Title: Ivory poachers and poison; drivers of Africa's declining vulture populations

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Abstract

A recent review has suggested that six vulture species in Africa may qualify for uplisting to Critically Endangered, and attributes their declining status partly to the impacts of widespread poisoning. Prior to 2012, vulture poisonings were mostly associated with illegal predator control by livestock farmers, where vultures were typically unintended victims. More recently, ivory poachers have been using poisons to kill elephants or to contaminate their carcasses specifically to eliminate vultures, whose overhead circling might otherwise reveal the poachers' presence. Between 2012 and 2014 we documented 11 poaching-related incidents in seven African countries, which collectively killed 155 elephants and 2,044 vultures. In at least two incidents the harvesting of vulture body parts (for fetish) may have provided an additional motive. We show that vulture mortality associated with ivory poaching has increased much more rapidly than that associated with other poisoning incidents, and now accounts for one-third of all vulture poisonings recorded since 1970. This recent surge in the illegal use of poisons exposes weaknesses in the regulations, for which we propose measures aimed primarily at retail controls. However, because ivory poachers already operate well outside of any legal framework, African governments require international support in applying more punitive sentencing against mass wildlife poisoning.

Arguably nature's most important scavengers, vultures provide essential ecosystem services by quickly decomposing carcasses, likely reducing the risk of disease transmission (Ogada et al. 2012). In India, the collapse of vultures has resulted in an increase in feral dogs—the main reservoir for rabies—which has subsequently led to an increase in rabies infections in humans and associated healthcare costs estimated at $34 billion (Sudarshan et al. 2007, Markandya et al. 2008). Despite their importance, nearly 70% of vultures (and condors) are listed as threatened or near-threatened by the IUCN (BirdLife International 2015).

Populations of African vultures are at critically low levels, having declined by an average of 63% over the past 30 years. As a result, six out of eight species now qualify for uplisting to critically endangered (Ogada et al., 2015). Over the past 45 years the major quantifiable threats to Africa's vultures have been poisoning (61% of recorded deaths) and unsustainable harvesting for trade in fetish (29% of recorded deaths) (Ogada et al., 2015). Across Africa poisoning is most often associated with illegal predator control, where lions, hyaenas, leopards, jackals and other predators are targeted by livestock farmers, vultures typically being the unintended victims The use of poisons to kill wildlife is silent, cheap, easy and effective, and due to its illicit nature the majority of incidents are never found or reported, making the true impacts on populations substantially higher and difficult to quantify (Vyas 1999, Ogada 2014).

Beginning in 2012, a substantial new threat to Africa's vultures emerged as a consequence of a spate of elephant poisonings linked to ivory poaching. Prior to 2012 there were a few, mostly anecdotal reports linking vulture mortality to elephant poisoning (Ledger, 1980; Truscott, 2011; Roxburgh & McDougall, 2012), which indicate that this threat likely began earlier but remained

poorly documented and under-reported. During 2012-2014, deaths associated with these incidents account for one-third of all vulture mortalities recorded since 1970 (see Ogada et al., 2015). Typically, vultures are poisoned in large numbers while feeding on contaminated elephant carcasses, the most commonly reported species being White-backed *Gyps africanus* followed by Lappet-faced Vulture *Torgos tracheliotos*. However, in the majority of incidents the species of vulture was not determined due to observer inexperience, or to the carcasses' advanced state of decay. For these reasons no information on age-class has been reported. While Hooded *Necrosyrtes monachus,* White-headed *Trigonoceps occipitalis* and Cape vultures *G. coprotheres* have also been recorded, these last two are frequently misidentified as White-backed Vultures by field-based personnel who often report on these incidents, but have limited bird identification skills. In addition to vultures, other scavenging species are killed at poisoned elephant carcasses, including hyaenas and Bateleurs *Terathopius ecaudatus*.

During March 2012 to July 2014 there were 11 known incidents in which vultures have been poisoned at illegally killed elephant carcasses, in seven sub-Saharan African countries (Table 1). Of 155 elephants killed, 135 were associated with one large incident in Zimbabwe, where cyanide was used. Collectively, the 11 incidents have caused the deaths of at least 2,044 vultures (mean = 186 vultures per incident; range = 1–500), as well as one lion, five hyaenas, two African wild dogs and two Bateleurs, illustrating the disproportionate vulture mortality associated with ivory poaching. Although the majority of incidents reported here occurred in southern Africa, we have heard of at least one unsubstantiated case from East Africa.

The rate of increase in vulture poisoning mortality associated with ivory poaching over these three years greatly exceeds that associated with other types of poisoning incidents over the past 45 years (Fig. 1). Similarly, the number of vulture fatalities associated with each ivory poaching incident (median = 191; n = 11) is more than 30 times that recorded in other poisoning incidents since 2012 (median = 6; n = 33). Since 2014 ivory poaching incidents leading to multiple vulture fatalities have continued, most recently in northern Kruger N.P., in September 2015 (A.B. pers. obs.). We emphasize again that due to the illicit nature of poisoning incidents and under-reporting, the number of fatalities reported here is likely an underestimate. While it may appear that vultures are merely unintended victims in these incidents poachers have a strong motive to kill vultures, whose overhead circling is an age-old indicator of a dead animal lying below. Because vultures inadvertently perform the role of aerial sentinels, revealing the poachers' locations to local wildlife authorities, they have become targets in their own right (Roxburgh & McDougall, 2012; Groom et al., 2013; Ogada, 2014). In at least two incidents, in Zimbabwe (Groom et al., 2013) and South Africa (A. Botha., see Table 1), the poachers had an additional motive, to kill vultures for their body parts (typically the head), which are used for fetish.

Worryingly, there is evidence that the use of poisons to kill elephants and rhinos in sub-Saharan Africa is increasing. The first known report of rhino poisoning in South Africa appeared in 2005 (Reuters, 2005), while the intensive and widely reported use of poisons to kill elephants elsewhere in sub-Saharan Africa began in 2012. A total of six rhinos and 181 elephants are known to have been poisoned in 17 incidents in Botswana, Democratic Republic of Congo, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe (Table 1; Reuters, 2005; The East African, 2012; Guardian, 2012; Moonga, 2013; EWT, unpub. data). These numbers are

surely underestimates of the actual totals, due to both under-reporting and to the difficulty in obtaining mortality data related to poisoning for elephants and rhinos. Recent killing methods include lacing elephant delicacies like watermelons, oranges and pumpkins (and cabbages in the case of rhinos) with pesticides (e.g. aldicarb and carbofuran), and poisoning salt licks and waterholes with pesticides or cyanide. While all these methods kill non-target species and are environmentally destructive, the tainting of waterholes is particularly reckless due to the myriad of species that rely on them, including humans and livestock.

The recent surge in the use of poisons for poaching represents a further exploitation of weak regulations and enforcement with regards to the accessibility and misuse of highly toxic pesticides and other substances. As a first step, African governments must ensure that pesticides listed on Annex III of the Rotterdam Convention (Rotterdam Convention, 2015) are no longer freely available over the counter, restricting their sale through a small number of licensed and trained distributors, and sold only in limited quantities to individual customers. Distributors must maintain a registry of the names and contact information of customers, and of the quantities of these pesticides sold, so that their misuse can be more easily tracked. Illegal importation or smuggling of these substances should also be stamped out at ports of entry.

International donors supporting anti-poaching efforts need to recognise the seriousness of this threat, and work with their African partners to curtail it. Industries involved in the manufacture or use of the most abused poisons (aldicarb, carbofuran and cyanide) must take greater responsibility for their misuse and step up with innovative solutions to phase out their manufacture and use. We further recommend:

1) Strengthening the legal framework to prosecute offenders and their employers;
2) Improving laboratory testing facilities in order to prosecute offenders;
3) Education with regards to pesticide regulations, including training of law enforcement officers, sensitising of magistrates, and national campaigns to raise awareness;
4) Training rangers and other field personnel to effectively manage incidents, including neutralising poisoning sites, and collecting reliable data on incidents so that preventative actions can be focused;
5) Establishing one continent-wide database to monitor the scale and distribution of poisoning incidents;
6) Investigating the effects on human health of ingesting meat, or of using vulture body parts harvested from poisoned carcasses.

Unrestricted access to highly toxic pesticides and poisons is having devastating effects on Africa's natural resources and the people who rely on them. As billions of dollars are being spent on the war against poaching, poachers are adopting increasingly secretive and lethal means of felling pachyderms, with devastating consequences for vultures. Wildlife authorities in many African nations are overwhelmed by the increasing use of poisons for poaching (Guardian, 2012; Moonga, 2013), which includes the widespread harvesting of bushmeat and fish—with unknown consequences for human health (de Feu, 2001; Opare-Ankrah, 2007; Odino, 2011; Mzumara et al., 2015).

Whether these illicit activities will prove responsive to the measures advocated here remains to be seen, given that the recent rapid acceleration in vulture poisoning is the work of elephant poachers; individuals already operating well outside of any legal framework, and for whom the

implementation of trade controls is likely to be of little consequence. However we should recognise that the intensity with which poisons are now being used to kill elephants, rhinos, vultures and, incidentally, a host of other species, represents a paradigm shift. African governments should be afforded the international legislative backing and material support required to apply much more punitive sentencing in the particular case of poaching with poisons.

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Biogeographical sketches

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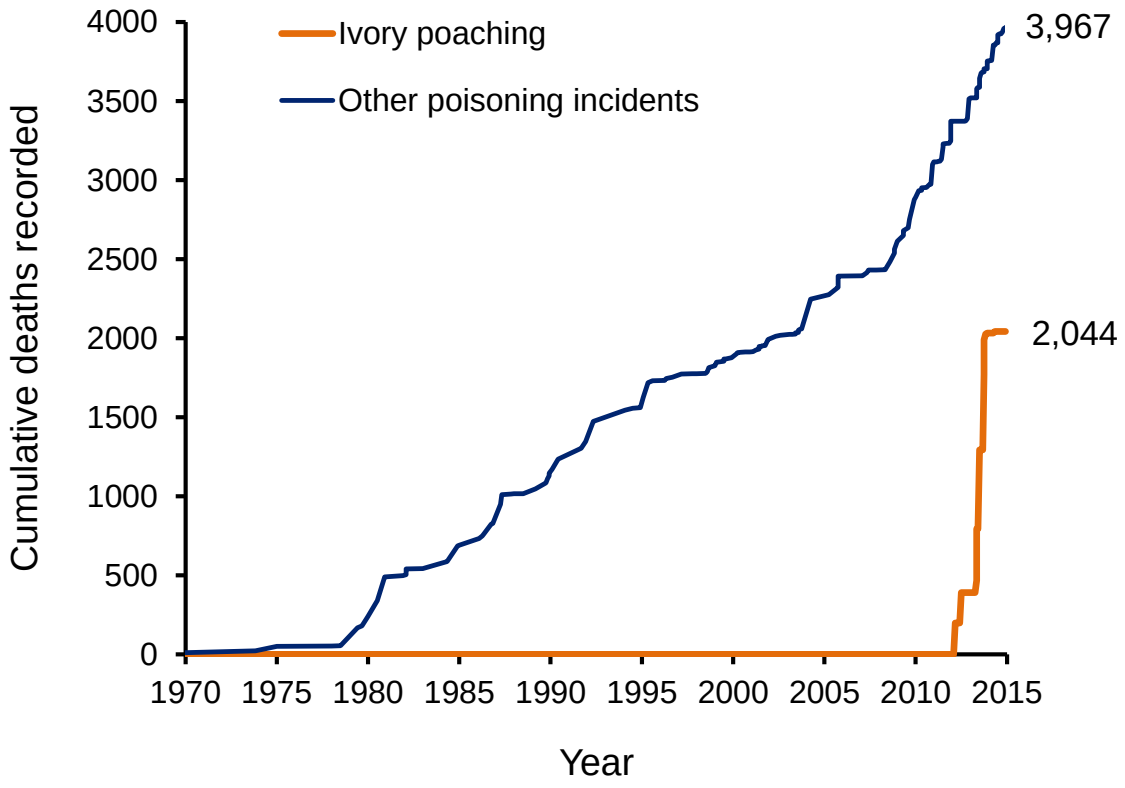
Phil Shaw's research is focused on bird conservation and on the contrasting life histories of temperate and tropical birds.

Table 1. Details of 11 vulture poisoning incidents at elephant carcasses poached for ivory in seven African countries.

Year	Month	Country	Location	Number of vultures poisoned	Number of elephants poisoned	Reference
2012	March	Botswana	Kwando	200*	1	Anonymous 2012
2012	July	Zimbabwe	Gonarezhou National Park	191	1	Groom et al. 2013
2013	May	Botswana	Kwando	326	3	McNutt et al. 2014
2013	May	Mozambique	Gonarezhou Transfrontier Park	78	1	T. Otto, personal communication
2013	July	Namibia	Bwabwata National Park	500*	1	IUCN 2013
2013	October	Zimbabwe	Hwange National Park	219	135	Zimbabwe Parks & Wildlife 2013; Muboko et al. 2014
2013	October	Zambia	North Luangwa National Park	476	4	Sichone 2014
2013	November	South Africa	Imfolozi Game Reserve	37	1	A. Botha unpub. data
2013	December	Zambia	Mfume, South Luangwa	6	1	R. McRobb, personal communication
2014	May	DRC	Virunga National Park	10	3	African Conservation Foundation 2014
2014	July	Zimbabwe	Zambezi National Park	1	4	Zimbabwe Parks & Management Authority 2014

* Estimates based on the number of vulture skulls and other bones found at the scene.

Fig. 1. Cumulative African vulture deaths caused by illegal poisoning (n=6011), associated either with ivory poaching (n=2044), in which vultures are targeted, or with other types of poisoning incident (n=3967), in which vulture deaths are typically incidental.


Ivory poaching
Other poisoning incidents
3,967
2,044
Cumulative deaths recorded
4000
3500
3000
2500
2000
1500
1000
500
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
Year