Animal Welfare Institute

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July 14, 2025

Hunting and Wildlife Conservation Council
c/o Doug Hobbs, Designated Federal Officer
U.S. Fish and Wildlife Service
5275 Leesburg Pike, MS: OC
Falls Church, Virginia 22041

**RE: Comments in Support of the Lead-Free Ammunition Voluntary Incentive Pilot Program**

Dear Chair and Members of the Hunting and Wildlife Conservation Council:

The Animal Welfare Institute ("AWI"), on behalf of our members and supporters nationwide, submits these comments in support of the Lead-Free Ammunition Voluntary Incentive Pilot Program ("Voluntary Pilot Program") implemented across seven national wildlife refuges in Fall 2024. We appreciate the Hunting and Wildlife Conservation Council's ("Council's") support of efforts to reduce the use of lead ammunition in hunting. Given the extensively documented adverse impacts of spent lead bullets and shot on the health of humans and wildlife, we urge the Council to continue to promote actions that successfully decrease the use of lead ammunition on federal public lands, including by expanding the Voluntary Pilot Program to additional national wildlife refuges.

AWI is a nonprofit organization whose mission is to alleviate the suffering caused to animals by people. We seek to improve the welfare of animals everywhere: in agriculture, in commerce, in our homes and communities, in research, and in the wild. Since 1951, AWI has advanced its mission through strategically crafted policy and legal advocacy, educational programs, research and analysis, litigation, and engagement with policymakers, scientists, industry, educators, other NGOs, the media, and the public. We seek scientifically-grounded protections for animals in all settings, and robust enforcement of those protections.

This comment contains three sections. Section I discusses the serious health consequences of lead exposure in humans, particularly in children. Section II sets forth the best available science on the effects of lead on wildlife. Section III discusses the widely available and effective alternatives to lead ammunition, as well as the hunting community's support for lead-free ammunition.

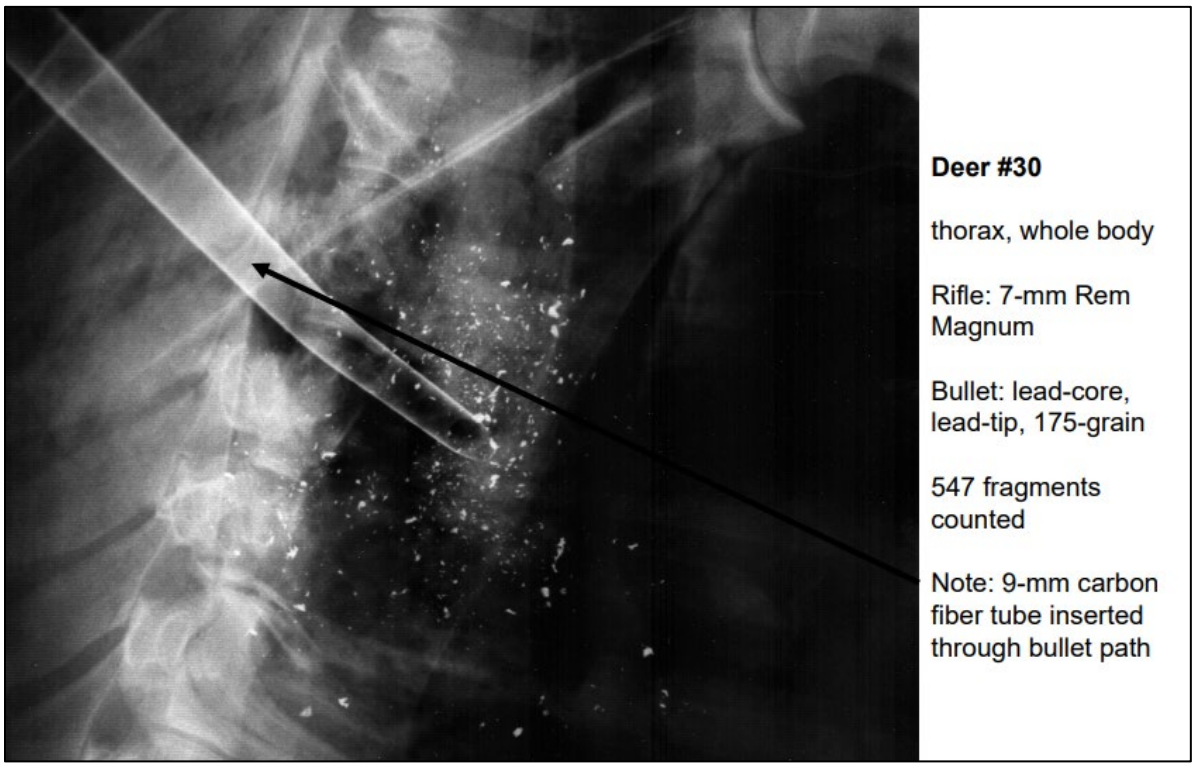
## I. Lead Ammunition is Toxic to Humans

Lead has been recognized as toxic to humans for centuries.[1] Although acute lead poisoning in the United States is now rare, chronic, low-level lead toxicity remains a public health problem. Spent lead bullets and shot has emerged as a concern among public health and medical professionals. Bellinger et al. noted:

> [P]roduction of lead-based ammunition in the United States accounted for >69,000 metric tons consumed in 2012; this is second only to the amount of lead used to manufacture storage batteries. However, there are few regulations regarding the release of lead into the environment through discharge of lead-based ammunition. For other major categories of lead consumption, such as lead batteries and sheet lead/lead pipes, environmental discharge and disposal are regulated. Therefore, lead-based ammunition is likely the greatest largely unregulated source of lead that is knowingly discharged into the environment in the United States. In contrast, the release or distribution of other major sources of environmental lead contamination . . . have been substantially regulated and reduced since the mid-1970s.[2]

Hunting is a conduit for lead poisoning because bullets with lead cores and copper jackets are among the most common ammunition types for hunting.[3] Upon entering an animal, these bullets fragment into millions of particles that scatter throughout the carcass, as demonstrated in the photo below.

[1] Lanphear, B. et al. 2024. Lead poisoning. New England Journal of Medicine. 391(17): 1621-1631. Available at: https://catastrophes.ltrr.arizona.edu/Lanphear2024LeadPoisoning.pdf.
[2] Bellinger, D.C. et al. 2013. Health risks from lead-based ammunition in the environment. Environmental Health Perspectives. 121(6): a178-a179 (citations omitted).
[3] Buenz, E.J. et al. 2024. X-ray screening of donated wild game is insufficient to protect children from lead exposure. Discover Food. 4(1): 31. Available at: https://link.springer.com/content/pdf/10.1007/s44187-024-00104-9.pdf.




*Radiograph of a deer shot with a lead bullet.*[4]

Many of these particles are undetectable by X-ray and impossible to completely remove from meat.[5] One study found that up to 76 percent of game birds killed by lead ammunition contain tiny fragments of shot that are both too small and too scattered to be detected or removed by a consumer.[6] Another study found that 34 percent of randomly selected packages of ground venison from 30 different game processors contained as many as 168 metal fragments each, identified as 93 percent lead. When these tainted packages were fed to domestic pigs, blood lead levels became elevated with two days of ingestion.[7] Buenz et al. (2024) used inductively-coupled plasma mass spectrometry to test samples of meat provided by hunters and found 48 percent contained lead quantities exceeding thresholds set by the U.S. Food and Drug Administration for

[4] Hunt, W.G. et al. 2005. Bullet fragments in deer remains: implications for lead exposure in scavengers. Wildlife Society Bulletin. 33(4): 167-170. Available at: https://www.biologicaldiversity.org/campaigns/get_the_lead_out/pdfs/Hunt_et_al_2005.pdf.

[5] Buenz, E.J. et al. 2024. X-ray screening of donated wild game is insufficient to protect children from lead exposure. Discover Food. 4(1): 31. Available at: https://link.springer.com/content/pdf/10.1007/s44187-024-00104-9.pdf.

[6] Pain, D.J. et al. 2010. Potential hazard to human health from exposure to fragments of lead bullets and shot in the tissues of game animals. PLoS ONE. 5(4): e10315. Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0010315.

[7] Hunt, W.G. et al. 2009. Lead bullet fragments in venison from rifle-killed deer: potential for human dietary exposure. PloS one. 4(4): p.e5330.

children (2.2 µg/day), yet X-ray screening was not sufficiently sensitive to detect such small quantities.[8]

Even minimal exposure to lead from tainted meat is a serious threat to human health, as the Centers for Disease Control and Prevention ("CDC") has determined that there is no safe level of lead exposure for humans.[9] Lead poisoning in adults often manifests as kidney disease, hypertension, and heart disease. Lead exposure is a risk factor for chronic kidney disease. In one study reported by Navas-Acien et al. (2009), researchers found that adults with blood lead levels over 24 µg/liter had a 56 percent higher chance of having a low glomerular filtration rate than people with levels below 11 µg/liter.[10] Harari et al. (2018) found people with blood levels above 33 µg/liter had a 49 percent high risk of kidney disease than those with lower levels.[11] Lead exposure can result in cellular alterations characteristic of hypertension and atherosclerosis. Conducting a lab study, Vaziri reported low-level lead exposure could cause hypertension by lowering levels of active nitric oxide, inducing vasoconstriction, raising oxidative stress.[12] One of the biggest risk factors for cardiovascular disease death is lead exposure.[13] Lanphear blamed lead exposure for 185,000 coronary heart disease deaths between 1988 and 1994.[14]

Lead exposure is particularly dangerous to children.[15] The CDC lists the following adverse health effects that children exposed to lead experience:[16]

- Damage to the brain and nervous system
- Slowed growth and development
- Learning and behavior problems
- Hearing and speech problems

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[8] Buenz, E.J. et al. 2024. X-ray screening of donated wild game is insufficient to protect children from lead exposure. Discover Food. 4(1): 31. Available at: https://link.springer.com/content/pdf/10.1007/s44187-024-00104-9.pdf.

[9] U.S. Centers for Disease Control and Prevention. 2025. About Childhood Lead Poisoning Prevention. March 13. Available at: https://www.cdc.gov/lead-prevention/about/index.html.

[10] Navas-Acien, A. et al. 2009. Blood cadmium and lead and chronic kidney disease in US adults: a joint analysis. American Journal of Epidemiology. 170(9): 1156-1164. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC2781739/.

[11] Harari et al. 2018. Blood lead levels and decreased kidney function in a population-based cohort. American Journal of Kidney Diseases. 72(3): 381-389. Available at: https://www.ajkd.org/action/showPdf?pii=S0272-6386%2818%2930556-0.

[12] Vaziri, N.D. 2008. Mechanisms of lead-induced hypertension and cardiovascular disease. American Journal of Physiology-Heart and Circulatory Physiology. 295(2): H454-H465. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC2519216/.

[13] Lanphear et al. 2018. Low-level lead exposure and mortality in US adults: a population-based cohort study. The Lancet Public Health. 3(4): e177-e184. Available at: https://www.thelancet.com/action/showPdf?pii=S2468-2667%2818%2930025-2.

[14] *Id.*

[15] U.S. Centers for Disease Control and Prevention. 2025. About Childhood Lead Poisoning Prevention. March 13.

[16] *Id.*

The CDC further stated that these effects can result in:

- Lower IQ
- Decreased ability to pay attention
- Underperformance in school

A study conducted by the Wisconsin Department of Health and Family Services and the federal Agency for Toxic Substances and Disease Registry found "a significant risk of elevated lead levels in blood among children consuming venison shot with lead ammunition," and recommended "the use of non-lead ammunition as the simplest and most effective solution to lead poisoning, in both humans and wildlife, arising from the consumption of deer killed with lead ammunition."[17] The study estimated that children seven years or younger who eat two meals a month of venison from deer killed by lead bullets may have a 90 percent chance of lead levels in their blood exceeding "tolerable" levels.[18]

Lead is also dangerous to unborn children. A 2025 study found that paternal lead exposure is a potential contributor to adverse pregnancy outcomes, including congenital anomalies.[19] The authors emphasized the need for "regulations targeting lead exposure among men of reproductive age."[20] Lead exposure is a risk factor for preterm birth at concentrations commonly found in pregnant women.[21] Fisher et al. (2023) found that an increase of 10 µg/liter in maternal blood lead levels was associated with a 70 percent increased risk of spontaneous premature birth.[22]

## II. Lead Ammunition is Toxic to Wildlife

There are documented examples of more than 130 species exposed to or killed by ingesting lead shot, bullet fragments, or prey contaminated with spent lead ammunition.[23] Birds

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[17] Thiboldeaux, R., 2008. The potential for ingestion exposure to lead fragments in venison in Wisconsin. Health Consultation, US Department of Health and Human Services: Atlanta, USA. Available at: https://www.dhs.wisconsin.gov/environmental/venisonandleadhc.pdf.

[18] *Id.*

[19] Kenechi et al. 2025. Paternal lead exposure and pregnancy outcomes: a systemic review and meta-analysis. Environmental Health Insights. 19: 1-14.

[20] *Id.*

[21] Taylor et al. Adverse effects of maternal lead levels on birth outcomes in the ALSPAC study: a prospective birth cohort study. BJOG: An International Journal of Obstetrics & Gynaecology. 122(3): 322-328; Bui et al. 2022. Does short-term, airborne lead exposure during pregnancy affect birth outcomes? Quasi-experimental evidence from NASCAR's deleading policy. Environment international. 166: 107354; Fisher, et al. Association between toxic metals, vitamin D and preterm birth in the Maternal-Infant Research on Environmental Chemicals study. Paediatric and Perinatal Epidemiology. 37(5): 447-457.

[22] Fisher, et al. 2023. Association between toxic metals, vitamin D and preterm birth in the Maternal–Infant research on environmental chemicals study. Paediatric and Perinatal Epidemiology. 37(5): 447-457. Available at: https://link.springer.com/content/pdf/10.1007/s44187-024-00104-9.pdf.

[23] Tranel, M.A. and Kimmel, R.O. 2009, Impacts of lead ammunition on wildlife, the environment, and human health – a literature review and implications for Minnesota., Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund.

in particular are primarily exposed to lead from lead ammunition.[24] Exposure to lead can also occur through air, water, soil contaminated by ammunition that missed its targets.[25] Animals suffering from lead poisoning can endure a long, painful death, often involving emaciation, paralysis, and organ failure.[26] Long-lived species are particularly susceptible to bioaccumulation of lead in bones, and repeated lead ingestion and accumulation in long-lived species can reduce bone mineralization, which could mean an increase in bone fragility.[27] Moreover, lead ammunition in felled wildlife is often consumed by other animals and passed along the food chain. Lead has highly negative effects on numerous wildlife, including raptors and carnivorous corvids, upland gamebirds, gruiformes, songbirds, and scavenging mammals, as discussed below. The adoption of lead-free ammunition by hunters is therefore an important method of protecting avian and other species from the harm of lead poisoning.

A. Raptors and Carnivorous Corvids

Lead shot is lethal to predatory and scavenging raptors feeding on hunter-killed carcasses, which has been documented in red-tailed hawks, northern goshawks, and great horned owls. Even small amounts of lead can kill raptors or significantly harm their health[28] through physiological and neurological effects.[29] Though raptors can be exposed to lead from inhaling polluted air and contact with soil, scavenging animals shot by lead ammunition is by far the most common exposure mechanism for lead levels that can result in detectable morbidity and mortality.[30] For example, several studies linked have linked lead exposure and poisoning in raptors to prairie dog shooting and the shooting of other similar small, burrowing mammals.[31] Prairie dog shooters predominantly use lead based, hollow-point bullets that scatter lead

[24] Cornell Wildlife Health Laboratory. 2002. Lead Toxicosis. Available at: https://cwhl.vet.cornell.edu/disease/lead-toxicosis#collapse35.
[25] Pain, D.J. et al. 2019. Effects of lead from ammunition on birds and other wildlife: a review and update. Ambio. 48(9): 935. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6675766/.
[26] *See id.*
[27] Gangoso et al. 2009. Long-term effects of lead poisoning on bone mineralization in vultures exposed to ammunition sources. Environmental Pollution. 157: 569-574.
[28] Pauli, J.N., and S.W. Buskirk. 2007. Recreational shooting of prairie dogs: a portal for lead entering wildlife food chains. Journal of Wildlife Management. 71(1): 103-108. Available at: https://wildlife.onlinelibrary.wiley.com/doi/abs/10.2193/2005-620.
[29] Herring, G. et al. 2021. Small-mammal shooting as a conduit for lead exposure in avian scavengers. Environmental Science & Technology. 55(18): 12272-12280. Available at: https://pubs.acs.org/doi/abs/10.1021/acs.est.1c01041.
[30] Hoffman, D.J. et al. 1981. Effects of lead shot ingestion on δ-aminolevulinic acid dehydratase activity, hemoglobin concentration, and serum chemistry in bald eagles. Journal of Wildlife Diseases. 17(3): 423-431; Herring, G. et al. 2021. Small-mammal shooting as a conduit for lead exposure in avian scavengers. Environmental Science & Technology. 55(18): 12272-12280.
[31] Knopper, L.D. et al. 2006. Carcasses of shot Richardson's ground squirrels may pose lead hazards to scavenging hawks. The Journal of Wildlife Management. 70(1): 295-299; Fisher, I.J. et al. 2006. A review of lead poisoning from ammunition sources in terrestrial birds. Biological conservation. 131(3): 421-432; Harmata, A.R. and Restani, M. 2013. Lead, mercury, selenium, and other trace elements in tissues of golden eagles from southwestern Montana, USA. Journal of Wildlife Diseases. 49(1): 114-124; Herring, G. et al. 2021. Small-mammal shooting as a conduit for lead exposure in avian scavengers. Environmental Science & Technology. 55(18): 12272-12280.

throughout the body.[32] Pauli and Buskirk (2007) detected lead in close to 90 percent of the prairie dogs in their study shot with expanding bullets.[33] Because prairie dogs are rarely shot for food, shooters typically do not remove carcasses.[34] At least nine raptor species are known to eat dead prairie dogs.[35] In some places, shot prairie dogs may be the primary food source of opportunistic raptors.[36] Close to 50 percent of available black-tailed prairie dog carcasses may contain enough lead to be lethal to nestlings.[37]

Ravens are also susceptible to lead poisoning, likely due to consumption of lead bullet fragments left behind in gut piles of hunted elk, deer and moose.[38] Craighead and Bedrosian (2009) documented that the blood lead levels of ravens around Grand Teton dropped with the increased use of non-lead ammunition by hunters on the National Elk Refuge and in Grand Teton National Park.[39]

B. Upland Gamebirds, Gruiformes, and Songbirds

Lead exposure and poisoning from ingesting spent lead shot has also been documented in many species of upland game birds such as chukar, grey partridge, ring-necked pheasant, wild turkey, scaled quail, northern bobwhite, American woodcock, ruffed grouse, and mourning dove.[40] A number of gruiformes have been shown to ingest lead shot, including greater sandhill

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[32] *Id*.
[33] Pauli, J.N., and S.W. Buskirk. 2007. Recreational shooting of prairie dogs: a portal for lead entering wildlife food chains. Journal of Wildlife Management. 71(1): 103-108.
[34] Stephens, R.M. 2005. Secondary lead poisoning in golden eagle and ferruginous hawk chicks consuming shot black-tailed prairie dogs. Thunder Basin National Grassland, Wyoming. Available at: https://core.ac.uk/download/pdf/17244967.pdf.
[35] Pauli, J.N. and S.W. Buskirk. 2007. Recreational shooting of prairie dogs: a portal for lead entering wildlife food chains. Journal of Wildlife Management. 71(1): 103-108.
[36] Cully Jr, J.F. 1988. Gunnison's prairie dog: an important autumn raptor prey species in northern New Mexico. Proceedings of the Southwest Raptor Management Symposium and Workshop. National Wildlife Federation Sci. Tech. Series. 11: 47-55.
[37] Herring, G. et al. 2021. Small-mammal shooting as a conduit for lead exposure in avian scavengers. Environmental Science & Technology. 55(18): 12272-12280.
[38] Craighead, D. and B. Bedrosian. 2008. Blood lead levels of common ravens with access to big-game offal. Journal of Wildlife Management. 72(1): 240-245; Craighead, D. and B. Bedrosian. 2009. a relationship between blood lead levels of common ravens and the hunting season in the Southern Yellowstone Ecosystem. Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund, Boise, Idaho, USA.
[39] Craighead, D. and B. Bedrosian. 2009. A relationship between blood lead levels of common ravens and the hunting season in the Southern Yellowstone Ecosystem. Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund, Boise, Idaho, USA; Hatch, C. 2010. Lead in ravens drops with copper bullets. Jackson Hole News & Guide. February 24.
[40] Campbell, H. 1950. Quail picking up lead shot. Journal of Wildlife Management. 14: 243-24; Damron, B.L. and H.R. Wilson. 1975. Lead toxicity of bobwhite quail. Bulletin Environmental Contamination Toxicology. 14: 489-496; Best, T.L. et al. 1992. Ingestion of lead pellets by scaled quail (*Callieppla squamata*) and northern bobwhite (*Colinus virginianus*) in southeastern New Mexico. Texas Journal of Science. 44: 99-107. Yamamoto, K. et al. 1993. The prevalence and retention of lead pellets in Japanese quail. Archives of Environmental Contamination and Toxicology. 24: 478-482; Kendall, R.J. et al. 1996. An ecological risk assessment of lead shot exposure in non-waterfowl avian species: upland game birds

cranes, American coots, clapper rails, king rails, Virginia rails, and sora.[41] Lead poisoning from ingested spent lead ammunition has also been documented in several songbird species in the United States, including white-throated sparrow, dark-eyed junco, brown-headed cowbird, yellow-rumped warbler, brown thrasher, and blue-headed vireo.[42] Ravens are also susceptible, likely due to consumption of lead bullet fragments left behind in gut piles of hunted elk, deer and moose.[43] Craighead and Bedrosian (2009) documented that the blood lead levels of ravens around Grand Teton dropped with the increased use of non-lead ammunition by hunters on the National Elk Refuge and in Grand Teton National Park.[44]

C. Lead Has Population-level Impacts on Certain Bird Species

Lead poisoning due to ingestion of spent shot or bullet fragments has had population-level effects for some bird species with low recruitment rates, depressed populations, or those in recovery, such as the California condor, bald and golden eagles, trumpeter swan, sandhill crane, and spectacled eider.[45] Bald and golden eagles that ingest lead shot embedded in the tissues or

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and raptors. Environmental Toxicology and Chemistry. 15:4-20; Akoshegyi, I. 1997. Lead poisoning of pheasants caused by lead shots. Magyar Allatorvasok Lapja. 119(6): 328-336; Keel, M.K. et al. 2002. Northern bobwhite and lead shot deposition in an upland habitat. Archives of Environmental Contamination and Toxicology. 43: 318-322; Battaglia, A. et al. 2005. Heavy metal contamination in little owl (*Athene noctua*) and common buzzard (*Buteo buteo*) from Northern Italy. Ecotoxicology and Environmental Safety. 60(1): 61-66: Butler, D.A. et al. 2005. Lead exposure in ring-necked pheasants on shooting estates in Great Britain. Wildlife Society Bulletin. 33(2): 583-589: Fisher, I.J. et al. 2006. A review of lead poisoning from ammunition sources in terrestrial birds. Biological Conservation. 131: 421-432; Schulz, J.H. et al. 2006. Acute lead toxicosis in mourning doves. Journal of Wildlife Management. 70: 413-421.

[41] Jones, J.C. 1939. On the occurrence of lead shot in stomachs of North American gruiformes. Journal of Wildlife Management. 3: 353-357; Kennedy, S. et al. 1979. Lead poisoning in Sandhill cranes. Journal of American Veterinary Medical Association. 171: 955-958; Fisher, I.J., et al. 2006. A review of lead poisoning from ammunition sources in terrestrial birds. Biological Conservation. 131: 421-432. Windingstad, R.M. et al. 1984. Lead Poisoning of Sandhill Cranes (*Grus canadensis*). Prairie Nat. 16, 21-24. Windingstad, R.M. 1988. Non hunting mortality in Sandhill cranes. Journal of Wildlife Management. 52(2): 260-263; Franson, J.C. and S.G. Hereford. 1994. Lead poisoning in a Mississippi Sandhill crane. Wilson Bulletin. 106: 766-768.

[42] Lewis, L.A. et al. 2001. Lead toxicosis and trace elements in wild birds and mammals at a firearms training facility. Archives of Environmental Contamination and Toxicology. 41: 208-214; Vyas, N.B. et al. 2001. Lead shot toxicity to passerines. Environmental Pollution. 111(1): 135-138; Vyas, N.B. et al. 2000. Lead poisoning of passerines at a trap and skeet range. Environmental Pollution. 107(1): 159-166.

[43] Craighead, D. and B. Bedrosian. 2008. Blood lead levels of common ravens with access to big-game offal. Journal of Wildlife Management. 72(1): 240-245; Craighead, D. and B. Bedrosian. 2009. A relationship between blood lead levels of common ravens and the hunting season in the Southern Yellowstone Ecosystem. Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund, Boise, Idaho, USA.

[44] Craighead, D. and B. Bedrosian. 2009. A relationship between blood lead levels of common ravens and the hunting season in the Southern Yellowstone Ecosystem. Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund, Boise, Idaho, USA. Hatch, C. 2010. Lead in ravens drops with copper bullets. Jackson Hole News & Guide, February 24.

[45] Grand, J.B. et al. 1998. Effect of lead poisoning on spectacled eider survival rates. Journal of Wildlife Management. 62: 1103-1109; Hennes, S.K. 1985. Lead shot ingestion and lead residues in migrant bald eagles at the Lac Qui Parle Wildlife Management Area, Minnesota. Master's Thesis.

the intestinal tract of waterfowl demonstrate acute and chronic symptoms of lead poisoning, and many studies have found high percentages of eagle populations across the United States that have elevated lead levels in their blood and organs.[46] Lead poisoning's effects on eagles included emaciation, evidence of bile stasis, myocardial degeneration and necrosis, and renal tubular nephrosis and necrosis.[47] In some areas of the country, approximately 15-20 percent of all bald eagle deaths are due to lead poisoning, usually from eating animals that were wounded with lead ammunition or from scavenging gut piles during and after the deer hunting season.[48] Lead shot from upland game hunting and lead bullet fragments from big game hunting and shooting are also a significant cause of lead toxicity for bald and golden eagles.[49] Pattee and Hennes (1983) and other researchers have found that elevated lead levels in bald eagles corresponded well (89 percent) with late fall and winter waterfowl hunting seasons.[50]

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University of Minnesota; Church, M.E. et al. 2006. Ammunition is the principal source of lead accumulated by California condors re-introduced to the wild. Environmental Science and Technology. 40(19): 6143-6150; Pattee, O.H. et al. 1990. Lead hazards within the range of the California condor. The Condor. 92: 931-937; Slabe, V.A. et al. 2022. Demographic implications of lead poisoning for eagles across North America. Science. 375: 779-782. 10.1126/science.abj3068.

[46] Hoffman, D. et al. 1981. Effects of lead shot ingestion on delta-aminolevulinic acid dehyratase activity, hemoglobin concentration, and serum chemistry in bald eagles. Journal of Wildlife Diseases. 17: 423-431; Miller, M. et al. 2001. Hemograms for and nutritional condition of migrant bald eagles tested for exposure to lead. Journal of Wildlife Diseases. 37(3): 481-488; Pattee, O.H., et al. 1981. Experimental leadshot poisoning in bald eagles. Journal of Wildlife Management. 45: 806-810; Coon, N.C. et al. 1969. Causes of bald eagle mortality, 1960-1965. Journal of Wildlife Diseases. 6: 72-76; Kaiser et al. 1980. Ingestion of lead shot by dunlin. The Murrelet. 61(1): 37; Harmata, A.R. and M. Restani. 1995. Environmental contaminants and cholinesterase in blood of vernal migrant bald and golden eagles in Montana. Intermountain Journal of Sciences. 1(1): 1-15.

[47] Franson, J.C. and R.E. Russell. 2014. Lead and eagles: demographic and pathological characteristics of poisoning, and exposure levels associated with other causes of mortality. Ecotoxicology. 23: 1722-1731.

[48] Eisele, T. 2008. Outdoors: time to get the lead out of all hunting, fishing. Special to The Capital Times. March 12; Strom, S.M. et al. 2009. Lead exposure in Wisconsin birds. Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund, Boise, Idaho, USA; J. L. Kramer, J.L. and P.T. Redig. 1997. Sixteen years of lead poisoning in eagles, 1980-1995: an epizootiologic view. Journal of Raptor Research. 32: 327-332; Clark, A.J. and A.M. Scheuhammer. 2003. Lead poisoning in upland-foraging birds of prey in Canada. Ecotoxicology. 12(1-4): 23-30.

[49] Harmata, A.R. and M. Restani. 1995. Environmental contaminants and cholinesterase in blood of vernal migrant bald and golden eagles in Montana. Intermountain Journal of Sciences. 1(1): 1-15. Fisher, I.J. et al. 2006. A review of lead poisoning from ammunition sources in terrestrial birds. Biological Conservation. 131: 421-432; Hunt, W.G. et al. 2006. Bullet fragments in deer remains: implications for lead exposure in scavengers. Wildlife Society Bulletin. 34: 168-171; Pauli, J.N. and S.W. Buskirk. 2007. Recreational shooting of prairie dogs: a portal for lead entering wildlife food chains. Journal of Wildlife Management. 71: 103-108.

[50] Pattee, O.H. and Hennes, S.K., 1983. Bald eagles and waterfowl: the lead shot connection. Transactions of the North American Wildlife and Natural Resources Conference. 48: 230-237; *see also* Neumann, K. 2009. Bald eagle lead poisoning in winter. Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund, Boise, Idaho, USA; Domenech, R. and H. Langner. 2009. Blood-lead levels of fall migrant golden eagles in West-Central Montana, extended abstract. Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund, Boise, Idaho, USA; Bedrosian, B., and D. Craighead. 2009. Blood lead levels of bald and golden eagles sampled during and after hunting seasons in the Greater Yellowstone Ecosystem, extended abstract. Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund, Boise,

D. Scavenging Mammals

Ingestion of lead by carrion scavenging mammals, such as coyotes, grizzly bears, black bears, wolves, wolverines and mountain lions feeding on so-called varmint carcasses, and gut piles and carcasses of big game during the hunting season, has rarely been studied. Large carnivores such as black bears, grizzly bears, wolves, and coyotes scavenge to varying degrees on ungulate offal piles abandoned by hunters. Mountain lions may periodically be exposed to lead at biologically significant levels because of the tendency to occasionally scavenge. Rogers et al. (2009) documented elevated lead blood levels in grizzly bears during hunting season, when they scavenge the remains of big game. Their preliminary data showed that 46 percent of tested bears in Yellowstone showed elevated blood lead levels.[51] The potential consequences for large mammalian scavengers are as yet unstudied.

## III. Alternatives to Lead

Alternative ammunition is widely available and effective. The U.S. Fish and Wildlife Service has approved fourteen types of nontoxic shot.[52] Many of these, like steel, copper, and bismuth, are readily available at major retailers and online. The price of non-lead shot has fallen since 1991, when lead shot for waterfowl hunting was banned nationwide, and a 2013 study found "no major difference" between the price of ammunition with or without lead for most popular calibers.[53]

Hunters consistently rate non-lead ammunition as equally effective.[54] Indeed, the National Rifle Association's *American Hunter* site noted that "[e]very now and then a new bullet comes along that redefines what we think we know about hunting projectiles. The Barnes all-copper X-Bullet was one of those, and it has become the most imitated big-game bullet on the market. It was introduced in 1989, and ever since the Barnes X has been a favorite of serious big game hunters wherever men take rifles into wild places."[55] Additionally, as Backcountry Hunters & Anglers state: "[t]he reasons for switching to non-lead are numerous: excellent weight

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Idaho, USA; Franson, J.C. and R.E. Russell. 2014. Lead and Eagles: Demographic and Pathological Characteristics of Poisoning, and Exposure Levels Associated with Other Causes of Mortality. Ecotoxicology. 23: 1722-1731.

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retention and penetration, consistent expansion, and less risk of lead fragments ending up on dinner plates and in the bellies of scavengers."[56]

## IV. Conclusion

With viable alternatives to lead ammunition widely available, and with clear scientific evidence on the devastating impacts of lead poisoning on humans and wildlife, we support the Council's continued implementation of the Voluntary Pilot Program, and hope that it is expanded to additional national wildlife refuges in the future. Thank you for providing an opportunity to submit comments and for your consideration of these comments. If you have any questions or there is any additional information we can provide, please do not hesitate to contact us.

Sincerely,

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