First confirmed case of lead poisoning in the endangered Egyptian Vulture (*Neophron percnopterus*) in the Balkans

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Introduction

Incidents of lead poisoning in birds have been continuously reported from all around the world (Fisher *et al.* 2006). There are different sources that can cause lead poisoning such as contaminated soil that can be found in the vicinity of mines and industrial plants (Garcia-Fernandez *et al*. 1995, Beyer *et al.* 2000) or sludge from sewage treatment facilities that is disposed in agricultural land (Pattee & Pain 1995) but the most common source causing lead toxicosis in birds is the ingestion of lead ammunition commonly used for hunting (Miller *et al.* 2002, Fisher *et al.* 2006). Birds of prey are one of the main groups affected by exposure to lead impacting several threatened species such as the White-tailed Eagle (*Haliaeetus albicilla*) and the Spanish Imperial Eagle (*Aquila adalberti*) (Mateo 2009). Vultures are particularly susceptible to lead ingestion from carcasses with embedded lead shot due to their scavenging nature and several cases

of poisoned vultures have been recorded mainly in Spain (Mateo *et al.* 1997, Gangoso *et al.* 2009, Rodriguez-Ramos *et al.* 2009). Here we report the case of an Egyptian Vulture (*Neophron percnopterus*) found in Greece with high levels of lead in the blood. This represents, to the authors' knowledge, the first confirmed lead poisoning incident in the species eastern-European range.

A five years old Egyptian Vulture was found alive on 30 April 2014 in Western Macedonia region (40°24'N, 21°30'E), Greece, by two forest wardens working in the Kozani Forestry Service. The bird originated from Bulgaria, where it had been ringed as a chick in the nest in 2010 by the Bulgarian Society for the Protection of Birds / Birdlife Bulgaria. It was initially admitted to the Wildlife First Aid Center in Kastoria (North-western Greece) and then moved to the more specialized ANIMA Wildlife Rescue Center in Athens (http://www.wild-anima.gr). The vulture weighed 1900 g [normal weight for adult is 1600-2200 g (Del Hoyo *et al.* 1994)] and showed extreme head and leg weakness, anorexia, dehydration and green faeces. There was not any apparent sign of trauma. We suspected the ingestion of a poisonous substance and we administered immediately intramuscular ultra-carbon charcoal plus 1 ml Dexamethasone as well as intramuscular cortisone and antibiotics in order to stabilize the animal before subsequent analyses; after that, every day we administered a total of 150 ml of fluids (Ringer's solution intravenously, Ringer's solution together with dextrose and vitamin B subcutaneously, and chicken broth with dextrose orally). Blood analysis was conducted in the Hellenic Veterinary Laboratories in Athens and the results (Table 1) showed an abnormal level of both Aspartate Aminotransferase (SGOT-AST) and Creatinine Phosphokinase (CPK) with serum values of 1298 IU/L and 3451 IU/L respectively. We also detected slight increase in the number of lymphocytes in the blood (i.e. lymphocytosis) that probably was a response to the stress of handling and treatment. Blood lead levels were extremely high, measuring 3210 μg/L (values of more than 1000 μg/L are considered toxic; Polo *et al.* 1992, Fransson 1996) thus confirming lead poisoning. X-rays revealed the absence of shots embedded in the vulture's body but since lead is rapidly dissolved due to the low PH in raptor stomachs, it can be absorbed and cause sudden illness or death (Gill & Langelier 1994). Thus

it is possible that the vulture might have fed on the carcass of an animal killed by lead shots. Such cases of lead poisoning represent the 24% of cases that involve raptors having ingested lead shots (Kenntner *et al.* 2005).

Table 1: Results of biochemical analysis carried out on a lead poisoned adult Egyptian Vulture (*Neophron percnopterus*) when it was admitted to ANIMA wildlife rescue center (3 May 2014) and after 10-day treatment (13 May 2014).

Analyses	**Results**		**Reference values**[1,2]
	3rd May 2014	13th May 2014	
Creatinine Phosphokinase (CPK) (IU/L)	3451	2509	346-464
Aspartate Aminotranferase (SGOT-AST) (IU/L)	1298	674	58.9-77.1
Protein (g/dL)	4.3	5.4	3.1-4.8
Haematocrit (%)	51	56	38-48
Lead (μg/L)	3210		<200: Background 200-1000:Subclinical >1000: Toxic

[1]: Polo *et al.* 1992

[2]: Fransson 1996

Once the vulture had recovered after 10-day treatment it was tagged with a satellite transmitter and released back in the area where it had been found. The bird eventually left this area and moved to north-eastern Greece, more than 350 km away.

The Egyptian Vulture is rapidly declining throughout its global range and is thus listed as "Endangered" in the IUCN Red List of Threatened Species (BirdLife 2014) with populations in Europe declining around 50% the last 50 years (Iñigo *et al.* 2008). Specifically in the Balkans the situation is worse, as the species has suffered a steep decrease of 80% in the last 30 years, at an estimated rate of 6% per year in the last decade (Velevski *et al.* 2015). This is thought to be due to a combination of several known threats such as poisoning (Skartsi *et al*. 2014), electrocution (Angelov *et al.* 2011) and direct persecution in their wintering grounds (Arkumarev *et al.* 2014). Lead poisoning is an additional threat that may be overlooked. The establishment of facilities that can perform toxicological analysis of vultures is needed in the Balkans in order to assess the threat, since any mortality that can be avoided especially in such a small population - less than 70 pairs left in the whole of the Balkans (Velevski *et al*. 2015) - is of key conservation importance. Lead shots and bullet fragments have been recognized as main sources of lead contamination in birds (Kendall *et al.* 1996 but see Pikula *et al.* 2013) and some countries in Europe have developed regulations against the use of lead shot for hunting (Mateo 2009); in Greece the use of lead shot for hunting is only banned in wetlands which helps some but not all species vulnerable to lead poisoning. Moreover, the hunting season in Greece ends each year on 28 February, so in the case we here report the lead ingested by the Egyptian Vulture most probably originated from an illegal hunting event. It is important that governments in the Balkans enforce any existing laws banning the use of lead ammunition, oblige hunters to comply with the hunting periods and educate hunting associations in order to restrict the effects of lead ammunition in the environment. Hunters can also contribute in this direction by shooting only the prey they can retrieve and by removing all the remains of hunted animals from the countryside. In addition, the construction of networks of small supplementary feeding stations in the areas where the last pairs of Egyptian Vulture survive could help mitigate

the problem in the short-term and at the same time also promote the conservation of other vulture species and opportunistic scavengers. Other key conservation measures suggested, although with results in the longer-term, are a complete lead ammunition ban combined with the promotion of non-toxic alternatives (e.g. steel) thus preventing endangered species such as the Egyptian Vulture suffering the additional burden of lead toxicosis, which can seriously impact the population as a whole.

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References

Angelov, I., Hashim, I. & Oppel, S. 2011. Persistent electrocution mortality of Egyptian Vultures Neophron percnopterus over 28 years in East Africa. *Bird Conservation International* 23: 1-6.

Arkumarev, V., Dobrev, V., Abebe, Y. D., Popgeorgiev, G. & Nikolov, S. C. 2014. Congregations of wintering Egyptian Vultures Neophron percnopterus in Afar, Ethiopia: present status and implications for conservation. *Ostrich* 85: 139-145.

Beyer, W. N., Audet, D. J., Heinz, G. H., Hoffman, D. J. & Day, D. 2000. Relation of waterfowl poisoning to sediment lead concentrations in the Coeur d'Alene River Basin. *Ecotoxicology* 9: 207-218.

BirdLife International. 2014. Species factsheet: *Neophron percnopterus*. Downloaded from http://www.birdlife.org on 29/10/15

Del Hoyo, J., Elliot, A. A. & Sargatal, J. 1994. *Handbook of the Birds of the World, Vol. 2. New World Vultures to Guineafowl.* Ediciones Lynx, Barcelona, Spain.

Fisher, I. J., Pain, D. J. & Thomas, V. G. 2006. A review of lead poisoning from ammunition sources in terrestrial birds. *Biological Conservation* 131: 421-432.

Franson, J. C. 1996. Interpretation of tissue lead residues in birds other than waterfowl. In: Beyer, W. N., Heinz, G. H. & Redmon-Norwood, A. W. (Eds). Environmental Contaminants in Wildlife: Interpreting Tissue Concentrations, pp. 265-279. Lewis Publishers, Boca Raton.

Gangoso, L., Alvarez-Lloret, P., Rodríguez-Navarro A. A., Mateo, R., Hiraldo, F. & Donazar, J. A. 2009. Long-term effects of lead poisoning on bone mineralization in vultures exposed to ammunition sources. *Environmental Pollution* 157: 569-574.

García-Fernández, A. J., Sánchez-García, J. A., Jiménez-Montalbán, P. & Luna, A. 1995. Lead and cadmium in wild birds in southeastern Spain. *Environmental Toxicology and Chemistry* 14: 2049-2058.

Gill, C. E. & Langelier, K. M. 1994. Acute lead poisoning in a bald eagle secondary to bullet ingestion. *The Canadian Veterinary Journal* 35: 303-304.

Iñigo, A., Barov, B., Orhun, C. & Gallo-Orsi, U. 2008. Action plan for the Egyptian Vulture Neophron percnopterus in the European Union. BirdLife International and European Commission, Brussels

Kendall, R. J., Lacker, T. E., Bunck, C., Daniel, B., Driver, C., Grue, C. E., Leighton, F., Stansley, W., Watanabe, P. G. & Whitworth, M. 1996. An ecological risk assessment of lead shot exposure in non- waterfowl avian species: Upland game birds and raptors. *Environmental Toxicology and Chemistry* 15: 4-20.

Kenntner, N., Tataruch, F. & Krone, O. 2005. Risk assessment of environmental contaminants in white-tailed sea eagles (Haliaeetus

albicilla) from Germany. In: Pohlmeyer, K. (Ed.). Extended Abstracts of the XXVIIth Congress of the International Union of Game Biologists, pp. 125-127. Hannover, Germany.

Mateo, R. 2009. Lead poisoning in wild birds in Europe and the regulations adopted by different countries. In: Watson, R. T., Fuller, M., Pokras, M. & Hunt, W. G. (Eds). Ingestion of lead from spent ammunition: implications for wildlife and humans, pp. 71-98. The Peregrine Fund, Boise.

Mateo, R., Molina, R., Grifols, J. & Guitart, R. 1997. Lead poisoning in a free ranging griffon vulture (Gyps fulvus). *Veterinary Record* 140: 47-48.

Miller, M. J. R., Wayland, M. E. & Bortolotti, G. R. 2002. Lead exposure and poisoning in diurnal raptors: a global perspective. In: Yosef, R. M., Miller, M. L. & Pepler, D. (Eds). Raptors in the New Millennium, Proceedings of the Joint Meeting of the Raptor Research Foundation and The World Working Group on Birds of Prey and Owls, pp. 224-245. Eilat, Israel.

Pattee, O. H. & Pain, D. J. 2003. Lead in the environment. In: Hoffman, D. J., Rattner, B. A., Burton, G. A., Jr. & Cairns, J., Jr. (Eds). Handbook of ecotoxicology, pp. 373-408. CRC Press, Boca Raton.

Pikula, J., Hajkova, P., Bandouchova, H., Bednarova, I., Adam, V., Beklova, M., Kral, J., Ondracek, K., Osickova, J. & Pohanka, M. 2013. Lead toxicosis of captive vultures: case description and responses to chelation therapy. *BMC Veterinary Research* 9: 11.

Polo, F., Celdran, J., Peinado, V., Viscor, G. & Palomeque, J. 1992. Hematological values for four species of birds of prey. *Condor* 94: 1007-1013.

Rodriguez-Ramos, J., Gutierrez, V., Höfle, U., Mateo, R., Monsalve, L., Crespo, E. & Blanco, J. M. 2009. Lead poisoning in wild birds in Europe and the regulations adopted by different countries. Extended abstract In: Watson, R. T., Fuller, M., Pokras, M. & Hunt, W. G. (Eds). Ingestion of lead from spent ammunition: implications for wildlife and humans, pp. 71-98. The Peregrine Fund, Boise.

Skartsi, T., Dobrev, V., Oppel, S., Kafetzis, A., Kret, E., Karampatsa, R., Saravia. V., Bounas, A., Vavylis, D., Sidiropoulos, L., Arkumarev, V.,

Dyulgerova, S. & Nikolov, S. C. 2014. Assessment of the illegal use of poison in the Egyptian vulture project sites in Greece and Bulgaria for the period 2003-2012. Technical Report, WWF Greece, Athens.

Velevski, M., Nikolov, S. C., Hallmann, B., Dobrev, V., Sidiropoulos, L., Saravia, V., Tsiakiris, R., Arkumarev, V., Galanaki, A., Kominos, T., Stara, K., Kret, E., Grubač, B., Lisičanec, E., Kastritis, T., Vavylis, D., Topi, M., Hoxha, B. & Oppel, S. 2015. Population decline and range contraction of the Egyptian Vulture *Neophron percnopterus* on the Balkan Peninsula. *Bird Conservation International* 25: 440-450.

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