



Illegal trade of pangolins in India with international trade links: an analysis of seizures from 1991 to 2022

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Received: 10 March 2023 / Revised: 9 June 2023 / Accepted: 27 June 2023 / Published online: 31 July 2023
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Abstract

Pangolins have become one of the most intensely poached and trafficked mammal species, exploited mainly for the food and traditional medicine trade. Intense and continued illegal exploitation for commercial trade has become the leading cause of pangolin declines in parts of Asia and Africa. Recent research has illustrated the growing threat this poses to pangolins in India. India is home to two species of pangolin, the Indian Pangolin *Manis crassicaudata* and the Chinese Pangolin *M. pentadactyla*, which have been assessed as endangered and critically endangered respectively. Pangolin seizures in India between 1991 and 2022 were analysed to gain a better understanding of illegal trade dynamics. A total of 426 seizures were collated, involving an estimated 8603 pangolins. The frequency of pangolin seizures increased over time as did the volume of estimated pangolins seized. This could be due to a range of different factors including rising poaching and trade levels, increased law enforcement and reporting, and awareness. Nevertheless, on the ground, investigations by the Wildlife Protection Society of India strongly indicate that the escalating poaching and trade in pangolins is driven by lucrative market demands from beyond India's borders, with a growing focus on the trade in live pangolins. Enforcement efforts appear to be undermined by low prosecution rates with only 1.4% of recorded seizures resulting in successful convictions. Asian pangolins have rapidly disappeared from their natural range and been locally extirpated in many parts of East and Southeast Asia. India's pangolin species are at similar risk if poaching and trafficking levels continue unmitigated.

Keywords Chinese pangolin · Indian pangolin · Illegal Wildlife Trade · Traditional Chinese medicine · Wildlife conservation

Introduction

Wild plants and animals are taken from the wild around the globe for a variety of purposes, both for subsistence and for commercial trade. Human demand for food, medicines, pets, entertainment, trophies, jewellery, clothing, luxury goods,

ornamental items, charms or talismans has resulted in a multibillion-dollar wildlife trade industry (TRAFFIC 2008; WAP 2020). The latter has come to be among the greatest threats to human health, economic security and biodiversity (TRAFFIC 2008). Unsustainable harvesting is now rife in many parts of the world, and in some regions, widespread indiscriminate commercial trade, both legal and illegal, is fast becoming the main driver of species declines (Harrison 2011; Van Uhm 2016; Symes et al. 2018).

Pangolins (Pholidota: Manidae) have become one of the most intensely poached and trafficked mammal species (Challender and Waterman 2017; Heinrich et al. 2017). Globally, there are only eight species of pangolins, which occur exclusively in Africa (four species) and Asia (four species). They have been exploited locally mainly for food and traditional medicine throughout history (Wu and Ma 2007; Zhang and Yin 2014; Mohapatra et al. 2015; Nijman 2015; Shairp et al. 2016). Currently, however, the main threat to pangolins, in both Asia and Africa, is large-scale poaching for illegal international commercial trade (Challender and Hywood

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2012; Xu et al. 2016). Hunted indiscriminately throughout their range, they are particularly susceptible to the destructive effects of overharvesting due to their low fecundity (Lim and Ng 2008). Consequently, Asian pangolins have rapidly disappeared from their natural range and been locally extirpated in parts of Asia, and a similar fate is predicted for the African species based on the current levels of exploitation (C4ADS 2020; EIA 2020). The main demand for pangolins in Asia comes from China and Vietnam, where their scales are used for traditional medicine and their meat is consumed as a sign of wealth and status (USAID 2021). When pangolin populations were depleted in East Asia, poaching of pangolins from Southeast Asia was noted to have increased (Pantel and Chin 2009). As populations started dwindling in the Southeast Asian region, there was a notable shift in the trafficking of pangolins from South Asia (e.g., India, Nepal) and Africa (Mohapatra et al. 2015; Challender et al. 2016; Gomez et al. 2016; Heinrich et al. 2016).

India is home to two species of pangolin, the Indian Pangolin (*Manis crassicaudata*) and the Chinese Pangolin (*M. pentadactyla*). The Indian Pangolin is assessed as endangered by the IUCN Red List of Threatened Species (herein after referred to as the IUCN Red List) with populations reportedly in decline across their range (Mahmood et al. 2019). This species is widely distributed throughout India, and while population data is lacking, local reports from throughout known ranges in India indicate a drastic decline in their numbers (WPSI, unpublished data). The Chinese Pangolin is assessed as critically endangered by the IUCN Red List based on a declining population trend and is marginally present in North and Northeast India (Challender et al. 2019). Both the Indian and Chinese Pangolin are protected under Part I of Schedule I under India's principal wildlife law, The Wild Life (Protection) Act, 1972. Consequently, for both species, the hunting, killing, unlicensed possession, unlicensed transport and any mode of transfer, apart from inheritance, of the listed species or products thereof, such as trophies and derivatives, is prohibited. Domestic and international trade or commerce in these species and their derivatives is also prohibited. Offences related to species listed in Schedule I are punishable with imprisonment between a minimum of 3 years and a maximum of 7 years as well as a fine of no less than INR25K (USD306). In the case of a second or subsequent offences, the imprisonment term remains the same, but the fine increases to a minimum of INR100K (USD1223). Since 1976, India has also been a Party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which regulates the international legal trade to safeguard certain listed wildlife species from over exploitation (www.cites.org). Pangolins are listed in Appendix I of CITES, and as such, international commercial trade in these animals, their parts or derivatives is essentially prohibited.

Despite these protection measures, pangolins are relentlessly hunted in India for commercial trade (TRAFFIC 2023). Between 2009 and 2014, there were 49 pangolin seizures reported in India which accounted for 913 kg of scales and two whole pangolins (Mohapatra et al. 2015). Between 2015 and 2017, there were 41 pangolin seizures, the majority of which were of scales amounting to 4852 kg (Choudhary et al. 2018). India was also identified as an important origin country for pangolins found in illegal international trade from 2010 to 2015 (Heinrich et al. 2017), and Aditya et al. (2021) report a significant increase in seizures during the COVID-19 lockdown from March to August 2020, in comparison to the same period in 2018 and 2019, pre-pandemic. These studies illustrate the growing threat of poaching and illegal trade to pangolin species in India. Seized pangolins in India are thought to be *en route* to China where demand for pangolin scales for traditional medicine is high (Xu et al. 2016; D'Cruze et al. 2018; EIA 2020; USAID 2020; WJC 2020). However, there is very little documentation of these trade dynamics or its scale. Monitoring and analysis of wildlife seizures can reveal much about the illegal nature of wildlife trade covering such aspects as trends over time, trafficking routes, poaching and trade hotspots, source, transit and destination countries and enforcement levels (Rosen and Smith 2010; Burgess et al. 2014; Chng 2014; Petrossian et al. 2016; Stoner et al. 2016; Siriwat and Nijman 2018). In this study, we analyse pangolin seizures in India to gain a better understanding of local and international illegal trade dynamics. This information can then be used to identify and prioritise mitigation measures for enforcement and conservation action.

Methodology

Data acquisition

Seizure data involving pangolins in India was systematically collected for the period January 1991–March 2022 by the Wildlife Protection Society of India (WPSI). This data is collated, categorised and stored in WPSI's database on wildlife crime. Primary information is collected from a network of field-staff, local non-government organisations (NGOs) and concerned citizens. WPSI also liaises with enforcement agencies, including the Forest Department, police and customs, to collect and/or verify information on seizures and other forms of wildlife crime. Information is also obtained from open sources such as the media, both local and regional, which is verified with the relevant agencies prior to entry into the database. A large amount of information has also been acquired by WPSI as part of wildlife trade studies conducted with state governments in India, and

the Right to Information Act 2005 has been used to elicit information about incidents of crime.

Data analysis

From each seizure incident, we extracted, where available, information on date of seizure, commodity (live animals, scales), quantities of each commodity seized, location of seizures and trafficking routes, suspects arrested and prosecution outcomes. Using this data, we mapped trade hubs and centres within India. The data were curated and summarised in the R software environment (Version 4.2.0). The figures were made using the ‘ggplot2’ package (Wickham 2016) and Excel. Each seizure incident could contain several records, e.g. if in one seizure incident different commodities were seized, such as scales and live pangolins. As such, for the summary of commodities through time, we used number of records instead of number of incidents. For this, we also categorised the different commodities into (i) scales (including scales only), (ii) live animals (including live animals only) and (iii) other (including all other commodities, see Table 1).

Estimation of whole pangolins

Chinese Pangolins were only specifically reported in 13 seizure incidents. As India is a range country, we assumed that the term ‘pangolin’ generally referred to the wide-ranging Indian pangolin (and not the more range-restricted Chinese Pangolin or any of the other six extant pangolin species that do not occur in India). As such, we acknowledge that we might be misclassifying seized Chinese Pangolin as Indian Pangolin in a limited number of cases.

The body and scale mass of pangolins can vary considerably, depending for instance, on the species, sex and life stage. We used the parameters reported in Challender et al. (2015) for Indian and Chinese pangolins for their average

individual weight, meat weight and scale weight (Table 1). The average number of scales per pangolin was reported to be 554.4 for Chinese pangolins (*M. pentadactyla*) (Ullmann et al. 2019). Ullmann et al. (2019) reported the number of scales per Indian pangolin (*M. crassicaudata*) to be an average of 495.11, whereas Algewatta et al. (2020) reported an average of 511 scales per Indian pangolin. We thus used an average scale count per Indian pangolin of 503.06 (Table 1).

For pangolin claws, it was assumed that the average of a minimum of 1 and a maximum of the number of seized claws (up to 20 claws per pangolin) represents the number of pangolins that were involved in an incident. Where pangolin scales were provided as a count instead of weight, we assumed that the average of a minimum of 1 pangolin (for up to 503.06 scales) and a maximum number of pangolins equalling the scale count represent the number of pangolins in that seizure incident. The same applied for an incident involving a scale ring, which was assumed to be made out of a single scale. Pangolin skins and trophies were assumed to equal one pangolin each. In a single incident where a pangolin skin, skull and bone were reported to be seized, these were assumed to also equal one pangolin. Finally, the averaged quantities for all commodities were rounded up to estimate the whole number of pangolins involved in each seizure incident. Hereinafter, any reference to ‘whole pangolins’ or ‘number of pangolins’ should be interpreted as representing an estimated volume based on commodities (i.e. dead, live, scales and other parts) seized. We note that standardised methods are urgently needed to estimate the number of pangolins involved per seizure from body parts. Currently, studies reporting estimated whole pangolins are not directly comparable as authors may use different conversion parameters as no guidelines nor established parameters exist yet to more accurately estimate whole pangolins involved in trade. This may lead to skewed and varying results even of the same seizure in different studies.

Table 1 Conversion parameters for Chinese and Indian pangolins (missing indicated by “–” if the combination did not occur)

Species	Commodity	Minimum (count)	Maximum (count)	Minimum (weight (kg))	Maximum (weight (kg))
Chinese pangolin	Scale	–	–	Weight/0.573	Weight/0.573
	Live	count	count	–	–
Indian pangolin	Scale	1 (up to 503.06)	Count	Weight/1	Weight/1
	Live	Count	Count	–	–
	Dead	Count	Count	–	–
	Meat			Weight/5.5	Weight/5.5
	Trophy	Count	Count	–	–
	Skin	Count	Count	–	–
	Scale ring	1 (up to 503.06)	Count	–	–
	Skin, skull and bone claw	Count	Count	–	–
		1 (up to 20)	Count	–	–

Results

We collated 426 seizures (hereafter also ‘incidents’) involving pangolins in India from 1991 to 2022. At least 5,788.94 kg and 4796 individual pangolin scales, 30 kg of meat, 192 live pangolins, 72 claws, 7 skins, 5 dead pangolins, 1 scale ring, 1 skin/scale/bone and 1 trophy were confiscated in these incidents. There were a further 22 incidents where no quantities were reported for commodities seized, i.e. three incidents involving meat, one incident involving claws and 18 incidents involving scales. Based on commodities seized and quantities provided, we estimated that these incidents accounted for a total of 8603 pangolins. Additionally, during the same time frame, there were 24 poaching cases involving 26 pangolins that are not included in further analysis as these incidents involved poachers caught in the act of having illegally killed pangolins in the wild. The carcasses were seized by the authorities but did not enter the illegal trade in pangolins.

Seizure incidents increased over time, especially since 2009, reaching its current maximum in the year 2021 with 89 incidents (Fig. 1). Similarly, the number of estimated pangolins seized each year started to increase in 2009, with the current maximum number of estimated pangolins involved in these seizures occurring in the year 2011 with 2074 pangolins. After a sudden decrease in seized volumes, the number of seized pangolins appears to be on the rise again since approximately 2018, following the pattern of the number of seizure incidents (Fig. 1).

The most frequently confiscated commodities were live pangolins and scales, constituting 40.7% and 53.9% of

seizures respectively. Through time, the number of incidents involving live pangolins appears to have increased and is now superseding that of scales (in terms of number of incidents) (Fig. 2a). However, in terms of the overall number (i.e., volume) of pangolins involved, 97% of pangolins came from seizures involving scales, while only 2% came from seizures involving live pangolins (Fig. 2b).

Most seizure incidents occurred in central India, with Odisha having the highest number of incidents (83 incidents), followed by Madhya Pradesh (51), and Maharashtra (49) (Fig. 3a). However, the highest volumes of pangolins, based on commodities seized, involved seizures in the eastern states bordering Bangladesh and Myanmar. Manipur had by far the most pangolins seized (3312 estimated pangolins), followed by Mizoram (1049), West Bengal (1038) and Assam (906) (Fig. 3b).

The mode of transport was only recorded in 40 incidents (9.4%), with the majority being by road (bus/car) in 28 instances, eight by train/rail and four by air. Domestic trade routes of the animals and their parts were only recorded in seven incidents. All pangolins in these seven incidents reportedly came from different states/districts of India (Assam, Chhattisgarh, Haryana, Uttar Pradesh, Jharkhand, Khorda, Maharashtra, Nagaland) and were on their way to other states of India (Assam, West Bengal, Manipur, Meghalaya, Odisha, Uttar Pradesh). International destinations were reported in three incidents i.e., China (one incident), Myanmar (one incident) and Nepal (one incident). There were a further two incidents where foreign nationals (Bhutanese — one incident; Burmese — one incident) were arrested in possession of pangolin products which

Fig. 1 Seizure incidents involving pangolins in India from 1991 to 2021. Displayed is the number of incidents (a) as well as the estimated number of pangolins involved in these seizure incidents (b). Note that the year 2022 is not displayed as it was incomplete

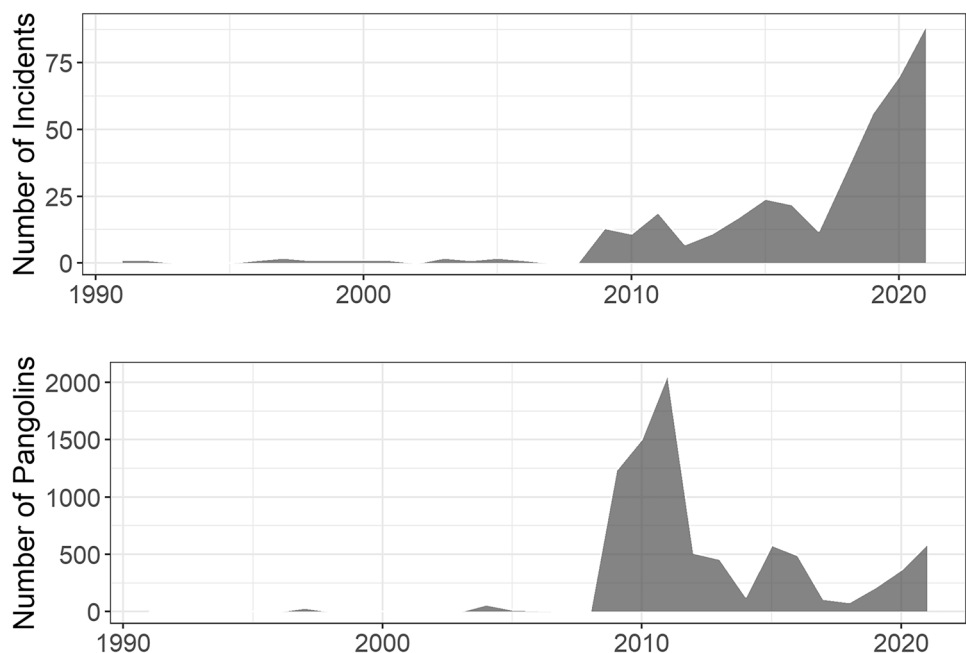
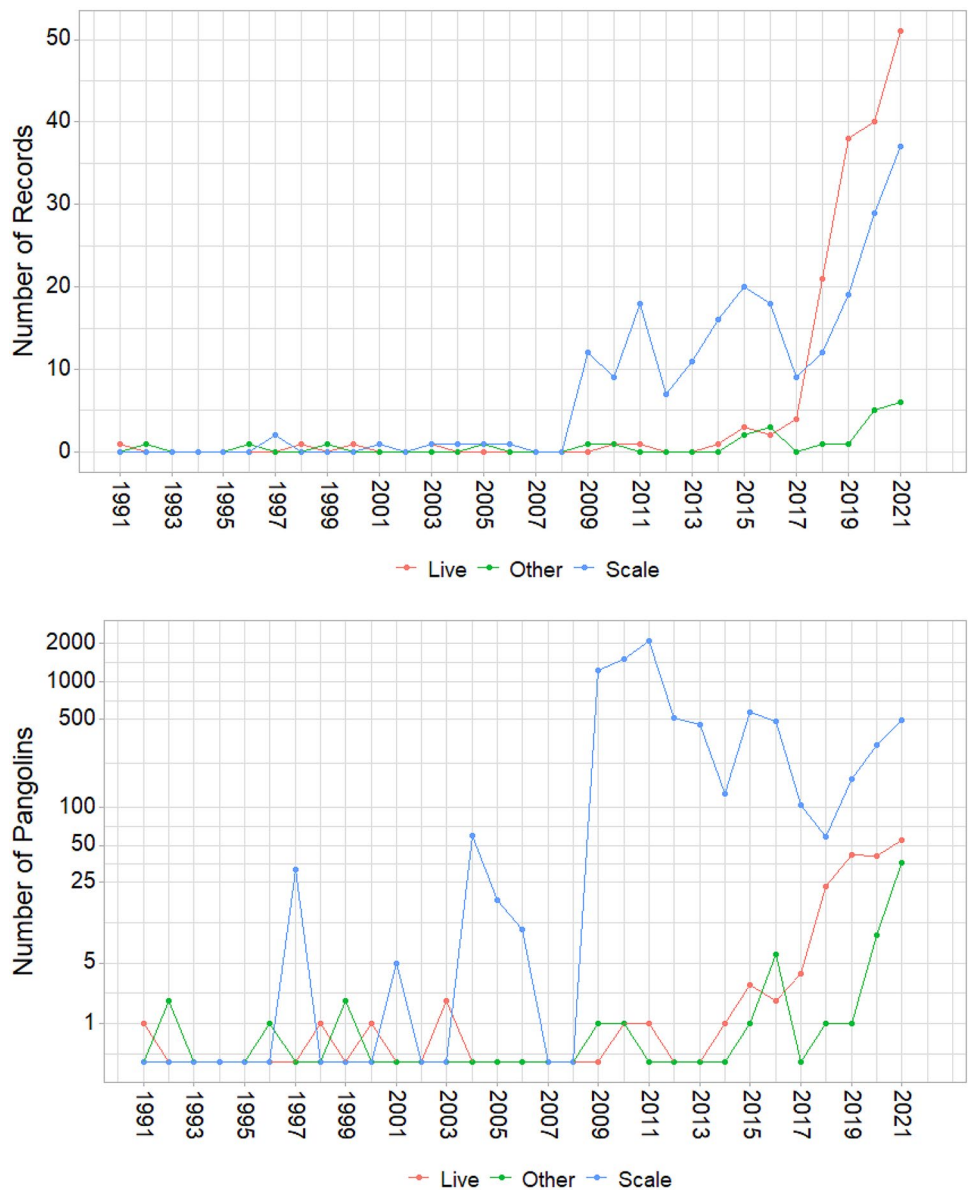


Fig. 2 Contribution of **a** the number of records per commodity and **b** the number of pangolins per commodities from 1991 to 2021. Note that the year 2022 is not displayed as the data was incomplete and that the y-axis in **b** is displayed on a log scale



potentially implicates these two countries in the trafficking of pangolins from India.

According to available information, a total of 1320 suspects have been arrested in connection to the 426 seizures, but only 1.4% of these incidents have so far resulted in successful prosecutions, with only 31 suspects convicted (Table 2). There was a wide range of penalties meted out — a sentence of 2 months imprisonment (although by law, the minimum sentence is 3 years for poaching and trading of protected species) was given to one suspect in Manipur for illegal possession of 10.7 kg of pangolin scales, while the maximum sentence of 7 years imprisonment was given to 13 suspects in one case in Madhya Pradesh for illegal possession of 0.3 kg of pangolin scales and turtle body parts.

Discussion

Our study confirms that illegal trade of pangolins is occurring throughout India with recorded seizures in most states across the country. It should be noted that while there are numerous beneficial insights into illegal wildlife trade from analysing seizure data, there are also various biases associated with such data. As such, our interpretation of the data set should not be considered as representing a complete picture of the illegal trade of pangolins in India. It should be further noted that the presented data set should not be assumed to encompass absolute trafficking volumes or scale of the pangolin trade in India given the overall inherently covert nature of the illegal wildlife trade. For example, India is composed of 28 states and eight Union Territories, and

Fig. 3 Spatial distribution of seizures in India from 1991 to 2022 in terms of **a** the number of seizure incidents per state and **b** the estimated volume of pangolins involved per state. The boundaries shown and the designations used on this map may not be correct and do not imply any official endorsement and/or acceptance by the authors or their respective institutional affiliations

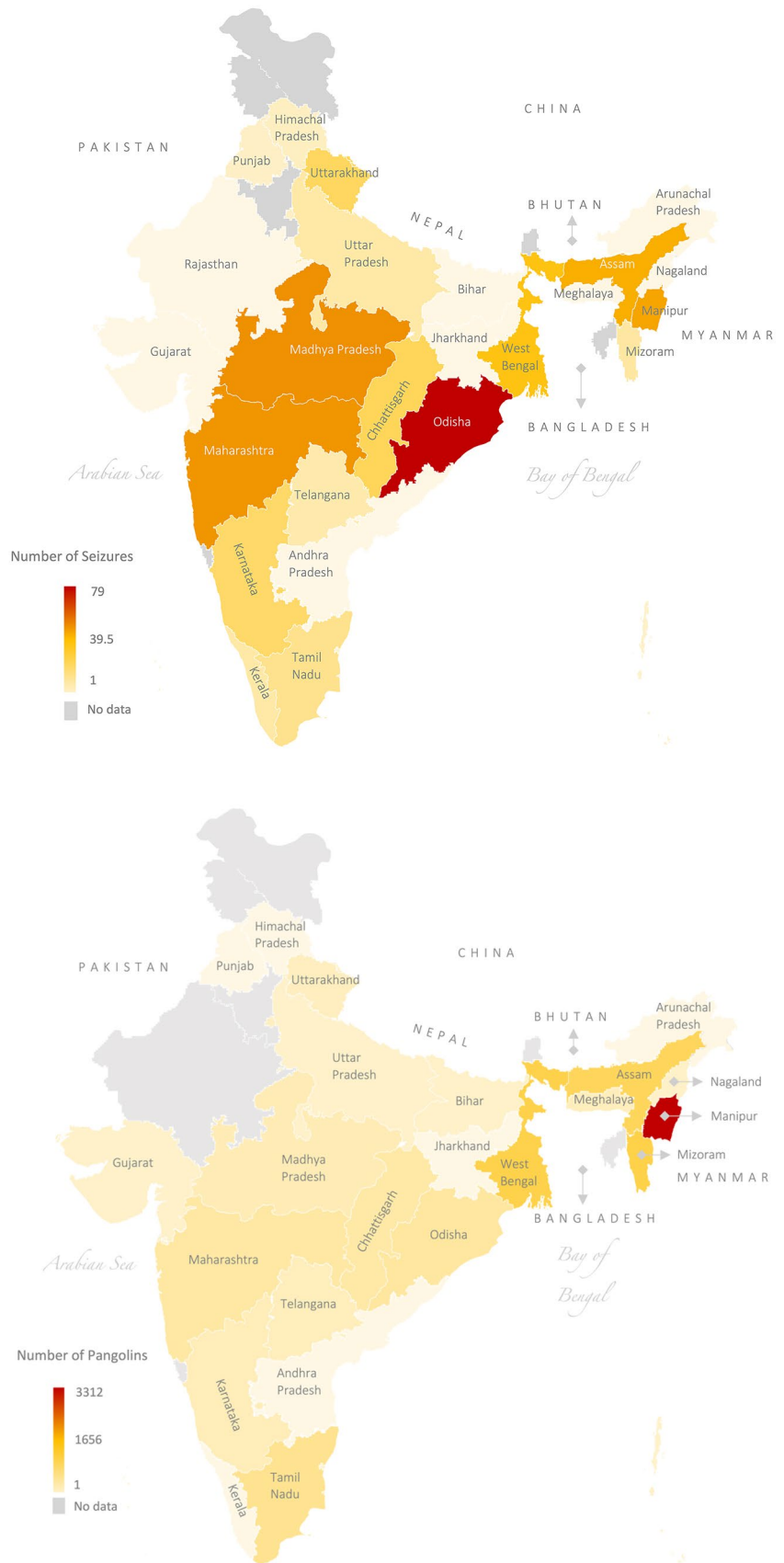


Table 2 Successful prosecution of seizures involving pangolins in India from 1991 to 2022

Year	Date	State	Suspects arrested	Outcome	Description
2013	31 Jul 2013	West Bengal	7	3 years imprisonment and fine of Rs. 10,000 (~USD122)	Forest Department officials seized 70 kg pangolin scales and 6 kg sea horses
2014	03 Jun 2014	Uttarakhand	1	3 years imprisonment and fine of Rs.10,000 (~USD122)	Forest Department officials arrested one person with 0.5 kg pangolin scales
2014	13 Nov 2014	Manipur	1	2 months imprisonment	Assam Rifles officials arrested one person and seized 10.7 kg pangolin scales
2017	18 Jan 2017	Madhya Pradesh	6	4 years imprisonment and fine of Rs. 10,000 (~USD122)	Forest Department officials seized pangolin scales and other wildlife products. 10 leg hold steel traps (use to catch tiger and leopard) were also seized
2017	05 May 2017	Madhya Pradesh	13	7 years imprisonment	Forest Department officials seized 0.3 kg of pangolin scales and turtle body parts
2021	15 Aug 2021	West Bengal	2	5 years imprisonment	Forest Department officials arrested two people and seized one pangolin skin in their possession

At least 76 incidents (17.8%) included the confiscation of multiple species. The most frequently seized species alongside pangolins were leopards *Panthera pardus* ($n=28$), Tigers *P. tigris* ($n=15$) and deer ($n=13$) (refer to supplementary table S1)

as such, law enforcement levels, arrests and prosecutions as well as level of recording and reporting of seizures are likely to vary across the country. These inconsistencies could for example explain why one state has more seizures than others. The data also shows that the frequency of pangolin seizures has increased over the years along with volumes of pangolins seized. There could be multiple reasons for this increase including improved enforcement efforts or better reporting of seizure incidents, which is perhaps expected since pangolins became a priority on the global conservation agenda in 2016 with their listing in CITES Appendix I, putting increased impetus on governments to tackle this threat. Moreover, pangolin conservation has been gaining traction on a global scale, and awareness has risen among conservation organisations, government agencies, media and the public regarding the scale of the threat to pangolins, which have been described as the most heavily trafficked mammals on the planet. The illegal trade of pangolins has garnered much attention in India over the last couple of years (see e.g. Mohapatra et al. (2015), Choudhary et al. (2018), D’Cruze et al. (2018), Aditya et al. (2021), TRAFFIC (2023)). This is likely to have had a positive impact on enforcement efforts, as well as drawn media attention to their plight.

Nevertheless, it is probable that the global demand for and high commercial value of pangolins scales (Xu et al. 2016; D’Cruze et al. 2018; EIA 2020; USAID 2020; WJC 2020) is also having an influence on poaching and trade of pangolins in India, i.e. pushing poaching levels up particularly since pangolins are depleted in many other parts of Asia. D’Cruze et al. (2018) concluded based on hunter interviews that tribal groups in Northeast India are targeting pangolins more for commercial gain than traditional use.

Similarly, WPSI, as part of continued investigations into the illegal trade of wildlife across India, has also noticed that known big cat poachers from traditional hunting communities have begun targeting pangolins (unpublished data). Based on seizure data alone, it is difficult to determine whether pangolins are being poached for domestic/subsistence needs or for the international commercial market, or a combination of the two. However, seizure data combined with WPSI on the ground investigations strongly indicate that the growing poaching and trade in pangolins is driven by lucrative market demands from outside India’s borders, with a growing focus on the trade in live pangolins. Pangolin meat is known to be consumed locally (Mohapatra et al. 2015; D’Cruze et al. 2018) and their scales kept as lucky charms (Ghosh 2019), but detailed information on the magnitude or scale of local use is lacking. It is not an uncommon practice to consume the meat of species after removing the tradeable body parts (Harrison et al. 2016; Nijman et al. 2017). Studies from multiple other sources have also flagged the main conservation threat to pangolins to be industrial scale global commercial demand (Ghosh 2019; C4ADS 2020; EIA 2020) which can be intertwined with subsistence use. This is exemplified in parts of Africa where traffickers use the local bushmeat trade to collect scales in bulk which are eventually smuggled to China (C4ADS 2020). Acknowledging these complications, the fact that live pangolins and pangolin scales in particular were the most common commodities confiscated during the study period, which corresponded with a recent TRAFFIC analysis of pangolin seizures (2018–2022) in India (TRAFFIC 2023), more broadly support commercial use being the main driver of pangolin poaching in India.

Most seizures occurred in the heart of India, particularly the states of Odisha, Madhya Pradesh and Maharashtra. Improved enforcement effort could account for more seizures in these states. It is also possible that these states are a key source of pangolins as they are among the top five states with the largest forest cover in the country (Forest Survey of India 2021). The greatest volume of pangolins was seized in the eastern States of Manipur, Mizoram, West Bengal and Assam. These eastern states also border Bangladesh, Bhutan, Myanmar and Nepal and are considered prominent trade routes in the trafficking of pangolin scales and other illicit wildlife from India into China. At least three seizure incidents confirm this link whereby China, Myanmar and Nepal were reported as intended destinations. In addition, in two other seizure incidents, a Bhutanese and a Burmese national were arrested in India for illegal possession of pangolin scales, further linking these two countries in the trafficking of pangolins to or from India. There were also numerous pangolin seizures reported in the Chandel district of Manipur and the Champhai district of Mizoram which are known trafficking routes in the smuggling of wildlife into Myanmar. Similarly, seizures in West Bengal, especially in the districts of Darjeeling and Jalpaiguri, are transit points for wildlife entering Bangladesh, Bhutan, Myanmar and Nepal. China remains one of the most significant end destinations in the illegal international trade of pangolins (USAID 2021). Despite China's ban on the trade in pangolins for food, patented medicines containing pangolin scales are still approved for commercial use by pharmaceutical companies (C4ADS 2020; EIA 2020). Myanmar is known to be a key gateway through which pangolins, particularly scales, enter China (Nijman et al. 2016; Zhang et al. 2017). Zhang et al. (2017) note the lax enforcement within Myanmar that facilitates the easy movement of illicit wildlife products into China. Nepal is another country known to be a transit route in the trafficking of wildlife from India to China (Li et al. 2000; Paudel et al. 2020; Bashyal et al. 2021). Information on Bangladesh and Bhutan's role in the illegal trade chain is scarce and warrants further investigation. Heinrich et al. (2017) in their global assessment of the illegal pangolin trade discovered 159 unique international trade routes used in a 6-year period reinforcing the highly mobile nature of smuggling networks.

It is not possible to accurately determine the impact of illegal trade on pangolin populations in India as their status in the wild is currently unknown (Challender et al. 2019; Mahmood et al. 2019). But the devastating impacts of illegal take and trade on pangolins can be witnessed across the rest of Asia (Challender and Waterman 2017; Challender et al. 2019; Mahmood et al. 2019). This is already apparent in the State of Assam where hunters claim that pangolins have become less abundant over the years (D'Cruze et al. 2018). Pangolins in India are clearly facing a perilous future

if the current threats posed by poaching and illegal trade are not addressed. This is particularly poignant considering the brutal ways pangolins are killed to retrieve scales for trade (D'Cruze et al. 2018). Furthermore, the growing trade in live pangolins is similarly devastating given their low rate of survival under captive conditions (Hua et al. 2015). In India, the general practice is to release confiscated live animals, if healthy, back to its natural habitat as soon as possible. However, if a seized animal is injured, it is sent to a rescue centre for treatment. Some of these animals are unlikely to survive while others end up in zoos and remain in captivity. While enforcement efforts throughout the country are evident through the occurrences of numerous seizures, it would appear these efforts are currently being undermined by the poor prosecution rates with only 1.4% of cases resulting in successful prosecution so far. This is likely a reflection of an overburdened judicial system. There are an estimated 44 million cases (not just wildlife) pending before the courts across the country. Except for high-profile cases taken up by the media (e.g., the pangolin case in Madhya Pradesh where 13 suspects were convicted in 2017), wildlife cases can sometimes take up to 10 years to reach a conclusion. During this time, cases often collapse due to the death/absence of the accused and/or witnesses and the loss of crucial documentation. Considering the detrimental impacts of commercial trade on many wildlife populations (Gray et al. 2018; Symes et al. 2018), it is imperative that wildlife crime be taken more seriously, and this includes increasing the risk of apprehension, prosecution and punishment (Wellsmith 2022; Shepherd et al. 2017). Furthermore, enforcement efforts need to be enhanced to include intelligence-led investigations to tackle the international trafficking of pangolins across India's borders and the trafficking syndicates involved, as well as to tackle demand from buyers and end consumers. Transnational cooperation between India and neighbouring countries needs to be strengthened and needs to encompass coordinated investigations to disrupt trafficking networks (WJC 2019). There also needs to be greater effort to investigate, record and report all crucial information relevant to pangolin seizures in India, which is needed to understand, monitor and assess illegal trade dynamics and subsequently to support conservation action plans. Continued detailed research into the domestic and international trade of pangolin is also warranted as it will benefit efforts to monitor trade trends and determine effective conservation strategies. Echoing D'Cruze et al. (2018), engagement with hunters and tribal communities, through education, awareness, behaviour change programmes and alternative livelihood solutions, will also be crucial in mitigating poaching threats to pangolins in India and prevent local hunters from being exploited by wildlife traffickers.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10344-023-01708-9>.

Acknowledgements We thank Born Free Foundation for supporting Wildlife Protection Society of India's project on pangolin anti-poaching and conservation in Odisha, and Project Director, Dr Biswajit Mohanty, for his tireless pangolin anti-poaching work and the collection of data and information from some of the richest and remotest pangolin habitats in India. We also thank World Animal Protection for supporting this research project and the US Fish and Wildlife Service for supporting WPSI's Wildlife Crime Database. We are grateful to our reviewers, as well as Chris R. Shepherd, Loretta Shepherd and Angie Elwin, for useful comments that helped improve this manuscript.

Author contributions All authors contributed to the study conception and design. Data collection was done by Tito Joseph and Belinda Wright, and data analysis were performed by Lalita Gomez and Sarah Heinrich. The first draft of the manuscript was written by Lalita Gomez and all authors subsequently contributed to writing, editing and review of all versions of the manuscript. All authors have read and approved the final manuscript.

Funding This research project was funded by World Animal Protection.

Data availability Data availability is available upon request to the Monitor Conservation Research Society.

Declarations

Competing interests The authors declare no competing interests. Neil D'Cruze holds the position of Head of Research at World Animal Protection, an international animal welfare-focused NGO. Our intent in carrying out this study was to provide insight that would help inform recommendations and advice for the improved protection of pangolins in India from the illegal wildlife trade. Our results pertaining to this study were in no way influenced by either the funding source, or our own personal views on animal welfare.

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