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Global Ecology and Conservation

journal homepage: www.elsevier.com/locate/gecco

Tracking the traffickers: Unmasking the illegal trade demographics of Temminck's pangolin in South Africa (2016–2024)

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ARTICLE INFO

Keywords:

Smutsia temminckii
Wildlife trafficking
Suspects apprehended
Court sentences

ABSTRACT

Pangolins (Order: Pholidota) are considered a very rare and threatened group of mammal taxa, and are widely recognized as the most trafficked mammals globally. In recent years, Africa has become an increasingly important source to supply demand, particularly from Asian markets. However, the extent and scale of the trade within South Africa remains poorly documented. Our study aimed to investigate the extent of the illicit trade in the Temminck's pangolin (*Smutsia temminckii*) in South Africa between 2016 and 2024. We investigate the category of pangolin commodity in the form of live animals, whole carcasses, skins or only scales. We further attempt to find an association of this trade with suspects nationality, asking price and, for those cases heard, the court outcome of sentences. We recorded a total of 302 pangolin retrieved from the trade, the large majority still alive (81.4 %), followed by dead carcasses (8 %), skins (7.6 %) and scales only (3 %). Pangolins were retrieved in eight of the nine South African provinces, primarily in Limpopo (n = 120, 39.7 %) and Gauteng (n = 91, 30.1 %), with an annual average spike in the austral spring month of October. A total of 679 individual suspects were arrested in 276 separate police operations, of which 51 % were known nationalities; predominantly South African (n = 170) followed by Zimbabwean (n = 119). Fifty-seven (52.9 %) of the total cases that proceeded to court were finalized. Victim impact statements (endangered species status and law governing the species in South Africa) compiled by a species specialist were added to the docket in 63 % of cases and contributed to more jail sentences imposed, longer jail terms and, in cases of a fine imposed, heftier fines. We propose the appointment of dedicated public prosecutors within specific provinces who specialize in wildlife crime, along with the development of national guidelines for cases involving particular taxa, such as pangolins. This would assist regional magistrates' courts better navigate the complexities of wildlife law enforcement.

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<https://doi.org/10.1016/j.gecco.2025.e03924>

Received 14 March 2025; Received in revised form 8 October 2025; Accepted 19 October 2025

Available online 20 October 2025

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1. Introduction

Modern man has been pursuing and hunting pangolins for at least the past 40,000 years (Harrisson et al., 1961; Corlett, 2007; Piper et al., 2007). This direct persecution of pangolins has even led to the global extinction of a species of giant Asian pangolin (*Manis paleojavanica*) around that time in Indonesian Borneo (Medway, 1977; Corlett, 2007; Piper et al., 2007). In more recent times, records indicate that commercial harvesting and international trade in pangolins took place throughout the early to mid-20th century (Challender et al., 2020) and the hunting of pangolins has continued in both Africa and Asia, where they are captured and traded in high unsustainable numbers (Corlett, 2007; Ingram et al., 2018; Tinsman et al., 2023).

Historically, pangolins were primarily targeted for their meat in Africa (Boakye et al., 2015) and for traditional medicine in the Asian market (Challender and Hywood, 2012).

However, the history of the use of pangolins in Africa remains unclear and not as well documented as it has been in Asian countries (Boakye et al., 2015). Asian pangolins, particularly the critically endangered Chinese Pangolin (*Manis pentadactyla*) (IUCN, 2019), of which only small remnant populations remain (Nash et al., 2016), have been used as a source of Traditional Chinese Medicine since the early Northern and Southern dynasties (420 – 589 AD) and can be traced back to a medical text entitled “*Bencaojing jizhu*” authored by Li in 1578 (Wang et al., 2023). Initially, its medicinal value was primarily related to spiritual ailments and later, in the Tong dynasty (618 – 907 AD), for more clinical applications, such as the treatment of malaria (Hu et al., 2012). The demand for pangolin scales has increased in modern times and it has further been estimated that upwards of a million pangolins have been harvested from the wild in the past decade alone (Challender and MacMillan, 2014). However, the large majority (83 %) of this trade is in the form of pangolin scales only and the actual numbers are difficult to quantify (Challender et al., 2020). However, unlike west and central Africa, the large volume of the trade in southern Africa is in living Temminck’s pangolins (*Smutsia temminckii*).

As the four Asian pangolin species have become even more scarce, the demand for pangolin scales has in turn increased in Africa at industrial levels in order to supply the Asian market demands (Wang et al., 2023). This connection has further been strengthened in the backdrop of the more recent growth in economic ties between Africa and Asia (Challender and Hywood, 2012). To address the growing demand in Asia, pressure has increasingly been directed towards certain African pangolin species from two genera: *Phataginus* and *Smutsia*, specifically *P. tetradactyla*, *P. tricuspis*, *S. gigantea*, and *S. temminckii* (Heinrich et al., 2016; Ingram et al., 2018, 2019; Emogor et al., 2021). As a result, international trade in all four African species has been banned since 2016, following their listing on Appendix I of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) (CITES, 2016). This Appendix I classification does not allow for any commercial trade in any pangolin species, globally (Challender and Waterman, 2017). Despite the trade ban and other protective measures, regions in Eastern, Middle, and Western Africa continue to illegally traffic pangolin scales to Asian countries (Challender et al., 2015; Heinrich et al., 2016; Heinrich et al., 2017; Ingram et al., 2019; Omifolaji et al., 2020; Emogor et al., 2021). Reports indicate that countries such as Nigeria, the Democratic Republic of the Congo, and Cameroon are major exporters of pangolin scales from Africa to Asia (Ingram et al., 2019; Xu et al., 2016; Nethavhani et al., 2025).

Interceptions of pangolin scales from Africa to China have increased remarkably in recent years totaling 6.4 tonnes (6400 kg) in 2014 (Baker, 2014), 6.3 tonnes in 2015, 18.9 tonnes in 2016, 46.8 tonnes in 2017, 39.7 tonnes in 2018 and more than 97 tonnes in 2019 (Nethavhani et al., 2025). Unfortunately, these seizures are likely to only represent a fraction of the actual trade as the majority remains undetected (Challender et al., 2020) and crime syndicates involved also operate closely with the trade in other wildlife from Africa in well-organised smuggling routes that are regularly adapted (Gomez et al., 2016). The illegal trade in pangolin scales has now become extremely lucrative as the price for pangolin scales exceeds US\$ 500/kg (Zhou et al., 2014) and pangolin scales retailed for US \$ 800/kg in China in 2016 (Challender et al., 2020), and a whole pangolin’s value surpasses US\$ 6000/animal (Challender and Hywood, 2012). These prices are likely much higher currently. South Africa is not exempt from this trade, and the number of live pangolins retrieved from the illegal wildlife trade in this country has increased dramatically in recent years (NDPP, 2018).

Internationally, *S. temminckii* is assessed as “vulnerable” by the International Union for Conservation of Nature (IUCN) red list and in South Africa, pangolins are listed as a Threatened or Protected Species (ToPS), where a fine not exceeding ZAR 10 million (~US\$ 559,597) or imprisonment for a period not exceeding ten years, or both such a fine and prison sentence, may be imposed (NEMBA, 2004). As such, state laws relating to the protection of pangolins in this country remain the most rigorous globally. However, national laws are often at odds with provincial laws which are more often imposed in regional, mostly rural, provincial magistrate’s courts as gazetted within provincial legislation (Table 1). This regional and national variation often makes sentencing difficult and confusing for

Table 1
Provincial legislation related to *S. temminckii* in South Africa.

Province	Pangolins listed as
National	A Vulnerable species in terms of NEMBA
Western Cape	Endangered Wild Animals (Schedule 1) in terms of the Western Cape Nature Conservation Laws Amendment Act, 3 of 2000.
North West	Protected Game (Schedule 2) Section 15 (1) (a) in terms of the Transvaal Nature Conservation Ordinance 12 of 1983.
Mpumalanga	Protected Game (Schedule 2) Section 4 (1) (b) in terms of the Mpumalanga Nature Conservation Act, 10 of 1998.
Northern Cape	Listed as Specially Protected Schedule 1 in terms of the Northern Cape Nature Conservation Act 9 of 2009.
Limpopo	Specially Protected Wild Animals (Schedule 2) in terms of the Limpopo Environmental Management Act, 7 of 2003.
Gauteng	Protected Game (Schedule 2) Section 15 (1) (a) in terms of the Nature Conservation Ordinance, 12 of 1983
Free State	Schedule 1 Protected Game (Section 2) in terms of the Nature Conservation Ordinance, 8 of 1969.
KwaZulu Natal	Specially Protected Game (Schedule 3) in terms of the Nature Conservation Ordinance, 15 of 1974.
Eastern Cape	Endangered Wild Animals (Schedule 1) in terms of the Cape Nature and Environmental Conservation Ordinance, 19 of 1974.

regional magistrates, particularly for a species that is notoriously not well known or even recognised as they are rare, predominantly nocturnal and solitary.

Historically, the accused found guilty of trading in pangolins were sentenced to a mere fine ranging from ZAR 500 (~US\$28) to ZAR 10,000 (~US\$560) (NPA, 2018). Sentencing has a direct impact and acts as a deterrent and can have a direct influence on the level of trade. Lesser sentences or fines are not effective deterrents and are not likely to reduce trade numbers (Merem et al., 2018). Prior to 2017, the South African courts had yet to impose a jail term for an accused found guilty of being illegally in possession of a pangolin. The National Prosecuting Authority of South Africa (NPA) recognized the steep increase in poaching and cross-border trafficking of pangolins from 2014 to 2018. This compelled the NPA to consult and include public and private stakeholders such as non-government organisations (NGOs) and species specialists to assist with evidence in aggravation of sentences within these cases (NDPP, 2018). This approach has proven to be successful, as improved collaborations and research yielded an increase in arrests and improved sentencing from mere financial fines to jail terms being imposed and carried out.

South Africa is regarded as one of the wealthiest countries in Africa and has attracted migrant labour from its neighbouring countries for many years (Dinbabo and Nyasulu, 2015). Live pangolins are often brought into South Africa from neighbouring countries such as Zimbabwe, Botswana, Namibia and Mozambique and locally sourced in provinces such as Limpopo, North-West, Mpumalanga and the Northern Cape provinces, where they occur naturally (NDPP, 2018). However, it remains unclear how many pangolins are traded locally and what proportion of these are intercepted by law enforcement. Additionally, it remains unclear as to the form of the commodity, whether it be in living pangolins, carcasses, skins or scales only. In this study, we aimed to investigate the extent of the illicit trade in the Temminck's pangolin (*Smutsia temminckii*) in South Africa between 2016 and 2024. Here, we investigate the category of pangolin commodity in the form of live animals, carcasses, skins or pangolin scales only. We further attempt to find an association of this trade with suspects nationality, asking price and, for those cases heard, the court outcome of sentences in an attempt to gain a better understanding of the demographics of pangolins retrieved out of the illegal trade.

2. Methods

2.1. Study area

Data were accumulated in all provinces in South Africa where pangolins (alive or dead) or their skins or individual scales were

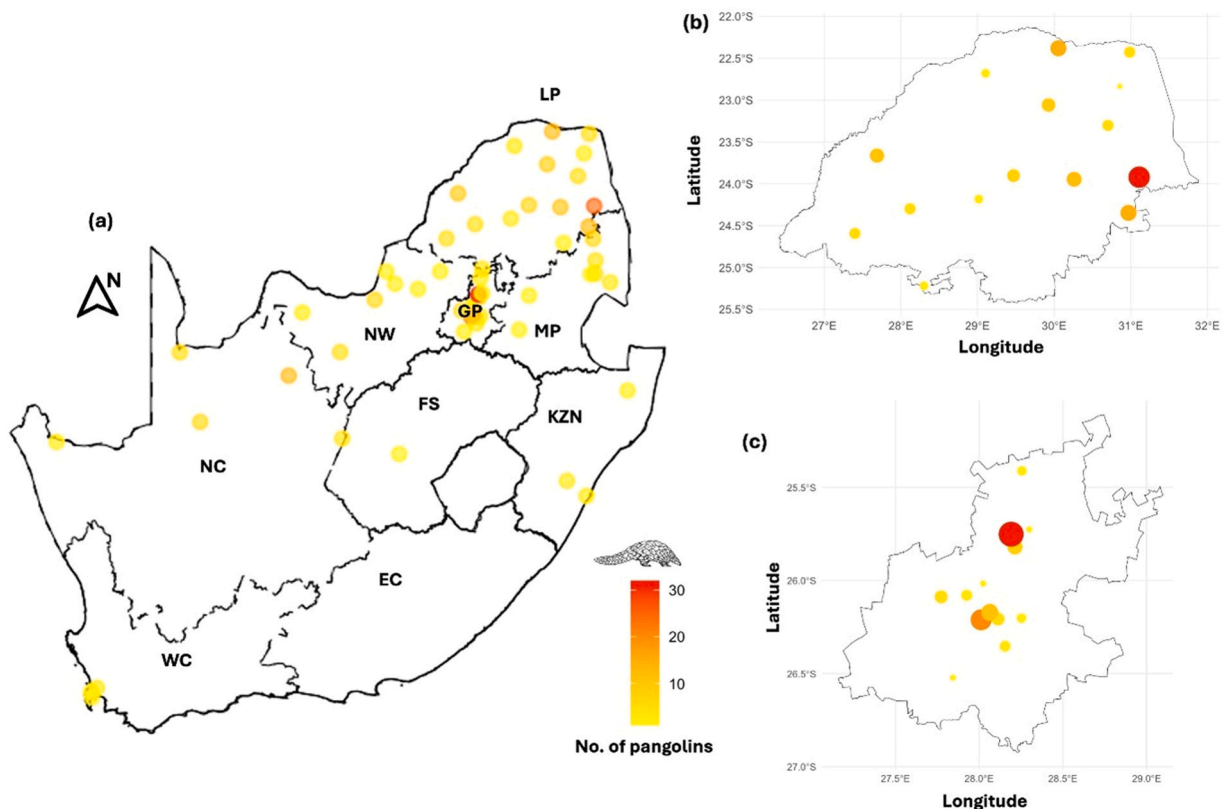


Fig. 1. Distribution of pangolin retrieval locations from the illegal trade across (a) South Africa, (b) Limpopo Province, and (c) Gauteng Province. In panel (a), circle sizes are uniform to indicate retrieval sites, while colour intensity is scaled to the number of pangolins retrieved. Panels (b) and (c) provide enlarged views of Limpopo and Gauteng, respectively, with both circle size and colour scaled to the number of pangolins retrieved.

intercepted by law enforcement. Some of these pangolins or body parts likely originated from neighbouring countries, such as Mozambique, Zimbabwe, Botswana, and Namibia, and smuggled into South Africa. However, these origins could not be determined. Records used for this study ranged from July 2016 to September 2024. A heatmap of pangolin trade occurrence for South Africa is presented in Fig. 1.

2.2. Data collection

In 2016, one of the authors (RJ) convened a meeting with representatives of the South African government branches of the National Prosecuting Authority (NPA), the Department of Forestry Fisheries and Environment (DFFE) and the South African Police Service (SAPS) to establish channels of communication regarding combating the illegal trade in pangolin in South Africa. RJ also established communication channels with the specialised branch of the SAPS focusing on Stock Theft and Endangered Species offences (STES) in all provinces in South Africa, with the exception of the Free State. Further channels of communication were established with the specialised branch of the SAPS; the Directorate for Priority Crime Investigation (DPCI or “HAWKS”). Information on successful operations involving the retrieval of pangolins in the country was then collated by RJ and a database was established.

2.3. Data compilation

Datasets on the number of pangolins recovered, the nature of contraband (e.g., dead, alive, skin, or scales), the number of suspects apprehended, along with the date, location, and province of each detention, were systematically documented and incorporated into the analyses. However, suspects' names, passport numbers or identity numbers, or any other personal information, were not included in our analyses. The data was verified by the SAPS investigating officer appointed to each case, and each data point is linked to a unique “SAPS CAS number” in our database. The CAS number is generated as follows: [SAPS police station] [number of case of the month] / [month] / [year], e.g., Cullinan 36/06/2025 = Cullinan police station, case number 36 of June in 2025. This CAS number is included in the police docket and also uploaded onto the SAPS online system.

Court case data (sentencing) was either recoded by one of the authors attending the court case as a species expert witness (RJ), or retrieved from a transcript of the court proceedings, or informed by the investigating officer for that particular case. In a portion of cases, victim impact statements were requested by the investigating officer from one of the authors (RJ). Victim impact statements involve a species specialist statement, often read into the court proceedings by a species specialist. This statement notes the conservation status, protection status and any other relevant information pertaining to the species in question.

The database can be considered comprehensive but does contain a limited number of gaps, particularly with regards some instances of suspect nationality and age and also social demographics such as level of education, employment status or levels of income. In a number of cases, data is also lacking for outstanding court judgements and sentencing as well as the number of suspects actually sentenced in relation to those arrested for each case. In the latter case, the National Public Prosecutor (NPP) may only have brought charges against some of the suspects arrested and not others for each individual case. This outstanding data was excluded from each particular analysis.

2.4. Procedures and record keeping

Pangolins recovered from the illegal wildlife trade was largely undertaken in intelligence-driven operations by the SAPS and the government branch of the Environmental Management Inspectorate (EMI, also referred to as the Green Scorpions), often in association with, or knowledge of, one of the authors (RJ). Prior to an operation, the SAPS investigating officer requests permission for an intelligence operation to take place via the state's National Public Prosecutor (NPP) as a 252 A request. The majority of operations took place at an agreed-upon location between the suspect (“seller”) and the state agent (“buyer”).

Once an arrest has been made, the suspect(s) details (identity number or passport number, age and nationality) is included in the SAPS docket with a unique SAPS “CAS number”. Our database is linked to each unique SAPS CAS number. Details of the operation, units involved, agent statement, victim impact statement, species expert statement, and any other pertinent information are added to the docket. Victim impact statements, species expert statements, and other statements from experts are read into the court proceedings as evidence. On conclusion of the case, a SAPS 69 form is recorded by the clerk of the court, and a copy is attached to the docket. The docket is then stored at the police station where the case was originally opened.

2.5. Data analyses

We conducted all statistical analyses in R Statistical Environment v. 4.4.1 (R Core Team, 2024). We accepted statistical significance at $P < 0.05$ for all tests and models. We constructed a line graph in R using *ggplot2* package (Wickham, 2016) to visualize temporal trends in the dataset, with time (years) and number of confiscated pangolins as x-axis and y-axis, respectively. The figure was further annotated in Microsoft PowerPoint.

Chi-square test of independence was used to test for association between the number of pangolins retrieved between years, months of the year, provinces, suspects' nationality, and the state or condition of the pangolin that was retrieved (living, carcass, skin with scales, scales only). We constructed a bubble plot in R using *ggplot2* to visualize the trend of the number of pangolin sold relative to the asking price over the years in different provinces. The dataset contained asking price (y-axis), year (x-axis), the number of pangolin sold represented by bubble size, and provinces in different colour to allow for regional comparison. We used regression analyses as the

General Linear Model (GLM) to investigate the association between the number of pangolins sold and the people responsible, the asking price, and the year. For this analyses we utilized the following input predictors: $\text{glm}(\text{formula} = \log(\text{asking_price}) \sim \text{pangolin_sold} + \text{people_responsible} + \text{year}, \text{family} = \text{gaussian}(\text{link} = \text{"identity"}), \text{data} = \text{Price})$. Furthermore, we generated a chord diagram in R using the *circlize* package (Gu et al., 2014) to visualize the relationship between the nationalities of arrested individuals and the provinces arrests took place. The width of the chord between nationality and province represented the number of arrests of individual of that nationality in that province.

3. Results

3.1. National trade

A total of 302 *S. temminckii* pangolins were retrieved in eight different provinces of South Africa (Fig. 2). There was a significant difference in the number of pangolin traded over years ($\chi^2 = 44.62$, $df = 8$, $p < 0.001$) (Fig. 3). The most pangolins retrieved in a single year in this period was in 2018 ($n = 48$) and 2023 ($n = 49$) (Fig. 3).

3.2. Provincial trade

There was a significant difference in the number of pangolin traded in different provinces over the study period of eight years and three months ($\chi^2 = 440.11$, $df = 8$, $p < 0.001$) (Fig. 4). Limpopo Province recorded the most pangolin trade ($n = 120$; 39.87 %) followed by Gauteng Province ($n = 91$; 30.23 %), while the Free State the least ($n = 1$; 0.33 %), and the Eastern Cape Province recorded none. Furthermore, Limpopo Province experienced a spike in trade ($n > 10$) in the years: 2018, 2020, and 2024; Gauteng Province in the years 2018 and 2022; and North West Province only in 2023 (Fig. 4b-j).

3.3. Seasonal trade

There was a significant difference in pangolin trade in different months ($\chi^2 = 43$, $df = 11$, $p < 0.001^5$). The most trade was recorded in austral spring month of October ($n = 45$), and least trade in austral autumn month of April ($n = 13$) (Fig. 5).

3.4. Suspects demographics

3.4.1. National demographics

A total of 679 individuals were arrested for pangolin trade in South Africa between 2016 and 2024. There was a significant difference between the number of arrests from 2016 to 2024 ($\chi^2 = 105.59$, $df = 8$, $p < 0.001$) where the years 2019, 2022 and 2023 recorded higher numbers of arrests ($n = 97$, 105 and 100 respectively) (Fig. 6a). Around 51 % of suspects arrested for pangolin trade

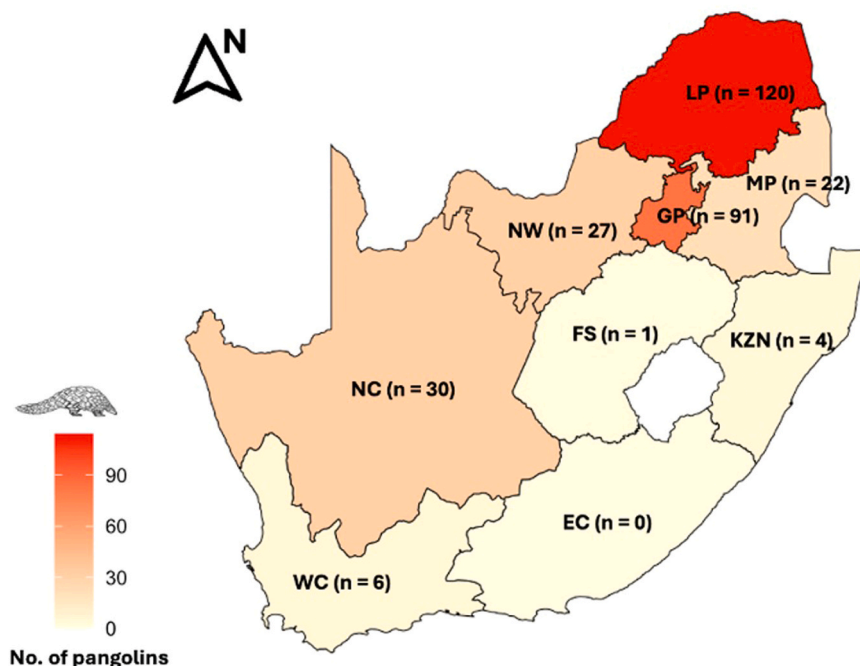


Fig. 2. The number of pangolins retrieved in different provinces of South Africa between July 2016 and September 2024.

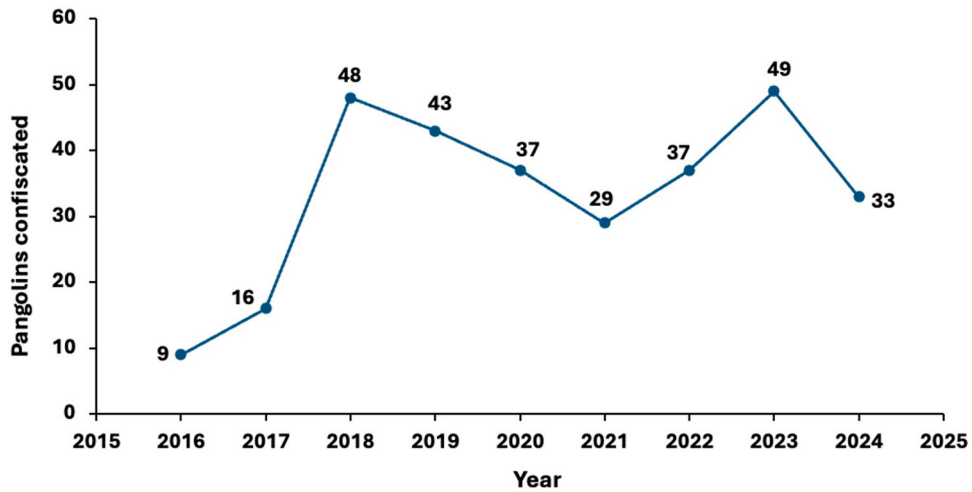


Fig. 3. The national pangolin trade trends over the period July 2016 to September 2024.

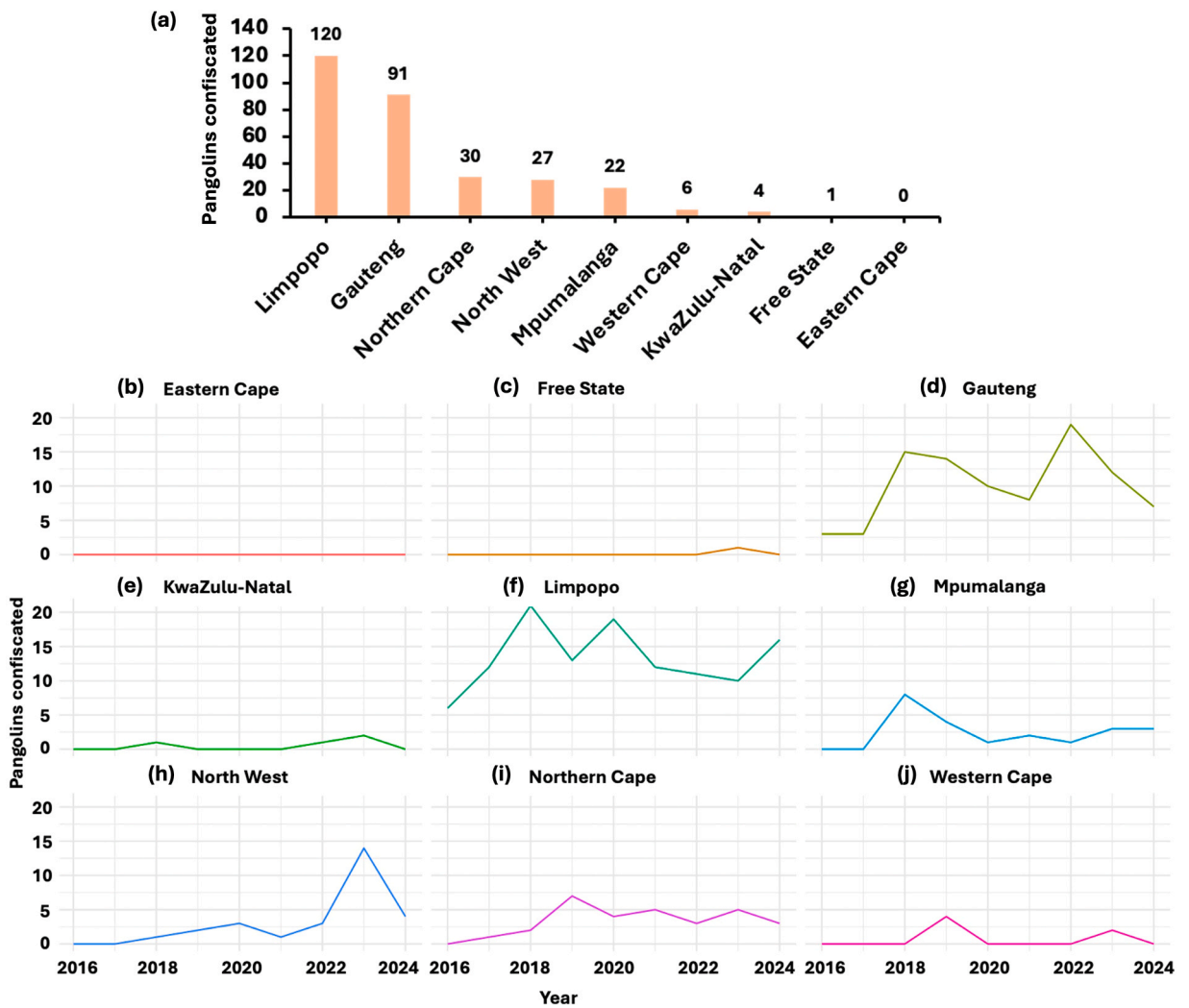


Fig. 4. The (a) total number of pangolins traded in South Africa, and (b-j) provincial trade trends over the period July 2016 to September 2024.

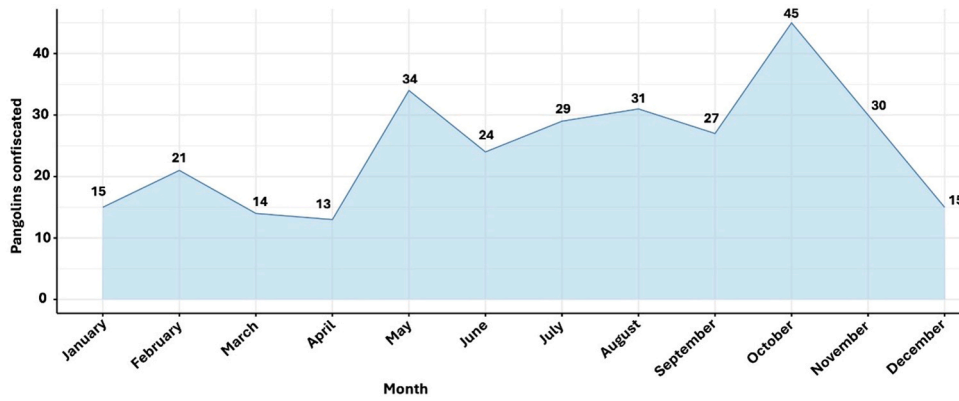


Fig. 5. The seasonal pangolin trade in South Africa over the period July 2016 to September 2024.

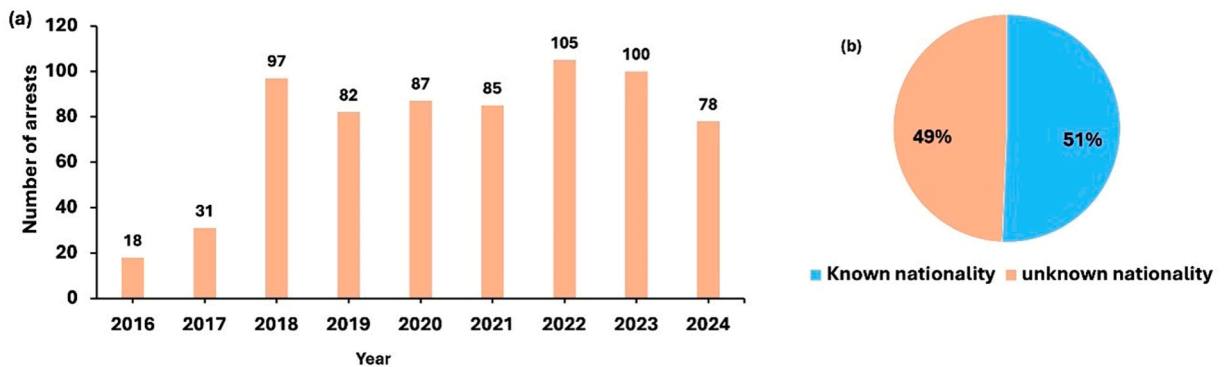


Fig. 6. The number of (a) suspects arrested with (b) known and unknown nationalities involved in pangolin trade between July 2016 and September 2024.

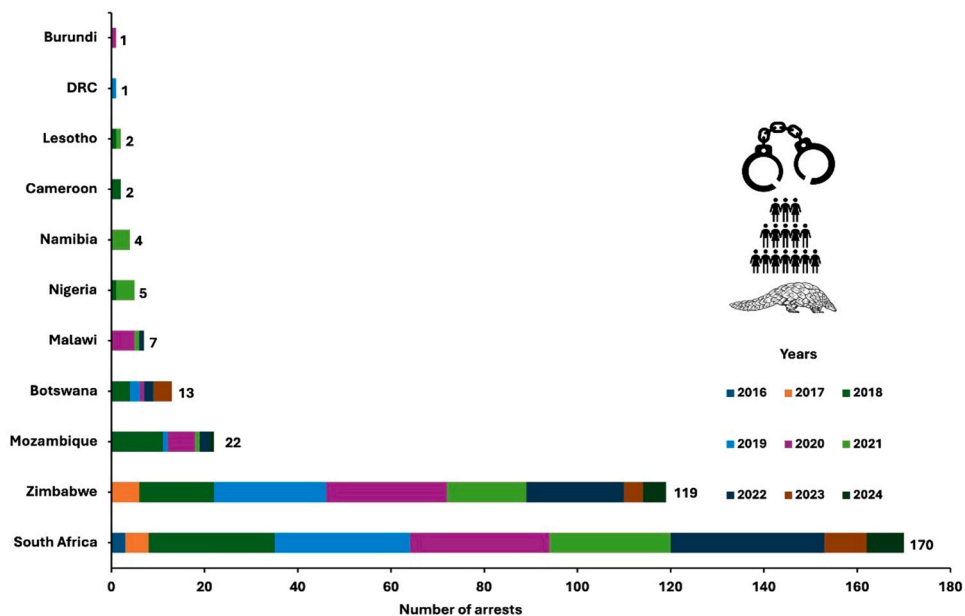


Fig. 7. The number of suspects arrested in each nationality involved in pangolin trade between July 2016 and September 2024.

belonged to eleven known nationalities i.e., Burundi, DRC, Lesotho, Cameroon, Namibia, Nigeria, Malawi, Botswana, Zimbabwe and South Africa (Fig. 6b).

For those arrested for which nationality was known, there was a significant difference between the various nationalities arrested ($\chi^2 = 1046.90$, $df = 10$, $p < 0.001$) where South Africans were the most arrested ($n = 170$; 49.13 %), followed by Zimbabweans ($n = 119$; 34.39 %) compared to other nationalities ($n < 23$) (Fig. 7). Furthermore, South African and Zimbabwean nationality arrest records date back to 2016. Mozambican, Botswana, Lesotho, Cameroon and Nigerian nationalities reported the first case of arrest in 2018; DRC only appeared in 2019; Malawi and Burundi in 2020 (Fig. 7). There were no repeated arrests for suspects trading in pangolins.

3.4.2. Provincial demographics

There was a significant difference between arrests recorded in different provinces over the study period ($\chi^2 = 1237.30$, $df = 10$, $p < 0.001$). However, analyses indicated no statistical difference between Gauteng and Limpopo provinces ($\chi^2 = 0.19$, $df = 1$, $p = 0.66$), nor between the North West and Northern Cape ($\chi^2 = 0.01$, $df = 1$, $p = 0.91$). Gauteng recorded the highest number of arrests ($n = 268$; 39.46 %), followed by Limpopo ($n = 258$; 38.00 %) (Fig. 8a) while the remaining Provinces arrested less than 100 suspects. Both Gauteng and Limpopo Provinces reported their first cases of arrests in 2016, throughout to 2024. Northern Cape recorded a first arrest in 2017, North West, KwaZulu-Natal and Mpumalanga in 2018, Western Cape in 2019 and Free State in 2023 (Fig. 8a). Of the total arrests in each province, 66.42 % had known nationalities in Gauteng, 40.70 % in Limpopo, 28.57 % in North West, 34.21 % in Northern Cape, 58.97 % in Mpumalanga, 50 % in Western Cape and 66.67 % in KwaZulu-Natal. Gauteng Province arrested nine nationalities (South Africa, Zimbabwe, Mozambique, Botswana, Malawi, Nigeria, Cameroon, Lesotho and Democratic Republic of Congo), with most suspects being South Africans and Zimbabweans (Fig. 8b). Limpopo recorded suspects from South Africa, Zimbabwe, Mozambique and Burundi. KwaZulu-Natal and Western Provinces recorded the arrest of suspects only from South Africa and Zimbabwe. North West Province arrested suspects from Botswana, Mozambique, South Africa, Zimbabwe and Malawi; Northern Cape arrested suspects from Lesotho, South Africa, Botswana and Namibia; and Mpumalanga arrests were from South Africa, Zimbabwe and Mozambique (Fig. 8b).

3.5. State of pangolins

Pangolins retrieved from the illegal trade were classified as living, carcass, skin (with scales) or scales only. There was a significant difference in the number of pangolins traded in different states ($\chi^2 = 711.14$, $df = 4$, $p < 0.001$) between 2016 and 2024. The majority of pangolin traded in South Africa were alive ($n = 245$; 81.40 %) and lowest being just scales ($n = 9$; 2.99 %) (Fig. 9a). Live pangolins were the most offered for sale in each province compared to other states (Fig. 9b). In contrast, the Western cape recorded more skins

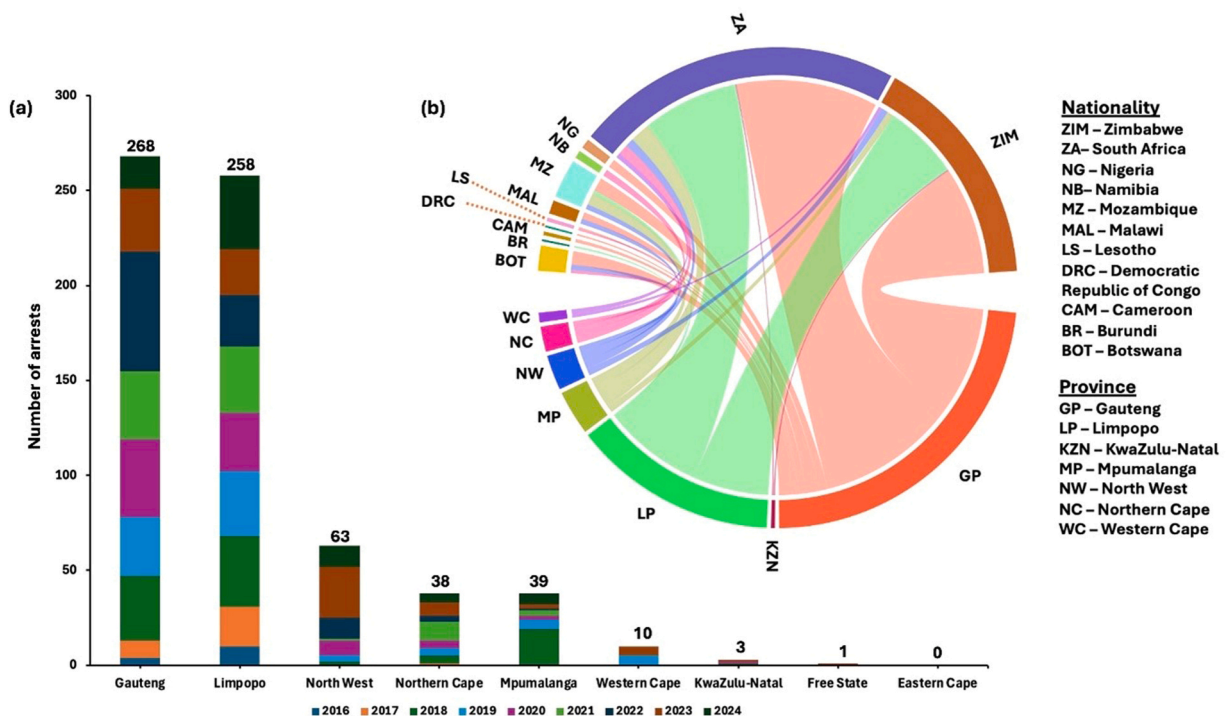


Fig. 8. The number of (a) arrests and (b) nationality of individuals arrested in each province of South Africa between July 2016 and September 2024.

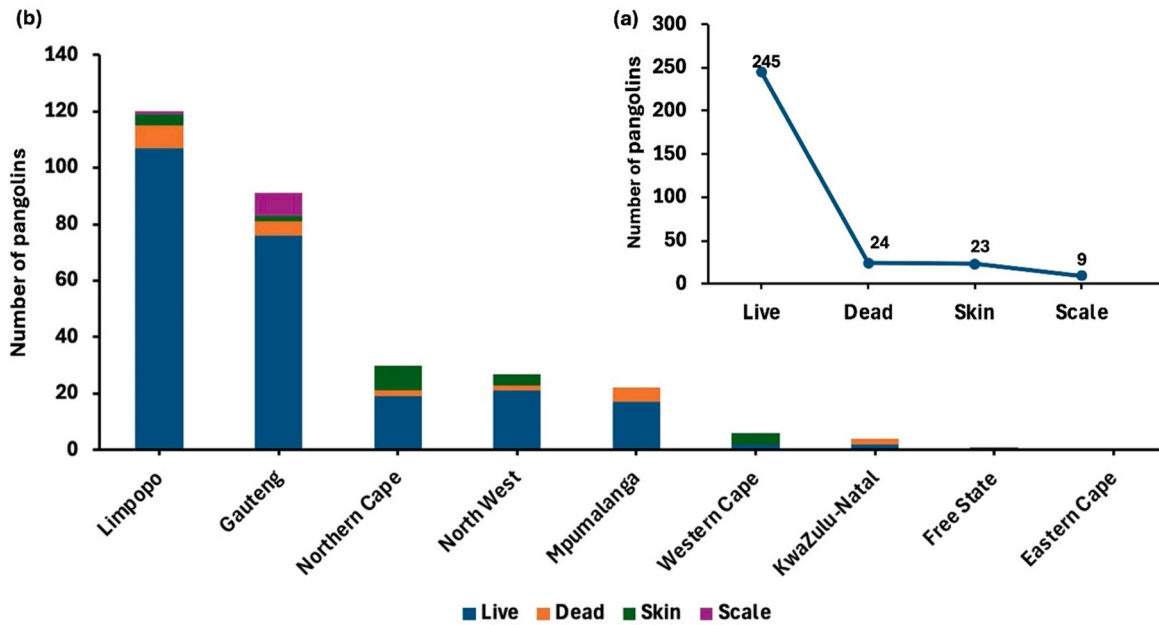


Fig. 9. (a) National and (b) provincial state of pangolins confiscated between July 2016 and September 2024.

confiscated compared to other states.

3.6. Prices over years

A total of 76 cases between 2019 and 2024 had information relating to the asking prices of pangolins. Sixty-seven (88.16 %) of these were selling only one pangolin at a time, and the remaining cases recorded two pangolins being sold at once. Conversion ratios used from South African Rand (R) to United States Dollar (US\$) at time of analyses is R17.87 to US\$1. The asking price of pangolins in South Africa ranged from R4000 (~US\$ 224) in Limpopo Province to R1 250,000 (~US\$ 69,950) in Gauteng Province (Fig. 10). Notably, most of the asking prices in Limpopo were lower than R250,000 (~US\$ 13,990), and as low as R45,000 (~US\$2580) for two pangolins. Northern Cape had only one case where a pangolin was sold for less than R100,000 (~US\$ 5596), and the rest were higher values. Compared to other Provinces, Gauteng had most cases selling pangolins for prices exceeding R250,000 (~US\$ 13,990). The GLM model showed a positive association between both the number of pangolins sold (estimate = 0.77, SE = 0.37, p = 0.043) and the number of people responsible (estimate = 0.19, SE = 0.06, p = 0.0014) and the asking price, indicating that the latter increased with the increase in number of pangolins sold and people involved in these transactions. In contrast, the effect of year was not significant (estimate = -0.017, SE = 0.08, p = 0.84), and there was a negative association between year and asking price, suggesting a decline in

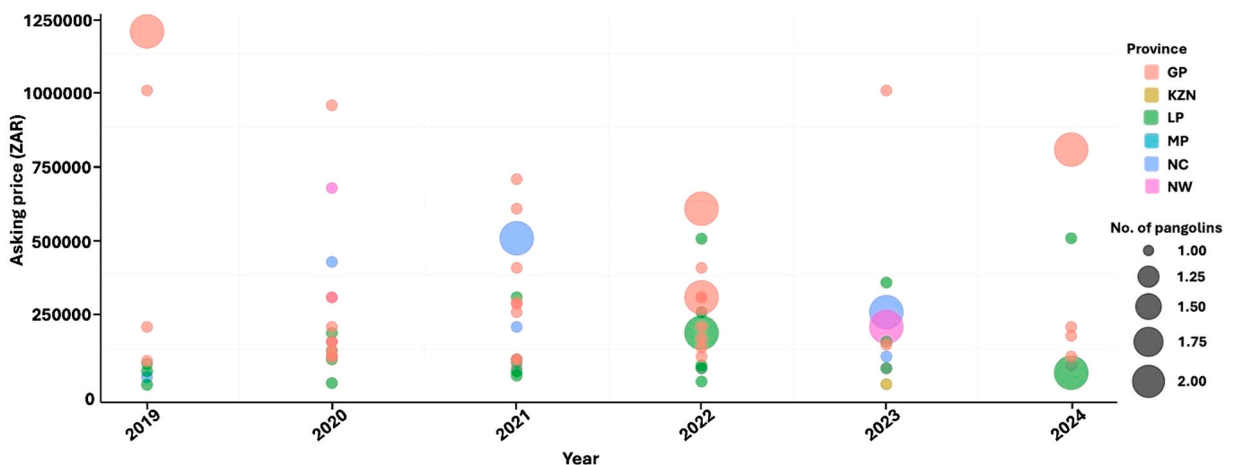


Fig. 10. The asking price and number of pangolins traded at a time in each province between 2019 and 2024.

asking price over more recent years.

3.7. Court outcomes

Overall, a total of 276 cases involving 679 suspects apprehended for the illegal trade of pangolins between 2016 and 2024 were recorded in South Africa. Out of these, 35.49 % of the cases involving 275 suspects proceeded to court. Fifty-seven (52.29 %) of the total cases that proceeded to court were finalized cases with final outcomes and the remaining were pending cases (Fig. 11).

The number of cases with victim impact statements was significantly different from cases with no impact statements ($\chi^2 = 7.72$, $df = 1$, $p = 0.01$). Here, 69 of the 109 cases had impact statements supplied in courts, while 40 had no impact statements (Fig. 11). The court outcomes both in cases with and without impact statements were categorised into three categories: (a) jail sentence without option of a fine or suspended sentence, (b) fines without option of a suspended sentence or a jail term and (c) suspended sentence without option of a jail term or fine.

The number of cases sentenced to jail, fine and suspended were significantly different for cases with impact statements ($\chi^2 = 8.00$, $df = 2$, $p = 0.02$). In contrast, there was no significant difference in number of sentences in different categories without impact statements ($\chi^2 = 8.00$, $df = 2$, $p = 0.02$). Notably, the number of jail sentences in courts with impact statements was more than those with no impact statements. In contrast, the number of fine sentences was higher in court cases with no impact statements, and the number of suspension sentences was similar in cases with and without impact statements. The time spent in jail for cases with impact statements ranged from three to ten years; fines sentences ranged from R5000 (~US\$ 280) to R 50,000 (~US\$ 2798) and cases were suspended for a period of three to five years. For cases with no impact statement, jail time sentences ranged from one to eight years, fines ranged from R6000 (~US\$ 336) to R30,000 (~US\$ 1679) and suspended sentences ranged from three to five years (Fig. 11).

4. Discussion

Based on international records and trends, there has been an exponential increase in the illegal trade in pangolins and pangolin body parts in recent years, particularly on the African continent (Nethavhani et al., 2025; UNODC, 2024). This was indeed the case in South Africa, where trends indicate the level of trade in *S. temminckii* has increased rapidly in recent years - this trend was also recognised by the South African government and published in the NPA's annual report of 2018 (NDPP, 2018).

It could be argued that this increase in arrests can be attributed to factors such as improved pangolin awareness from the public and local law enforcement, where global pangolin awareness and the plight for the entire Order has increased within the last decade (Thomson and Fletcher, 2020). However, we believe this alone is unlikely to be responsible for driving such a significant rise in pangolin trade cases. An increase in wildlife crime involving a wide range of species has been well documented in South Africa (Gonçalves, 2017; NISCWT, 2017) and is underpinned largely by illegal financial incentives. Similar to the illicit wildlife trade in rhino horn and elephant ivory, money seems to be the driving force of the illicit trade in pangolins and with historical low arrest rates and weak court sentences, the risks involved in trading in pangolins is largely outweighed by the potential financial rewards, often advertised over social media or police reports openly indicating the value of the contraband. Negotiations in selling the animal is often by a local South African middleman, and prices requested range from R50,000 (~US\$ 2798) to R2 million (~US\$ 111,919) (pers. obs. R. Jansen). In the majority of cases, the price requested far exceed what can possibly be paid in destination countries such as mainland China, but the perception within southern African communities is that this animal is worth large volumes of money, particularly if it is still alive. As such, this trade can only be addressed by either cutting out the demand and dropping the black market price or by increasing the punishment substantially, such that it outweighs its current alluring financial illegal trade benefits (Abotsi et al., 2016). Furthermore, there is increasing evidence that this pangolin trade in South Africa is falling under organised crime, where pangolins, along with other illicit contraband such as rhino horn, elephant ivory, and uncut diamonds, are on offer from sellers (Rija et al., 2020; R. Jansen pers. obs.).

4.1. Provincial variation

Although *S. temminckii* is the most widespread pangolin species in Africa (Pietersen et al., 2020), its local distribution in South Africa is limited to the far north-eastern border with Mozambique, far northern border with Zimbabwe and the far north-western border with Botswana and Namibia. As a result, the species only occurs in the Northern Cape, North West, Limpopo, Mpumalanga and KwaZulu-Natal Provinces (IUCN, 2019, Pietersen et al., 2020). Based on this distributional range, it was expected that the majority of pangolin confiscations would also take place within these provinces and be poached locally. However, the province with the second highest confiscations (Gauteng) falls out of the species natural distribution range. The province with the highest pangolin trade retrievals was Limpopo, which falls within this species natural distribution but is also the province that borders Zimbabwe and Mozambique and had the highest proportion of foreign nationals arrested in possession of a pangolin. Post-apartheid (1994-) migrant labour has increased rapidly in South Africa, and both these provinces harbour the largest population of illegal migrants from both Mozambique and Zimbabwe, often in desperate search for work and a better way of life (Trimikliniotis et al., 2008). Limpopo Province provides many opportunities for 'cheap' farm labour opportunities (Hall et al., 2012), and Gauteng is the wealthiest province in the country, with the highest population of people, best known for its gold mines. Wildlife crime is well documented within both of these countries, especially in the case of Zimbabwe, whose wildlife has been significantly impacted by corruption and an unstable economy over the last two decades (Gandiwa et al., 2013). However, financial rewards for illegal wildlife are substantially higher in South Africa, as Zimbabwe's economy has all but collapsed, and Mozambique is not much better. We believe the financial reward

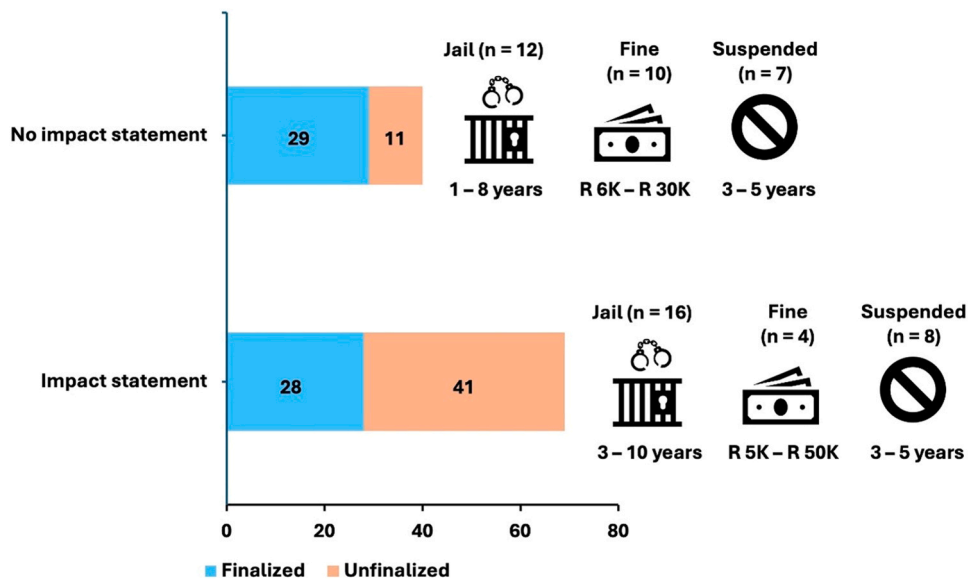


Fig. 11. Outcomes of court cases that proceeded to court in different provinces of South Africa between 2019 and 2024.

opportunities in selling illegal wildlife, in addition to possible work opportunities in South Africa, and less strict conviction penalties compared to Zimbabwe, are driving the cross-border pangolin trade in the country.

4.2. Seasonal variation

Our findings have indicated a peak in the trade of pangolins during the austral spring season, particularly during September, just prior to the onset of the first rains. It is therefore possible this is also the season of *S. temminckii* being more active and so seen and sourced more readily. Home range studies on this species of pangolin undertaken in the arid Kalahari (Pietersen et al., 2014) suggest that home range size and activity may change between seasons and between sexes, where a single male pangolin covered a large area in winter and the female covered a larger area in summer. However, this was not supported in our study as there was no significant difference in the trade between sexes, and activity patterns may not account for trade levels, or further studies need to be made on activity patterns for the species. If we assume that trade levels are indeed influenced by pangolin distribution and activity patterns, our findings then support the idea that male and female pangolins share more similar behaviour patterns throughout seasons, and both sexes are then equally susceptible to the threat of poaching throughout the year.

The natural distribution of *S. temminckii* in southern Africa falls primarily within the Savannah biome (Laakso et al., 2013) which has its rainy season over the austral summer from November to March (Mucina et al., 2006). During this time, and with increased precipitation, the foliage and grass layer will also be at its most dense and inhibit visibility. In contrast, winter and spring seasons fall during a drier period, with more sparse vegetation and thus improved visibility. As evening temperatures decrease during the dry winter period (Rutherford et al., 2006), *S. temminckii* have been known to adapt and embrace a more diurnal behaviour (Pietersen et al., 2014; F. Meyer pers. obs.), which may increase the probability of encounters with humans. It stands to reason then that poachers will also have less difficulty pursuing these animals during drier and favourable conditions. These factors may contribute to why pangolin confiscations increase after the summer season and peak during spring, as the odds of poaching success may increase with improved visibility. To fully understand the seasonal behaviour of *S. temminckii* and what role it may play in the illicit trade of this species, further long-term studies are required on habitat use, dietary preferences, and distribution patterns.

4.3. Suspects demographics

The majority of suspects arrested were local South African nationals, followed by Zimbabwean nationals. This was particularly evident in Limpopo and Gauteng Provinces, where a large proportion of people actively harvesting wild pangolins, likely from neighbouring Zimbabwe, are poor migrant labour individuals seeking employment or some form of income in South Africa (pers. obs. R Jansen). Zimbabwe's economic meltdown since the early 2000's created hyperinflation and an unemployment rate of 90% (Munangagwa, 2009), resulting in severe economic pressures and a lack of income that can very likely incentivise participation in illicit wildlife trade opportunities (Janssen et al., 2024) spilling over into South Africa. In Zimbabwe, laws are very strict in that any person convicted of the illegal possession of a pangolin (or any other specially protected species) is liable, on first conviction, to imprisonment for a period of not less than nine years (Shepherd et al., 2016). Due to historical lenient court sentences for pangolin and other wildlife crime in South Africa, and the more severe sentences in Zimbabwe, these may not serve as effective deterrents for crime related to wildlife trafficking (MacBeath and Whitfort, 2024).

4.4. Court outcomes

Due to the large number of pangolin-related court judgement outcomes still pending, our analyses can be regarded 'preliminary' in its findings. Nevertheless, some interesting observations can be made with regards supplying the court with species expert victim impact statements and, in a number of cases, the species expert testifying in court and expanding on these impact statements (R. Jansen testimony in 33 court cases since 2017).

Often, wildlife-related crimes are perceived as technical breaches of conservation regulations rather than as a serious criminal offence (South, 2014). Here, the need for sentencing that considers both the extent of harm to the animal and the impact on the state of an endangered species is often marginalised or not considered at all (MacBeath and Whitfort, 2024). Historically, socially constructed conceptions have traditionally excluded animals from being represented in court as victims of crime (Skinnider, 2011).

In our study, case judgements that had species victim impact statements enrolled in the case docket, resulted in more jail sentences handed out (rather than fines and suspended sentences), longer jail terms imposed and higher fine sentences. In those cases where the maximum jail term of 10 years imprisonment was imposed, each case had a species victim impact statement included in the docket and read out during court proceedings. The first pangolin case to have a species victim impact statement, as well as the species specialist testify in aggravation of sentencing, was held in Mankweng regional court, east of the city of Polokwane in Limpopo Province in August of 2017. A Zimbabwean national arrested in 2016 was sentenced to three years direct imprisonment followed by deportation. We believe this to be the first case where a jail sentence was imposed in a pangolin-related case in South Africa.

In the large majority of cases where foreign nationals were arrested with a pangolin and received bail, they flee back to their home countries, and the case remains unresolved on the court roll.

4.5. Limitations

This study was limited by the lack of historical data relating to the retrieval of pangolins from the illegal wildlife trade in South Africa where sufficient record-keeping had only been initiated in 2016. Nevertheless, interesting trends could be observed by mining the last eight years data. This study limited its data to all individuals who were arrested in the act of attempting to sell live pangolins, dead pangolins, pangolin skins or pangolin loose scales for commercial gain and not for any other purposes such as cultural use or traditional belief rituals.

5. Conclusion and recommendations

The large increase in the illegal trade of pangolins both globally and in South Africa is a growing concern for the entire Order. Our study suggests that the trade in *S. temminckii* in South Africa is significant and we acknowledge that our study only represents a portion (possibly only 15 %) of the actual trade. We also note, with concern, the slow turnover rate that pangolin cases proceed to court and are finalised with a large percentage still having to be heard. It was further our findings that a significant proportion of the cases did not hold vital information in the docket such as victim impact statements nor reference to the Animals Protection Act (Act 71 of 1962), which prohibits causing unnecessary suffering to any animal.

Our study noted that communities, private organisations, non-profit organisations and government spheres of policing and conservation all played a pivotal role in the retrieval of pangolins out of the wildlife trade in South Africa. These types of collaborations should be encouraged to help develop and establish effective standard operating procedures for combatting this illegal trade and set an example for other pangolin range states further into Africa and in Asia.

In South Africa, wildlife crime responsibility spans the mandates of at least 10 government departments, and each department approaches the problem(s) through the lens of their mandate (Gonçalves, 2017). The complexity increases even more where each province has its own environmental legislation (see Table 1). A national guideline relating to cases involving specific threatened taxa, such as pangolins, needs to be developed to refine this complexity from law enforcement on the ground to regional magistrates' courts. The establishment of the Department of Forestry Fisheries and Environment (DFFE) Fusion Centre in 2021 is a good start. Here, this Centre receives information and data from agencies with different reporting lines and provides support to investigating officers (SAMLIT, 2023). However, it remains unclear if this has been used at all since its inception in pangolin-related offences.

On the ground, South Africa has only one dedicated SAPS Endangered Species Unit (ESU) based in Limpopo Province, whose priority focus is on wildlife crime offences involving Threatened or Protected Species (ToPS). This was not the case with all other provinces previously, where the SAPS ESUs, founded nationally in 1989, but were later disbanded in the early 2000's and merged into Stock Theft and Endangered Species (STES) units, moving the focus into both livestock theft cases as well as those of endangered species. Combining the units diluted the focus on wildlife crime, as resources and attention became divided between livestock theft and wildlife protection, thus stretching capacity to the maximum. We strongly recommend that the SAPS ESU be reinstated within specific provinces that warrant such units, particularly in Limpopo and Gauteng Provinces and possibly also in North West and Northern Cape that have experienced increases in pangolin-related trade. In addition, we propose dedicated public prosecutors within each of these provinces who specialise in wildlife crime-related cases. It is our experience that prosecutors and magistrates are often ill-informed with regard to the legislation and severity of crimes related to the trafficking and trade in endangered and protected species in South Africa, particularly in rural courts.

CRedit authorship contribution statement

Raymond Jansen: Writing – review & editing, Methodology, Investigation, Data curation, Conceptualization. **Francois Meyer:** Writing – review & editing, Methodology, Investigation, Data curation. **Zwannda Nethavhani:** Writing – original draft, Investigation, Formal analysis.

Acknowledgements

We are very grateful to the various state government bodies for collaborating in retrieving pangolins out of the illegal trade, providing details on law enforcement operations that led to the retrieval of pangolins and arrest of suspects and with details of subsequent court proceedings. We are particularly grateful to the SAPS Stock Theft and Endangered Species unit of Cullinan that initially spearheaded operations that led to the retrieval of pangolins from the illegal trade in South Africa. We are also grateful to Glen Thompson for managing the database over the past few years.

Funding: this research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. Financial reimbursement for travelling to operations and to testify in court proceedings nationally was gratefully provided by the African Pangolin Working Group.

Declaration of Competing Interest

The authors declare no conflict of interest.

Data Availability

Data will be made available on request.

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