

Science for Environment Policy

High lead exposure for griffon vultures in Spain correlates with soil lead and ammunition from game hunting

Maps of the risk of griffon vultures' exposure to lead in north-eastern Spain have been produced in a new study. High-risk places are mountainous areas where there are high levels of bioavailable sources of lead in the soil, but also where game hunting is prevalent, and carcasses scavenged by the birds may contain lead ammunition.

Lead is a highly poisonous metal that at high exposure levels is fatal to people and wildlife and even at lower exposure levels can cause adverse health effects. For some wildlife populations, such as scavenging raptors, (birds of prey, such as vultures), lead ammunition in the carcasses of shot animals they eat is a major cause of lead poisoning.

In the European Union (EU), there is no harmonised legislation on lead in shot; different countries have different regulations governing the use of lead ammunition for hunting. For example, Denmark and the Netherlands have banned the use of lead shot for all hunting, and the use of lead ammunition is partly or fully banned in wetlands in 14 Member States. The European Commission has requested that the European Chemicals Agency ([ECHA](#)) assesses the risk of lead in ammunition to human health and the environment, along with the need for EU-wide action beyond any national measures already in place. They have also requested that the ECHA starts to collect information for the assessment of the risk and the socio-economic impact for any other uses of lead ammunition, including hunting in terrains other than wetlands, and target shooting, with a view to preparing, if necessary, another Annex XV dossier for restriction under the Registration, Evaluation, Authorisation and Restriction of Chemicals ([REACH](#)) legislation¹.

This study investigated the exposure to lead of griffon vultures (*Gyps fulvus*) in north-eastern Spain. The study area covers almost 50 000 km² and around 21% of the Spanish and 15% of the European griffon vulture populations are found there. The area is characterised by intensive pig, poultry and rabbit farming in the plains, and cattle, goat and sheep farming and big-game hunting in the Pyrenees in the north and Iberian mountains in the south and west.

The threat from bovine spongiform encephalopathy (BSE), more commonly known as mad cow disease, has meant that farmers have to remove dead animals from their land that might otherwise have been eaten by the vultures. Conservation concerns for the birds resulted in the authorities setting up 50 feeding stations, which are commonly provided with dead livestock from the area.

To determine the vultures' exposure to lead, the researchers measured lead concentrations in blood samples taken from 691 vultures, captured year-round at 25 feeding stations during the period 2008–2012. They considered the background concentration of lead in the blood from environmental sources — 200 nanograms of lead per millilitre of blood (ng/ml), according to literature. The researchers also measured the birds' wing spans and weighed the birds.

The researchers found 310 (almost 45%) of the birds had levels of lead in the blood above the 200 ng/ml background level, 29 (less than 5%) of the vultures had clinically high blood-lead concentrations in the 500–1 000 ng/ml range and 10 (approximately 1.5%) of the vultures were exposed to potentially lethal lead concentrations greater than 1 000 ng/ml.

Continued on next page.



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1. [Request to the European Chemicals Agency to prepare restriction proposals conforming to the requirements of Annex XV to REACH](#)

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To trace the source of lead exposure, the researchers also analysed the composition of lead isotopes (different forms of lead atoms that vary in atomic mass) in the blood of 40 vultures. This analysis found that the signature of lead in the blood of birds with blood-lead levels more than 470 ng/ml was similar to the signature of lead found in lead ammunition sourced from different parts of the world.

Isotopic analysis also revealed that griffon vultures with blood-lead levels more than 470 ng/ml had isotope signatures that were consistent with lead from soil sources. Lead is more readily bioavailable in soils with high lead levels or with a low soil pH. Vultures might consume lead from the soil through lead in the grazing livestock they scavenge.

Using their results, the researchers modelled blood-lead concentrations for griffon vulture populations across the region and produced maps to illustrate the risks of lead exposure for the birds. These maps revealed that the highest risk of lead exposure above the 200 ng/ml threshold was in almost 18% of the region and concentrated in the north and central south-west mountain regions. These are the areas that have extensive game hunting. That these high-risk areas also contain soils that have naturally high lead levels and low soil pH is concerning, as point sources of lead from ammunition may add to the burden of lead in griffon vultures.

In contrast, the maps revealed that the plain areas where poultry, rabbits and pigs are intensively farmed had the lowest risk of lead exposure for the griffon vultures. The maps also highlighted that the highest risks occurred in winter, covering almost 44% of the area, where game hunting is particularly prevalent in autumn and winter months.

Griffon vultures are widely distributed apex species. They cover large distances when looking for carrion and eat carcasses, including those from hunting, which other species, such as the threatened Spanish imperial eagle *Aquila adalberti*, also eat. All these characteristics make griffon vultures useful as biomonitors of lead in the environment. Given their food is subsidised by livestock at feeding stations and hunting carcasses in the field, the researchers say they are particularly suited to identify potential risks to people who eat game meat.

The researchers say their maps can help managers to target high-risk areas and take suitable action, such as controlling the use of lead ammunition in these places to minimise exposure of wildlife and people to lead. The researchers further recommend that the presence of lead should be minimised (e.g. in hunting ammunition, mines, etc.) even in those areas where feeding stations have been established to conserve avian scavengers through the provision of alternative and safe food resources.

This study could be useful in the assessment of risks of lead in ammunition to human health and the environment, particularly in light of the ongoing assessment of the ECHA concerning possible REACH restrictions.

