African vultures under the gun as lead ammunition takes a toll

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- *Fragments of lead ammunition in abandoned animal carcasses may be poisoning Africa's vultures, a new study has found.*
- *Researchers found elevated blood lead levels among vultures in hunting areas and during hunting season in Botswana.*
- *This study adds to the growing evidence from around the world that identifies lead ammunition as a problem for a number of bird species.*
- *South African hunters are sympathetic to vultures but oppose a total ban on lead ammunition, citing the cost and availability of lead-free alternatives.*

Lead bullet fragments in animal carcasses left behind by game hunters could be poisoning vultures in Botswana, according to a new study that echoes similar findings from elsewhere around the world.

The African white-backed vulture (*Gyps africanus*) is already under grave threat. Its populations have declined by as much as 90 percent across much of its range, and the species is now classified as critically endangered on the IUCN Red List. Much of the catastrophic decline has come from the vultures consuming poisoned carcasses left behind by poachers wanting to prevent the birds from drawing attention to the animals they kill, or by pastoralists intending to kill predators to protect their livestock.

A new study published in *Science of the Total Environment* now suggests that vultures face yet another threat: poisoning from lead ammunition.

'No other logical explanation'

Hunting wildlife, both for meat and sport, has long been a popular pursuit across the southern African nations. Botswana was considered a premier game-hunting destination prior to the ban of all hunting on state-owned land in 2014. Hunters often leave the internal organs of carcasses, known as gut piles, or even entire carcasses out in the bush. This poses a problem for the vultures, scientists say.

"Hunting is such a huge industry in Africa which led us to investigate whether vulture populations in Africa could be at risk of poisoning from ingesting spent ammunition,"

said lead author Rebecca Garbett, a researcher with the non-profit Raptors Botswana and a doctoral student at the University of Cape Town, South Africa. “When an animal is shot, the lead bullet will release fragments widely throughout the carcass. Vultures can then ingest fragments while they are feeding.”

To assess the possible risk of lead poisoning from ammunition, Garbett and her team captured and drew blood from 566 vultures at 15 locations, in both hunting and non-hunting areas across Botswana, between 2012 and 2015. The researchers did this all year round to see if blood lead levels changed between the hunting season, from April to November, and the non-hunting season, from December to March.

“Thirty percent of almost 600 white-backed vultures that we tested had elevated blood lead levels above what could be considered background exposure,” Garbett said.

The team also found some distinct patterns: vultures that had been captured from hunting areas had higher blood lead levels than those captured from non-hunting areas. Moreover, vultures captured during hunting season had higher blood lead levels than those captured outside of hunting season. The researchers say these results suggest that lead ammunition is likely responsible for the vultures’ elevated blood lead levels.

“There is no other logical explanation for this pattern, other than these higher levels were linked to lead ammunition associated with hunting,” said co-author Arjun Amar, a conservation biologist at the University of Cape Town, who oversaw the study.

Vinny Naidoo, a professor of veterinary pharmacology at the University of Pretoria, South Africa, who was not involved in the study, agreed that lead poisoning could be affecting vultures.

“Lead is a neurological toxin and commonly affects the brain,” Naidoo said. “The most common clinical signs are weakness, stargazing, blindness, seizures, depression and inability to walk.”

Lead can also affect vultures in less visible ways, such as reduced breeding success with infertile eggs, and weak or abnormal chicks, he added.

However, Naidoo cautioned against stating definitively that ammunition was the only source of the vultures’ high blood lead levels.

There is “certainly a strong causal link,” Naidoo said. But it could be argued that there are factors other than lead ammunition that may be poisoning vultures, he added.

Where's the lead from?

One finding that Garbett's team did not expect was that blood lead levels of vultures in both hunting and non-hunting areas increased after the 2014 hunting ban. The researchers think this increase can be explained by the vultures feeding on carcasses in private game farms where hunting still continues (the 2014 ban applies only to state-owned land) or by a possible increase in illegal hunting after the ban.

According to Naidoo, the high blood lead levels post-ban could also indicate that there were other potential sources of lead besides ammunition. In a study published in 2016, Naidoo and other researchers concluded that environmental factors explained some of the elevated blood lead levels in three African vulture species that his team examined in South Africa. One factor he identified was high level of lead in soil from leaded fuels regularly used in South Africa until 2006. There was still a proportion of lead poisoning the research team was unable to account for, but they said it could be explained by leaded ammunition.

One challenge in pinpointing the source of lead in the blood of vultures is that the birds range widely.

"For Lappet-faced vultures [*Torgos tracheliotos*] that were tagged in Botswana we know they spent time in all of the five countries surrounding Botswana," Amar said. These are Namibia, South Africa, Zimbabwe, Zambia and Angola.

When vultures cover such a wide area, proving conclusively that lead ammunition is the leading cause of increased lead levels in the birds' blood can be challenging.

"Nonetheless, I'm convinced that leaded bullets are a problem," Naidoo said.

A widespread problem

The findings square with similar research done elsewhere.

"This is an expected result because it has been found in many other areas around the world," said Rafael Mateo, a toxicology expert from the Institute for Game and Wildlife Research (IREC) in Spain.

In the U.S., for example, conservationists have been concerned since the 1930s about waterfowl being poisoned by lead shot. Shotguns commonly used for hunting waterfowl fire cartridges that contain tiny lead pellets known as shot. When hunters fire over water, a large amount of shot inevitably enters the water. Many waterfowl swallow small, hard pebbles to grind up food in their gizzards, and the birds that mistake the shot for pebbles then become exposed to lead poisoning. Lead

ammunition is now a widely accepted threat to waterfowl around the globe, by hunters and conservationists alike.

Lead poisoning has also been identified as a threat to the critically endangered California condor (*Gymnogyps californianus*), with the state of California banning the use of lead ammunition for hunting within the condor's range in 2008.

In 2012, Myra Finkelstein and Donald Smith of the University of California, Santa Cruz, published a study showing that lead ammunition was still the major source of lead poisoning in California condors despite the 2008 ban. To arrive at this conclusion, the researchers matched the chemical makeup of locally used lead ammunition to the lead found in the birds' blood.

"Our studies show that lead-poisoned condors most commonly exhibit blood lead isotopic signatures that match the signatures in lead ammunition," Smith said. "We have only encountered a small number of birds lead-poisoned from sources other than ammunition."

Finkelstein and Smith's research was an important part of the evidence that convinced the California Fish and Game Commission to ban the use of lead ammunition for all wildlife hunting statewide in October 2013. The ban comes into effect in 2019, and Finkelstein said she was hopeful it would reduce lead poisoning rates among California condors.

A loaded subject

Given the findings of their own study, Garbett and Amar, too, are now calling for a similar ban in southern Africa.

"A regional ban on the use of lead ammunition is needed — but a national ban would be a start," Garbett said.

However, "the hunting industry may not be so convinced without more proof," Naidoo said. The use of lead ammunition has been a hotly debated topic across the globe, with strong opinions on both sides.

"The hunting lobby … is very strong and actively engaged in environmental conventions," said Masumi Gudka, vulture conservation manager with BirdLife International.

At the IUCN World Conservation Congress in Hawaii in 2016, for instance, conservationists proposed a motion to phase out all lead ammunition. FACE, the European Federation of Associations for Hunting and Conservation, fought fiercely against this, resulting in a watered-down version of the motion requesting

governments to limit the use of lead shot over wetlands and in areas where scavengers are at particular risk.

Similarly, in the U.S., a ban on lead ammunition for hunting on state lands was introduced as one of the last acts of the Obama administration in 2017. The ban was immediately overturned by the new secretary of the interior, Ryan Zinke, a keen hunter himself — a move that was strongly applauded by pro-gun groups like the National Rifle Association.

In both instances, pro-hunting organizations questioned the scientific basis on which the bans were proposed, and the issue became highly politicized.

There are no major hunting associations in Botswana, but Mongabay spoke with three executive members of the South African Hunters and Game Conservation Association (SAHGCA). Although all three members were opposed to an all-out ban on lead ammunition, their position was sympathetic to the plight of Africa's vultures.

"We cannot condone any activities or products that could be detrimental to scavenging birds," said Gerhard Verdoorn, president of the SAHGCA.

The SAHGCA reviewed the evidence on lead two years ago and says it believes it's possible to mitigate against vulture lead poisoning without banning lead ammunition. According to Fred Camphor, chief executive of the SAHGCA, the only "materially supported evidence" they were able to find directly linking lead ammunition to lead poisoning in vultures was that of the California condor.

Based on this evidence, the SAHGCA has advised its members to remove the wound channel, the path that a bullet takes through the animal, and burn any removed material to ensure it is not ingested by vultures or other scavengers.

Alternative ammunition is available: premier bullets have the lead core bonded to the outer shell or jacket of the bullet, leaving minimal lead scatter in the target's flesh upon impact. There are also monolithic bullets, made from solid copper or brass, that are totally lead-free. But at roughly three times the price of regular ammunition, the cost and limited availability of these alternatives remain the main barriers for a ban on lead ammunition, said Brian Reilly, vice president of conservation at the SAHGCA.

Despite the higher costs, Verdoorn said he believed that persuading members to switch to alternatives for hunting was a realistic proposition, so long as the cheaper lead alternatives could still be used on shooting ranges.

"The percentage of bullets used for hunting compared to that used for target shooting is very small," he said. "We are already convincing our members to use these [lead-free] bullets for hunting."

Verdoorn added that, in general, hunters had a positive attitude toward vultures, and many were simply not aware that lead ammunition may be poisoning Africa's vultures.

"I am sure once they know, their acceptance of monoliths and premier bullets will rise," he said. "If we have to make small sacrifices to protect vultures we will do so."

UCSC's Smith, who has studied the effects of the partial hunting ban in California and found it not very effective, said a total ban on lead ammunition was necessary.

"My professional opinion is that industrial uses of lead … should be eliminated, especially when a viable alternative is available, as it is for ammunition," he said.

Despite their precipitous declines, African vultures have not captured the public conscious and support in the same way other charismatic African species like elephants have. And without more support, funding, public awareness and political will, their position remains perilous.

Garbett said more research was needed to fully understand the impacts of lead ammunition. But with time running out for Africa's vultures, lead ammunition should be a comparatively easy issue to address, she said.

"We hope that the fight for vultures only gets bigger and stronger," Garbett said. "However, we may already be too late."

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