

Science Links Lead Ammunition to Lead Exposure
in California Condors (*Gymnogyps californianus*)

Statement of Scientific Agreement

July 10, 2007

We, the undersigned, endorse the scientific chain of evidence linking lead ammunition to lead exposure in the endangered California condor as sufficiently strong to support a ban of lead ammunition in condor country. This conclusion flows from a robust chain of evidence, namely: (1) California condors are obligate scavengers on mammal carcasses, including deer and other big game; (2) large numbers of deer are killed with lead ammunition in condor country; (3) free-flying condors frequently have elevated levels of lead in their blood, and these levels peak during the fall deer hunting season; and, (4) isotopic analysis of lead in the blood of pre-release and free-flying condors in California strongly supports the link between lead ammunition and lead exposure. Lead exposure is the major, preventable obstacle to the success of condor reintroduction: all wild condors must be captured for lead testing, held for emergency treatment when suffering acute toxicity, and, for fear of lead exposure, offered lead-free food at artificial feeding stations. Untreated, lead exposure affects all major organs, interferes with digestion, hinders normal behaviors, and can cause death. Due to the preponderance of evidence, we believe that any reduction in lead ammunition in condor country will significantly increase the success of reintroduction efforts of California condors.

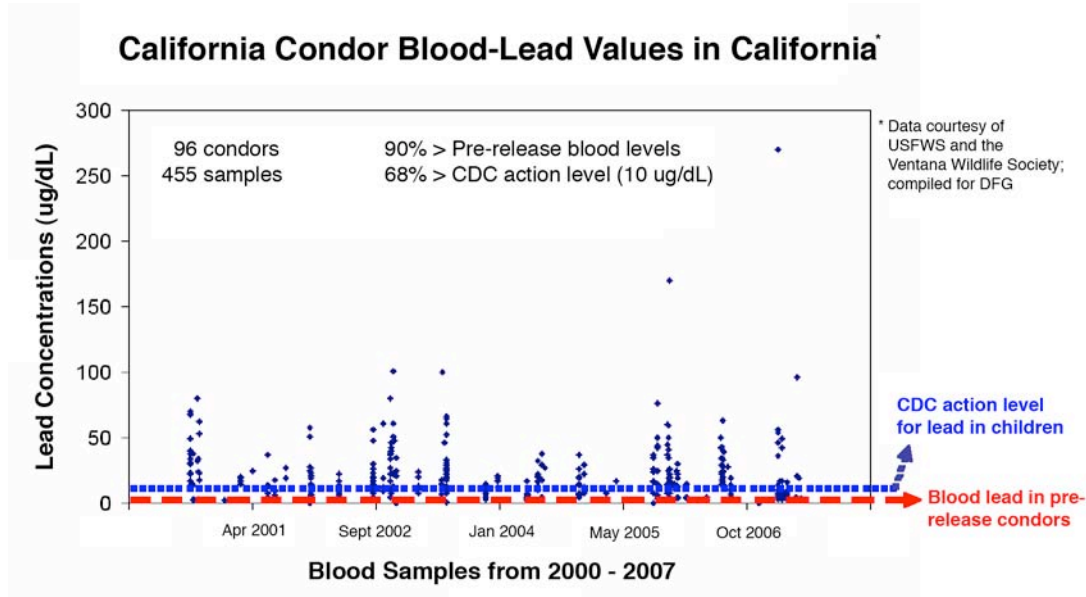
1. **California condors are obligate scavengers on mammal carcasses, including deer and other big game.** This foraging trait is clearly established in the scientific and popular literature (e.g., Snyder and Schmitt 2002).¹
2. **Large numbers of deer are killed with lead ammunition in condor country.** The Department of Fish and Game study by Fry (2003)² indicates that 106,000 game animals are taken annually in condor range in California with an estimated 30,000 carcasses or gut piles left in field. Hunt et al. (2006)³ showed that hunted deer had lead ammunition fragments broadly distributed along the wounds that increase the potential for accidental ingestion by condors and humans. Ninety percent of offal piles (i.e., gut piles after field dressing deer) showed lead fragments. Of these piles, 75% contained more than 10 fragments, and 50% of the piles contained more than 100 lead ammunition fragments.
3. **Free-flying condors frequently have elevated levels of lead in their blood, and these levels peak during the fall deer hunting season.** Lead exposure has been recognized as a major threat to condors for several decades, and ingestion of ammunition has long been considered the primary source of this exposure. Free-flying condors have detectable blood lead levels that often require emergency veterinary intervention (Fry 2003²). The vast majority of condors tested in the last ten years have blood lead levels that exceed the Centers for Disease Control (CDC) threshold for immediate clinical intervention in children of 10 µg/dL, and many condors have been observed with blood lead levels exceeding 100 µg/dL.

¹ Snyder, N. F. R., and N. J. Schmitt. 2002. California Condor (*Gymnogyps californianus*). In *The Birds of North America*, No. 610 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

² Fry, D. Michael. 2003. *Assessment of Lead Contamination Sources Exposing California Condors*. California Department of Fish and Game Species Conservation and Recovery Report. 2003-02: 1-60.

³ Hunt, W.G., W. Burnham, C. Parish, K. Burnham, B. Mutch, and J.L. Oaks. 2006. Bullet Fragments in Deer Remains: Implications for Lead Exposure in Avian Scavengers. *Wildlife Society Bulletin* 34(1): 167-170.

Sorenson and Burnett (2007)⁴ documented a sharp increase in blood lead levels in condors during the fall hunting season. Lead ammunition is the only documented source that could cause acute lead exposure at the very high levels seen in wild condors. Since lead is not biologically accumulated, acute levels of blood lead, as seen in the vast majority of condors in the graph below, are most reasonably derived from repeated ingestion of tiny lead fragments; condors must consume lead directly from highly concentrated sources such as lead ammunition.



4. **Isotopic analysis of lead in the blood of pre-release and free-flying condors in California strongly supports the link between lead ammunition and lead exposure.** Lead isotope ratios have been used for over 25 years to trace source(s) of environmental lead exposure. The use of lead isotope ratios for evaluating lead exposure is based on the natural existence of lead in four stable isotopes. The natural relative abundances of these isotopes often varies across different lead-containing industrial products (e.g., leaded paint or ammunition) because lead used in making those products comes from different sources of lead. Lead isotopic ratios in lead-exposed animals are like fingerprints that can be traced back to a particular source of lead exposure. Indeed, lead isotopes offer the most accurate way to trace the sources of elevated lead exposures, and they have been used to trace the sources and pathways of lead exposure in humans, as well as in wildlife such as California condors.

Church et al. (2006)⁵ evaluated the sources of elevated lead exposure in California condors based on: (i) knowledge of the plausible sources of lead exposure to the condor, including lead concentrations; (ii) the quantified isotopic ratios of those plausible lead sources within that environment; and, (iii) information about behavioral habits, as well as an evaluation of viable pathways of exposure to the organism. This study clearly shows that pre-release condors have an isotopic signature that is significantly different from lead in free-flying condors in central California, whereas the blood lead isotopic signature of the majority of free-flying condors

⁴ Sorenson, K. J. and L. J. Burnett. 2007. Lead Concentrations in the Blood of Big Sur California Condors. In: *California Condors in the 21st century* (Mee A, Hall LS, Grantham J). Special publication of the American Ornithologists' Union and Nuttall Ornithological Club.

⁵ Church, M. et al. 2006. Ammunition is the Principal Source of Lead Accumulated by California Condors Re-Introduced to the Wild. *Environ. Sci. Technol.* 40: 6143-6150.

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approached or matched the isotopic signature of lead ammunition collected from the condors' central California range. Lead ammunition is, therefore, the principal, and only plausible, documented source of lead exposure in condors. The Church et al. (2006) study underwent rigorous scientific peer review in the publication process for Environmental Science and Technology. This publication is an American Chemical Society journal and one of the top-ranked scientific journals in the areas of environmental chemistry and environmental toxicology.

Taken as a whole, the chain of evidence from all sources, including peer-reviewed journals, supports the conclusion that California condors are suffering lead exposure primarily due to the ingestion of lead ammunition from game. Lead exposure is the major, preventable obstacle to the success of the condor reintroduction. Due to the preponderance of evidence, we believe that any reduction in lead ammunition in condor country will significantly improve the success of reintroduction efforts of California condors.

Signed,

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