



# Ostrich

## Journal of African Ornithology

ISSN: 0030-6525 (Print) 1727-947X (Online) Journal homepage: <https://www.tandfonline.com/loi/tost20>

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To cite this article: Lindy J Thompson & Andrew C Blackmore (2020): A brief review of the legal protection of vultures in South Africa, *Ostrich*, DOI: [10.2989/00306525.2019.1674938](https://doi.org/10.2989/00306525.2019.1674938)

To link to this article: <https://doi.org/10.2989/00306525.2019.1674938>



Published online: 05 Mar 2020.



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## A brief review of the legal protection of vultures in South Africa

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Vulture numbers are globally in a decline and many species are considered as either endangered or critically endangered. The same applies to vultures in South Africa, raising concerns about the long-term persistence of these ecologically important birds in this country. The government is obliged to exercise its fiducial duties to bring into force legislation and exercise multilateral environmental agreements that provide for the protection of vultures. Despite vultures' importance and the paramount need to conserve them, there has been little critical review on the relevance and content of laws protecting vultures. We evaluated domestic and international legislation that provides for the protection of vultures in South Africa. These legal provisions were distributed across an array of biodiversity and non-biodiversity orientated statutes that are generally non-specific in nature, being embedded in general provisions that could be interpreted in a manner that provides for the protection of the country's vultures. These legal provisions are also fragmented, making their enforcement difficult. Laws that are most geared towards protecting vultures in South Africa are environmental laws at provincial scales. For vultures to enjoy the highest degree of protection under these provincial laws, all species of vultures that occur in South Africa must be elevated to 'Specially Protected' status.

## Un bref aperçu de la protection juridique des vautours en Afrique du Sud

À l'échelle mondiale, le nombre de vautours est en déclin et de nombreuses espèces sont considérées en danger ou en danger critique. Il en va de même pour les vautours d'Afrique du Sud, ce qui suscite des inquiétudes quant à la persistance à long terme de ces oiseaux d'importance écologique dans ce pays. Le gouvernement est obligé d'exercer ses obligations judiciaires pour mettre en vigueur une législation et appliquer des accords environnementaux multilatéraux prévoyant la protection des vautours. En dépit de l'importance des vautours et de la nécessité primordiale de les conserver, peu d'examen critiques ont été consacrés à la pertinence et au contenu des lois protégeant les vautours. Nous avons évalué les législations nationales et internationales prévoyant la protection des vautours en Afrique du Sud. Ces dispositions juridiques étaient réparties dans un éventail de lois relatives à la diversité biologique et non axées sur la biodiversité, qui sont généralement de nature non spécifique, et qui sont intégrées à des dispositions générales pouvant être interprétées de manière à protéger les vautours du pays. Ces dispositions légales sont également fragmentées, ce qui rend leur application difficile. Les lois qui visent le plus à protéger les vautours en Afrique du Sud sont les lois environnementales à échelle provinciale. Pour que les vautours jouissent du plus haut degré de protection en vertu de ces lois provinciales, toutes les espèces de vautours présentes en Afrique du Sud doivent être élevées au « Statut spécialement protégé ».

**Keywords:** environmental law, multilateral environmental agreements

### Introduction

Vultures provide crucial ecosystem services, which include nutrient cycling, reducing the risk of animal diseases by rapidly removing carcasses from the landscape and their spiritual value (Rodríguez et al. 2006; Moleón et al. 2014; DeVault et al. 2016). Unfortunately, many Old World vulture populations are in rapid decline (Ogada et al. 2016b) and the six vulture species that are known to regularly breed in South Africa (Taylor et al. 2015) have suffered regional declines between 25% and 83%,

with the highest rate of loss recorded for the Bearded Vulture *Gypaetus barbatus* (Table 1). This has resulted in a regional conservation status of either Endangered or Critically Endangered for all of South Africa's vulture species (Table 1).

These declines are the result of numerous anthropogenic threats, the most important of which is poisoning, either intentionally or unintentionally, by people (Ogada et al. 2016b). Intentional poisoning of vultures occurs when

**Table 1:** Vulture species that occur in the Republic of South Africa (RSA), their conservation status and rate of decline. Species are listed in taxonomic order following Gill and Donsker (2018)

Species	Global	Regional*	Regional* decline	National population estimates	References
Palm-nut Vulture <i>Gypohierax angolensis</i>	LC	unknown	not threatened, but data deficient	40 individuals (in RSA)	a, b
Bearded Vulture <i>Gypaetus barbatus</i>	NT	CR	83% over last 3 generations (53 y)	352 to 390 individuals (c. 200 mature birds) regionally	a, c, d
Egyptian Vulture <i>Neophron percnopterus</i>	EN	extinct	unknown	Extinct <sup>a</sup> as a breeding species (in RSA)	a, e
Hooded Vulture <i>Necrosyrtes monachus</i>	CR	CR	≥ 25% in 1 generation	100–200 mature individuals (in RSA)	a, e
White-backed Vulture <i>Gyps africanus</i>	CR	CR	80% over 3 generations	3 435 breeding pairs (in RSA)	a, e
Rüppell's Vulture <i>Gyps rueppellii</i>	CR	None (vagrant)	Not applicable	1 breeding bird (paired with a Cape Vulture) in RSA	a, f, g
Cape Vulture <i>Gyps coprotheres</i>	EN	EN	≥ 50% in 3 generations (48 y)	4 400 pairs (8 800 mature individuals) regionally	a, e
White-headed Vulture <i>Trigonoceps occipitalis</i>	CR	CR	≥ 25% in 1 generation	68 breeding pairs (in RSA)	a, e, h, i
Lappet-faced Vulture <i>Torgos tracheliotos</i>	EN	EN	≥ 50% in 3 generations (45 y)	166 breeding pairs (in RSA)	a, e

\*Regional refers to South Africa, Lesotho and Swaziland. <sup>a</sup>The most recent breeding record of the Egyptian Vulture in RSA was in 1923 (Mundy 1978). References: a = IUCN (2019), b = Rushworth and Piper (2004), c = Krüger (2014), d = Krüger et al. (2014a), e = Taylor et al. (2015), f = Snyman (1999), g = Venter (2017), h = B. Hoffman, pers. comm., i = B. Covertale, pers. comm.

the birds are specifically targeted, either for belief-based use (Mander et al. 2007; McKean et al. 2013; Daboné et al. 2019), or to remove vultures from an area, in order to prevent the sentinel discovery of a poaching event (Roxburgh and McDougal 2012; Ogada 2014; Ogada et al. 2016a). The unintentional (secondary) poisoning of vultures occurs when various livestock managers use poison baits to target damage-causing animals, such as jackal and caracal (Allan 1989; Van Niekerk et al. 2013; Santangeli et al. 2017). A more insidious threat to vultures is lead poisoning caused by ingesting lead fragments from leaded ammunition (Gangoso et al. 2009; Iqbal et al. 2009; Kelly and Johnson 2011; Garbett et al. 2018b; Plaza and Lambertucci 2019). Both intentional and unintentional poisoning could have similarly devastating effects that contribute significantly to the decline in vulture numbers (Murn and Botha 2018). Other threats include habitat loss (Yosef and Bahat 2000; Mullié et al. 2017), electrocution on or collision with energy infrastructure (Boshoff et al. 2011; Angelov et al. 2012; Rushworth and Krüger 2014), anthropogenic disturbance (Bamford et al. 2009) and the illegal trade in vulture eggs (Dalton 2018).

These threats collectively highlight the need, *inter alia*, for robust laws to protect vultures and restrict harmful activities in their breeding and foraging habitats. These threats also raise the question of how much legal protection is currently afforded to the protection of vultures in South Africa. In this paper, we aim to collate the diverse hard and soft law, at international, national and provincial scales, that could be applied to mitigate threats to vultures. We collate this information for the particular benefit of conservationists, policy makers and decision makers. We also aim to conduct a critical review of these laws and propose amendments where necessary, to better protect vultures against current and emerging threats.

We acknowledge that poor enforcement of environmental legislation could render environmental laws meaningless (Sundström 2013). In some instances, the drivers of wildlife crime could overwhelm regulatory approaches, leading to environmental and health insecurity and necessitating alternative strategies for nature conservation (Challender and MacMillan 2014; Gore et al. 2019). These are complex and interrelated and although we do not delve deeper into the application of the law in this paper, we acknowledge the need for improved enforcement of South Africa's environmental legislation. We further recognise a need to develop ways to improve enforcement of the laws protecting South Africa's vultures.

We begin our review with the various multilateral environmental agreements, then we present the regional legal instruments, national legislation and finally, the relevant provincial ordinances. Where appropriate, we mention how each particular piece of legislation benefits vultures and where it could be strengthened.

## Global Multilateral Environmental Agreements

### Convention on Biological Diversity

The Convention on Biological Diversity (United Nations 1992) was ratified by South Africa in 1995 and, *inter alia*, binds the country to ensure the conservation and

sustainable use of biodiversity (Article 8(c)) by the implementation of national strategies, plans or programmes. It is thus common cause that the provisions of the Convention are extended to the conservation and protection of vultures for the benefit of current and future generations (preamble to the Convention, Article 6). Article 8 of the Convention refers to *in situ* conservation and outlines contracting parties' obligations to: (i) establish systems of protected areas (8(a)); (ii) maintain viable populations of species *in situ* (8(d)); promote the recovery of threatened species by implementing plans or other strategies (8(f)); and cooperate in providing financial support for *in situ* conservation (8(m)). Article 8(k) states that contracting parties shall '[d]evelop or maintain necessary legislation and/or other regulatory provisions for the protection of threatened species and populations'. This has direct relevance to the vulture species that occur in South Africa, most of which are highly threatened (Table 1). It would be thus reasonable, if not a requirement, for South Africa to adopt legislation that provides for the implementation of various domestically binding instruments that provide for the conservation and protection of vultures. These legal instruments are discussed briefly below.

### CITES

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was enacted in South Africa in 1975. CITES outlines restrictions on the import and export of threatened and endangered species, aiming to ensure that trade in these species does not threaten their survival. All of the vulture species that occur in South Africa (including their parts and derivatives) are listed on CITES Appendix II (Table 2; UNEP-WCMC 2019). This means that these species are 'not necessarily now threatened with extinction, but they could become so unless trade is closely controlled' (Appendix II, CITES 1973). CITES does not require import permits for species listed on Appendix II and a CITES export permit could be legally obtained, as long as there is no detriment to the survival of the species (Appendix IV, CITES 1973). In an African context, trade in vultures and their body parts, is principally limited to within-country informal belief-based use where such is predominantly based on illegal trade (Sodeinde and Soewu, 1999; Whiting et al. 2013). Vultures were originally included on the CITES lists by listing the order Falconiformes as a means to focus on those species

potentially threatened by trade (e.g. eagles, hawks and falcons) (Table 2). There is, however, some evidence for an international illegal trade in live vultures for belief-based use, both in southern Africa (Mashele 2020) and elsewhere (Wallace 1986; MaMing and Xu 2015). However, given the inconsequential legal trade of southern African vultures or vulture derivatives across international boundaries (Mashele 2020), their listing as Appendix II species on the Convention currently provides little direct, if no, protection to these birds. Despite this observation, however, it has been recommended that an up-listing of all Old World vulture species to CITES Appendix I would assist in addressing the illegal trade in live birds and their body parts (Saidu and Buij 2013).

### Convention on the Conservation of Migratory Species of Wild Animals

The Convention on the Conservation of Migratory Species of Wild Animals (CMS), also referred to as the Bonn Convention, is administered under the United Nations Environment Programme. The CMS focuses on the conservation of migratory species and their habitats, across a species' range states. All of the vultures that occur in South Africa (except for the Bearded Vulture and the Palm-nut Vulture) are listed on Appendix I (Table 2), which comprises endangered migratory species. We recommend that the Bearded Vulture be up-listed to CMS Appendix I, in line with the South Africa's other vulture species (Table 2). South Africa became a party to the CMS in 1991, however, three of South Africa's six neighbouring countries are not signatories to the CMS, which could render it regionally ineffective.

On 4 December 2008, South Africa signed the CMS Memorandum of Understanding on Birds of Prey (the CMS Raptors MoU), a non-binding Multilateral Environmental Agreement aiming to improve domestic legal protection for migratory birds of prey. In October 2017, the Conference of the Parties to CMS (COP12) adopted the 'Multi-species Action Plan to conserve African-Eurasian vultures', which covers 128 vulture range states, including South Africa (Botha et al. 2017). This plan, serving as a guideline, requires vulture range states to draft and implement their own conservation plans that are specific to the country's individual circumstances, which includes consolidating the legislative provisions that provide for the protection of vultures. At the drafting of this paper, the 'Multi-species

**Table 2:** Dates of entry of South Africa's vulture species onto Appendix I and II of the CMS Raptors MoU and Appendix II of CITES

Species	CMS Raptors MoU	CITES
	Appendix I/II	Appendix II
Palm-nut Vulture <i>Gypohierax angolensis</i>	– / –	2013
Bearded Vulture <i>Gypaetus barbatus</i>	– / 1979	2013
Egyptian Vulture <i>Neophron percnopterus</i>	2008 / –	2013
Hooded Vulture <i>Necrosyrtes monachus</i>	2017 / 1979	2013
White-backed Vulture <i>Gyps africanus</i>	2017 / 1979	2013
Rüppell's Vulture <i>Gyps rueppellii</i>	2017 / 1979	2013
Cape Vulture <i>Gyps coprotheres</i>	2017 / 1979	2013
White-headed Vulture <i>Trigonoceps occipitalis</i>	2017 / 1979	2013
Lappet-faced Vulture <i>Torgos tracheliotos</i>	2017 / 1979	2013

Biodiversity Monitoring Plan for the Conservation of Vultures in South Africa' was still being formulated and had not been published for implementation.

CMS parties are encouraged by the IUCN's Hawai'i Recommendation (IUCN 2016), 'A path forward to address concerns over the use of lead ammunition in hunting', to engage with hunters, industry and other stakeholders (section 2.a) and to phase-out 'lead ammunition used for hunting in areas where scavengers are at particular risk from the use of lead ammunition' (section 2.b). Parties are also encouraged to consider the implementation of CMS Resolution 11.15 'Preventing poisoning of migratory birds', which was adopted at the 11th meeting of the Conference of Parties to CMS in Quito, 2014. This resolution recommended the phasing-out of leaded ammunition across all habitats and the replacement of leaded ammunition with non-leaded alternatives before 2017. The IUCN's Hawai'i Recommendation notes that 'there is some potential for lead poisoning to occur wherever lead ammunition is used for shooting' and that the ingestion of lead ammunition 'can cause avoidable suffering and mortality'... 'in some wildfowl, raptor and scavenger species' (Mateo et al. 1997; Fisher et al. 2006; Franson and Pain 2011). South African restrictions on lead ammunition relate only to a partial ban on lead shot for waterfowl (Avery and Watson 2009). We recommend that South Africa should enact legislation banning the use of leaded ammunition for the benefit of vultures and other scavengers. This could entail regulating lead (and the pathways by which vultures could feasibly ingest lead) in the provincial ordinances (Table 3), which currently refer to poison only in the context of chemical substances laid down to deliberately kill animals.

### Stockholm Convention on Persistent Organic Pollutants

The Stockholm Convention on Persistent Organic Pollutants was adopted in 2001 (UNEP 2009). It aims to protect human and environmental health by regulating and banning persistent organic pollutants (POPs). The Convention's list of regulated POPs includes DDT and dieldrin, organochlorine pesticides that have been linked to population-level reproductive problems in raptors worldwide (Ames 1966; Grier 1982; Opdam et al. 1987; Newton and Haas 1988; Olsen et al. 1992). Although South Africa became a signatory to the Convention in 2001 and ratified it in 2002 and particularly following the malaria epidemic in 2000, the Country argued for a continuation of use (although at significantly reduced levels) of DDT as a means for the control of this disease (Bouwman et al. 2006; Wells and Leonard 2006; Sharp et al. 2007; Ranson et al. 2011). The occurrence of residues of DDT and its metabolites (DDE and DDD) in White-backed, Lappet-faced and Cape Vultures in South Africa (Van Wyk et al. 1993; Van Wyk et al. 2001) is likely to persist in the vulture populations foraging in the malarial areas of southern Africa as a result of the previous and continued use of DDT. Without better enforcement, the Stockholm Convention on Persistent Organic Pollutants is unlikely to have a significant positive impact on the conservation of vultures, at least, in southern Africa.

**Table 3:** The varying levels of protection provided to vultures in each of South Africa's nine provinces, according to their respective provincial acts governing the use of nature and the corresponding maximum penalties for contraventions of the provisions of the ordinances, with respect to the vulture species afforded the greatest legal protection

Province	Vulture species that have been afforded legal protection	These species are listed as:	Maximum fine	Maximum imprisonment	Reference
Eastern Cape	BV	Endangered	R100 000 (US\$5 379)	10 years	a
Free State	All	Protected game	R100 000 (US\$5 379)	10 years	b
Gauteng	All	Protected game	R 1 500 (US\$81)	18 months	c
KwaZulu-Natal	BV, CV, EV, PnV	Specially protected birds	R10 000 (US\$538)	two years	d
Limpopo	CV, EV, HV, LfV, WbV, WhV	Specially protected wild animals	R250 000 (US\$13 448)	15 years	e
Mpumalanga	All	Protected game	unspecified	five years	f
North West	All	Protected game	R 2 000 (US\$108)	two years	g
Western Cape	BV	Endangered wild animals	R100 000 (US\$5 379)	10 years	h
Northern Cape	All	Specially protected species	unspecified	10 years	i

BV = Bearded Vulture *Gypaetus barbatus*; CV = Cape Vulture *Gyps coprotheres*; EG = Egyptian Vulture *Neophron percnopterus*; HV = Hooded Vulture *Necrosyrtes monachus*; LfV = Lappet-faced Vulture *Torgos tracheliotos*; RV = Rüppell's Vulture *Gyps rueppellii*; WbV = White-backed Vulture *Gyps africanus*; WhV = White-headed Vulture *Trigonoceps occipitalis*. References: a = Eastern Cape Province (1974), b = Free State Province (1969), c = Gauteng Province (1983), d = KwaZulu-Natal Province (1974), e = Limpopo Province (2003), f = Mpumalanga Province (1998), g = North West Province (1983), h = Western Cape Province (1974) and i = Northern Cape Province (2009)

### ***Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade***

The Rotterdam Convention was signed in 1998 and entered into force in 2004 (UNEP-FAO 2017). It focuses on prior informed consent as a key tool for developing countries to make informed decisions on the import and use of highly toxic chemicals. It enables member governments (including South Africa) to exchange information on banned or severely restricted chemicals and to prevent unwanted trade in certain chemicals (Annex III). This list comprises pesticides that have been banned or severely restricted for health or environmental reasons and it includes carbofuran, an agricultural pesticide that can kill non-target species, such as humans and vultures, where poisoning could occur via the food chain, by secondary exposure and by direct poisoning with laced bait (Otieno et al. 2010). It is difficult to say whether the Rotterdam Convention has resulted in a reduction on the use of these chemicals, which, at the time of drafting this manuscript, still seem to be widely available in South Africa and have been implicated in numerous vulture mass-poisoning events (Ogada et al. 2016a). Indeed, the easy availability of carbamate, organophosphate and other pesticides, could be the key cause of intentional and unintentional poisoning of vultures in South Africa (Ogada 2014)

### ***Agreements to create Transfrontier Conservation Areas***

Although there is no specific legislation that provides for transfrontier initiatives, there are multilateral agreements between South Africa and various neighbouring countries, which have resulted in six transfrontier conservation areas being established. These include the (i) |Ai-|Ais/Richtersveld Transfrontier Park, (ii) Kgalagadi Transfrontier Park, (iii) Great Limpopo Transfrontier Conservation Area (TFCA), (iv) Greater Mapungubwe TFCA, (v) Lubombo TFCA and (vi) Maloti-Drakensberg TFCA (Department of Environmental Affairs 2019). The latter is particularly important for vultures, as it comprises much of the breeding range of southern Africa's geographically and genetical isolated population of Bearded Vultures (Krüger et al. 2014a; Krüger 2014). Similarly, the 35 000 km<sup>2</sup> Great Limpopo TFCA contains breeding populations of four vulture species (Murn et al. 2013; Thompson et al. 2017) and the South African section of the Lubombo TFCA might be important for White-backed (Taylor et al. 2015) and Palm-nut Vultures (IUCN 2019). The South African Development Community's (SADC) Protocol on Wildlife Conservation and Law Enforcement requires each of the states that have signed memorandums of understanding to establish Transfrontier Conservation Areas to cooperate in the conservation and sustainable use of their shared wildlife resources (SADC 1999). The SADC Protocol is discussed in more detail below.

### ***Convention Concerning the Protection of the World Cultural and Natural Heritage 1972***

The Convention Concerning the Protection of the World Cultural and Natural Heritage 1972 (also known as the World Heritage Convention) (UNESCO 1972), links nature conservation to the preservation of cultural properties. Its

definition of 'natural heritage' includes 'areas that constitute the habitat of threatened species of animals' (Article 2). South Africa ratified the convention in 1997 and as of 31 January 2017, there were 193 states of the convention. The states recognise that their heritage constitutes a world heritage and they accept that it is their duty to protect it (Article 6).

Where a world heritage site includes habitat critical for the survival of one of more species of vultures and should this habitat be included in the outstanding universal values that led to the site's inscription, the state party responsible for the site would be obliged to safeguard that habitat as part of a global heritage. Should, however, the vulture habitat not be included in the outstanding universal values that led to the site's inscription, the Convention would provide little if any impetus to have the habitat safeguarded. Furthermore, whereas the Convention covers both natural and cultural physical in intangible heritage (Articles 2 and 3), a species irrespective of its threatened status or its global charisma, by definition, cannot qualify as an 'outstanding universal value'. In many respects, such limitation adds to the sentiment that the scope of the Convention requires reconsideration (Strasser 2002). Thus, vultures and vulture habitat occurring inside inscribed world heritage sites enjoy little protection under the World Heritage Convention.

### **Regional and subregional legal instruments**

#### ***Revised African Convention on the Conservation of Nature and Natural Resources***

The Revised African Convention on the Conservation of Nature and Natural Resources (also known as the Maputo Convention) was adopted in Maputo in 2003 and entered into force in 2016 and was amended by its parties in 2017 (African Union 2003). This Convention aims to 'enhance environmental protection' and 'foster the conservation and sustainable use of natural resources' (Article II) and it supports the creation of a network of conservation areas and environmental management that is based on scientific research (Article XVIII). The Convention was ratified by South Africa in 2013 and is speculated to have played a significant role in the drafting of South Africa's biodiversity conservation legislation (Blackmore 2018). Parties are obliged, under Article IX, to 'maintain and enhance species and genetic diversity of plants and animals', paying particular attention to 'socially, economically and ecologically valuable species that are threatened'. With regards to hunting and capturing, the Convention prohibits the use of indiscriminate means of taking and the use of means that are capable of causing serious disturbance to populations of a species (Article IX, 3 (b) (iii)), which must include drugs and poisons. It is the most comprehensive regional treaty on the conservation of natural resources and the environment, however, as with most Multilateral Environmental Agreements (MEAs), there are few penalties for non-compliance, making full implementation very unlikely (Ogada 2014). Nonetheless, this Convention, together with the SADC Protocol discussed below, provides individual and collective foundation for, at least, southern African states to conserve and protect vultures.

### **SADC Protocol on Wildlife Conservation and Law Enforcement**

The Southern African Development Community (SADC) is a regional organisation that was established in 1992, to continue strengthening ties within the Southern African region. SADC protocols are legally binding documents, to which member states are committed. SADC passed its Protocol on Wildlife Conservation and Law Enforcement in 1999. The protocol aims to establish a common framework for the conservation and sustainable use of wildlife resources among member states and to assist with the enforcement of laws governing those resources (SADC 1999). It encourages SADC states to cooperate over shared resources and prohibits them from damaging neighbouring biodiversity (Wolmer 2003; Holmes-Watts and Watts 2008; Blackmore and Trouwborst 2018). Old World vultures can be considered a shared resource, because their large home-ranges transcend international borders: South African legislation can affect vultures that travel between Lesotho, Swaziland, Mozambique, Zimbabwe, Botswana, Zambia, Namibia and Angola (Phipps et al. 2013; Krüger et al. 2014b; Botha et al. 2017), all of which are among the 14 SADC members. SADC states are required to develop public education programmes concerning wildlife conservation, to support research that contributes to the sustainable use and conservation of wildlife conservation and to adopt and enforce policy and legal instruments necessary to ensure the conservation and sustainable use of wildlife resources (Articles 5, 6 and 7). Parties must also have restrictions on trade in wildlife resources and products and protect wildlife resources and wildlife habitats to ensure the maintenance of viable wildlife populations (Article 7). Parties must also cooperate in wildlife law enforcement and allocate appropriate financial and human resources required for the effective application of the legislation governing the conservation and sustainable use of wildlife (Article 9).

The Protocol provides an effective vehicle for neighbouring SADC countries to set in place transfrontier conservation areas (TFCA) and parks (TFCP) (Article 4). A transfrontier conservation area differs from a park (which is usually intended strictly for conservation) in that it contains multiple land uses that promote the conservation of, *inter alia*, biodiversity (Wolmer 2003). In both instances (TFCA and TFCA), the threat to vultures (e.g. poisoning, capture) could be specifically regulated, if not precluded. As mentioned earlier, the Protocol is a powerful tool that could be used specifically for the protection of vultures at a regional scale. The application and effectiveness of the Protocol, together with the Maputo Convention, to conserve and protect vultures, however, need to be ascertained.

### **National legislation (South Africa)**

#### **Constitution of the Republic of South Africa**

All South African legal provisions are based on the Constitution (Republic of South Africa 1996), where Section 24 in the Bill of Rights (the Environmental Right) states that: Everyone has the right –

- (a) to an environment that is not harmful to their health or wellbeing; and

- (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –

- (i) prevent pollution and ecological degradation;
- (ii) promote conservation; and
- (iii) secure ecologically sustainable development and use of natural resources, while promoting justifiable economic and social development.

The premise of vulture conservation is protected under Subsection (b) of the Environmental Right, because ecologically functional vulture populations are essential to avoid ecological degradation (Markandya et al. 2008). The Environmental Right is operationalised mainly via South Africa's National Environmental Act 107 of 1998 (NEMA). This statute is discussed below.

#### **Environment Conservation Act No. 73 of 1989**

The Environment Conservation Act No. 73 of 1989 has now mostly been replaced by NEMA and the specific environmental legislation this Act provides for, but some provisions remain in force. The Act provides for 'effective protection and controlled utilisation of the environment' (Republic of South Africa 1989). The Act is relevant to vultures, in that it covers (in Part V, section 21 (2)): land use and transformation: resource removal, including natural living resources: energy generation and distribution: and recreation. All of which harbour both direct and indirect threats to vultures.

#### **National Environmental Management Act No. 107 of 1998**

The National Environmental Management Act No. 107 of 1998 (NEMA) serves as environmental framework legislation for the sustainable use of the natural environment and the conservation of biodiversity in South Africa (Nel and Du Plessis 2001; Blackmore 2015). NEMA provides a number of key provisions directly relevant to the conservation and protection of vultures.

The first is the provision of general principles of environmental management that are to be applied in all decision making undertaken by the state where the environment may be affected (Section 2). The primary purpose of these principles is to ensure the progressive achievement of the 'environmental right' held in the Bill of Rights in the country's constitution (Republic of South Africa 1996).

The second key provision is the requirement for an environmental impact assessment (EIA) to be undertaken prior to any activity taking place that may significantly harm the environment (Section 22 and 28). These activities are listed in three Government Gazette notices. It is common cause that the effectiveness of the EIA process is directly dependent on the environmental assessment practitioner, avian specialists and, importantly the assessing government official, to understand the susceptibility of vultures to both direct and indirect consequences of a potentially harmful activity being undertaken. Such understanding would need to include the applicability of mitigation and remediation measures that would render the impact on vultures negligible should the activity be permitted. In making this observation, cognisance is made of the threat of powerlines, wind turbines and other associated aerial infrastructure to vultures. We recognise

that the EIA is the principle legal instrument to avoid or mitigate the impacts of this infrastructure on vultures. Although these impacts have been extensively studied (see, for example, De Lucas et al. 2008; Boshoff et al. 2011; Angelov et al. 2012; Carrete et al. 2012; Rushworth and Krüger 2014; Buechley et al. 2018), the effectiveness of these assessments with view to determining whether dedicated legislation is required that goes beyond the Protection of Threatened or Protected Species Regulations (see below) remains to be explored.

Thirdly, NEMA provides for the promulgation of specific environmental legislation. Those specific environmental statutes that are relevant to the conservation and protection of vultures are discussed below.

#### **National Environmental Management: Biodiversity Act No. 10 of 2004**

The National Environmental Management: Biodiversity Act No. 10 of 2004 (Republic of South Africa 2004) aims to provide for the conservation of South Africa's biodiversity under the framework of the National Environmental Management Act of 1998. The purpose of chapter 4 of the Biodiversity Act is to:

- '(b) provide for the protection of species that are threatened or in need of protection to ensure their survival in the wild:
- (c) give effect to the Republic's obligations under international agreements regulating international trade in specimens of endangered species: and
- (d) ensure that the utilisation of biodiversity is managed in an ecologically sustainable way.'

The Act enables the restriction of activities that negatively affect those species that are vulnerable, endangered or critically endangered (Chapter 4, Part 2). This in turn gives rise to national and provincial 'Protection of threatened or protected species' (ToPS) Regulations, which govern the possession, movement and trade of vultures and their parts.

#### **NEMBA Biodiversity Management Plan for *Gypaetus barbatus meridionalis***

Arising from the Biodiversity Act (and the ToPS Regulations) is the National Environmental Management: Biodiversity Act (10/2004): Biodiversity Management Plan for *Gypaetus barbatus meridionalis* (Department of Environmental Affairs 2014). This management plan for the long-term survival of Bearded Vultures in South Africa will likely be integrated into the Multi-species Biodiversity Monitoring Plan for the Conservation of Vultures in South Africa, the drafting of which is being steered by the Department of Environmental Affairs. Both the effectiveness of ToPS Regulations and this management plan on improving the conservation status of vultures needs to be explored to determine whether these instruments have had a positive impact on ameliorating the threats to vultures and to determine whether (as mentioned above) additional legislative interventions are required.

#### **National Environmental Management: Protected Areas Act No. 57 of 2003**

Chapter 3 of the Protected Areas Act (Republic of South Africa 2003) lists various guiding principles, some of which pertain to vultures and their conservation. These include: promotion of 'the recovery of endangered and vulnerable

species': protection of 'South Africa's threatened or rare species': and assistance in ensuring 'the sustained supply of environmental goods and services' (Chapters 3, 17. (l), (e) and (g), respectively). This has special relevance to South Africa's vulture species, most of which are endangered or critically endangered (Table 1) and provide important, if not critical, environmental services to people and livestock (Whelan et al. 2008; Moleón et al. 2014; Morales-Reyes et al. 2015).

#### **National Environmental Management: Waste Act No. 59 of 2008**

The Waste Act No. 59 of 2008 (Republic of South Africa 2009) regulates waste management to protect public health and the environment. It provides for measures to prevent pollution and ecological degradation and for the remediation of contaminated land. Habitat used by vultures for bathing, breeding and foraging may be protected under Part 6, section 26(1)(a) of the Act, which prohibits the disposal of waste on land or in waterbodies. Similarly, littering is prohibited under section 27(2)(a) of the Act and this should benefit Cape Vultures in particular, as this species is known to ingest small pieces of plastic and glass (Benson et al. 2004; Pfeiffer et al. 2017b).

#### **Other relevant legislation (South Africa)**

##### *National Heritage Resources Act No. 25 of 1999*

The National Heritage Resources Act No. 25 of 1999 (Republic of South Africa 1999) empowers civil society to conserve, at a national level, the Republic's national heritage resources 'so that they may be bequeathed to future generations'. The National Heritage Resources Act (NHRA) also provides for provincial heritage resources authorities to designate heritage areas to 'protect any place of environmental or cultural interest' (section 31). Many South Africans have strong cultural beliefs surrounding vultures and therefore the NHRA could perhaps be used to designate areas that protect vultures, such as breeding, bathing and foraging habitat.

##### *Animal Protection Act No. 71 of 1962*

Sections 2(d) and 2(j) of the Animals Protection Act No. 71 of 1962 (Republic of South Africa 1962) respectively state that an offence has been committed by: Any person who – 'lays or exposes any poison or any poisoned fluid or edible matter of infectious agents, except for the destruction of vermin or marauding domestic animals or without taking reasonable precautions to prevent injury or disease being caused to animals' or 'lays any trap or other device for the purpose of capturing or destroying any animal, wild animal or wild bird the destruction of which is not proven to be necessary for the protection of property or for the prevention of the spread of disease'. Any person found guilty of such offences may be fined up to R5 000 (US\$268) (Republic of South Africa 1985), or imprisoned for up to twelve months (Republic of South Africa 1997).

##### *South African National Forest Act, Section 15(1)*

Under Section 15(1) of the South African National Forests Act, 1998, 'no person may cut, disturb, damage, destroy or remove any protected tree: or collect, remove, transport,



export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister' (Republic of South Africa 1998). Contravention of this Act is an offence and may result in a fine and/or imprisonment for up to three years. Certain vulture nesting trees, including *Breonadia salicina*, in which Hooded Vultures nest in Limpopo Province (LJ Thompson and John Davies, Birds of Prey Programme, Endangered Wildlife Trust, South Africa, pers. obs.) are protected under this Act (Republic of South Africa 2011) and the current sale of furniture made from this tree species at various locations in the Lowveld (LJ Thompson and John Davies, Birds of Prey Programme, Endangered Wildlife Trust, South Africa, pers. obs.) without a permit, is an offence and requires investigation and enforcement. Another vulture nesting tree species listed as protected is *Vachellia erioloba*, which is widely used by nesting White-backed Vultures in the Northern Cape and Free State (Mundy et al. 1992). Despite its protection, *V. erioloba* is vulnerable to clearing for 'improved grazing' and it is used for firewood and building materials (Seymour and Milton 2003; Colahan 2004). Other vulture nesting trees, such as *Diospyros mespiliformis*, *Ficus sycomorus* and *Senegalia nigrescens*, are not listed (see Republic of South Africa 2011), but, because of their important roles as regular nesting trees for highly threatened vultures, these tree species require some form of legal protection. We suggest that the list of protected trees be revised and updated.

#### *Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act No. 36 of 1947*

Section 7 (2) (a) of the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies No. 36 of 1947 (Republic of South Africa 1947) requires that:

'No person shall for reward or in the course of any industry, trade of business –

- (i) use, or recommend the use of, any agricultural remedy or stock remedy for a purpose or in a manner other than that specified on the label on a container thereof or described on such container;
- (ii) use any agricultural remedy unless he is a pest control operator registered in terms of this Act or otherwise than in the presence and under the supervision of a pest control operator so registered.'

Under Section 7 (2) (b) of the Act, there is an exemption for veterinarians to use stock remedies for purposes other than those instructed on the label.

Under this Act, the maximum penalty for people guilty of offences involving agrichemicals is a R1 000 (US\$54) fine and/or two years' imprisonment. Recently, a multimillionaire game breeder in Limpopo (Comrie 2015) was fined R2 500 (US\$134) for poisoning two critically endangered White-backed Vultures (Phillips 2015), a fine that would be of little consequence. We therefore recommend that South Africa's Department of Agriculture, Forestry and Fisheries should update Act 36 of 1947, to impose harsher penalties. Given that poisoning is the main reason for population declines in African vultures (Botha et al. 2017), we further recommend that agrichemicals are made available to landowners only under the direct supervision of government nature conservation agencies (Allan 1989). See Ogada

(2014) for a list of 38 African countries, including South Africa, where it is illegal to use poison for hunting wildlife, and the names of the relevant legislation.

#### *Hazardous Substances Act No. 15 of 1973*

The Hazardous Substances Act No. 15 of 1973 (Government of South Africa 2000) controls the importation, manufacture, sale, use, operation and application of hazardous substances, including those that are toxic, corrosive and irritant. Substances listed as Group I or Group II hazardous substances have specific requirements for their sale and distribution. Group IA hazardous substances includes leaded paint (Department of Health 2009), which has been shown to reduce fertility of captive Cape Vultures (Naidoo et al. 2012). Group I hazardous substances also includes some pesticides, such as strychnine, which was widely used in South Africa to poison mammalian predators and indirectly poisoned vultures (Berliner 1984; Allan 1989).

#### **Provincial legislation**

The protection of wild birds in each of South Africa's nine provinces is governed by the provisions set out in their respective legislation (Table 3). Poisoning or otherwise killing vultures in contravention of these provincial Acts may result in fines of varying amounts and/or imprisonment of varying periods, depending on the level of protection afforded to vultures under these Acts (Table 3). For example, in the Eastern Cape, the Bearded Vulture is listed as an 'endangered' wild animal under Schedule 1 of the Eastern Cape Nature Conservation Ordinance No. 19 of 1974 (chapter IV), whereas other vultures occurring in the Province, such as the Cape Vulture, which breeds there (Pfeiffer et al. 2017a), are not listed as 'endangered' and therefore not given the same legal protection. In contrast, all six of the vulture species that occur in Limpopo Province are afforded maximum protection under the Limpopo Environmental Management Act (LEMA) No. 7 of 2003. We recommend that these provincial Acts (Table 3) be revised where necessary, so that all of the vulture species occurring in each respective province are afforded the highest level of protection possible, leading to perpetrators of crimes involving vultures being given maximal penalties. Notwithstanding the value of the Adjustment of Fines Act 11 of 1991 to adjust outdated fines to be contemporary relevant (Republic of South Africa 1991), we also recommend that penalties for crimes against wildlife, particularly vulnerable or endangered species, be reviewed more frequently than is currently the case and increased to take into consideration the conservation status of the species concerned.

#### **Discussion**

South Africa has a range of provincial, national and international legal protection for its vulture species. These legal provisions are distributed across various biodiversity and non-biodiversity orientated statutes that are generally non-specific in nature, being embedded in general provisions that may be interpreted in a manner that provides for the protection of the country's vultures. These legal provisions are also fragmented, making their enforcement difficult. We reiterate the need for a separate

review of enforcement of South Africa's environmental legislation with respect to vultures, taking into account the drivers of wildlife crime.

Laws that are most geared towards protecting vultures in South Africa are environmental laws at provincial scales. For vultures to enjoy the highest degree of protection under these provincial ordinances, all species of vultures that occur in South Africa should be elevated to 'Specially Protected' status. Correlative studies suggests that species protection is a highly relevant tool for conservation (Koleček et al. 2014). For example, a comparison of population trends of bird species in ten Eastern European countries before (1970–1990) and after (1990–2000) modern environmental legislation was enacted, revealed a significant, positive correlation between national legislation and improved population trends of protected species (Koleček et al. 2014). Similarly, supranational conservation policy brought measurable conservation benefits for birds in the European Union (Donald et al. 2007) and for species in North America (Male and Bean 2005). Given their dire conservation status (IUCN 2019) and plummeting populations of southern African vulture species (Garbett et al. 2018a), the suggestions we offer for amendments to current legislation may increase the legal protection of vultures in South Africa, which, by reducing the number and degree of the various threats to these birds, is seen to be paramount to improving their conservation status.

**Acknowledgements** — We are grateful to Sonja Krüger and Brent Coverdale (Ezemvelo KZN Wildlife) and to Lyle Wiggins (Limpopo Economic Development, Environment and Tourism), for helpful discussions about provincial environmental laws in South Africa. Dania Bruwer (National Prosecuting Authority) referred us to two cases where convictions were secured and John Davies kindly allowed us to use his reference library. We also thank two anonymous reviewers whose comments greatly improved this manuscript. The supportive environment provided by the Endangered Wildlife Trust (EWT), Ezemvelo KZN Wildlife (EKZNW) and the University of KwaZulu-Natal (UKZN) is acknowledged. The legal instruments cited and discussed in this article are current as of 14 June 2019. The ideas, arguments and opinions expressed in this article are the authors' own and do not necessarily represent those of the EWT, EKZNW or UKZN.

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## References

African Union. 2003. African Convention on the Conservation of Nature and Natural Resources. Available from: <https://au.int/en/treaties/african-convention-conservation-nature-and-natural-resources-revised-version>. [Accessed 31 January 2019].

Allan DG. 1989. Strychnine poison and the conservation of avian scavengers in the Karoo, South Africa. *South African Journal of Wildlife Research* 19: 102–106.

Ames PL. 1966. DDT residues in the eggs of the osprey in the north-eastern United States and their relation to nesting success. *Journal of Applied Ecology* 3: 87–97.

Angelov I, Hashim I, Opper S. 2013. Persistent electrocution mortality of Egyptian Vultures *Neophron percnopterus* over 28 years in East Africa. *Bird Conservation International* 23: 1–6.

Avery D, Watson RT. 2009. Regulation of lead-based ammunition around the world. (p 161–168). In: *Ingestions of lead from spent ammunition: implications for wildlife and humans*. Watson RT, Fuller M, Pokras M, Hunt G (Eds). Boise, United States: The Peregrine Fund.

Bamford AJ, Monadjem A, Hardy IC. 2009. Nesting habitat preference of the African White-backed Vulture *Gyps africanus* and the effects of anthropogenic disturbance. *Ibis* 151: 51–62.

Benson PC, Plug I, Dobbs JC. 2004. An analysis of bones and other materials collected by Cape Vultures at the Kransberg and Blouberg colonies, Limpopo Province, South Africa. *Ostrich* 75: 118–132.

Berliner D. 1984. The use of strychnine poison by farmers in the NW Transvaal and their attitudes towards vultures. *Vulture News* 12: 7–8.

Blackmore A. 2015. The relationship between the NEMA and the public trust doctrine: The importance of the NEMA principles in safeguarding South Africa's biodiversity'. *South African Journal of Environmental Law and Policy* 20: 89–118.

Blackmore AC. 2018. Rediscovering the origins and inclusion of the public trust doctrine in South African environmental law: a speculative analysis. *Review of European, Comparative & International Environmental Law* 27: 187–198.

Blackmore AC, Trouwborst A. 2018. Who owns and is responsible for the elephant in the room? Management plans for free-roaming elephant in South Africa. *Bothalia* 48: 1–6.

Boshoff AF, Minnie JC, Tambling CJ, Michael MD. 2011. The impact of power line-related mortality on the Cape Vulture *Gyps coprotheres* in a part of its range, with an emphasis on electrocution. *Bird Conservation International* 21: 311–327.

Botha AJ, Andevski J, Bowden CGR, Gudka M, Safford RJ, Tavares J, Williams NP. 2017. Multi-species action plan to conserve African-Eurasian vultures. CMS raptors MOU technical publication no. 5. CMS Technical Series No. 4. Coordinating unit of the CMS raptors MOU, Abu Dhabi, United Arab Emirates. [https://www.cms.int/raptors/sites/default/files/publication/vulture-msap\\_e.pdf](https://www.cms.int/raptors/sites/default/files/publication/vulture-msap_e.pdf). [Accessed 23 February 2020].

Bouwman H, Sereda B, Meinhardt H. 2006. Simultaneous presence of DDT and pyrethroid residues in human breast milk from a malaria endemic area in South Africa. *Environmental Pollution* 144: 902–917.

Buechley ER, McGrady MJ, Çoban E, Şekercioğlu ÇH. 2018. Satellite tracking a wide-ranging endangered vulture species to target conservation actions in the Middle East and East Africa. *Biodiversity and Conservation* 27: 2293–2310.

Carrete M, Sánchez-Zapata JA, Benítez JR, Lobón M, Montoya F, Donazar JA. 2012. Mortality at wind-farms is positively related to large-scale distribution and aggregation in griffon vultures. *Biological Conservation* 145: 102–108.

CITES 1973. Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973. Available from: <https://www.cites.org/sites/default/files/eng/disc/CITES-Convention-EN.pdf>. [Accessed 29 January 2019].

Challender DW, MacMillan DC. 2014. Poaching is more than an enforcement problem. *Conservation Letters* 7: 484–494.

Colahan BD. 2004. The status and conservation of vultures in the Free State Province of South Africa. In: The vultures of southern Africa - Quo Vadis? Proceedings of a workshop on vulture research and conservation in southern Africa. (p 81–86). Monadjem A, Anderson MD, Piper SE, Boshoff AF (Eds). [http://sungura.co.uk/Library/VultureStudyGProceedings\\_final.pdf](http://sungura.co.uk/Library/VultureStudyGProceedings_final.pdf). [Accessed 23 February 2020].

Comrie C. 2015. Ramaphosa lost a golden goose. *City Press*. Available from: <https://citypress.news24.com/News/Ramaphosa-lost-a-golden-goose-20150928>. [Accessed 28 January 2019].

Daboné C, Buij R, Oueda A, Adjakpa JB, Guenda W, Weesie PD. 2019. Impact of human activities on the reproduction of Hooded Vultures *Necrosyrtes monachus* in Burkina Faso. *Ostrich* 90: 53–61.

- Dalton J. 2018. Live vultures and endangered bird eggs found in man's bag at Heathrow. *The UK Independent*. Available from: <https://www.independent.co.uk/news/uk/home-news/>. [Accessed 16 January 2019].
- de Lucas M, Janss GF, Whitfield DP, Ferrer M. 2008. Collision fatality of raptors in wind farms does not depend on raptor abundance. *Journal of Applied Ecology* 45: 1695–1703.
- de Lucas M, Ferrer M, Bechard MJ, Muñoz AR. 2012. Griffon vulture mortality at wind farms in southern Spain: Distribution of fatalities and active mitigation measures. *Biological Conservation* 147: 184–189.
- Department of Environmental Affairs. 2014. National Environmental Management: Biodiversity Act (10/2004): Biodiversity Management Plan for Gypaetus Barbatus Meridionalis. Gazette no. 37620. Available from: [https://www.environment.gov.za/sites/default/files/gazetted\\_notices/nemba\\_biodiversitymanagement\\_plangypaetusbarbatusmeridionalis\\_g37620gn350\\_0.pdf](https://www.environment.gov.za/sites/default/files/gazetted_notices/nemba_biodiversitymanagement_plangypaetusbarbatusmeridionalis_g37620gn350_0.pdf). [Accessed 1 June 2019].
- Department of Environmental Affairs. 2019. Transfrontier Conservation Areas. Available from: [https://www.environment.gov.za/projectsprogrammes/transfrontier\\_conservation\\_areas#kgalakgadi](https://www.environment.gov.za/projectsprogrammes/transfrontier_conservation_areas#kgalakgadi). [Accessed 1 June 2019].
- Department of Health. 2009. Government Notice No. 801. Declaration of leaded paint as Group 1 hazardous substance. Available from: [http://us-cdn.creamermedia.co.za/assets/articles/attachments/22770\\_not\\_801.pdf](http://us-cdn.creamermedia.co.za/assets/articles/attachments/22770_not_801.pdf). [Accessed 5 March 2019].
- DeVault TL, Beasley JC, Olson ZH, Moleón M, Carrete M, Margalida A, Sánchez-Zapata JA. 2016. Ecosystem services provided by avian scavengers. (p 235–270). In: *Why birds matter: Avian ecological function and ecosystem services*. Şekercioğlu CH, Wenny DG, Whelan CJ (Eds). Chicago, United States: University of Chicago Press.
- Donald PF, Sanderson FJ, Burfield IJ, Bierman SM, Gregory RD, Waliczky Z. 2007. International conservation policy delivers benefits for birds in Europe. *Science* 317: 810–813.
- Eastern Cape Province. 1974. Nature Conservation Ordinance No. 19 of 1974. Available from: [https://sherloc.unodc.org/res/cld/document/nature-and-environmental-conservation-ordinance-19-of-1974-eastern-cape-province\\_html/EC\\_Environment\\_and\\_Nature\\_Conservation\\_Ordinan.pdf](https://sherloc.unodc.org/res/cld/document/nature-and-environmental-conservation-ordinance-19-of-1974-eastern-cape-province_html/EC_Environment_and_Nature_Conservation_Ordinan.pdf). [Accessed 11 February 2019].
- Fisher IJ, Pain DJ, Thomas VG. 2006. A review of lead poisoning from ammunition sources in terrestrial birds. *Biological Conservation* 131: 421–432.
- Franson JC, Pain DJ. 2011. Lead in Birds. In: *Environmental contaminants in biota: Interpreting tissue concentrations*. 2nd edition. Nelson Beyer W, Meador JP (Eds). Boca Raton, United States: CRC Press, Taylor and Francis Group.
- Free State Province. 1969. Free State Nature Conservation Ordinance 8 of 1969. Available from: <https://invasives.org.za/files/66/Provincial%20Conservation%20Regulations/293/%20Free%20State%20Ordinance.pdf>. [Accessed 13 February 2019].
- Gangoso L, Alvarez-Lloret P, Rodríguez-Navarro AA, Mateo R, Hiraldo F, Donazar JA. 2009. Long-term effects of lead poisoning on bone mineralization in vultures exposed to ammunition sources. *Environmental Pollution* 157: 569–574.
- Garbett R, Herremans M, Maude G, Reading RP, Amar A. 2018a. Raptor population trends in northern Botswana: A re-survey of road transects after 20 years. *Biological Conservation* 224: 87–99.
- Garbett R, Maude G, Hancock P, Kenny D, Reading R, Amar A. 2018b. Association between hunting and elevated blood lead levels in the critically endangered African White-backed Vulture *Gyps africanus*. *Science of the Total Environment* 630: 1654–1665.
- Gauteng Province. 1983. Transvaal Nature Conservation Ordinance No. 12 of 1983. Available from: <https://cer.org.za/wp-content/uploads/2016/03/12-83-Nature-Conservation-Ordinance.pdf>. [Accessed 14 February 2019].
- Gill F, Donsker D. 2018. IOC World Bird List (v 8.2). <http://www.worldbirdnames.org/>. [Accessed 13 January 2019].
- Gore ML, Braszak P, Brown J, Cassey P, Duffy R, Fisher J, Graham J, Justo-Hanani R, Kirkwood AE, Lunstrum E, Machalaba C. 2019. Transnational environmental crime threatens sustainable development. *Nature Sustainability* 2: 784–786.
- Government of South Africa. 2000. Hazardous Substances Act 15 of 1973. Available from: <https://cer.org.za/wp-content/uploads/2016/10/Hazardous-Substances-Act.pdf>. [Accessed 5 March 2019].
- Grier JW. 1982. Ban of DDT and subsequent recovery of reproduction in Bald Eagles. *Science* 218: 1232–1235.
- Holmes-Watts T, Watts S. 2008. Legal frameworks for and the practice of participatory natural resources management in South Africa. *Forest Policy and Economics* 10: 435–443.
- Iqbal S, Blumenthal W, Kennedy C, Yip FY, Pickard S, Flanders WD, Loring K, Kruger K, Caldwell KL, Brown MJ. 2009. Hunting with lead: Association between blood lead levels and wild game consumption. *Environmental Research* 109: 952–959.
- IUCN. 2019. The IUCN Red List of Threatened Species. Version 2018–2. <http://www.iucnredlist.org/>. [Accessed 13 January 2019].
- IUCN. 2016. A path forward to address concerns over the use of lead ammunition in hunting. The World Conservation Congress, Hawai'i, United States, 1–10 September 2016. Available from: [https://portals.iucn.org/library/sites/library/files/resrecfiles/WCC\\_2016\\_RES\\_082\\_EN.pdf](https://portals.iucn.org/library/sites/library/files/resrecfiles/WCC_2016_RES_082_EN.pdf) [Accessed 8 August 2019].
- Kelly TR, Johnson CK. 2011. Lead exposure in free-flying Turkey Vultures is associated with big game hunting in California. *PLoS One* 6: e15350.
- Koleček J, Schleuning M, Burfield IJ, Báldi A, Böhning-Gaese K, Devictor V, Fernández-García JM, Hořák D, Van Turnhout CA, Hnatyna O, et al. 2014. Birds protected by national legislation show improved population trends in Eastern Europe. *Biological Conservation* 172: 109–116.
- Krüger SC. 2015. Bearded Vulture. (pp 55–57). In: *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. MR Taylor (Ed.). Johannesburg, South Africa: BirdLife.
- Krüger SC, Allan DG, Jenkins AR, Amar A. 2014a. Trends in territory occupancy, distribution and density of the Bearded Vulture *Gypaetus barbatus meridionalis* in southern Africa. *Bird Conservation International* 24: 162–177.
- Krüger S, Reid T, Amar A. 2014b. Differential range use between age classes of southern African Bearded Vultures *Gypaetus barbatus*. *PLoS One* 9: e114920.
- KwaZulu-Natal Province. 1974. Nature Conservation Ordinance No. 15 of 1974. Available from: [https://sherloc.unodc.org/res/cld/document/nature-conservation-ordinance-15-of-1974-kwazulu-natal-province\\_html/KZN\\_Nature\\_Conservation\\_Ordinance.pdf](https://sherloc.unodc.org/res/cld/document/nature-conservation-ordinance-15-of-1974-kwazulu-natal-province_html/KZN_Nature_Conservation_Ordinance.pdf). [Accessed 11 February 2019].
- Limpopo Province. 2003. Limpopo Environmental Management Act No. 7 of 2003. Available from: [https://www.unodc.org/res/cld/document/limpopo-environmental-management-act-7-of-2003\\_html/Limpopo\\_Enviro\\_Management\\_Act.pdf](https://www.unodc.org/res/cld/document/limpopo-environmental-management-act-7-of-2003_html/Limpopo_Enviro_Management_Act.pdf). [Accessed 10 February 2019].
- Male TD, Bean MJ. 2005. Measuring progress in US endangered species conservation. *Ecology Letters* 8: 986–992.
- MaMing R, Xu G. 2015. Status and threats to vultures in China. *Vulture News* 68: 3–24.
- Mander M, Diederichs N, Ntuli L, Mavundla K, Williams V, McKean S. 2007. Survey of the trade in vultures for the traditional health industry in South Africa. Durban: South Africa: FutureWorks.
- Markandya A, Taylor T, Longo A, Murty MN, Murty S, Dhavala K. 2008. Counting the cost of vulture decline - an appraisal of the human health and other benefits of vultures in India. *Ecological Economics* 67: 194–204.
- Mashele NM. 2019. Assessing threats to African vultures and the

- effectiveness of conservation efforts in the Kruger to Canyons Biosphere Region, Mpumalanga, South Africa. MSc thesis, University of KwaZulu-Natal, Pietermaritzburg, South Africa.
- Mateo R, Molina R, Grifols J, Guitart R. 1997. Lead poisoning in a free ranging Griffon Vulture (*Gyps fulvus*). *The Veterinary Record* 140: 47–48.
- McKean S, Mander M, Diederichs N, Ntuli L, Mavundla K, Williams V, Wakelin J. 2013. The impact of traditional use on vultures in South Africa. *Vulture News* 65: 15–36.
- Moleón M, Sánchez-Zapata JA, Margalida A, Carrete M, Owen-Smith N, Donázar JA. 2014. Humans and scavengers: The evolution of interactions and ecosystem services. *Bioscience* 64: 394–403.
- Morales-Reyes Z, Pérez-García JM, Moleón M, Botella F, Carrete M, Lazcano C, Moreno-Opo R, Margalida A, Donázar JA, Sánchez-Zapata JA. 2015. Supplanting ecosystem services provided by scavengers raises greenhouse gas emissions. *Scientific Reports* 5: 7811–7816.
- Mpumalanga Province. 1998. Mpumalanga Nature Conservation Act No. 10 of 1998. Available from: <https://cer.org.za/wp-content/uploads/2016/03/10-of-1998-Mpumalanga-Nature-Conservation-Act.pdf>. [Accessed 14 February 2019].
- Mullié WC, Couzi FX, Diop MS, Piot B, Peters T, Reynaud PA, Thiollay JM. 2017. The decline of an urban Hooded Vulture *Necrosyrtes monachus* population in Dakar, Senegal, over 50 years. *Ostrich* 88: 131–138.
- Mundy PJ. 1978. The Egyptian vulture (*Neophron percnopterus*) in southern Africa. *Biological Conservation* 14: 307–315.
- Mundy PJ, Butchart D, Ledger JA, Piper SE. 1992. The vultures of Africa. Randburg, South Africa: Acorn Books and Russel Friedman Books.
- Murn C, Botha A. 2018. A clear and present danger: Impacts of poisoning on a vulture population and the effect of poison response activities. *Oryx* 52: 552–558.
- Murn C, Combrink L, Ronaldson GS, Thompson C, Botha A. 2013. Population estimates of three vulture species in Kruger National Park, South Africa. *Ostrich* 84: 1–9.
- Naidoo V, Wolter K, Espie I, Kotze A. 2012. Lead toxicity: consequences and interventions in an intensively managed (*Gyps coprotheres*) vulture colony. *Journal of Zoo and Wildlife Medicine* 43: 573–578.
- Nel W. 2001. An evaluation of NEMA based on a generic framework for environmental framework legislation. *South African Journal of Environmental Law and Policy* 8: 1–36.
- Newton I, Haas MB. 1988. Pollutants in merlin eggs and their effects on breeding. *British Birds* 81: 258–269.
- North West Province. 1983. Nature Conservation Ordinance No. 12 of 1983. Available from: [https://www.unodc.org/res/cld/document/nature-conservation-ordinance-12-of-1983-north-west-province\\_html/NW\\_Nature\\_Conservation\\_Ordinan.pdf](https://www.unodc.org/res/cld/document/nature-conservation-ordinance-12-of-1983-north-west-province_html/NW_Nature_Conservation_Ordinan.pdf). [Accessed 14 February 2019].
- Northern Cape Province. 2009. Northern Cape Nature Conservation Act No. 9 of 2009. Available from: [https://www.unodc.org/res/cld/document/northern-cape-nature-conservation-act-9-of-2009\\_html/NC\\_Nature\\_Conservation\\_Act.pdf](https://www.unodc.org/res/cld/document/northern-cape-nature-conservation-act-9-of-2009_html/NC_Nature_Conservation_Act.pdf). [Accessed 14 February 2019].
- Ogada DL. 2014. The power of poison: Pesticide poisoning of Africa's wildlife. *Annals of the New York Academy of Sciences* 1322: 1–20.
- Ogada D, Botha A, Shaw P. 2016a. Ivory poachers and poison: Drivers of Africa's declining vulture populations. *Oryx* 50: 593–596.
- Ogada D, Shaw P, Beyers RL, Buij R, Murn C, Thiollay JM, Beale CM, Holdo RM, Pomeroy D, Baker N, et al. 2016b. Another continental vulture crisis: Africa's vultures collapsing toward extinction. *Conservation Letters* 9: 89–97.
- Olsen P, Emison B, Mooney N, Brothers N. 1992. DDT and dieldrin: Effects on resident peregrine falcon populations in south-eastern Australia. *Ecotoxicology (London, England)* 1: 89–100.
- Opdam P, Burgers J, Müskens GJDM. 1987. Population trend, reproduction and pesticides in Dutch sparrowhawks following the ban on DDT. *Ardea* 75: 205–212.
- Otieno PO, Lalah JO, Virani MZ, Jondiko IO, Schramm KW. 2010. Carbofuran and its toxic metabolites provide forensic evidence for Furadan exposure in vultures (*Gyps africanus*) in Kenya. *Bulletin of Environmental Contamination and Toxicology* 84: 536–544.
- Pfeiffer MB, Venter JA, Downs CT. 2017a. Cliff characteristics, neighbour requirements and breeding success of the colonial Cape Vulture *Gyps coprotheres*. *Ibis* 159: 26–37.
- Pfeiffer MB, Venter JA, Downs CT. 2017b. Observations of microtrash ingestion in Cape Vultures in the Eastern Cape, South Africa. *African Zoology* 52: 65–67.
- Phillips L. 2015. Game rancher receives hefty fine from industry body for wildlife poisoning. *Farmer's Weekly*. <https://www.farmersweekly.co.za/agri-news/south-africa/>. [Accessed 16 January 2019].
- Phipps WL, Willis SG, Wolter K, Naidoo V. 2013. Foraging ranges of immature African White-Backed Vultures (*Gyps africanus*) and their use of protected areas in southern Africa. *PLoS One* 8: e52813.
- Plaza PI, Lambertucci SA. 2019. What do we know about lead contamination in wild vultures and condors? A review of decades of research. *Science of the Total Environment* 654: 409–417.
- Ranson H, N'Gouessan R, Lines J, Moiroux N, Nkuni Z, Corbel V. 2011. Pyrethroid resistance in African Anopheline mosquitoes: What are the implications for malaria control? *Trends in Parasitology* 27: 91–98.
- Republic of South Africa. 1947. Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act No. 36 of 1947. Available from: <https://www.daff.gov.za/daffweb3/LinkClick.aspx?fileticket=fF3LYuob1Ds%3D&portalid=0>. [Accessed 28 January 2019].
- Republic of South Africa. 1962. Animals Protection Act 71 of 1962. Government Gazette Extraordinary, 22nd June, 1962. Available from: [https://www.daff.gov.za/doaDev/sideMenu/acts/11%20Animal%20Protection%20No71%20\(1962\).pdf](https://www.daff.gov.za/doaDev/sideMenu/acts/11%20Animal%20Protection%20No71%20(1962).pdf). [Accessed 27 January 2019].
- Republic of South Africa. 1985. Animals Protection Amendment Act, No. 20 of 1985. Available from: [https://www.gov.za/sites/default/files/gcis\\_document/201503/act-20-1985.pdf](https://www.gov.za/sites/default/files/gcis_document/201503/act-20-1985.pdf). [Accessed 11 June 2019].
- Republic of South Africa. 1989. Environment Conservation Act No. 73 of 1989. Available from: [https://cer.org.za/wp-content/uploads/2014/02/73-of-1989-ENVIRONMENT-CONSERVATION-ACT\\_18-Sep-2009-to-date.pdf](https://cer.org.za/wp-content/uploads/2014/02/73-of-1989-ENVIRONMENT-CONSERVATION-ACT_18-Sep-2009-to-date.pdf). [Accessed 31 January 2019].
- Republic of South Africa. 1991. Adjustment of Fines Act 101 of 1991. Available from: [https://www.gov.za/sites/default/files/gcis\\_document/201505/act-101-1991.pdf](https://www.gov.za/sites/default/files/gcis_document/201505/act-101-1991.pdf). [Accessed 13 June 2019].
- Republic of South Africa. 1996. 'Constitution of the Republic of South Africa'. Available from: <http://www.justice.gov.za/legislation/constitution/SACConstitution-web-eng.pdf>. [Accessed 12 February 2019].
- Republic of South Africa. 1997. Abolition of Corporal Punishment Act, 1997. Gazette No. 18256, Vol 387, Cape Town, 5 September 1997. Available from: [https://www.gov.za/sites/default/files/gcis\\_document/201409/a33-97.pdf](https://www.gov.za/sites/default/files/gcis_document/201409/a33-97.pdf). [Accessed 13 June 2019].
- Republic of South Africa. 1998. National Forests Act (No. 30 of 1998). Available from: [https://www.gov.za/sites/default/files/gcis\\_document/201409/a84-98.pdf](https://www.gov.za/sites/default/files/gcis_document/201409/a84-98.pdf). [Accessed 2 June 2019].
- Republic of South Africa. 1999. National Heritage Resources Act 25 of 1999. Available from: <http://www.dac.gov.za/sites/default/files/Legislations%20Files/a25-99.pdf>. [Accessed 31 January 2019].
- Republic of South Africa. 2003. National Environmental Management: Protected Areas Act 57. Government Gazette, Vol. 464, No. 26025. Available from: [https://www.environment.gov.za/sites/default/files/legislations/nema\\_amendment\\_act57.pdf](https://www.environment.gov.za/sites/default/files/legislations/nema_amendment_act57.pdf). [Accessed 12 February 2019].
- Republic of South Africa. 2004. National Environmental Management: Biodiversity Act 10. Government Gazette, Vol. 467, No. 26436. Available from: <https://www.sanbi.org/wp-content/uploads/2018/04/>

- biodiversityact2004pdf.pdf. [Accessed 29 January 2019].
- Republic of South Africa. 2009. National Environmental Waste Act 59 of 2008 Available from: [https://www.environment.gov.za/sites/default/files/legislations/nema\\_amendment\\_act59.pdf](https://www.environment.gov.za/sites/default/files/legislations/nema_amendment_act59.pdf). [Accessed 18 February 2019].
- Republic of South Africa. 2011. Notice of the list of protected tree species under the National Forests Act, 1998 (Act no 84 of 1998). Available from: <https://www.sanbi.org/wp-content/uploads/2018/04/saprotectedtrees2011.pdf>. [Accessed 2 June 2019].
- Rodríguez JP, Beard TD, Bennett EM, Cumming GS, Cork SJ, Agard J, Dobson AP, Peterson GD. 2006. Trade-offs across space, time and ecosystem services. *Ecology and Society* 11: 28–41.
- Roxburgh L, McDougall R. 2012. Vulture poisoning incidents and the status of vultures in Zambia and Malawi. *Vulture News* 62: 33–39.
- Rushworth IA, Piper SE. 2004. Palm-nut Vulture *Gypohierax angolensis*. In: The vultures of southern Africa - Quo Vadis? Proceedings of a workshop on vulture research and conservation in southern Africa. In: Monadjem A, Anderson MD, Piper SE, Boshoff AF.(Eds). *The vultures of southern Africa - Quo Vadis?* Proceedings of a workshop on vulture research and conservation in southern Africa. p 46–50. (Birds of Prey Working Group). [http://sungura.co.uk/Library/VultureStudyGProceedings\\_final.pdf](http://sungura.co.uk/Library/VultureStudyGProceedings_final.pdf). [Accessed 23 February 2020].
- Rushworth I, Krüger S. 2014. Wind farms threaten southern Africa's cliff-nesting vultures. *Ostrich* 85: 13–23.
- SADC. 1999. Protocol on Wildlife Conservation and Law Enforcement. Available from: [https://www.sadc.int/files/4813/7042/6186/Wildlife\\_Conservation.pdf](https://www.sadc.int/files/4813/7042/6186/Wildlife_Conservation.pdf). [Accessed 16 February 2019].
- Saidu Y, Buij R. 2013. Traditional medicine trade in vulture parts in northern Nigeria. *Vulture News* 65: 4–14.
- Santangeli A, Arkumarev V, Komen L, Bridgeford P, Kolberg H. 2017. Unearthing poison use and consequent anecdotal vulture mortalities in Namibia's commercial farmland - implications for conservation. *Ostrich* 88: 147–154.
- Seymour C, Milton S. 2003. A collation and overview of research information on *Acacia erioloba* (Camelthorn) and identification of relevant research gaps to inform protection of the species. Report for Department of Water Affairs and Forestry. Contract no. 2003/089, 32 pp.
- Sharp BL, Kleinschmidt I, Streat E, Maharaj R, Barnes KI, Durrheim DN, Ridl FC, Morris N, Seocharan I, Kunene S, et al. 2007. Seven Years of Regional Malaria Control Collaboration—Mozambique, South Africa and Swaziland. *The American Journal of Tropical Medicine and Hygiene* 76: 42–47.
- Snyman J. 1999. Rüppell's Griffon breeding in Blouberg. *Vulture News* 41: 31–32.
- Sodeinde OA, Soewu DA. 1999. Pilot study of the traditional medicine trade in Nigeria. *Traffic Bulletin* 18: 35–40.
- Strasser P. 2002. Putting Reform Into Action — Thirty years of the World Heritage Convention: How to reform a Convention without changing its regulations. *International Journal of Cultural Property* 11: 215–266.
- Sundström A. 2013. Corruption in the commons: Why bribery hampers enforcement of environmental regulations in South African fisheries. *The International Journal of the Commons* 7: 454–472.
- Taylor MR, Peacock F, Wanless RM. 2015. The 2015 Eskom Red Data Book of birds of South Africa, Lesotha and Swaziland. Johannesburg, South Africa: BirdLife South Africa.
- Thompson LJ, Davies JP, Gudehus M, Botha AJ, Bildstein KL, Murn C, Downs CT. 2017. Visitors to nests of Hooded Vultures *Necrosyrtes monachus* in north-eastern South Africa. *Ostrich* 88: 155–162.
- UNEP. 2009. Stockholm Convention on Persistent Organic Pollutants (POPs). Available from: [https://www.wipo.int/edocs/lexdocs/treaties/en/unep-pop/trt\\_unep\\_pop\\_2.pdf](https://www.wipo.int/edocs/lexdocs/treaties/en/unep-pop/trt_unep_pop_2.pdf). [Accessed 16 February 2019].
- UNEP-FAO. 2017. The Revised Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade. Available from: <file:///C:/Users/IC%20PMB/Downloads/UNEP-FAO-RC-CONVTEXT-2017.English.pdf>. [Accessed 16 February 2019].
- UNEP-WCMC. 2019. Species+: Authoritative information on taxonomy, legislation, distribution and trade in MEA-listed species. Available at: [https://speciesplus.net/#/taxon\\_concepts/](https://speciesplus.net/#/taxon_concepts/). [Accessed 29 January 2019].
- UNESCO. 1972. Convention Concerning the Protection of the World Cultural and Natural Heritage (1972). Available from: <https://whc.unesco.org/archive/convention-en.pdf>. [Accessed 16 February 2019].
- United Nations. 1992. Convention on Biological Diversity 1992.
- Van Niekerk HN. 2010. The cost of predation on small livestock in South Africa by medium-sized predators. Doctoral dissertation, University of the Free State
- Van Niekerk HN, Taljaard PR, Grové B, De Waal HO. 2013. Factors affecting small livestock predation in the Western Cape Province of South Africa. 19th International Farm Management Congress. Warsaw, Poland. p 1–9. [http://wp.ifmaonline.org/wp-content/uploads/2014/08/13\\_van\\_Niekerk\\_eta1\\_P315-323v2.pdf](http://wp.ifmaonline.org/wp-content/uploads/2014/08/13_van_Niekerk_eta1_P315-323v2.pdf). [Accessed 23 February 2020].
- van Wyk E, Bouwman H, van der Bank H, Verdoorn GH, Hofmann D, Anderson MD. 2001. Persistent organochlorine pesticides detected in blood and tissue samples of vultures from different localities in South Africa. *Comparative Biochemistry and Physiology C* 129: 243–264.
- van Wyk E, Van der Bank FH, Verdoorn GH, Bouwman H. 1993. Chlorinated hydrocarbon insecticide residues in the Cape Griffon Vulture (*Gyps coprotheres*). *Comparative Biochemistry and Physiology Part C* 104: 209–220.
- Venter I. 2017. What happens when Rüppell's and Cape Vultures share a cliff? *Limpopo Mirror*. Available at: <https://www.limpopomirror.co.za/articles/news/44644/2017-10-27/>. [Accessed 12 February 2019].
- Wallace MP. 1986. Some observations on birds of prey in Peru. *Birds of Prey Bulletin* 3: 80–81.
- Wells M, Leonard L. 2006. DDT contamination in South Africa. In: *The International POPs Elimination Project (IPEP): Fostering active and effective civil society participation in preparations for implementation of the Stockholm Convention*. Prepared by Groundwork, Pietermaritzburg, South Africa. URL: [www.lpen.org](http://www.lpen.org). [Accessed 1 July 2008].
- Western Cape Province. 1974. Nature Conservation Ordinance No. 19 of 1974. Available from: <https://www.capenature.co.za/wp-content/uploads/2013/10/Nature-Conservation-Ordinance-19-of-1974.pdf>. [Accessed 14 February 2019].
- Whelan CJ, Wenny DG, Marquis RJ. 2008. Ecosystem services provided by birds. *Annals of the New York Academy of Sciences* 1134: 25–60.
- Whiting MJ, Williams VL, Hibbitts TJ. 2013. Animals traded for traditional medicine at the Faraday market in South Africa: Species diversity and conservation implications. In: *Animals in traditional folk medicine*. (p 421–473). Berlin, Heidelberg, Germany: Springer.
- Wolmer W. 2003. Transboundary conservation: The politics of ecological integrity in the Great Limpopo Transfrontier Park. *Journal of Southern African Studies* 29: 261–278.
- Yosef R, Bahat O. 2000. Habitat loss and vultures: A case study from Israel. (p 207–212). In: *Raptors at risk*. Chancellor RD, Meyburg B-U (Eds). Surrey, United Kingdom: WWGBP Hancock House.