frontiers | Frontiers in Ecology and Evolution

ORIGINAL RESEARCH
published: 13 June 2022
doi: 10.3389/fevo.2022.906398

Wildlife Trade for Belief-Based Use: Insights From Traditional Healers in South Africa

Jennah Green[1], Pippa Hankinson[2], Louise de Waal[2], Emma Coulthard[3], John Norrey[3], David Megson[3] and Neil D'Cruze[1]*

[1] World Animal Protection, London, United Kingdom, [2] Blood Lions NPC, Hermanus, South Africa, [3] Ecology and Environment Research Centre, Department of Natural Science, Manchester Metropolitan University, Manchester, United Kingdom

The use of animals and plants as traditional remedies for medical and magico-religious purposes has a long history of socio-cultural and economic importance in South Africa. Herein, we aim to characterize the social and economic value of wild animal species used in traditional, belief-based medicine within South Africa from traditional healers' perspective and to explore healers' knowledge of plant-based alternatives to wildlife-based derivatives for this type of trade. Through structured surveys with five traditional healers, we sought to gain insight into the range of wild animal species used, as well as the purpose, the perceived commercial value and the perceived availability of commonly used species. Particular focus was placed on exploring the socio-economic value of lions due to their prominence within the traditional medicine market, both in South Africa and internationally. Three of the respondents interviewed had been generating an income from traditional healing for between 30 and 50 years, and the overall monetary gain across all respondents was between ZAR 30,000 (1,800 USD) and 120,000 (7,200 USD) per annum. Our study confirms that a wide range of wild animal species are used in traditional healing practices in South Africa, for both medicinal and magico-religious purposes. The traditional healers we interviewed cited 20 common wild animals from a range of vertebrate classes including birds, reptiles, mammals, and one invertebrate. These included a number of species listed as threatened on the IUCN Red List of Threatened Species. Traditional healers cited 32 different uses for wild animal parts, as well as 19 alternative plant-based preparations. For lions specifically, four out of five practitioners listed lions among their top three profitable derivatives and three practitioners reported that lion had become the most rare or unavailable species in the last 5 years. Although our study is based on a limited number of interview participants, we believe that our findings provide valuable initial insights into the socio-economic drivers of traditional healing practices in South Africa, and that further research quantifying medicinal and belief-based use of wild animal ingredients and their plant-based alternatives could help to inform approaches to managing related pressures exerted on wild populations in South Africa in the future.

Keywords: South Africa, traditional medicine, wildlife trade, conservation, animal welfare, ethnozoology, lions

OPEN ACCESS

Edited by:
Balázs Deák,
Hungarian Academy of Sciences, Hungary

Reviewed by:
Stephen Awoyemi,
Society for Conservation Biology (SCB), United States
Muhammad Kabir,
The University of Haripur, Pakistan

****Correspondence:***
Jennah Green
Jennahgreen@worldanimalprotection.org

Specialty section:
This article was submitted to Conservation and Restoration Ecology, a section of the journal Frontiers in Ecology and Evolution

Received: *28 March 2022*
Accepted: *23 May 2022*
Published: *13 June 2022*

Citation:
Green J, Hankinson P, de Waal L, Coulthard E, Norrey J, Megson D and D'Cruze N (2022) Wildlife Trade for Belief-Based Use: Insights From Traditional Healers in South Africa. Front. Ecol. Evol. 10:906398. doi: 10.3389/fevo.2022.906398

INTRODUCTION

Traditional or belief-based medicine, commonly known as "muthi" in southern Africa, refers to substances containing plant and/or animal material for medicinal and/or spiritual use (Mashele et al., 2021). The use of animals and plants as traditional remedies for medical purposes has a long history of cultural importance in South Africa (Williams and Whiting, 2016), where more than 200,000 traditional healers are considered highly valued and esteemed members across many communities (Nieman et al., 2019; Mthembu, 2021). These thousands of traditional healers have been formally recognized as medical practitioners within South Africa since the introduction of the Traditional Health Practitioners Act 35 in 2004, following the state's failure to recognize them as legitimate practitioners during the apartheid era (Nkabinde and Morgan, 2006). Traditional, belief-based medicine is now believed to be expanding so rapidly in South Africa that traditional healers outnumber western doctors by 2,000:1 in some areas, and an estimated 60–80% of its citizens consult traditional healers for medical concerns (Nieman et al., 2019). The traditional, belief-based medicine industry contributes significantly to local economies, employing at least 133,000 people, a large percentage of which are rural women, and has previously been estimated to be worth ZAR 2.9 billion per year (Mander et al., 2007).

Across South Africa, traditional healers are consulted for a wide range of medical conditions including (but not limited to) sexually transmitted diseases, arthritis, strokes, headaches, shingles, stomach problems, chest problems, mental health issues, blood pressure/heart problems, HIV/AIDS, infertility, epilepsy, diabetes, and cancer (Cook, 2009). Traditional healing [defined by the World Health Organization as traditional medicine with therapeutic practices that were developed before the existence of western allopathic medicine (Mthembu, 2021)] also encompasses conditions often referred to as spiritual or magical ailments, indicating a significant degree of socio-cultural importance in addition to treating medical disorders (Cook, 2009; Nieman et al., 2019). As such, these traditional healing practices place an equal or greater value on curing supernaturally derived ailments such as harm from evil spirits and demons, spirit illnesses, bad luck, ancestral problems, witches and spiritual enemies, as well as helping with increasing intelligence, acquiring wealth and casting love charms (Cook, 2009; Nieman et al., 2019).

The majority of traditional, belief-based medicine remedies are of botanical origin, and currently the use of animal parts is comparatively poorly documented (Williams and Whiting, 2016). Nevertheless, wildlife used as traditional medicine comprises a vast array of species from all taxonomic groups (D'Cruze et al., 2020a, 2021). In a consultation session with the Associations of Traditional Healers in South Africa it was explained that traditional healers make extensive use of lion (*Panthera leo*), leopard (*Panthera pardus*), elephant (*Loxodonta species*) and rhino (*Ceratotherium simum and Diceros bicornis*) derivatives (High Level Panel, 2021). Apart from the use of lion and leopard skins for cultural and traditional purposes, the use of bones, horns, fat and claws of lion, leopard, elephant and rhino for medicinal purposes is significant (High Level Panel, 2021). One recent study recorded 71 vertebrate species and morphospecies (including 12 species of conservation concern) used in traditional medicinal practices, constituting around 4.5% of all terrestrial mammal, reptile, and bird fauna found in South Africa (Nieman et al., 2019). Specific uses attributed to individual species varied between traditional healers and between communities, but mammals were found to be the most prominent taxonomic group overall with the most diverse uses attributed to the Cape porcupine (*Hystrix africaeaustralis*), leopard, and Chacma baboon (*Papio ursinus*) (Nieman et al., 2019). The rapidly expanding traditional healing market may be affecting wild populations of species used in the highest densities, particularly leopard, lion, Cape clawless otter (*Aonyx capensis*), several vulture species (unspecified taxonomy), brown hyena (*Hyaena brunnea*), and several key reptile taxa, namely puff adder (*Bitis arietans*), monitor lizard species (*Varanus spp.*) and African rock python (*Python natalensis*) (Nieman et al., 2019).

The widespread abundance of traditional healers across South Africa and the use of wild animal species in traditional, belief-based medicine practices has raised concerns regarding its potential impact on wildlife (Nieman et al., 2019). Although some aspects of these practices may be carried out sustainably, use of specific species has led to targeted harvesting of fauna, which can jeopardize long-term wild population survival for species that are especially popular, threatened, localized, range-restricted, habitat-specific or have small population sizes (Williams and Whiting, 2016). Such circumstances can have knock-on effects for sustainability, biodiversity and habitat protection, and for the subsequent environmental services provided by natural areas and the species contained therein (Merem et al., 2018). These impacts are further compounded by the rapid increase and widespread growth in wildlife trade to other geographic regions (Assou et al., 2021). Consequently, the persistent diminishing of threatened species has reached an alarming level across sub-Saharan Africa (Merem et al., 2018).

Harvesting or breeding wild animals for commercial use can also have severe consequences for both animal welfare and public health. When humans have direct contact with wild species there is increased opportunity for pathogen transmission, facilitating the emergence and spread of zoonotic diseases, which has been noted as a potential cause for concern among traditional healers handling wild animals in South Africa (Nieman et al., 2019) and for husbandry staff at captive lion breeding facilities across the country (Green et al., 2020). Both wild capture and captive breeding of wildlife are inherently associated with animal welfare concerns as the potential for suffering exists throughout every stage of the trade chain (Baker et al., 2013; D'Cruze et al., 2020b). Wildlife trade can also have widespread repercussions for ecosystems and communities; pesticides and other poisons are increasingly used to harvest wildlife for the commercial trade in traditional medicine (Ogada, 2014), the effects of which cascade out to threaten human, wildlife, and ecosystem health as they indiscriminately poison non-target species (Gore et al., 2020). This is particularly concerning in cases where such activities occur in or near protected areas, such as the vulture populations targeted for

use in traditional medicine close to the Kruger National Park (Mashele et al., 2021).

Despite the implicit link between the use and trade of wildlife in traditional, belief-based medicine, its acknowledged importance to indigenous communities in South Africa, and the state of wild populations and biodiversity across the region, there has been only limited research in this area to date (Nieman et al., 2019). A recent surge in ethnozoology studies in KwaZulu-Natal, the Faraday market in Johannesburg, the Eastern Cape Province and the Western Cape Province has greatly improved our understanding of this topic in specific regions, but a noticeable gap still remains (Williams and Whiting, 2016; Nieman et al., 2019). In particular, there is a need to better understand the relative contributions of cultural and socio-economic drivers behind the symbolic use of wildlife in traditional medicine across South Africa (Williams and Whiting, 2016). Assessing the dynamic trade of animals for traditional medicine is essential to inform policies that balance socio-economic and cultural requirements with the diverse demands of biodiversity maintenance and ecosystem health (Nieman et al., 2019).

Herein, we aim to characterize the social and economic value of wild animal species used in traditional, belief-based medicine within South Africa from traditional healers' perspective. To achieve this, we sought to gain insight into the range of wild animal species used by traditional healers, the perceived commercial value of those most commonly used, and healers' knowledge of any plant-based alternatives to wildlife-based derivatives. Particular focus was placed on exploring the socio-economic value of lions due to their frequently cited status as a commonly traded and profitable species within the traditional medicine market, both in South Africa and internationally (Williams et al., 2017a). Employing interviews with traditional healers to identify socio-economic aspects of the industry can provide preliminary information about the nature of consumer demand for wild animal based traditional medicine and the current availability of plant-based alternatives (D'Cruze et al., 2020a), as well as developing a better understanding of product prices for specific species, local purchasing power, and practitioner and consumer behavior and preferences at a fine resolution (Nieman et al., 2019; Mashele et al., 2021). Given the global relevance of the wildlife based traditional medicine, the demand for African species' products in other parts of the world, and their cultural importance for belief-based uses within South Africa (Nieman et al., 2019; Assou et al., 2021), insights into the socio-economic dimensions of this type of wildlife trade can help inform approaches to managing related pressures exerted on wild populations.

MATERIALS AND METHODS

Data Collection

Structured surveys based on a set of predetermined questions [including open-ended, closed, and multiple-choice questions were carried out with five traditional healers between February and June 2021. We also refer to these traditional healers as "respondents" and "participants" throughout the remainder of the text. The surveys were undertaken by three researchers, all researchers were present at each interview. Two surveys were conducted in English, and three were conducted in the respondents' local language (not specified for anonymity purposes), and the results subsequently translated to English. Respondents were selected through a chain referral process. The first two respondents were known by one of the researchers, and the remaining respondents were identified through contacts and/or referrals (Newing et al., 2011), whereby participants recommended other potential participants or asked others to take part. Due to the niche area of expertise required for the interviews, there was no demographic-based selection of participants, and the only selection criterion was that traditional healers had undergone Ukuthwasa (the process to become a traditional healer). Due to the sensitive nature of the subject and the specific expertise required, we recruited a small sample of respondents ($N = 5$) and are careful to consider this throughout the interpretation of our results. In accordance with the British Sociological Association Statement of Ethical Practice (British Sociological Association, 2017) informed consent was obtained from every survey participant prior to the interview, participants were made aware of their rights to voluntarily participate or to decline.. The database collated was entirely anonymous and no personally identifying data was collected. In addition, traditional healers were coded in the database and names not reported to further protect study participants from harm or discrimination (John et al., 2016).

Specifically, traditional healers were asked to identify and rank the 10 wild animals (using local common names) that they currently considered to be the most profitable (as opposed to most valuable per item or most commonly traded), and the 10 wild animals that they considered to have most increased in rarity (and therefore inferred reduced availability) over the past 5 years (corresponding to the period 2015–2020). Common names relating to taxonomic class (e.g., bird and mammal) or below were included in the analysis of the survey responses but were excluded when considering conservation status. Traditional healers were also asked to provide additional information including the wildlife body parts sold, their minimum and maximum price, estimated number of units sold (in the last year, last 5 years and last 10 years) and their intended purpose. Monetary values were reported in South African Rand (ZAR) and converted to US dollars (USD) using 1 ZAR = 0.06 USD (conversion rate as of 20.12.21[1]).

Interviews included questions focused on African lions based on traditional healer recollections of their own trade activity. Questions focused on specific body parts sold, purpose and price per item, source country, estimated number of animals sold, customer type [tourists (one visit), causal customers (< five visits per year), and regular customers (> five visits per year)], and species availability (a mean "availability score" was calculated based on respondents answers to the question on how available African lion derivatives were now compared to 5 years prior) (see **Supplementary Material**).

[1]xe.com

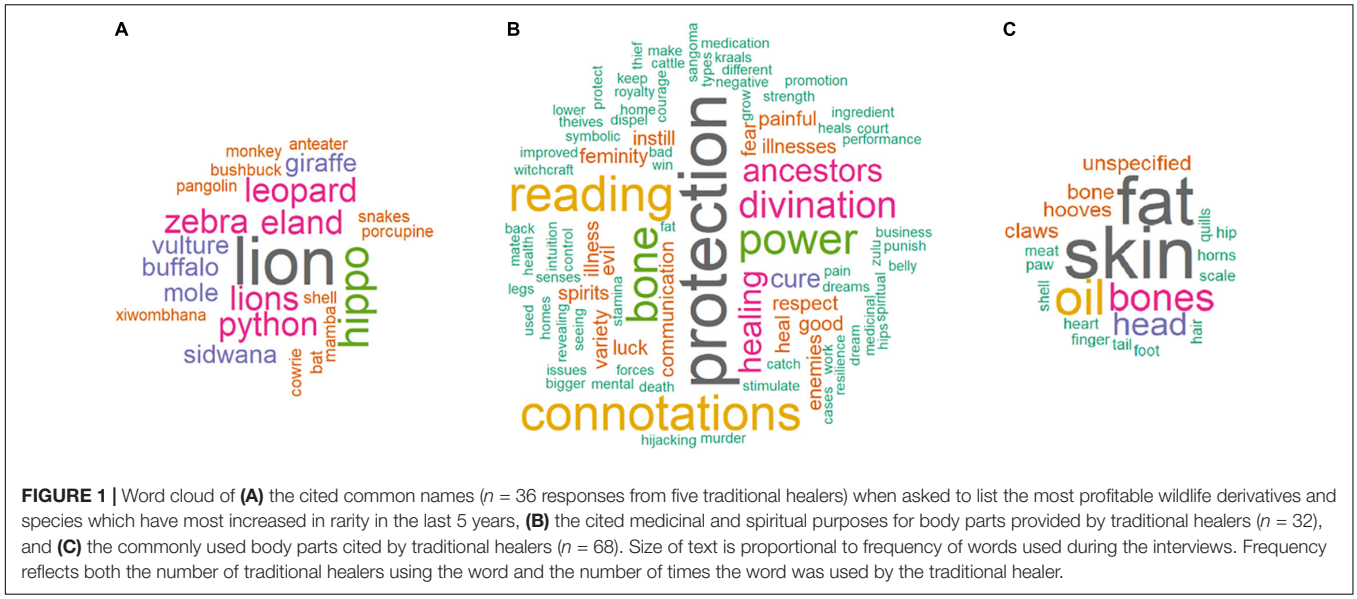

FIGURE 1 | Word cloud of **(A)** the cited common names (n = 36 responses from five traditional healers) when asked to list the most profitable wildlife derivatives and species which have most increased in rarity in the last 5 years, **(B)** the cited medicinal and spiritual purposes for body parts provided by traditional healers (n = 32), and **(C)** the commonly used body parts cited by traditional healers (n = 68). Size of text is proportional to frequency of words used during the interviews. Frequency reflects both the number of traditional healers using the word and the number of times the word was used by the traditional healer.

The same traditional healers were also asked questions related to the sale of plants as traditional medicine. Initial questions focused on whether they had any awareness of plant-based items that could be used to treat medical and/or spiritual issues and, if so, could they identify the three most common plant-based items sold and state their purpose. They were also questioned if they themselves sold any plant-based items, if not why this was the case and, if so, to provide an estimate of the proportion of their sales that involved plant-based items. Traditional healers were also specifically asked about their awareness of any plant-based items that could be used as direct replacement for African lion.

For wildlife, local common names provided by traditional healers in local languages were translated into English. A list of inferred species and their respective scientific names were assigned to each of the common names based on the documented presence of wild species in South Africa, according to the International Union for Conservation of Nature Red List of Threatened Species (IUCN, 2021) (hereafter the IUCN Red List). For all species, information regarding their conservation status and population trend was also gathered from global species assessments on the IUCN Red List because comprehensive national level assessments are not yet available for South Africa. This excludes names relating to taxonomic class or above, which were considered too broad, e.g., "bird" and "mammal" and any common names relating to invertebrates and fish, given a relative lack of Red List data relating to these taxonomic groups. Threat status was recorded in accordance with the 2001 IUCN Red List Categories and Criteria system (version 3.1) as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC) or Data Deficient (DD). For all species, information regarding their international legal trade status was gathered from the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) website[2].

[2]https://www.cites.org

Data Analysis

We used descriptive statistics to describe patterns and trends in the data. Statistical analysis was carried out using R statistical software version 4.0.3 (R Core Team, 2020). The uses for animals communicated by the respondents were simplified, summarized and then categorized into word strings. The words in the strings were used to generate a word cloud produced by the "Wordcloud" package in R in which the sizes of the words are proportional to the frequency with which the words (i.e., uses) recurred (i.e., were mentioned by respondents). The packages "tm," "SnowballC" and "RColorBrewer" were also used to create the word cloud. A word cloud was generated for the number of times a common name was associated with a use, thereby indicating the animals with greatest number of uses mentioned by the respondents.

RESULTS

Demographics

Three female and two male traditional healers, whose ages ranged from 36 to 70 years, participated in our study. Participants consisted of both married and widowed individuals from the Mooi River (KwaZulu Natal), Cape Town (Western Cape), and Ehlanzeni (Mpumalanga) districts. Participants reported living in households with between three and 15 people and having between one and six children. One participant had no formal education, whilst the other four completed their education between Grade 9 (Senior Primary School) and BA Hons (University). Two individuals identified as having no religion, whereas the other three identified as Zionist, Christian and Muslim. Three of the five practitioners reported traditional medicine as their primary source of income and those that were willing to report on this, estimated their income for this business to be between ZAR 30,000 and ZAR 120,000 per annum. Participants reported practicing traditional medicine between one and 50 years (one participant 1 year, one participants

11 years, two participants approximately 30 years and one participant approximately 50 years).

Species Used in Traditional Medicine

Across all the responses to all questions from the five participants, a total of 20 distinct common species names were given (**Figure 1**).

When asked to list the species with the most profitable derivatives currently sold, the most frequently mentioned common names (n = 17) were "lion" (n = 3; 18%), "hippo" (*Hippopotamus amphibius*) (n = 3; 18%) and "leopard" (n = 2; 12%). Other species mentioned were eland (*Tragelaphus oryx*), vulture (unspecified taxonomy), python (unspecified taxonomy), zebra (*Equus species*) and mole (unspecified taxonomy) (**Figures 1A**, **2**).

When asked to list the species they considered to have most increased in rarity, the most frequently mentioned common names (n = 19) were "lion" (n = 4; 21%), "hippo" (n = 3; 15%) and "giraffe" (n = 2; 11%) and "python" (n = 2; 11%) (**Figure 3**).

Overall, 32 different uses were cited by participants (n = 68 responses from five respondents). The most commonly cited uses were "protection" (n = 12; 18%), "healing" (n = 8; 12%), "bone reading" (n = 6; 9%), and "power" (n = 5; 7%) (See **Supplementary Table 1** for all uses, parts and purposes given).

A total of 19 (n = 55 responses from five respondents) different body parts were mentioned by the traditional healers (**Figure 1B**). The most commonly cited was "skin" (n = 11; 20%), "fat" (n = 10; 18%), "oil" (n = 7; 13%) and "bones" (n = 6; 11%) (**Figure 1B**) (see **Supplementary Table 1** for all uses, parts and purposes given).

Prices

Across all species and product types, at the time of the interviews, items sold for between 0.62 USD (for a single body part, bat hair) and 133 USD (for a whole set of lion bones) (**Supplementary Table 1**). The most expensive individual items were derived from lion (133 USD), leopard (63 USD), zebra (57 USD). Body parts derived from python, mamba (*Dendroaspis species*), vulture, lion, buffalo (*Syncerus caffer*) and mole all sold for 32 USD (**Supplementary Table 1**). Prices for lion parts vary from 2 USD (for a small portion of lion oil) up to 133 USD for a whole set of bones for divination purposes (**Supplementary Table 1**).

Lions in Traditional Medicine

Respondents were asked about the use of lion derivatives specifically in traditional medicine. When asked about the body parts, purposes and prices of lion derivatives, the most frequently cited derivative was "oil" (n = 4; 80%), followed by "claws" (n = 2; 40%) and "eyes" (n = 2; 40%) (**Supplementary Table 1**). A total of 33 different responses were given for uses of lion derivatives. The most frequently mentioned uses for were "protection from evil spirits," "power," "healing," "protection," and "sexual health and wellbeing" (all n = 3; 10%) (**Supplementary Table 1**).

Plant-Based Alternatives

When asked about plant-based alternatives to traditional medicine, all five respondents reported being aware of such alternatives, and also confirmed prescribing them. Four out of the five respondents reported that they were aware of plant-based alternatives specifically for lion parts, and one was unaware of any plant-based alternative. When asked to list plant based alternative species, 19 common names were given. Respondents were unable to provide an estimation of the proportion of their sales that involved plant-based items. Authors did not determine the conservation status of the plant based alternative species cited by the respondents.

DISCUSSION

Wildlife Derivatives

Our study confirms that a wide range of wild animal species are used in traditional healing practices for both medicinal and spiritual purposes in South Africa. Twenty common wild animal names were cited across five traditional medicine practitioners, constituting a range of vertebrate classes including birds (vulture), reptiles (mamba and python) and mammals (eland, monkey, lion, leopard, giraffe, zebra, porcupine, pangolin, anteater, mole, hippo, buffalo, bushbuck, and bat), and one invertebrate (cowrie shell). The listed common names for mammals represent at least 124 species (**Supplementary Table 2**), signifying the huge range of wild fauna species potentially involved in South Africa's traditional healing industry (**Figure 4**). This supports previous reports of hundreds of species surveyed at traditional medicine markets across the country, where the greatest species diversity also come from mammalian taxa (Whiting et al., 2013; Nieman et al., 2019). The South African National Biodiversity Institute lists 563 mammals are known to exist across the country, which indicates 22% of national mammal species are used by traditional healers for traditional, belief-based purposes (Barraclough, 2012).

The interviews with traditional healers presented here summarize the economic and cultural importance of traditional healing in South Africa. Of the 32 different uses for wild animal parts that were cited across all five respondents, the most common uses were "protection," "healing," "bone reading," and "power." Less than half of the total 20 species cited by practitioners were used in the context of medical treatment, whereas the majority of species were used for at least one spiritual or magical purpose (excluding bushbuck and giraffe). This concurs with previous literature that suggests many cultural groups across South Africa place equal or greater value on the use of animal parts and derivatives for curing spiritual and magical ailments than curing medical afflictions (Nieman et al., 2019). One respondent gave further insights into how wildlife derivatives are used, particularly for bone readings, describing how pangolin scales can be used in readings to imply either protection or exposure based on the pangolin's ability to "turn in on itself," and how monkey fingers can "point" to those that are working against you or behind your back. This further confirms the spiritual belief-based culture surrounding much of South Africa's traditional healing industry.

The overall monetary gain for practitioners working in the industry was reported between ZAR 30,000 and ZAR 120,000 per

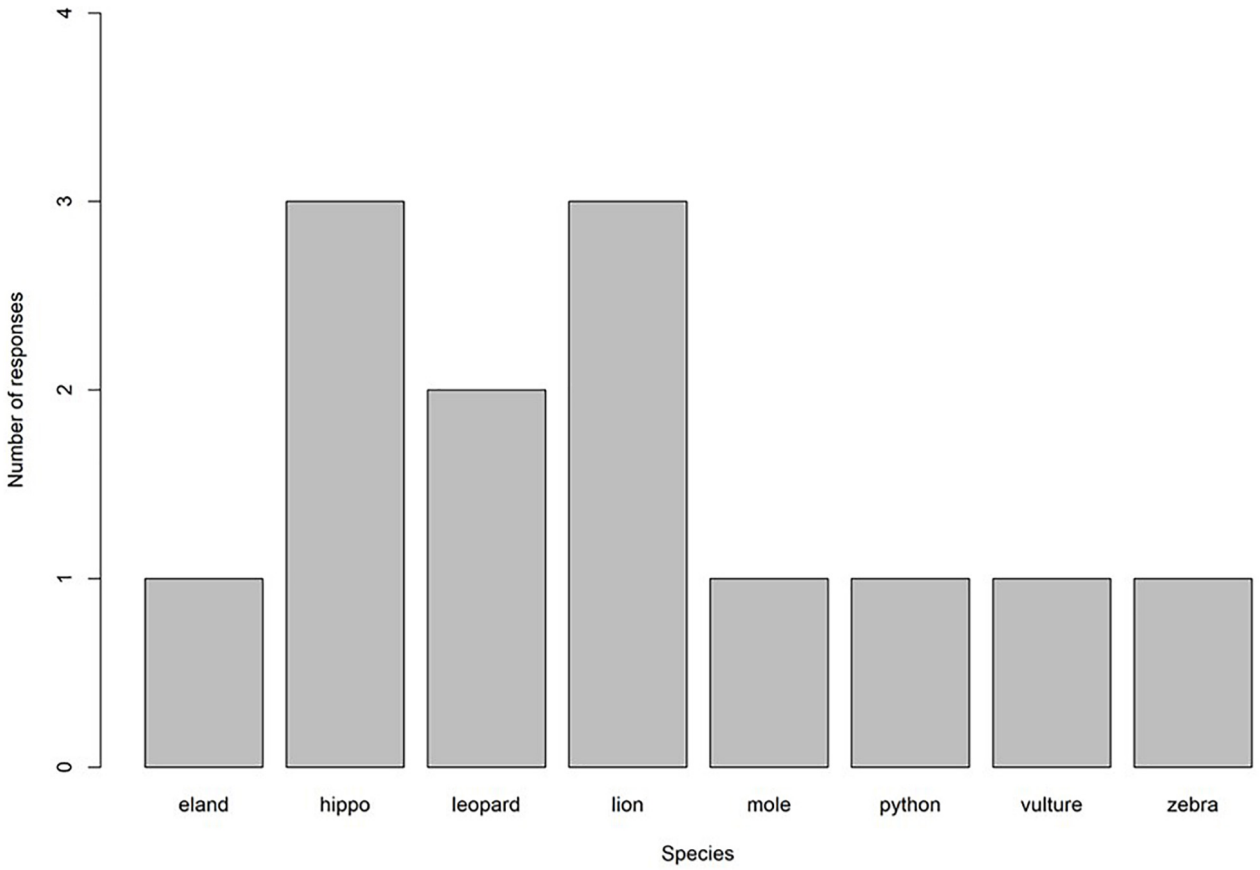

FIGURE 2 | Species common names mentioned (n = 20) by five traditional healers when asked to name the most profitable derivatives they use in traditional medicine.

annum {from 14% below to 55% above South Africa's average annual income of ZAR 45,600 in 2020 [International Labour Organization [ILO], 2022]}. Three of the five traditional healers interviewed reported traditional medicine as their primary source of income, and three respondents reported they had been generating an income from traditional healing for between 30 and 50 years. Consultations with healers operate on a two-tiered system, whereby a baseline fee is negotiated depending on the healer's experience, length of practice and previous success rate, followed by a secondary fee negotiated based on the client's perception of how they have benefited from the healing session. Baseline figures for consultations cited in our study extended to around ZAR 600 (36 USD). Of the 20 wild animal species cited for practitioner use, the economic value of body parts and derivatives ranged from 0.62 USD (bat hair) to 133 USD (set of lion bones). Although these results give an indication that trade in wild animals for the traditional medicine industry can be lucrative, interviewers noted that several respondents withdrew slightly during questions around pricing and suppliers, which may be due in part to the sensitive nature of illegal aspects of the industry. It is therefore possible that prices and availability of species are higher than reported in this study. Future studies would benefit from specialized questioning techniques designed to counteract the possibility of false answers arising from social desirability and illegality bias (Nuno and John, 2015).

Lion Derivatives

We particularly focused on exploring the socio-economic value of lions because of their frequently cited status as a commonly traded and profitable species within the traditional medicine market in South Africa and internationally (Williams et al., 2017b) (**Figure 5**). On the domestic market, lion teeth, skin, fat and claws are reportedly used for traditional, medicinal and ceremonial purposes (Hutchinson and Roberts, 2020) and fat in particular appears to be a general panacea for most ailments (Williams et al., 2017b). Our results support this, showing oil/fat as the most frequently cited lion derivative among four of the five of the respondents, followed by claws (two respondents). Our interview results signal that lion bones and paws symbolize power and can be used by traditional healers during bone reading consultations to indicate whether spirits are in or out of one's favor, depending on where they land. One practitioner highlighted that lion parts are also widely used by community leaders to garner respect, and to increase power and leadership qualities in a business context. The most frequently mentioned reasons for prescribing lion parts across all respondents were

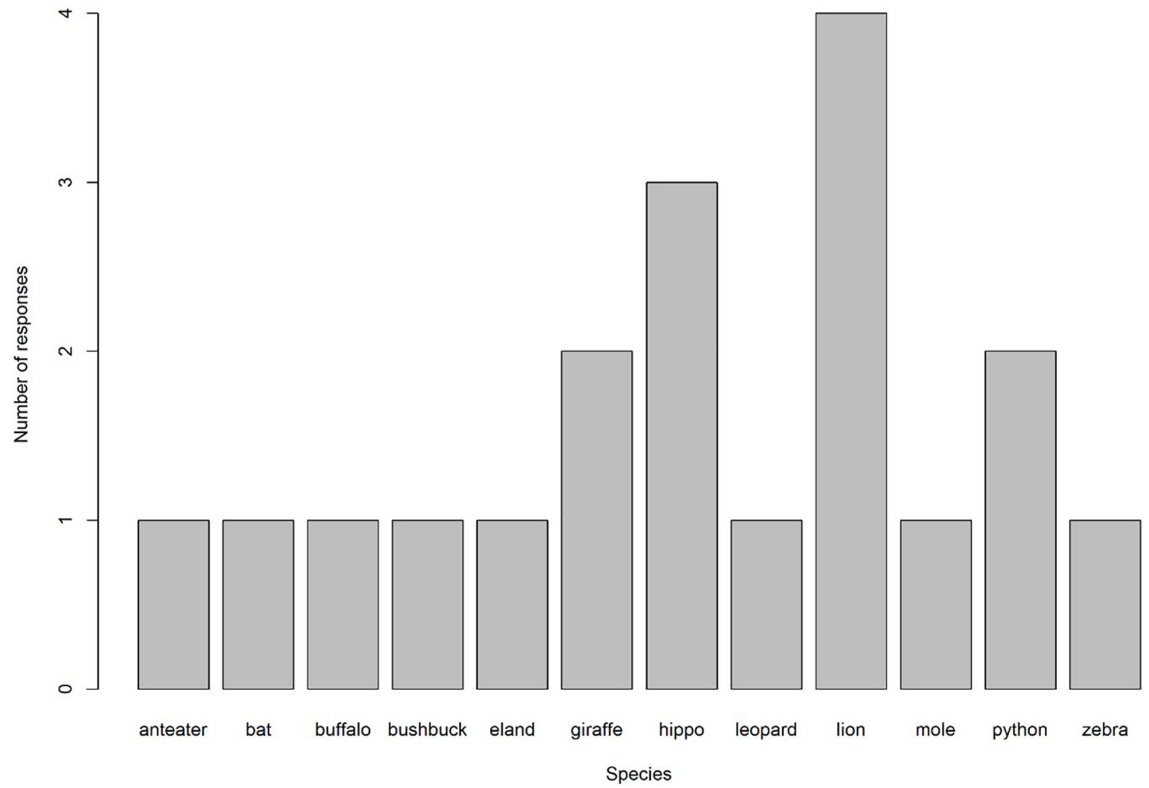

FIGURE 3 | Species common names mentioned (n = 19) across five traditional healers when asked to name the species most increasing in rarity over the last 5 years.

FIGURE 4 | A wide variety of wild animal species on display at Kwa Mai Mai traditional medicine market in Johannesburg South Africa. © Anonymous.

"protection from evil spirits," "power," "healing," "protection," and "sexual health and wellbeing."

Four out of five practitioners listed lions among their top three profitable derivatives, and two of the five practitioners said it was the most profitable wildlife derivative used. Although our sample size limits the extent to which we can interpret these results, high profitability of a species could indicate an increased risk of targeted exploitation. Concurrently, three practitioners reported that lion had become the most rare or unavailable species in the last 5 years. Wild lion populations in South Africa are considered stable and nationally classified as "least concern" by the IUCN (Hutchinson and Roberts, 2020) and South Africa also has large captive lion population that are commercially bred (Williams and 't Sas-Rolfes, 2019). Due to the small number of respondents in our study we cannot reliably speculate that the decline in availability reported among our study participants is indicative of a change in population status of wild lions on a local or regional scale, however, the noted reduction in market supply

FIGURE 5 | Lion parts and derivatives on sale at an unknown location in South Africa (left) and Kwa Mai Mai traditional medicine market in Johannesburg South Africa (right). © Anonymous.

could warrant further investigation considering lions' Vulnerable conservation status across most of their range states (Bauer et al., 2016). It may be particularly important to understand and monitor the availability and source of lion parts in the coming years during South Africa's intended phase out of the commercial captive breeding industry (Green et al., 2021), which may have been a source of lion parts previously, and thus the closure of the industry could risk increase poaching pressure on wild populations if this is not carefully monitored and adequately addressed (Green et al., 2021).

Participants in our study also referred to the extent of illegal activity and the international nature of criminality for trade in lion parts in South Africa, stating an increasing problem whereby people fraudulently pose as traditional healers but, in reality, work for or act as wildlife traders, buying lion parts to sell on the international market rather than for self-use or for clients. There has been an increase in wildlife trade (both legal and illegal) between South Africa and Southeast Asia in recent years, aided by the growth of special economic zones in South Africa with high numbers of workers from China and Southeast Asia, evident in the sharp increase in the volume of shipments of wildlife species to these regions in recent years (Nguyen and Roberts, 2020). Two of our respondents mentioned lion parts sourced internationally (from Malawi and Mozambique) and increasing occurrences of parts sourced for export to Asia. While we cannot draw any conclusions from anecdotal evidence provided by such a small number of respondents, we highlight that the growing international nature of wildlife trade from South Africa means that any negative consequences associated with this type of trade activity may have effects that extend across the world.

Potential Risks

In addition to threatening traded species and co-existing biota, the growing global trade in wildlife also has widespread repercussions that negatively affect ecosystems and societies through promoting the spread of invasive species (Cardoso et al., 2021; Diagne et al., 2021), creating opportunity for zoonotic disease emergence and transmission (Nieman et al., 2019; D'Cruze et al., 2020b), and causing substantial animal welfare concerns throughout the trade chain (Baker et al., 2013). The number of people handling wild animals and their parts and derivatives in the traditional medicine industry, including (but not limited to) poachers, breeders, middlemen, practitioners and consumers, puts a large number of people at increased risk of contracting zoonotic diseases (Green et al., 2020). Mammals are particularly common hosts of zoonotic diseases (White and Razgour, 2020), and are also the class with the greatest species diversity identified for use in traditional healing in our study and similar other studies (Whiting et al., 2013; Nieman et al., 2019). Infectious diseases can transmit through human populations on epidemic or pandemic scales, as demonstrated by the wildlife origins of the SARS-CoV-2 virus that caused the COVID-19 pandemic in 2019 (Morens et al., 2020). One respondent voiced that they occasionally source carcasses from a provincial wildlife authority, who provide access *via* a permit system to body parts from animals that have died from natural causes. While there are undoubtedly benefits to having an authority monitoring the use of carcasses and such a system may have positive effects on reducing illegal poaching pressure this could raise cause for concern from an infectious disease perspective.

Welfare issues exist in many aspects of the wildlife trade, including but not limited to the captive breeding and keeping of wildlife, the capture and transport of wild animals, and the slaughter of both captive bred and wild caught animals. Thus, welfare issues associated with the capture and trade of wild animal species remain a cause for concern despite all five practitioners in our study stating that no live wild animals are used in their traditional healing. Animal welfare refers to the physical and mental state of an animal in relation to the conditions in which it lives and dies (Nunny, 2020). The latter is pertinent to wildlife in South Africa, where there is documented evidence that wild species, specifically rhino, were ranked as the highest level of inhumane welfare compromise possible in a study

addressing the welfare impact of poaching (Derkley et al., 2019). "Time to death" has been used as a way to evaluate aspects of the humaneness of kill methods for wild animals, as sentient beings may experience fear, breathlessness, thirst, pain, nausea, hunger, sickness, anxiety, weakness, debility, helplessness, and other forms of distress between the attempted kill and time to unconsciousness or death (Nunny, 2020).

Many additional aspects can affect how much wild animals suffer when they are killed, including the cause of death (for example poisoning, snares, traps or bullets) and the effectiveness of the attempted kill (for example, where the bullet strikes the body or how fast a hemorrhage bleeds); most hunted terrestrial animals die from exsanguination (blood loss) because hunters target the thoracic area (Nunny, 2020). The potential impact on other animals is also a welfare consideration, for example dependent young may be left behind, unable to fend for themselves and dying of starvation when its mother is killed (Nunny, 2020). In Zimbabwe, South Africa and Mozambique, a number of opportunistic lion body part removals believed to be for traditional medicine purposes were from mortalities that occurred as a result of by-catch in snares (Everatt et al., 2019; Coals et al., 2020). While hunting and trapping methods may vary between countries, industries and individuals, inhumane capturing and killing techniques remain a consistent concern.

Our results also highlight a number of potential conservation concerns associated with this type of wildlife use. The scope of fauna cited by participating practitioners include species listed across the IUCN Red List of Threatened Species categories "Near Threatened," "Vulnerable," "Endangered" and "Critically Endangered" (**Supplementary Table 2**). In particular, the most profitable derivatives cited by practitioners were lion, leopard and hippo, all of which have populations considered "Vulnerable" on the IUCN Red List and require the regulation of international trade through CITES (**Supplementary Table 2**). Given the scale of the traditional medicine industry in South Africa, where traditional healers are thought to outnumber western doctors by 2,000:1 in some areas, and an estimated 60–80% of its citizens consult traditional healers (Nieman et al., 2019), common use of threatened or vulnerable species has the potential to be a significant cause for concern. Many of the species reportedly used in traditional healing play a key role in the maintenance of South Africa's biodiverse ecosystems, for example hippo whose foraging activities dictate the structure of both terrestrial and aquatic ecosystems within its habitat (Dudley et al., 2016) and herbivores such as eland that play a pivotal role in seed dispersal throughout the region (Shiponeni and Milton, 2006). Thus, the impacts of declining populations may have broader consequences for South Africa's ecosystems than the target species alone.

Sustaining healthy wild animal populations is particularly important for South Africa whose rural economy is reliant on ecotourism (Snyman, 2014), an industry which relies on biodiversity and key mega-fauna such as the "Big Five" that include lion and leopard, to maintain tourism that contribute to South Africa's GDP in a meaningful way and reach the national target to become one of the top 50 destinations worldwide (Glocker and Haxton, 2020). While there may be no direct link between wild animal use for traditional medicine and depleting populations of wildlife in South Africa, practitioners in our study reported that lion, vulture, leopard, python, eland, hippo, and mole have increased in rarity or become unavailable over the last 5 years. The small number of participants limit the extent to which we can interpret this perceived decrease in species availability but could indicate that further investigation into the health of these populations, as well as potential drivers of population changes (for example, the emergence and growth of competing markets such as international trade to Asia), is warranted. This is particularly significant as the rapidly expanding traditional healing market has previously been suggested as a possible contributing factor in the decline of wild populations of species used in the highest densities for traditional medicine in South Africa (Nieman et al., 2019).

Potential Solutions

Promoting the use of plant-based alternatives has been recommended as a solution to mitigate some of the animal welfare, conservation and public health concerns associated with wild animal use for traditional medicine in parts of West Africa (D'Cruze et al., 2020a). In South Africa, the majority of traditional medicine remedies are already of botanical origin (Williams and Whiting, 2016), and our results show that all five practitioners reported prescribing plant-based remedies (19 plant-based preparations were cited across our respondents) and all would be willing to prescribe them as an alternative to wild animal parts. For example, four out of five practitioners knew of plant-based alternatives to lion parts, citing a range of plants and herbs that can be used as direct substitutions, including (but not limited to) Cycads, Clivia species, Boophone disticha, Walnut and Agapanthus species.

All respondents in our study expressed willingness to engage in switching from animal-based to plant-based practices, but key consumer groups would also play a pivotal role in achieving this industry shift. One respondent specified that prescribing plant-based alternatives would depend on the patient's willingness to accept plant-based remedies, and that "a culture of toxic masculinity within South Africa can create barriers" to consumers being open to plant-based alternatives. Cultural beliefs of manhood and gender issues have been cited as barriers to access other forms of healthcare for Xhosa-speaking men in South Africa (Beck, 2004). These cultural beliefs highlights the potential effects of social constructs on the success of practitioner options and the importance of remaining cognizant of cultural influence and values on health care and belief-based practices. The respondents in our study also indicated that many of their clients perceive animal-based remedies as being more powerful, so building awareness of plant-based alternatives among consumers would be an important part of creating change in the industry, although this requires further investigation due to the small number of practitioners in our study.

Future work to comprehensively identify appropriate plant-based alternatives for the full range of wild animals

used in traditional medicine would require engagement with traditional healing experts, representatives of traditional medicine associations of South Africa and other relevant stakeholders, to ensure plant substitutes identified are accurate, safe, and sustainable. Over 3,000 plant species are used in traditional medicine practices in South Africa alone, some of which are classified as threatened according to the IUCN Red List of Threatened Species and would benefit from sustainable practices to ensure the conservation of local flora populations (Dold and Cocks, 2002; Cousins et al., 2012; Williams et al., 2013; Xego et al., 2016). One respondent from our study reported prescribing plant-based remedies by collecting cuttings and propagating plants rather than using destructive practices to acquire ingredients, reflecting efforts to enable traditional practices to coexist with well-managed, sustainable cultivation of plants and the conservation of natural spaces. Measures to promote plant diversity and conservation while supporting sustainable use and rural livelihoods are already recognized and outlined in "South Africa's Strategy for Plant Conservation" (Raimondo, 2015). Additionally, collaborative meetings between traditional healers, conservation practitioners, muthi gatherers and law enforcement officials have taken place in recent years to discuss the future sustainability of medicinal plants [South African National Biodiversity Institute [SANBI], 2020], which suggests a positive future for the plant-based traditional healing practices in South Africa.

Conclusion

To our knowledge this is one of the first studies in the peer-reviewed scientific literature to provide initial insights into belief-based use of wild animals, particularly lions, from the perspective of traditional healers in South Africa. We acknowledge the results of our study are based on a limited number of interview participants, and that this limits the extent to which the information presented can be extrapolated. However, despite the small number of traditional healers involved we believe that our findings provide valuable insights into the socio-economic drivers of traditional healing practices in South Africa, particularly the specific uses of wild animal parts for belief-based and medicinal practices and the existing plant-based alternatives to wild animals established within the industry. We suggest that additional investigation into the perceived rarity of some key species, such as lions, would be beneficial to ascertain the reality of a perceived reduction in availability of derivatives, and identify drivers contributing to such market changes. We hope the insights presented here can be used to understand medicinal and belief-based use of wild animal ingredients and their plant-based alternatives, to inform approaches to managing related pressures exerted on wild populations in South Africa in the future.

DATA AVAILABILITY STATEMENT

The original contributions presented in this study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

PH, ND'C, and LW designed the study and collected data from interview participants. EC, JN, and DM analyzed the data and created the figures and text for the results section. JG wrote the original manuscript. All authors reviewed and edited the manuscript.

ACKNOWLEDGMENTS

We would like to thank T. R. Mathebula for facilitating interviews with three of the respondents in our study in their local language (not specified for anonymity purposes) and for providing a translation of their responses in to English for the purpose of our analysis. His participation in this study was invaluable to gain insights into the traditional healing industry in South Africa.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fevo.2022.906398/full#supplementary-material

REFERENCES

Assou, D., Elwin, A., Norrey, J., Coulthard, E., Megson, D., Ronfot, D., et al. (2021). Trade in African Grey Parrots for Belief-Based Use: insights From West Africa's Largest Traditional Medicine Market. *Front. Ecol. Evol.* 29:612355. doi: 10.3389/fevo.2021.612355

Baker, S. E., Cain, R., Van Kesteren, F., Zommers, Z. A., D'cruze, N., and Macdonald, D. W. (2013). Rough trade: animal welfare in the global wildlife trade. *BioScience* 63, 928–938.

Barraclough, D. A. (2012). *Checklist of South African Diptera. Animal checklist website*. Available Online at: (http://biodiversityadvisor.sanbi.org/research-and-modelling/checklists-and-encyclopaedia-of-life/south-african-animal-checklist/) (accessed May 5, 2022).

Bauer, H., Packer, C., Funston, P., Henschel, P., and Nowell, K. (2016). *Panthera leo (errata version published in 2017). The IUCN Red List of Threatened Species 2016:e.T15951A115130419*. Available Online at: http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T15951A107265605.en (accessed 26 Aug, 2019).

Beck, D. (2004). *Men and ARVs: How Does Being a Man Affect Access to Antiretroviral Therapy in South Africa? An Investigation Among Xhosa-Speaking Men in Khayelitsha*. South Africa: University of Cape Town.

British Sociological Association (2017). *Statement of Ethical Practice*. Available online at: https://www.britsoc.co.uk/media/24310/bsa_statement_of_ethical_practice.pdf (accessed June 01, 2022).

Cardoso, P., Amponsah-Mensah, K., Barreiros, J. P., Bouhuys, J., Cheung, H., Davies, A., et al. (2021). Scientists' warning to humanity on illegal or unsustainable wildlife trade. *Biol. Conserv.* 263:109341. doi: 10.1016/j.biocon.2021.109341

Coals, P., Dickman, A., Hunt, J., Grau, A., Mandisodza-Chikerema, R., Ikanda, D., et al. (2020). Commercially-driven lion part removal: what is the evidence from mortality records? *Glob. Ecol. Conserv.* 24:e01327.

Cook, C. T. (2009). Sangomas: problem or solution for South Africa's health care system. *J. Nat. Med. Assoc.* 101, 261–265. doi: 10.1016/s0027-9684(15)30855-5

Cousins, S. R., Williams, V. L., and Witkowski, E. T. F. (2012). Uncovering the cycad taxa (*Encephalartos* species) traded for traditional medicine in Johannesburg and Durban, South Africa. *S. Afr. J. Bot.* 78, 129–138.

D'Cruze, N., Green, J., Elwin, A., and Schmidt-Burbach, J. (2020b). Trading Tactics: time to Rethink the Global Trade in Wildlife. *Animals* 10:2456. doi: 10.3390/ani10122456

D'Cruze, N., Assou, D., Coulthard, E., Norrey, J., Megson, D., Macdonald, D. W., et al. (2020a). Snake oil and pangolin scales: insights into wild animal use at "Marché des Fétiches" traditional medicine market, Togo. *Nat. Conserv.* 39:45.

D'Cruze, N., Galarza, F. E. R., Broche, O., El Bizri, H. R., Megson, S., Elwin, A., et al. (2021). Characterizing trade at the largest wildlife market of Amazonian Peru. *Glob. Ecol. Conserv.* 28:e01631.

Derkley, T., Biggs, D., Holden, M., and Phillips, C. (2019). A framework to evaluate animal welfare implications of policies on rhino horn trade. *Biol. Conserv.* 235, 236–249.

Diagne, C., Leroy, B., Vaissière, A. C., Gozlan, R. E., Roiz, D., Jariæ, I., et al. (2021). High and rising economic costs of biological invasions worldwide. *Nature* 592, 571–576. doi: 10.1038/s41586-021-03405-6

Dold, A. P., and Cocks, M. L. (2002). The trade in medicinal plants in the Eastern Cape Province, South Africa. *S. Afr. J. Sci.* 98, 589–597.

Dudley, J. P., Hang'Ombe, B. M., Leendertz, F. H., Dorward, L. J., de Castro, J., Subalusky, A. L., et al. (2016). Carnivory in the common hippopotamus H ippopotamus amphibius: implications for the ecology and epidemiology of anthrax in A frican landscapes. *Mamm. Rev.* 46, 191–203.

Everatt, K. T., Kokes, R., and Pereira, C. L. (2019). Evidence of a further emerging threat to lion conservation; targeted poaching for body parts. *Biodivers. Conserv.* 28, 4099–4114.

Glocker, D., and Haxton, P. (2020). *Leveraging Tourism Development for Sustainable and Inclusive Growth in South Africa*. OECD Economics Department Working Papers, No. 1621. Paris: OECD Publishing. doi: 10.1787/457c263d-en

Gore, M. L., Hübschle, A., Botha, A. J., Coverdale, B. M., Garbett, R., Harrell, R. M., et al. (2020). A conservation criminology-based desk assessment of vulture poisoning in the Great Limpopo Transfrontier Conservation Area. *Glob. Ecol. Conserv.* 23:e01076.

Green, J., Jakins, C., Asfaw, E., Bruschi, N., Parker, A., de Waal, L., et al. (2020). African Lions and Zoonotic Diseases: implications for Commercial Lion Farms in South Africa. *Animals* 10:1692. doi: 10.3390/ani10091692

Green, J., Jakins, C., Waal, L., de, D., and Cruze, N. (2021). Ending Commercial Lion Farming in South Africa: a Gap Analysis Approach. *Animals* 11:1717. doi: 10.3390/ani11061717

High Level Panel (2021). *The High-Level Panel of Experts for the Review of Policies, Legislation and Practices on Matters of Elephant, Lion, Leopard and Rhinoceros Management, Breeding, Hunting, Trade and Handling. High Level Panel Report for Submission to the Minister of Environment, Forestry and Fisheries.* Available online at: https://www.dffe.gov.za/sites/default/files/reports/2020-12-22_high-levelpanel_report.pdf

Hutchinson, A., and Roberts, D. L. (2020). Differentiating captive and wild African lion (*Panthera leo*) populations in South Africa, using stable carbon and nitrogen isotope analysis. *Biodivers. Conserv.* 29, 2255–2273.

International Labour Organization [ILO] (2022). *Statistics on Wages*. Geneva: International Labour Organization.

IUCN (2021). *The IUCN Red List of Threatened Species. Version 2021-3*. Available online at: https://www.iucnredlist.org

John, F. S., Brockington, D., Bunnefild, N., Duffy, R., Homewood, K., Jones, J. P., et al. (2016). Research ethics: assuring anonymity at the individual level may not be sufficient to protect research participants from harm. *Biol. Conserv.* 196, 208–209. doi: 10.1016/j.biocon.2016.01.025

Mander, M., Ntuli, L., Diederichs, N., and Mavundla, K. (2007). Economics of the traditional medicine trade in South Africa care delivery. *S. Afr. Health Rev.* 2007, 189–196.

Mashele, N. M., Thompson, L. J., and Downs, C. T. (2021). Uses of vultures in traditional medicines in the Kruger to Canyons Biosphere Region, South Africa. *J. Raptor Res.* 55, 328–339.

Merem, E. C., Twumasi, Y., Wesley, J., Isokpehi, P., Fageir, S., Crisler, M., et al. (2018). Assessing the menace of illegal wildlife trade in the sub Saharan African region. *Adva. Life Sci.* 8, 1–25.

Morens, D. M., Breman, J. G., Calisher, C. H., Doherty, P. C., Hahn, B. H., Keusch, G. T., et al. (2020). The origin of COVID-19 and why it matters. *Am. J. Trop. Med. Hyg.* 103:955. doi: 10.4269/ajtmh.20-0849

Mthembu, N. (2021). Relevance for Traditional Medicine in South Africa: experiences of Urban Traditional Healers, Izinyanga. *Int. J. Med. Health Sci.* 15, 132–145.

Newing, H., Eagle, C., Puri, R. K., and Watson, C. W. (2011). *Conducting Research in Conservation*, Vol. 775. Oxfordshire: Routledge.

Nguyen, T., and Roberts, D. L. (2020). Exploring the Africa-Asia trade nexus for endangered wildlife used in traditional Asian medicine: interviews with traders in South Africa and Vietnam. *Trop. Conserv. Sci.* 13:1940082920979252.

Nieman, W. A., Leslie, A. J., and Wilkinson, A. (2019). Traditional medicinal animal use by Xhosa and Sotho communities in the Western Cape Province, South Africa. *J. Ethnobiol. Ethnomed.* 15, 1–14. doi: 10.1186/s13002-019-0311-6

Nkabinde, N., and Morgan, R. (2006). 'This has happened since ancient times…it's something that you are born with': ancestral wives among same-sex sangomas in South Africa. *Agenda* 20, 9–19.

Nunny, L. (2020). Animal welfare in predator control: lessons from land and sea. How the management of terrestrial and marine mammals impacts wild animal welfare in human–wildlife conflict scenarios in Europe. *Animals* 10:218. doi: 10.3390/ani10020218

Nuno, A., and John, F. A. S. (2015). How to ask sensitive questions in conservation: a review of specialized questioning techniques. *Biol. Conserv.* 189, 5–15.

Ogada, D. L. (2014). The power of poison: pesticide poisoning of Africa's wildlife. *Ann. N. Y. Acad. Sci.* 1322, 1–20. doi: 10.1111/nyas.12405

R Core Team (2020). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing.

Raimondo, D. (2015). *South Africa's strategy for plant conservation*. Pretoria: South African National Biodiversity Institute and the Botanical Society of South Africa.

Shiponeni, N. N., and Milton, S. J. (2006). Seed dispersal in the dung of large herbivores: implications for restoration of Renosterveld shrubland old fields. *Biodivers. Conserv.* 15, 3161–3175.

Snyman, S. (2014). The impact of ecotourism employment on rural household incomes and social welfare in six southern African countries. *Tour. Hosp. Res.* 14, 37–52.

South African National Biodiversity Institute [SANBI] (2020). *Traditional healers discuss sustainable use of medicinal plants. South African National Biosiversity Institute News Room*. Pretoria: South African National Biosiversity Institute.

White, R. J., and Razgour, O. (2020). Emerging zoonotic diseases originating in mammals: a systematic review of effects of anthropogenic land-use change. *Mamm. Rev.* 50, 336–352. doi: 10.1111/mam.12201

Whiting, M. J., Williams, V. L., and Hibbitts, T. J. (2013). "Animals traded for traditional medicine at the Faraday market in South Africa: species diversity and conservation implications," in *Animals in Traditional Folk Medicine*, eds R. Alves and I. Rosa (Berlin: Springer), 421–473.

Williams, V. L., Loveridge, A. J., Newton, D. J., and Macdonald, D. W. (2017a). A roaring trade? The legal trade in *Panthera leo* bones from Africa to East-Southeast Asia. *PLoS One* 12:e0185996. doi: 10.1371/journal.pone.0185996

Williams, V. L., Loveridge, A. J., Newton, D. J., and Macdonald, D. W. (2017b). Questionnaire survey of the pan-African trade in lion body parts. *PLoS One* 12:e0187060. doi: 10.1371/journal.pone.0187060

Williams, V. L., and 't Sas-Rolfes, M. J. (2019). Born captive: a survey of the lion breeding, keeping and hunting industries in South Africa. *PLoS One* 14:e0217409. doi: 10.1371/journal.pone.0217409

Williams, V. L., Victor, J. E., and Crouch, N. R. (2013). Red listed medicinal plants of South Africa: status, trends, and assessment challenges. *S. Afr. J. Bot.* 86, 23–35.

Williams, V. L., and Whiting, M. J. (2016). A picture of health? Animal use and the Faraday traditional medicine market, South Africa. *J. Ethnopharmacol.* 179, 265–273. doi: 10.1016/j.jep.2015.12.024

Xego, S., Kambizi, L., and Nchu, F. (2016). Threatened medicinal plants of South Africa: case of the family Hyacinthaceae. *Afr. J. Tradit. Complement. Altern. Med.* 13, 169–180.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.