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Aspects of the illegal hunting and trade of vultures in northern KwaZulu-Natal, South Africa

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The harvesting and trade of species for use in traditional medicine, or *muthi*, is predominantly illegal, unregulated, and likely unsustainable, representing a major conservation challenge. In South Africa, vulture populations have declined considerably in recent decades, but evidence shows a consistent use of vultures by traditional health practitioners. However, less is understood about the key factors that underpin the hunting of these birds. We evaluated aspects of the illegal hunting and trade of vultures in northern KwaZulu-Natal Province. Data were collected using in-depth interviews with local hunters and *muthi* traders. A mixed-method sampling design was used, and data were analysed using the thematic analysis approach. The results revealed that vultures were hunted mainly by local men aged 24–40 years. The vultures were obtained using multiple techniques, but poison (38%) and firearms (31%) were the preferred methods. Vultures were hunted upon request and traded through local networks comprising hunters, traditional health practitioners and *muthi* traders. Carcasses were sold directly to traditional health practitioners, but some were destined for the local market. Prices for the whole carcass ranged from ZAR500 (US\$29) to ZAR2 000 (US\$116). Perceptions held by respondents concerning the hunting and trade of vultures alluded to the difficulty of obtaining birds. This was attributed to vultures' conservation status and the risk of being found in the possession of a vulture or any of its by-products. Live vultures were reportedly hard to find as they mostly inhabited protected areas, and their low numbers were also highlighted as an exacerbating factor. The use of vultures in African traditional medicine is a well-established practice; however, presently, this threatens the long-term persistence of vultures in the wild. Intricate socio-economic influences are at play, and addressing these may facilitate positive conservation outcomes for vultures and other target species in northern KwaZulu-Natal.

Aspects de la chasse et commerce illégal des vautours dans le nord du KwaZulu-Natal, Afrique du Sud

Le prélèvement et commerce d'espèces destinées à la médecine traditionnelle, ou *muthi*, est essentiellement illégal, non réglementé et probablement non durable, ce qui représente un défi majeur pour la conservation. En Afrique du Sud, les populations de vautours ont considérablement diminué au cours des dernières décennies, mais les praticiens de la médecine traditionnelle continuent à utiliser régulièrement les vautours. Cependant, les facteurs clés qui sous-tendent la chasse de ces oiseaux sont moins bien compris. Nous avons évalué certains aspects de la chasse et du commerce illégaux des vautours dans le nord du KwaZulu-Natal. Les données ont été collectées au moyen d'entrevues approfondies avec des chasseurs locaux et des négociants de *muthi*. Une méthode d'échantillonnage mixte a été utilisée et les données ont été analysées à l'aide de l'approche de l'analyse thématique. Les résultats ont révélé que les vautours étaient principalement chassés par des hommes locaux âgés 24–40 ans. Ils étaient capturés selon diverses techniques, mais le poison (38%) et les armes à feu (31%) étaient les méthodes préférées. Les vautours sont chassés sur demande et commercialisés par le biais de réseaux locaux comprenant des chasseurs, des praticiens de santé traditionnels et des commerçants de *muthi*. Les carcasses sont vendues directement aux praticiens de médecine traditionnelle, mais certaines sont destinées au marché local. Le prix des carcasses entières allait de 500 ZAR (29 USD) à 2 000 ZAR (116 USD). Les perceptions des personnes interrogées concernant la chasse et le commerce des vautours font référence à la difficulté d'obtenir des oiseaux. Cela a été attribué au statut de conservation des vautours ainsi qu'au risque d'être trouvé en possession d'un vautour ou de l'un de ses produits dérivés. Les vautours seraient difficiles à trouver car ils passent la plupart du temps dans des zones protégées, et leur faible nombre a également été souligné comme un facteur aggravant. L'utilisation des vautours dans la médecine traditionnelle africaine est une pratique bien établie. Cependant, elle menace actuellement la persistance à long terme des vautours dans la nature. Des influences socio-économiques complexes sont en jeu et leur prise en compte pourrait faciliter l'obtention de résultats positifs en matière de conservation pour les vautours et d'autres espèces cibles dans le nord du KwaZulu-Natal.

Keywords: *Aegypius occipitalis*, conservation, *Gyps africanus*, *muthi* markets, protected areas, socio-economic factors, *Torgos tracheliotos*, wildlife crimes

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Introduction

In recent decades there has been a measurable shift towards valuing biodiversity for the range of goods and ecosystem services it provides (Cunningham 2016). Ecosystem services can be subtle, but also tangible and obvious; highlighting these benefits strengthens the argument for biodiversity conservation (Wilson and Primack 2019). The key premise is that people can, directly and indirectly, derive benefits by maintaining and preserving the healthy functioning of natural systems (Cunningham 2016). Certainly, human societies largely recognise and value the role of biodiversity and various ecological functions performed by species that, in turn, support their wellbeing and livelihoods (Craig et al. 2018; Mdhilano et al. 2018; Manqele et al. 2023a). Healthy ecosystems that provide services over considerable spatial and temporal scales require optimum biodiversity functionality (Sekericioglu et al. 2016). Globally, conserving ecosystems has become challenging as biodiversity collapses under multiple human-induced threats (Liang et al. 2013). The commercialisation of biological resources — a shift from subsistence use — represents one of the major threats to biodiversity globally (Ling et al. 2013; Young et al. 2016).

The world's biodiversity hotspots are experiencing increased wildlife off-takes for trade (Nellemann et al. 2016). Trade occurs at local and international levels (Broad et al. 2014) and involves a wide range of wild fauna and flora (Gluszek et al. 2021). Some of the world's biodiverse regions in Africa, Latin America and Southeast Asia have experienced a notable increase in the harvesting and trade of wild animals (Nellemann et al. 2016; Gluszek et al. 2021). This form of trade is massive and underpins the sales of live animals to be kept as pets or used for food, ornamentation or traditional medicine (Lindsey et al. 2013; Young et al. 2016; Burivalova et al. 2017; Wilson and Primack 2019). Wildlife trade is entrenched in the socio-economic conditions of local communities, which are often marginalised (Broad et al. 2014). Culture has been underscored as one of the key factors facilitating trade in wildlife products (Williams et al. 2014). Persistent poverty in low-income regions has been shown to drive increased trade and consumption of wildlife (Nellemann et al. 2016). Trade is structured in network systems typically involving harvesters, middlemen and retailers (Broad et al. 2014). According to Abi-Said et al. (2018), the wildlife trade represents an important source of income for many marginalised people residing in biodiversity-rich environments.

However, a large part of the trade in wildlife resources occurs illegally and is likely unsustainable (Buij et al. 2016). Illegal wildlife trade is the world's fourth-largest form of crime, accounting for US\$7–23 billion annually (Nellemann et al. 2016), and involves numerous species of high conservation concern, including protected, threatened, keystone and rare species (Buij et al. 2016; Shepherd et al. 2017). Illegal wildlife trade directly contributes to the defaunation and degradation of ecosystems worldwide (do Nascimento et al. 2015; Benítez-López et al. 2017). Extensive removal of wildlife leading to reductions in populations has been shown to result in “empty forests” (Redford 1992; Ripple et al. 2016). Having lost their

ecological functionality, these biomes cannot effectively support wildlife, human wellbeing or livelihoods over time (Benítez-López 2017).

The outbreak of zoonotic diseases and the distribution of alien invasive species are some of the major consequences of illegal wildlife trade practices (Liang et al. 2013; Broad et al. 2014). Research on the illegal wildlife trade emanating from multiple disciplines has considerably improved our understanding of such a complex phenomenon and significantly driven policy formulation towards conserving threatened species. However, most work has focused predominantly on transnational trade involving large charismatic mammals, such as African elephants (*Loxodonta* spp.), bears (*Ursus* spp.), rhinos (family Rhinocerotidae), pangolins (family Manidae) and tigers *Panthera tigris*. Initiating a better understanding of domestic wildlife trade is equally important as it can support strategies to manage trade at both national and supranational levels (Atuo et al. 2015; McEvoy et al. 2019). Such intervention is crucial, especially for cultural keystone species, which have increasing regional importance.

Uses by local people which are embedded in traditional belief systems have been highlighted as one of the major drivers behind the present crisis in regard to African vultures (Ogada et al. 2016; Botha et al. 2017; Mashele et al. 2021a; Williams et al. 2021; Daboné et al. 2023). A main concern is the poisoning of vultures as a hunting method (Botha et al. 2017; Gore et al. 2020; Manqele et al. 2023b); this growing practice causes rapid large-scale declines in these social birds, with potential overarching ecological and socio-economic ramifications. Research shows that vultures are valuable in traditional medicine and related practices in South Africa (McKean et al. 2013; Mashele et al. 2021a,b); they are items perceived to treat some physical ailments, but most uses emanate from the perception that vultures possess spiritual or magic-based capabilities (McKean et al. 2013; Mashele et al. 2021a; Manqele et al. 2023b). To this end, vultures are highly sought-after by hunters, traditional healers and *muthi* traders despite the populations having declined considerably in the last few decades (Ogada et al. 2016; Botha et al. 2017; Coverdale and Cragie 2023).

Various legal instruments protect vultures across South Africa and in its provinces. Six of the seven resident species in the country are listed in the Threatened or Protected Species (ToPS) Regulations, promulgated in terms of the National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA) (RSA 2023). This means these species may not be hunted or killed by any means, method or device, including searching, pursuing, luring or injuring to hunt or kill, except for conservation, enforcement or scientific purposes (Creecy 2023). Additional legislation protecting vultures is reviewed in Thompson and Blackmore (2020). However, it is acknowledged that the laws have not been effective in halting the illicit hunting and trade of vultures. This subsequently highlights the need for an improved understanding of the dynamics underpinning the sourcing and trade of vultures to guide integrated conservation

strategies. To this end, we conducted a study to examine hunting as a cultural practice and its influence on the trade of vultures in northern KwaZulu-Natal province (KZN), South Africa. Northern KZN is a main region in South Africa where vulture populations are declining consistently, with poisoning for traditional medicine being flagged as one driving factor (McKean et al. 2013; Coverdale and Cragie 2023).

Materials and methods

Study sites

Protected areas

This study was designed mainly to provide insights into the dynamics of hunting practices and the sourcing and trade of vultures in northern KZN. It was conducted in the Zululand district of the province, specifically in tribal communities adjoining two protected areas—Hluhluwe-iMfolozi Park (HiP) and Mkhuze Game Reserve (Figure 1). The provincial conservation authority, Ezemvelo KZN Wildlife, manages the two protected areas. The study region is home to four species of tree-nesting vultures (Rushworth et al. 2018). Three of these are recognised as globally threatened: the White-headed *Aegypius occipitalis* and White-backed Vulture *Gyps africanus* are listed as Critically Endangered, and the Lappet-faced Vulture *Torgos tracheliotos* is currently listed as Endangered (BirdLife International 2021a, 2021b, 2021c). The monitoring of White-backed, Lappet-faced and White-headed vultures in northern KZN shows a general population decline in these species from 2004. The White-headed vulture is reportedly locally extinct in this region, with the last record of an active nest being in 2017 (Coverdale and Cragie 2023).

Hluhluwe-iMfolozi Park (HiP) is the largest state-owned protected area in northern KZN, covering ~900 km² (Rushworth et al. 2018). The park was formed through the consolidation of the Hluhluwe and iMfolozi game reserves, both proclaimed in 1895. These two game reserves are joined together by the Corridor Reserve established in 1989 (Brooks 2005). Hluhluwe-iMfolozi Park is located in an African savanna landscape, with several rare, endemic and threatened species found there, making it a key conservation area and renowned tourist destination in the country (Rushworth et al. 2018). Three adjacent communities were selected for the study: Nsolweni, Gunjaneni and Siyembeni (Figure 1).

Mkhuze Game Reserve covers ~348 km² and is situated at the western end of the Indian Ocean coastal plain that runs from Mozambique to South Africa (Gush 2000). The reserve is one of South Africa's earliest game reserves, established in 1912. It is a part of iSimangaliso Wetland Park, one of the country's most important ecological systems and a World Heritage Site (UNESCO 1999; Taylor and Peacock 2018). A tribal community occupying the southern boundary of the reserve, Ngwenya, was selected for this study (Figure 1).

The study sites (Figure 1) are inhabited by Zulu-speaking Nguni communities that practise subsistence and small-scale commercial agropastoralism (Nsukwini and Bob 2016). Livestock farming in these areas comprises cattle, goats, sheep and donkeys, while common crops

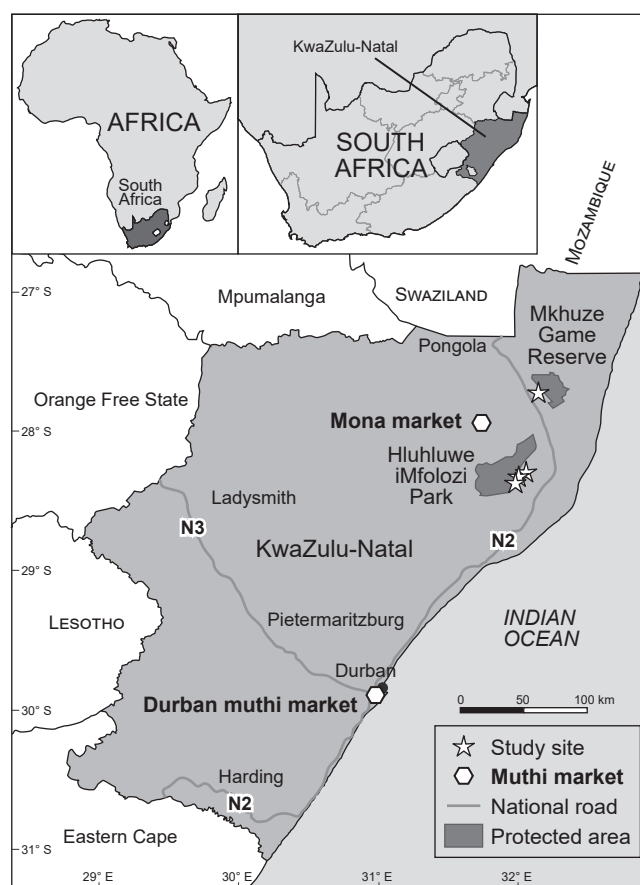


Figure 1: Study sites for research on aspects of the illegal hunting and trade of vultures in northern KwaZulu-Natal, South Africa

include sugarcane, maize, yams, peanuts, sweet potatoes and cotton (Nsukwini and Bob 2019; pers. obs.). Large commercial farms specialising in crops, livestock and game animals form part of the broader landscape (pers. obs.). The local communities are characterised by poverty and high levels of unemployment, especially among the youth. Nsukwini and Bob (2016) recorded an unemployment rate of 77.7% in their study conducted in KwaNompondo, a community neighbouring HiP and typical of most communities adjacent to the park. The authors observed a similar situation in other communities in the area and noted a dependence on remittances and social grants as the main sources of household income (Nsukwini and Bob 2019).

Mona Market

Mona Market is a large wholesale market situated near Hlabisa, also in northern KZN (Figure 1). The market operates once every month for four days (Eshowe 2017). Goods sold in the market include vehicles, cattle, craftwork, traditional attire, traditional food, medicinal plants, wild animal carcasses and body parts or by-products, such as skins, bones, feathers and fats. Mona Market supports hundreds of informal traders from northern and central regions of the province; it attracts customers from across KZN and neighbouring provinces; and there are traditional healers on site.

Data collection and analyses

The research instrument was drafted by the 1st author, who has expertise in designing questionnaires and interview guides used in rural communities. The instrument was reviewed by members of the researcher's supervisory committee, who evaluated the design and content. The research instrument used in the study (Supplementary Table S1) was approved by the Ethics Committee of the University of KwaZulu-Natal, under reference no. HSS/1089/108D, after a rigorous review. The interview guide consisted mainly of open-ended questions to gain depth from the responses. The interview questions were tested in a controlled environment and reviewed before use in data collection. The researchers arranged and held meetings with tribal leaders to introduce the study and seek permission to conduct interviews with the relevant community groups. Data collection took place between August and September 2020.

We adopted a mixed sampling method consisting of purposive and snowball sampling techniques (Cohen et al. 2002). Existing evidence on the direct hunting and poisoning of vultures was incorporated in the selection of relevant communities for the study. At each site, the researchers were accompanied by a local resident who was familiar with hunting and trade activities in the area (Kanagavel et al. 2016). These individuals also participated in the study as key informants. Participant selection was guided by key informants and referrals from other respondents (Kanagavel et al. 2016). Because of the sensitivity of the study, the two techniques adopted were envisaged to enrich the interview process by allowing respondents to engage objectively (Chang et al. 2017). Snowball sampling is a qualitative research technique often used when the population is hidden or hard to find, and it is therefore suitable for research investigating illegal activities and sensitive issues (Kanagavel et al. 2016; Brancati 2018). The same technique was used to recruit participants from among *muthi* traders; out of eight traders approached, only four consented to participate in the study.

A total of 25 participants were successfully recruited, consisting of 21 hunters and 4 *muthi* traders. Verbal consent was attained with each participant before the interviews began. No personal details were obtained, and participants could withdraw from the interview at any time if they wanted to. The interviews were administered using an interview guide mainly consisting of open-ended questions. All interviews were conducted in isiZulu and lasted 15–45 min. Some participants seemed uncomfortable regardless of the assurance of anonymity, therefore some information was withheld despite probing efforts. In research involving human subjects, participants' concern about the legal implications of disclosing certain information is one of the most common challenges in collecting data, especially on illegal activities (Chang et al. 2017).

Most interviews were conducted in the participants' homes, but in some cases they happened outside, in the fields, for those we found tending to livestock. For traders, visits to the market consisted of observations and informal conversations before potential participants were identified and approached for an interview. All the interviews were recorded, with consent from each participant, and then transcribed

verbatim and translated into English (Aiyadurai et al. 2010). Furthermore, the data were assigned codes and manually organised into themes following the thematic analysis approach, which allows for the systematic identification and organisation of data into patterns of meaning (Braun and Clarke 2012). The main themes derived from the dataset, which were also affiliated with research objectives, were traditional hunting norms, vulture hunting and trade dynamics.

Results

Hunting in northern KwaZulu-Natal

The study involved participants residing adjacent to HiP and Mkhuze Game Reserve. We interviewed local hunters (84%, $n = 21$) and *muthi* traders operating in Mona Market (16%, $n = 4$). Of the 21 hunters interviewed, 9 (43%) were from the community adjoining Mkhuze Game Reserve, while 12 (57%) lived adjacent to HiP. Our study consisted of 24 male participants (96%) and one female (4%) (Table 1; Supplementary Table S2).

Our results revealed that hunting in the rural areas of northern KZN is a long-standing, relatively prevalent practice. The hunters interviewed consisted of young, middle-aged and old males; the youngest hunter interviewed was age 24, and the oldest was age 65. It was reported that boys could start hunting, often in the nearby woodlands, while herding and caring for livestock as early as 9 years old. The majority of respondents (81%, $n = 17$) described their hunting as recreational (socio-cultural), with the remainder reportedly hunting for subsistence purposes (19%, $n = 4$). Notably, recreational and subsistence hunting overlapped considerably at times because meat obtained during recreational hunting expeditions (predominantly for antelope) would be consumed at home and shared with neighbours.

Subsistence hunters reportedly hunted alone or in small groups of 2 or 3 men. Hunters targeted various antelope species, mainly for household consumption but also traded within the community. Subsistence hunters frequented protected areas and used various hunting techniques, including dogs, snares and traps. Our results indicate that subsistence hunting represented a vital source of cash income for some local young men. One asserted: "*We do not have jobs, so we live off the land. This is what we know*" (HU-05). In addition, hunters sold animal by-products, such as hides, horns and teeth, for use in traditional medicine or making traditional regalia.

Recreational hunting was typically performed with dogs, referred to as 'greyhounds' (Figure 2). These dogs were known to be fast runners, and the main target species were antelope. Hunters often placed bets on the dogs, and the dog that caught the targeted animal first would be the winner for that hunt. Well-performing dogs were sometimes traded among the hunters, and both money and livestock were used in exchange for dogs. A hunter, who also specialised in raising hunting dogs, claimed that an adult dog costs between ZAR8 000 (~US\$464) and ZAR10 000 (~US\$580), equivalent to six goats. Puppies were supposedly sold for ~ZAR4 000 (~US\$232) each. Hunters further indicated that hunting helped them maintain good health. It also played a role in controlling or keeping at bay problem-causing animals, such as hyaenas (*Hyaenidae*

Table 1: Summary of the sample participants for the study of aspects of the illegal hunting and trade of vultures in northern KwaZulu-Natal, South Africa

Study site	Total no. of participants	Males	Females	Mean age $\pm$ SD (range) (years)
Hluhluwe-iMfolozi Park (HiP)	12 hunters	12	0	64 $\pm$ 14 (24–65)
Mkhuze Game Reserve	9 hunters*	9	0	49 $\pm$ 13 (33–65)
Mona Market	4 <i>muthi</i> traders	3	1	35 $\pm$ 8 (24–42)
Total	25	24	1	

*Includes two key informants



Figure 2: Examples of hunting dogs owned by study participants (photographed in September 2020)

spp.) inhabiting forest patches outside protected areas: *“Hunting is more like a sport and some kind of exercise for us. We mainly hunt for antelope, but we also chase away problem-causing animals. If we are always in the forest, we can keep them away from the village because they are quite problematic”* (HU-04).

Hunting trips were undertaken at least twice a week. Hunters went out in groups of more than 50 men from the local areas (hosts) and adjacent towns (visitors). For example, in Mkhuze, visiting hunters came from uPhongolo, Nongoma and Mtubatuba. Hunting took place mainly on communal lands outside of formally protected areas. One of the respondents reported having obtained 11 animals on his last hunting expedition, and 13 animals at other times. Respondents revealed that everything encountered was hunted, but the main target was antelope. In addition, most hunters claimed that they only hunted during the winter when the grass is usually shorter and when hunting is less likely to interfere with the breeding activities of wild animals, antelope in particular. Notably, hunting activities were frequently observed by the researchers in early spring, in August and September. One of the respondents corroborated these observations and claimed *“We change areas so that antelope numbers can recover, but we do not have specific hunting seasons.”* From this, we deduced that hunting took place throughout the year and possibly peaked during the winter season. Hunters were aware of the unsustainable nature of their hunting patterns and the

consequences thereof. The majority of hunters, especially older men, reported that most wildlife had declined outside of protected areas. For example: *“I hunt a lot. Do you see those mountains? We go there and even beyond, looking for antelope, but they are not as many as they used to be. Some have disappeared completely, for example, you do not see uMziki (oribi Ourebia ourebi) anywhere in this area anymore”* (HU-17). Other hunters admitted that the decline in wildlife was a result of unregulated hunting practices by local people: *“Previously, there were hunting seasons but now people hunt at any time”* (HU-14). Nonetheless, others expressed confidence that wild animals could not be depleted: *“People have been hunting here for years and there are still some animals left, they can never be finished”* (HU-02).

The illegal sourcing of vultures for trade in northern KwaZulu-Natal

Our findings indicated that hunters who participated in the illicit hunting of vultures operated in small groups of 3–5 hunters within local communities and were not widespread across the study region. Based on the interviews, feedback from community members, and data from monitoring programmes (e.g. Wildlife ACT, unpublished data), we estimated that at the time of the study there were ~5–8 groups of hunters targeting vultures within the birds’ northern KZN range. Respondents who admitted to hunting vultures were from HiP, aged 24–40 years, with informal, part-time jobs. Those interviewed indicated that hunting

vultures was primarily performed by a faction of hunters who had identified this niche as a profitable and viable income supplement. Those interviewed further reported that vulture hunting was predominantly deliberate and required serious planning. However, this practice did not seem desirable or practical to most respondents, as they reported that the techniques and tools used to kill vultures were not common or easily accessible. For example, *“I don’t think people who hunt vultures are ordinary hunters. Because ordinary hunters hunt with dogs and you cannot hunt vultures with dogs because they can detect the scent from a distance and get away”* (HU-11).

The respondents’ most frequently cited vulture hunting techniques were poison (38%) and firearms (31%) (Figure 3). Vultures were reportedly caught by hunters when scavenging in communal lands outside of formally protected areas, but these encounters were rare. Alternatively, hunters lured vultures out of protected areas and private game reserves using livestock carcasses as bait. In the case of poisoning, the carcass would be laced with a lethal substance, resulting in death after ingestion. Hunters used goats, cattle, donkeys and sometimes antelope carcasses as bait. Respondents acknowledged that donkeys were available in most HiP communities. One respondent claimed that there was a period when the game reserve purchased donkeys from local people (possibly as part of a supplementary feeding initiative), which led to these animals being kept in large numbers. However, this was for a short to medium term, and when the game reserve suspended the initiative, residents abandoned their many donkeys as they had no alternate use for them. Now, these animals were available to hunters who used them as bait for capturing vultures. One participant explained, *“The reserve used to buy donkeys from the local people. People raised donkeys, but now the reserve is not buying them anymore. Most of them [the donkeys] are abandoned, and now hunters use them to lure vultures out of the game reserve. I suggest that the reserve collects all the stray donkeys to reduce vulture poisoning in this area”* (HU-01).

Trade networks and prices

Respondents reported that vulture hunters worked within networks consisting of hunters, traditional healers and *muthi* traders. Vultures were reportedly hunted upon request, and in most cases these were requests for a single vulture: *“No one would ask you for more than one vulture at a time”* (HU-02). Hunters sold their vulture harvests directly to traditional healers, but also to traders working in *muthi* markets and local towns. Except for vultures sold within the community, most respondents reported that vultures harvested from the region were mainly destined for Mona Market (Figure 4).

Hunters reported selling vultures whole at prices ranging from ZAR500 (~US\$29) to ZAR1 000 (~US\$58). One hunter claimed: *“In most cases, I do not sell them for much because I cannot do anything with the bird, once it is in my possession, I want to quickly get rid of it. So, we are open to negotiations with buyers, and we may end up having to sell the birds for lower prices than initially planned”* (HU-02). In comparison, the traders reportedly sold the birds in portions or sometimes whole at higher prices than

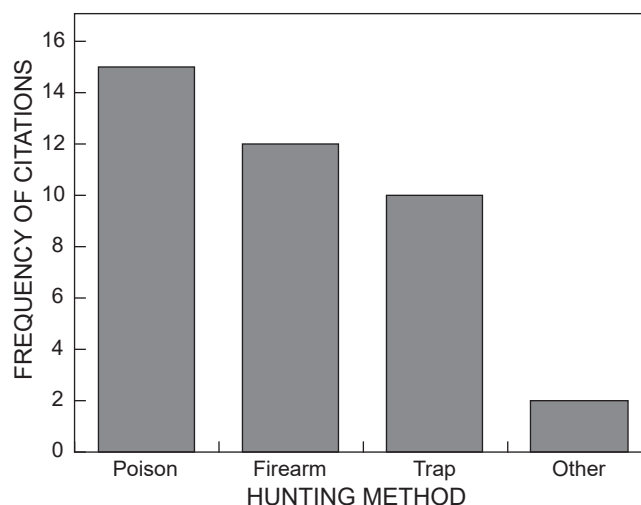


Figure 3: Methods used to hunt vultures in northern KwaZulu-Natal, South Africa, and the number of times each method was mentioned by respondents ($n = 39$)

the hunters. Trader prices for a whole vulture carcass ranged from ZAR1 500 (~US\$87) to ZAR2 000 (~US\$116), and ZAR500 (~US\$29) for just the head. Respondents reported that prices varied greatly depending on the product quality and the place of sale. For example, fresh carcasses or parts and vultures sold far from the source or in large cities where the demand is high (e.g. Durban *muthi* market) were more expensive.

Perceptions and uses of vultures

Respondents were aware that hunting and trade activities involving vultures were prohibited and that having a vulture in one’s possession was a risk: *“They are protected in this country and having a vulture in your possession is a serious crime”* (HU-10). Participants reported that vultures were dangerous to humans and hard to kill: *“If there is a dead animal they set traps, you cannot easily approach that bird because it is dangerous, it can kill you”* (HU-19). Most respondents reported that vultures avoided human contact and consequently spent most of their time in game reserves. Furthermore, the birds avoided carcasses that were located close to human habitation and activities: *“Vultures are not easy to find. They are not killed very often because they do not come to villages but spend most of the time in game reserves where they are not disturbed”* (HU-15). Respondents indicated that the birds were coming to the villages less often, which they associated with the increase in human settlements: *“It is not easy to get a vulture because they are not as many as they used to be”* (HU-17). Vultures were also reported to generally avoid places where they had been hunted or experienced disturbances previously. A declining trend in local vulture populations was observed by the respondents; one claimed *“There used to be a lot of them [vultures] feeding on livestock carcasses in these [communal] lands, but now years go by without seeing them. They spend most of their time in game reserves now. Livestock die and end up being consumed by dogs and hyaenas”* (HU-15).



Figure 4: Images of a whole vulture (left) and parts (right) displayed for sale at Mona Market, KwaZulu-Natal, South Africa, and respective prices (photographed in June 2020)

Respondents reported hyaena numbers to have increased dramatically outside protected areas and hyaenas were linked to numerous livestock depredation incidents in local communities adjoining protected areas. One hunter said: *"Hyaenas killed 11 goats a few weeks ago, here. They are too many and are a big problem, but no one is doing anything about it. We need help on how to remove them from here because even dogs are terrified of them"* (HU-09).

Vulture parts were popular as ingredients in traditional medicine and related practices. The use of vulture parts in traditional medicine was informed by their scavenging nature. Respondents perceived vultures to be able to locate carcasses from vast distances, using a heightened sense of smell facilitated by a substance found in their brains known in the traditional medicine culture as *ithuko* (cerebral fluid). Vultures were considered extremely sensitive to signals carried through the air; hence, they are locally called *izwangomoya*: *"Besides their ability to sense, vultures are wary of their surroundings, they can tell if a place is dangerous and leave. For example, if they smell the blood of another vulture, they will not eat there"* (HU-18).

Vulture parts mentioned by respondents as used in traditional medicine were the head/brain, heart and bones. It was further indicated that these parts were used for various purposes with either medicinal or belief-based orientations. For example, vulture parts were reportedly used to increase prey detection in hunting dogs (41%, $n = 12$) and to enhance divination in humans (38%, $n = 11$) (Figure 5). Other uses reported by respondents included good fortune, attracting customers, attaining strength and bravery, and treating headaches and mental illness.

Discussion

Hunting in northern KwaZulu-Natal

Wildlife hunting is a long-standing cultural practice for many indigenous societies worldwide (Luz et al. 2017; Eid and Handal 2018). It is at the frontier of the human–wildlife

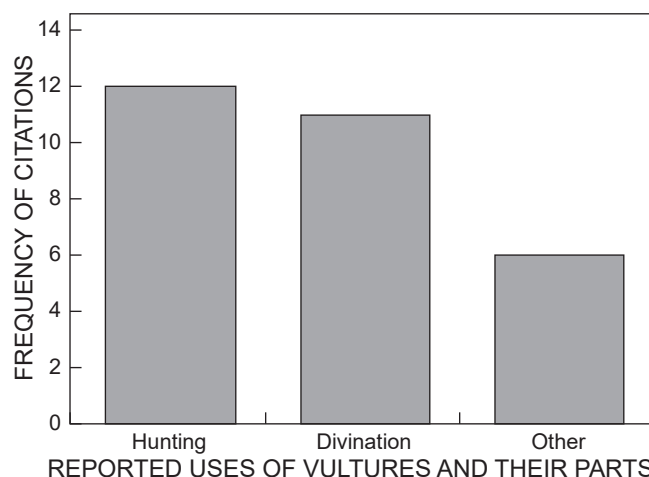


Figure 5: Human uses of vultures, as reported by respondents in the present study ($n = 29$). "Divination" refers to vulture parts used as ingredients in concoctions to purportedly enhance divination powers in humans

interface (Bonwitt et al. 2017). In the present study, we found hunting to be prevalent despite the relatively low numbers of wildlife remaining on communal lands. Hunting was predominantly performed by males (Dlamini 2005). A strong cultural element of hunting was observed in this study, as in other studies (Bonwitt et al. 2017; Manqele et al. 2018). Most hunters were adults; boys were taken to the field to hunt as early as age 9. This knowledge transfer system indicates the importance and relevance of this practice in the present day.

We identified two dominant types of hunting which we categorised as recreational (socio-cultural) and subsistence (economic), as in other studies (van Vliet et al. 2016). We observed some overlap and levels of integration between the functionalities of these two types of hunting. Recreational

hunting was the most prevalent and was performed mainly for enjoyment and socialisation. This activity was associated with significant levels of bushmeat consumption as the main target species were antelope; meat from hunting expeditions was consumed with other hunters or with neighbours at home. Thus, hunting plays a role in improving food security, as shown in other studies (van Vliet et al. 2016). A by-product of the activity was livestock protection, as hunters reportedly killed problem-causing animals when encountered during hunting trips. Recreational hunting also presented opportunities for income-generation for some hunters, primarily through dog sales. At the time of the study, one respondent had recently sold two of his hunting dogs for ZAR16 000 (~US\$928). In addition, hunters locally traded in animal parts such as skins, bones and feathers. Although antelope were the main target species, all animals encountered were hunted. Therefore, we surmise that the practice is poorly regulated and is consequently unsustainable.

Subsistence hunting constituted the hunting of bushmeat species primarily for household consumption, which was often accompanied by meat sales within the community. Subsistence hunters frequented protected areas, hunted in small groups, and utilised diverse hunting tools, possibly to increase their catch. The observed high levels of unemployment in our study areas implied that hunters had more time to be out in the wilderness. This attribute was significant as a motivator and an enabler for involvement in hunting activities, both recreational and subsistence. Moreover, a key element in hunting was income-generation, with both recreational and subsistence hunters able to generate income. Although this was a by-product of both types of hunting, it draws attention to the marginalisation and scarcity of formal economic activities in the study area.

Poor agricultural productivity, low monthly incomes, high inequality and limited economic opportunities are important economic factors driving local people's dependence on wildlife resources (Aiyadurai et al. 2010; Lindsey et al. 2011; Duffy and St John 2013; Manqele et al. 2018). These conditions are increasingly common in most communities near wildlife areas in the Global South (McMillan and Nguyen 2014; Nsukwini and Bob 2019). However, participants in the present study demonstrated a relatively low level of consistent dependence on wildlife resources for subsistence; this has also been shown in other studies (Sandalj et al. 2016; Manqele et al. 2018; Rogan et al. 2018). The shift in dependence on wildlife has been driven mainly by the low numbers of wildlife remaining in communal lands, and the risk of hunting in protected and private properties where a decent amount of wildlife remains.

The illegal sourcing of vultures for trade in northern KwaZulu-Natal

We found that the hunting of vultures, in particular, was an endeavour that had developed in response to the persistent demand for vultures in traditional medicine practices, as previous studies have shown (McKean et al. 2013; Pfeiffer et al. 2015; Mashele et al. 2021a; Williams et al. 2021). Vultures in northern KZN were illegally hunted by local hunters who operated in groups of 3–5 men. These hunting syndicates were not widespread across the region. Except for opportunistic harvests, we estimated about 5–8 hunting groups targeting vultures across the birds' northern KZN

range. Kret et al. (2018) similarly noted a group of 10 hunters who frequently visited a Niger ecosystem to hunt vultures and other raptors. These operations are conducted in small networks, possibly to conceal them better. The hunting of vultures was not a full-time economic activity but took place mainly in response to irregular requests. Even so, respondents also reported that they occasionally hunted without any requests and then searched for buyers within their networks when cash was scarce, as well as to cover urgent and unexpected expenses.

Those who hunted vultures were reportedly discreet in their operations within the communities. Their activities were not widely known or talked about. We attributed this to a combination of potential factors. Although hunting is a locally accepted cultural practice and a livelihood activity in rural KZN (Dlamini 2005; Manqele et al. 2018), the hunting of vultures was somewhat contested within local communities. We found from our previous study that vultures were valued for their ecological role as scavengers and as a part of the local natural heritage (Manqele et al. 2023a). This may result in vulture hunting being opposed by some community members. In addition, criminal activities in rural communities are abhorred and those who commit wildlife crime would necessarily be discreet. The majority of local people's disapproval of illegal hunting and trade in wildlife has been shown to reduce wildlife crimes (Gastañaga et al. 2011). Gastañaga et al. (2011) indicate that local people believed that illegal wildlife activities tainted the image of their community and threatened its tourism potential. In light of this, most residents were against wildlife crimes. Hence, this social construct reduces wildlife-related crimes among residents.

In addition, the rapid decline in vulture populations over the last few decades has solicited increased attention and dedication from the conservation sector (Botha et al. 2017). Some strategies implemented include awareness-raising, population monitoring and the presence of law enforcement in areas deemed as hotspots for vulture hunting and/or trade, including the area covered by this study. This increased presence has improved awareness regarding the present plight of vultures and reinforced the illegality of capturing or possessing them. This has potentially translated to fewer people engaging in illegal vulture harvesting, and those who choose to engage in the activity are compelled to operate secretly. Increased conservation awareness has been associated with changes in behaviour that potentially reduce illegal activities against wildlife (Keane et al. 2011). However, it remains uncertain whether the combination of local appreciation and increased conservation efforts has resulted in fewer people engaging in vulture hunting or hunters keeping their activities well concealed.

The hunting of vultures was predominantly commercial. We found that hunters who targeted these birds were financially precarious young people between the ages of 24 and 40. Often, low-income groups practice illegal wildlife trade (Atuo et al. 2015). McKean et al. (2013) indicated that most people involved in the vulture trade were low-income groups. Because of the sensitive nature of our research, we could not solicit adequate information on specific socio-economic attributes of those respondents who were directly involved in vulture harvesting and trade. Most likely,

the respondents' involvement in illegal activities involving vultures could have been driven mainly by the need to supplement their income. Vultures have been shown to fetch relatively high prices in markets, making their trade profitable (Williams et al. 2021).

Poison and firearms were the most-used tools for killing vultures. Poisoning has been flagged in Africa as one of the main contributors to the present vulture crisis (Virani et al. 2011; Botha et al. 2017; Gore et al. 2020). However, the majority of vulture poisoning incidents are reportedly indirect; for example, vultures fall victim to farmer–carnivore conflicts and game-poaching activities. Nonetheless, it appears that the direct poisoning of these birds has gained momentum in the study region and is driven by the demand for parts in traditional medicine (McKean et al. 2013; Coverdale and Cragie 2023). Respondents' mentioned that firearms were gaining preference over poisoning (although the latter was still used more often because of easy access) since most traditional healers had become cautious of buying poisoned vultures/body parts, as likewise found by Mashele et al. (2021a). Poison also remains the most-used method for killing vultures owing to the relatively high cost of obtaining a firearm and ammunition. In other parts of Africa, hunters navigate this challenge by using handmade rifles (Kret et al. 2018). Except for infrequent instances where vultures visit communal lands to scavenge, these birds are mainly lured out of protected areas and private game reserves to be killed in communal lands, with livestock carcasses (cattle, goats and donkeys) used as bait. Respondents in our study reported that the availability of donkeys in communal lands was understood to have aided the killing of vultures. One respondent claimed that the availability of donkeys around HiP had been facilitated by a previous partnership between residents and the game reserve. Hunters only secured other livestock carcasses from incidents of depredation, disease and drought-related mortalities; this is because cattle and goats mainly serve cultural and legitimate economic purposes in rural African communities.

Trade networks and indirect implications of the decline in vulture populations

We found that trade in vultures did not follow a single route and was therefore unpredictable, which is a common phenomenon in the illegal wildlife trade (Leberatto 2016). The trade occurred within closed networks comprised of hunters, traditional healers and traders. Hunters sold vultures directly to traditional healers in the community through their own network or to traders who then sold them in *muthi* markets. Atuo et al. (2015) observed a similar pattern in an assessment of trade in avian body parts in West Africa, whereby products were sold through a door-to-door system and also in open markets. Mona Market is within 50 km of the study site (communities and protected areas); it is a local wholesale market for craftwork, livestock, medicinal plants, and wild animal carcasses and by-products, among other items. Considering costs and travel risks for the hunters, this market was the most convenient platform for selling vultures obtained in the region. Because this market opens once a month for about 1 week, other avenues were likely used to sell the remaining vulture carcasses and parts. Some vultures harvested from northern KZN were also

found among *muthi* sold at Warwick Junction (pers. obs.), the biggest market in the province, ~300 km from the study site. Small-scale off-market sales were also observed in local towns and city centres (pers. obs.).

Vultures were sold whole or in portions. Whole vultures were found fresh, while parts were sold dried. We generally observed significant variations in the pricing of vultures. Hunter prices and trader prices differed, with hunters selling the birds whole for relatively lower prices. Broad et al. (2014) showed uneven revenue distribution along the trade system, whereby harvesters often generate lower incomes than middlemen and retailers. Trader prices for a whole vulture carcass ranged from ZAR1 500 (~US\$87) to ZAR2 000 (~US\$116). Notably, traders alternatively sold birds in parts (i.e. head, wings, feet). For example, a head alone could be sold for ZAR500 (~US\$29) and was the most expensive and sought-after part in the market, as shown in other studies (McKean et al. 2013; Mashele et al. 2021a, 2021b).

Vulture prices also varied among traders, depending on the product quality and the place of sale. Fresh vultures and ones sold far from the source and in high-demand locations (e.g. Durban) were more expensive. Mashele et al. (2021a) shared similar inferences in a study conducted in the Kruger to Canyons Biosphere Region, South Africa. The authors further highlighted that vulture prices varied based on traders' economic background, source and the level of difficulty in obtaining items, and sex of the bird, with lower prices for male vultures (Mashele et al. 2021a, 2021b). Despite the observed differences in revenue along the trade route, it was evident that vultures were highly valued species in the markets.

We found that a combination of three factors accounted for the high commercial value of vultures in local markets. First, the protection status given to vultures and awareness of the laws regarding illegal trade suggest that possession is a high risk (Challender and MacMillan 2014), which justifies the high market prices for vultures. Second, vultures were perceived to evade communal lands and spend more time in reserve areas, which limits their accessibility. This aligns with observed declines in their populations. Species exploited for human use that are perceived as declining are often assigned higher market prices (Atuo et al. 2015). In addition, as species become rare, the cost of capturing them increases as they likely require greater hunting skills and more effort (Abi-Said et al. 2018). Third, vultures are highly revered in traditional medicine as a result of belief-based uses (McKean et al. 2013; Boakye et al. 2019; Mashele et al. 2021a, 2021b). Durojaye and Olufemi (2015) noted that a species' price in the market could be determined by the perceived benefits expected from its use.

The respondents expressed that problem-causing animals, particularly hyaenas, burdened them. The recent perceived increase in hyaenas in communal areas was linked to the decline in vultures. Respondents claimed that livestock carcasses in communal lands were attracting more hyaenas following a decline in the number of vultures and their retreat to protected areas. Prey abundance and lack of intraspecific competition were most likely driving this increase and facilitating permanent residence of hyaenas in communal areas. In our previous study (Manqele et al.

2023), residents underscored the important role of vultures in livestock carcass removal, especially because of the proneness of the area to seasonal droughts, which often leads to high cattle mortality. The link between the reduction in vulture populations and the reported increase in mammal scavengers is noteworthy and merits further investigation.

Ogada et al. (2012) presented evidence signalling a correlation between declines in vulture populations and the increased presence of facultative scavengers, especially hyaenas and jackals (*Caninae* spp.), in Kenya. Their results showed that facultative scavengers take dominance in the absence of vultures. They further observed that carcasses remain in the environment longer without vultures, attracting more mammal scavengers, facilitating contact with domestic animals and representing a serious risk of disease transmission. The increase in hyaena populations outside protected areas is of concern considering human health and livelihoods (Ogada et al. 2012; Mhlunga et al. 2019).

According to our participants, vulture parts, especially the head/brain, were used in traditional medicine, mainly for hunting dogs. A concoction made with vulture head/brain was perceived to strengthen dogs' hunting senses. This was in accordance with the seemingly increasing practice of recreational hunting. Parts of the head/brain were dried, crushed into powder and mixed with body parts from other meat-eating animals, such as eagles (family *Accipitridae*). The concoction was administered to the dog through feeding (mixed with food) or sniffing. The majority of hunters obtained this product from traditional healers, while a few knew how to mix it themselves. Using this product on a dog was believed to strengthen its detection abilities, enabling the dog to run faster and find prey quicker. Although most hunters used this product, excessive and prolonged use was believed to result in dogs preying on goats and having to be put down. According to our knowledge, this is the first report of vulture-derived *muthi* use on a domestic animal.

Study limitations

This study was initiated to assess aspects relating to the hunting of vultures in northern KZN. This research was qualitative, and the data were derived primarily from interviews and supplemented by observations. Although the interviews were guided, conversations with the participants differed significantly because of the sensitive nature of our probe into illegal wildlife trade. There was a possibility of encountering hunters involved in other illegal activities and possessing critical information, for example, one respondent was a former rhino poacher. In light of the aforementioned, certain questions were deliberately omitted while others were added with careful discretion. However, key questions were asked, and probes were also employed to ensure responses to key questions. Scientific research standards were carefully adhered to, for data-quality management. Data synthesis was deliberately limited to retain data originality and keep up with the qualitative nature of the research. The data presented here may offer limited potential for generalisation, considering that the study involved two sites in a relatively large region and a small sample size. However, broader and long-term monitoring of local *muthi* markets and hunting activities could generate large datasets that might provide a robust picture of illegal

activities involving vultures and other threatened species in KwaZulu-Natal.

Conclusions

Although an ancient practice, wildlife hunting predominates in contemporary rural areas of developing countries. Hunting takes place for various purposes, including subsistence, recreation, culture, income-generation and the management of problem-causing animals. Hunting has been closely linked to socio-economic conditions endemic to remote rural areas in the Global South, where poverty is accompanied by high unemployment and limited economic activities. In these settings, the livelihood strategies of local people tend to be diverse though mainly involved in living off the land and the natural resources it furnishes. This study was primarily aimed at examining aspects of the sourcing and trade of vultures for use in traditional medicine; importantly, we found that this practice was not exclusive nor new, but in fact part of a deep-rooted cultural system.

Our findings reveal that the hunting of vultures in northern KZN contributes to income-generation for economically disadvantaged young men. However, the activity is detrimental to the survival of these socio-ecologically valuable species. Vultures are the most-threatened group of raptors worldwide. In the study region, most vulture species are characterised by declining populations, with one species probably now locally extinct (Coverdale and Cragie 2023). Traditional medicine use and trade have been highlighted as the main driving forces. Although formal impact assessments have not been conducted, there is enough evidence to raise serious concerns about the region's biodiversity integrity, the viability of conservation strategies, sustainable development and law enforcement.

If the main driver for the harvesting and trade of vultures in northern KZN is the compelling need to generate income, as this study shows, the practice is projected to stand in accordance with the persistent, increasingly unfavourable economic climate facing the country and many parts of the world. Nonetheless, we recommend targeted awareness initiatives involving young people to educate and change perceptions and behaviours now and in the future.

Moreover, we recommend strategies to change the perceptions of local people and the judicial sector to recognise and treat wildlife crimes as serious crimes. This may reduce the occurrence of these activities, especially because the conservative culture of rural communities tends to endorse unity and integrity, and disapprove of criminal activities.

Future studies that will comprehensively investigate the substances used in killing vultures, with a focus on access control and management protocols, may be of great value. Finally, because of the multifaceted nature of the issue under investigation, various strategies should be co-implemented to improve effectiveness.

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Data availability — Data for this study is available on request from the authors but belongs to the University of KwaZulu-Natal.

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