from illegal hunting for its scales and requires conservation attention. We used a geographical information system to quantify the range of the Indian pangolin on the Plateau and to compare this with the range estimated in the IUCN Red List assessment of the species. We found that the species occupies c. 89% of the Plateau, in eight of the 10 protected areas, compared with the IUCN estimate of 71%, and we recorded the species at 40 locations on the Plateau outside the range predicted by the IUCN assessment. We collected data on the illegal capture and killing of the species, recording 412 individuals that had been killed at 48 locations between January 2011 and the end of April 2013. The highest number of killings was recorded in Chakwal District (n = 156, at 13 sites) followed by the Attock District (n = 149, at eight sites). Although the Indian pangolin's range on the Potohar Plateau is c. 18% larger than that estimated in the IUCN assessment, the species is under pressure from illegal killing and requires urgent conservation measures to save the small remaining population and avoid the extirpation of this vital insectivorous predator from the area.

**Keywords** Distribution, Indian pangolin, IUCN assessment, killing, *Manis crassicaudata*, Pakistan, Potohar, spatial range

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## Introduction

The Indian pangolin *Manis crassicaudata* is categorized as Endangered on the IUCN Red List (Baillie et al., 2014) because of its declining populations, which is a result of illegal hunting and increased levels of poaching for its scales and meat (Baillie et al., 2014). It is one of four Asian pangolin species, all of which have protective keratinized scales (Gaudin et al., 2006; Gaubert, 2011). The scales are used in traditional medicine in China and other countries, and Indian pangolins are traded illegally throughout East Asia (Challender et al., 2015), with many reports of seizures in Vietnam in recent years (EIA, 2015).

All eight species of pangolins (four Asian and four African) are on Appendix I of CITES (2017), and pangolins are considered to be the most trafficked wild mammal globally (Challender et al., 2015), with an estimated > 277,000 individuals of both Asian and African origin traded since 2000. This trade is recognized as having a severe impact on the status of pangolin populations (Challender et al., 2015).

The Indian pangolin occurs in five countries: Pakistan, India, Nepal, Bangladesh and Sri Lanka (Baillie et al., 2014). In Pakistan the distribution is localized, with the species occurring in the provinces of Sind, Balochistan, some parts of Khyber Pakhtunkhwa and Punjab, including the Potohar Plateau (Roberts, 1997).

The Indian pangolin occurs in barren hilly areas and sub-tropical thorn forests (Roberts, 1997), usually ranging from moist to dry and thorn to grassland (Pai, 2008). It occurs at naturally low population densities and prefers forested environments of various types (Gaudin et al., 2006). It is also found in ruined wasteland near human settlements (Yang et al., 2007). The pangolin's scales provide defence against predators; when threatened, it rolls up into a ball to protect its delicate, vulnerable underside. Demand for the scales for use in traditional medicine has fuelled intensive poaching of the species, resulting in a decline of c. 79% in its native range (Irshad et al., 2015).

The Potohar Plateau is the core distribution range of the Indian pangolin in Pakistan, with only localized, patchy distributions in other areas. Previous studies (e.g. Mahmood et al., 2012) have highlighted the illegal trade and killing of Indian pangolins in Pakistan and the smuggling of their scales into China via Hong Kong (and perhaps

Singapore). In April 2012 information was reported (GACC, 2012) on a seizure in China of 25.4 kg of pangolin scales that were apparently sourced from Pakistan, where illegal smuggling is facilitated by weak law enforcement.

We aimed to estimate the distribution range of the Indian pangolin on the Potohar Plateau, where a high intensity of illegal killing has been reported, and compare it with the IUCN estimate, to assess the intensity of illegal hunting pressure on the species on the Plateau, and to evaluate the efficacy of the protection system in place.

## Study area

The study was conducted on the Potohar Plateau in north-east Pakistan (Fig. 1) during 2011–2013. The 22,255 km<sup>2</sup> study area comprises four districts (Attock, 6,857 km<sup>2</sup>; Chakwal, 6,525 km<sup>2</sup>; Jhelum, 3,587 km<sup>2</sup>; Rawalpindi, 5,286 km<sup>2</sup>), and also some parts of the capital city, Islamabad (Bhutta, 1999). The Plateau is at 330–1,000 m altitude and the climate is semi-arid to humid, with mean annual rainfall of 380–510 mm. The mean maximum temperature in summer is 45°C, dropping to below freezing during winter (Encyclopaedia Britannica, 2010). Of the 178 protected areas in Pakistan 10 occur on the Potohar Plateau: six National Parks (Kala Chitta, Chinji, Ayub, Margalla Hills, Murree-Kahuta-Kotli Sattiyani and Ayubia), two Wildlife Sanctuaries (Chumbi Surla and Islamabad) and two Game Reserves (Domeli-Diljaba and Khairi Murat; Fig. 1).

## Methods

Preliminary species occurrence data were obtained by interviewing local people using a questionnaire (Supplementary Material 1). Field data were collected during surveys of all natural areas of the four districts (Jhelum, Chakwal, Rawalpindi and Attock) of the Plateau. The interviews and field surveys were conducted between January 2011 and the end of April 2013. The field surveys were conducted using a motor vehicle driven at 25–30 km per hour along all accessible roads, guided by the published occurrence records of the species. Direct (sightings, capture, dead bodies) and indirect (burrows, faeces) signs of the species were recorded at stops every 5–7 km. Thorough searches were carried out at sites where the species was reported to occur. Geographical coordinates of the locations of occurrence were recorded using a global positioning system, and were used to construct distribution maps of the species and estimate its distribution range in the study area.

The occurrence data were georeferenced and uploaded to *GoogleEarth* (Google Inc., Mountain View, USA) and saved in Keyhole Markup Language format before being imported into *QGIS v. 1.8.0* (QGIS Development Team, 2012) and converted into shapefiles. The result was a layer of location

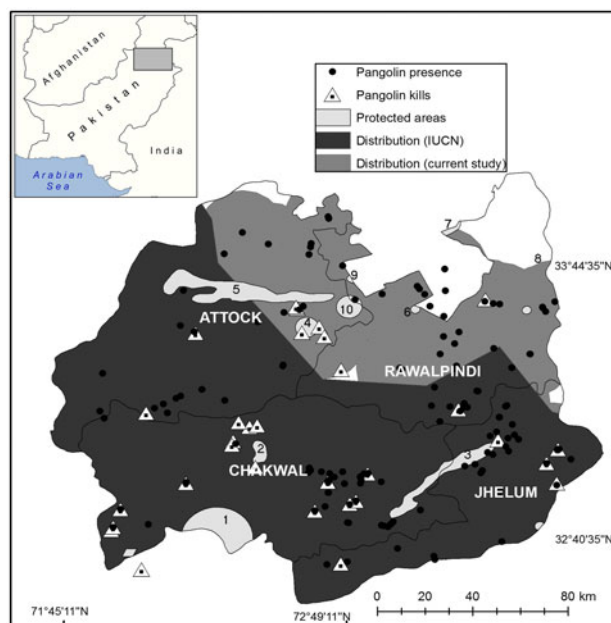


FIG. 1 The distribution of the Indian pangolin *Manis crassicaudata* on the Potohar Plateau estimated by this study and indicated by the IUCN assessment for the species (Baillie et al., 2014), with locations where pangolins were recorded, and locations where illegal capture and killing of pangolins was recorded. Protected areas are numbered as in Table 2.

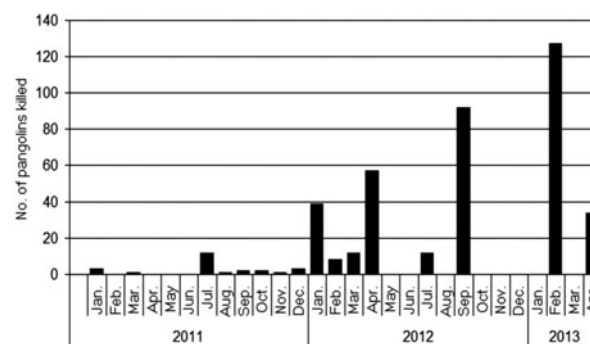


FIG. 2 Numbers of Indian pangolins killed illegally on Potohar Plateau, Pakistan (Fig. 1) during January 2011–April 2013.

points where the species was known to be present. For each location point we created a buffer of 5 km<sup>2</sup>, which approximates our estimate of the home range size of the Indian pangolin in Pakistan based on its daily activity. There are no published records of the home range size of the Indian pangolin, although the home range of the Sunda pangolin *Manis javanica* in Singapore was estimated to be considerably smaller (c. 0.7 km<sup>2</sup> for females, and larger for males; Lim & Ng, 2008).

We then clipped areas outside the study area, using a shapefile of the Plateau obtained from the global topographical data layer from WebGIS (2012). We created a polygon incorporating all the buffers to construct the distribution range of the Indian pangolin in the study area. The

TABLE 1 Records of illegal capture and killing of the Indian pangolin *Manis crassicaudata* in the four districts of the Potohar Plateau (Fig. 1) during 2011–2013.

Site name	Date of record collection	Details of capture/kill
<b>Jhelum District</b>		
Dhoke Jamroz	Undated	1 jacket of scales
PD Khan	Undated	5 dead pangolins
PD Khan	July 2011	2 captures, 10 kills
Diljaba-Domeli	Aug. 2011	1 complete scale jacket
Farash Pamal	Apr. 2012	1 individual killed
PD Khan	Apr. 2012	2 live captures, 2 killed, 1 scale jacket (in addition to the kills)
Mohal	10 Apr. 2012	2 pangolins caught by nomads
Rohtas	10 Apr. 2012	12 pangolins reported to be caught & sold to nomads
Dhok Rajo	10 Apr. 2012	9 pangolins caught & sold by local people (nomads gave 15–20 kg fish for 1 pangolin)
Dhongi, Sohawa	10 Apr. 2012	15–20 pangolins caught in 2–3 months; no more pangolins were found here. Nomads distributed cards to local young people to collect information about pangolins, for poaching purposes.
<b>Chakwal District</b>		
Jubairpur	Undated	5 dead pangolins
Kallar Kahar	Undated	2 pangolins killed
Mureed	Jan. 2011	1 adult male
Chumbi Surla	Jan. 2011	1 adult male, plus 1 kg of scales
Thoha Mehram	Sep. 2011	2 individuals
Jubairpur	Oct. 2011	2 individuals
Jubairpur	Dec. 2011	3 individuals
Sardhi, Kallar Kahar	Feb. 2012	2 individuals
Ratta Sharif, Kallar Kahar	Mar. 2012	2 individuals
Talagang city	Jan. 2012	3 individuals
Chakwal city	Feb. 2012	24 kg of scales
Mathrala	20 Feb. 2013	5–6 pangolins caught by local people, plus 10–15 caught in December 2012 by local people & sold to nomads
Kot sarang	20 Feb. 2013	10–20 caught & sold for PKR 2,000–5,000 each
Dhok lunda	21 Feb. 2013	7 caught in previous few months
Dhoke Sehla	21 Feb. 2013	4 caught by local people & sold to nomads
Khokhar Zair	21 Feb. 2013	4 caught by local people & sold to nomads
Mureed	21 Feb. 2013	2 caught by local people, 1 more killed
Talagang	21 Feb. 2013	20–30 caught in previous few months
Lawa	20 Feb. 2013	34 pangolins caught by nomads
Chakora	20 Feb. 2013	1 pangolin caught by local farmer
Chandu wali	20 Feb. 2013	3 caught in previous 3 months
Danda Shah Balawal	20 Feb. 2013	7 caught in previous few months, plus 1 killed
<b>Rawalpindi District</b>		
Ghakkar Sanhal	Undated	5 killed
Malpur -Islamabad	Undated	1 adult, plus 2 baby pangolins, plus 1 road kill
Kanyat Ladhu	Mar. 2011	1 individual
Chakri village	Nov. 2011	1 individual
Banni Gala	Feb. 2012	3 individuals
Chakri	27 Apr. 2013	7 pangolins caught, plus 2 caught in previous week
Kanyat Ladhu	27 Apr. 2013	1 killed; all pangolins present here were caught during previous 8–10 months and there are none remaining
Kanaisar	28 Apr. 2013	16 caught in previous 3 months
<b>Attock District</b>		
Khairi Moorat, Near Tanaza Dam	13 Sep. 2012	50 caught (during Jan.–Sep. 2012)
Tanaza Dam colony	12 July 2012	2 caught by watchman
Jaspal	13 Sep. 2012	3 caught by local people
Near Jamat Chowk	12 Sep. 2012	25–30 caught by nomads in 2 months
Haddo wali	14 Sep. 2012	20–30 caught during previous 3 months. Population extirpated according to local people

Table 1 (Cont.)

Site name	Date of record collection	Details of capture/kill
Rattowal, Fateh Jang	16 Sep. 2012	6–7 caught
Dhok Chaki	16 Sep. 2012	7–8 caught by local boys & sold to nomads
Kisran	16 Sep. 2012	14 caught by nomads in previous 3 months

TABLE 2 The 10 protected areas on the Potohar Plateau, Pakistan (Fig. 1), indicating whether the Indian pangolin has been recorded and whether there were any records of poaching or killing of the species during 2011–2013 (Table 1).

	Protected area	Designation	District	Area (km <sup>2</sup> )	Pangolin occurrence	Poaching/killing
1	Chumbi Surla	Wildlife Sanctuary	Chakwal	559	Yes	Yes, 1 adult male captured plus 1 kg scales
2	Chinji	National Park	Chakwal	61	Yes	No evidence
3	Diljaba-Domeli	Game Reserve	Jhelum	1,181	Yes	No evidence
4	Khairi Murat	Game Reserve	Attock	56	Yes	Yes, c. 50 individuals
5	Kala Chitta	National Park	Attock	1,326	Yes	No evidence
6	Ayub Park	Other	Rawalpindi	9	Yes	No evidence
7	Ayubia	National Park	Rawalpindi (Murree)	17	No	No
8	Murree-Kahuta-Kotli Sattayan	National Park	Rawalpindi (Kahuta)		No	No
9	Margalla Hills	National Park	Islamabad	174	Yes	Yes, c. 7 individuals
10	Islamabad Wildlife Sanctuary	Wildlife Sanctuary	Islamabad	70	Yes	No evidence

distribution of the Indian pangolin provided by IUCN was retrieved as a shapefile from the Red List of Threatened Species (IUCN, 2014). To examine the occurrence of the Indian pangolin with respect to protected areas, we compared the species' distribution to the locations of the protected areas on the Potohar Plateau, obtained from the World Database on Protected Areas (IUCN, UNEP-WCMC, 2014).

Questionnaire surveys (Supplementary Material 1) were conducted with local people in the study area (including hunters, shepherds, shop keepers and school children) to gather data about illegal capture and killing of Indian pangolins. During the survey period a total of 36 monthly field visits were conducted. Based on information obtained from the questionnaires we recovered a number of dead pangolins (without scales), and scale jackets (which remain after a pangolin has died and decayed). Local people do not use scale jackets for decorative purposes but sell them in local markets.

## Results

### Spatial distribution

We recorded 158 locations across the four Districts of the Potohar Plateau (Attock, 34; Chakwal, 44; Jhelum, 35;

Rawalpindi, 45) where there were direct sightings or indirect signs of Indian pangolins (Fig. 1). Based on these occurrences we determined that the species occurs in c. 89% (19,854 km<sup>2</sup>) of the Plateau rather than in the c. 71% (15,801 km<sup>2</sup>) indicated in the IUCN Red List account for the species (Baillie et al., 2014; Fig. 1). At least 40 locations (in Rawalpindi and Attock Districts) were outside the range indicated by IUCN. The elevational range of the Indian pangolin on the Plateau was 202–879 m; in Rawalpindi District the species occurred from 457 (Gujar Khan) to 593 m (Kahuta), in Chakwal District from 478 (Mureed) to 879 m (Basharat Hills), in Jhelum District from 202 (Haranpur Victoria pul) to 631 m (Sohawa), and in Attock District from 285 (Haddowali) to 523 m (Durnal).

### Illegal capture and killing of the species

From January 2011 to the end of April 2013 we collected 412 items of evidence of the illegal capture and/or killing of Indian pangolins from 48 locations across all four districts of the Potohar Plateau (Table 1; Fig. 1). The highest number of records of illegal capture or killing were in Chakwal District (n = 156; 13 locations), followed by Attock (n = 149; eight locations), Jhelum (n = 57; eight locations) and Rawalpindi Districts (n = 50; five locations). The highest number of illegal killings occurred in February

2013 (n = 127), followed by September 2012 (n = 92), April 2012 (n = 57) and January 2012 (n = 39) (Fig. 2).

### Protected areas

The Indian pangolin has been recorded in eight of the 10 protected areas on the Potohar Plateau (Table 2), with no records in Ayubia or Murree-Kahuta-Kotli Sattayan National Parks. There are reports of poaching and killing of Indian pangolins in some of these eight protected areas (Table 2).

### Discussion

The Indian pangolin was categorized as Near Threatened on the IUCN Red List in 2009 but was recategorized as Endangered in 2014 'because it is subject to hunting and increasing levels of poaching' (Baillie et al., 2014). In Pakistan the species is categorized as Vulnerable (Sheikh & Molur, 2004). Under the Punjab Wildlife Acts and Rules (1974) it is included in Category Three of the Third Schedule and is therefore protected throughout the year (Shafiq, 2005). Despite being protected, however, the species is heavily hunted for trade (Molur, 2008), although there is limited evidence of the trade or of threats to the species (CITES, 2000). Data on any hunting and trade are required to design effective conservation strategies for the species. Without conservation efforts the population is likely to continue to decline, and could be lost from the wild in Pakistan. Baseline information about the species' biology and ecology, including habitat requirements/preferences, population and feeding habits, is also needed to inform conservation efforts.

We found that the species is widely distributed in all four districts of the Plateau and occupies 18% more of the Plateau than previously estimated (Baillie et al., 2014). It is possible that the species is broadening its range in response to hunting pressure or, more likely, that it was overlooked previously at some sites because of its cryptic nature. Given the species' low reproductive rate (Roberts, 1997), it could be extirpated from the Plateau without improved protection. Although poachers do not target individuals of a particular sex, 16 of 21 individuals recorded in a separate study were male (T. Mahmood, 2015, unpubl. data). Although this suggests a male-biased sex ratio, the sample size was small, and it is possible that males travel more widely, are more active or are easier to find.

Although pangolins are traded internationally in Asia (Wu & Ma, 2007; Challender et al., 2015), CITES does not record this trade centrally. Data from seizures of pangolins in Asia (including derivatives, species, and number of individuals in trade) between July 2000 (when zero export quotas for wild-captured individuals of the four Asian pangolin species came into effect) and 2013 indicate the level of trade and provide the most comprehensive means of analysing

illicit trade (Rosen & Smith, 2010; Underwood et al., 2013). Historically, Asian pangolin species have been exploited locally for a range of consumptive uses (e.g. as a protein source, a tonic food, and an ingredient in traditional medicine), most conspicuously in China, but also for the international trade in their scales (Herklots, 1937; Harrison & Loh, 1965). The seizure data and records of trade indicate that between July 2000 and December 2013 there were at least 886 seizures involving pangolins in Asia, with an estimated 227,278 individuals traded illegally (Challender et al., 2015). The trade was mainly of scales (41%) as well as live and dead individuals (31%) and meat (26%) (Challender et al., 2015).

There are no reports of consumption of pangolin meat in Pakistan, and the limited local trade in pangolin scales does not account for the large number of pangolins killed. Thus we conclude that the high level of poaching is driven by demand for the international trade. At present, the penalty for poaching the Indian pangolin is a fine of c. PKR 10,000 (c. USD 100) and/or 1 week in prison. This is an ineffective deterrent, as a single adult pangolin may be sold for PKR 50,000 (c. USD 500). Recent population estimates indicate the species has declined by c. 79% (Irshad et al., 2015), and that the decline is ongoing. To reduce poaching of the Indian pangolin and protect the population on the Potohar Plateau we recommend increasing the patrol and enforcement efforts and increasing the penalties for poaching. We passed our findings to the local authorities at District level (Punjab Wildlife and Parks Department, Government of the Punjab) and they have increased their efforts to protect pangolins in the study area. There are now fewer reports of pangolin captures. However, this could also indicate that Indian pangolins are continuing to decline on the Potohar Plateau and poachers are finding fewer individuals.

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### Author contributions

TM designed the study and secured funding for the research. FA, NI and RH collected field data. TM and FA analysed the data and wrote the article. AA, HF and SA assisted with the analysis and writing.

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## Biographical sketches

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