CALIFORNIA FISH AND GAME COMMISSION

REPORT ON THE LEVELS OF LEAD FOUND IN CALIFORNIA CONDORS DURING 2008

June 29, 2009

This report summarizes the levels of lead reported in California condors in California during 2008 and was prepared pursuant to Section 3004.5 of the Fish and Game Code. The report was adopted by the Fish and Game Commission at its June 24, 2009 meeting.

CALIFORNIA FISH AND GAME COMMISSION

REPORT ON THE LEVELS OF LEAD FOUND IN CALIFORNIA CONDORS DURING 2008

Summary

The data on blood lead levels detected in California condors sampled during calendar year 2008 were provided to the California Department of Fish and Game by the U.S. Fish and Wildlife Service (USFWS) to inform the Fish and Game Commission for this report.

As neither the Department, nor the Commission, collects the condor blood data, we are reluctant to re-interpret or re-analyze the raw data, not knowing the assumptions and/or caveats that may need to be considered for any analysis. Consequently, the Department and Commission relied on the USFWS provisional report summarizing the results of blood lead levels for 72 free-flying condors in California during 2008. Their summary is attached in its entirety as Attachment III. During the period January-June 2008, 59 percent of the condors sampled had blood lead levels that were considered above background (>10 micrograms/deciliter) levels; 45 percent of condors exhibited blood lead levels above background levels during July-December 2008.

The Department and Commission have concluded that this information, representing the initial year after adoption of the regulation to prohibit lead in condor range, is not systematically collected in a manner to effectively address the reasonable questions related to the Commission's reporting requirement. Thus, the information should not be considered conclusive of any "cause and effect" relationship between the prohibition of lead projectiles in condor range and blood lead levels detected in condors. In part, this is because the sources of lead in sampled condors are unknown, relationships of sampled condors to hunting activity are unknown, and as it relates to the regulations in place that prohibit lead projectiles in condor range, the condor feeding habits for this period of time are also unknown.

Notwithstanding the preliminary nature of the data and lack of knowledge regarding direct causation, the Commission recognizes that blood lead levels as reported were lower during the second half of 2008 compared to the first half of 2008. If this initial pattern holds in the future, this should be beneficial to the recovery of the California condor.

While the data are inadequate for any in-depth or meaningful comparative analyses regarding the possible consequences of the "2008 lead ammo ban" in condor range, they do begin to provide the basis for future comparison. The Department and Commission are of the understanding that beginning in Fall 2009, a more comprehensive and collaborative strategy to collect, compile, and report on condor blood levels will be in place.

In 2007, California Fish and Game Commission regulatory action (Sections 353 and 475 of Title 14, California Code of Regulations relating to methods of take) prohibited the use of projectiles containing lead for hunting of big game species and for nongame species within the range of the California condor (Attachment I and Figure 1). These regulations implemented Section 3004.5 of the Fish and Game Code (Attachment II). In practice, the regulations ban the use of lead ammunition for hunting of deer, wild pig, elk, black bear, pronghorn antelope, coyote, and ground squirrel within the range of the California condor.

The purpose of the regulation change was to reduce the potential for lead poisoning of condors by eliminating lead that could be contained as fragments within carcasses of hunted big game and nongame species. In hunting of big game, the animal is required to be retrieved, however, there are occasions where the animal is lost and not retrieved and field dressing of harvested big game often results in the internal organs being left in the field (referred to as offal or gut piles). Nongame species that are hunted are not required to be retrieved by the hunter and may be left in the field, thereby potentially being a source of food for condors.

As part of the legislation, the Commission will prepare and issue a report on findings:

> *"The commission shall issue a report on the levels of lead found in California condors. This report shall cover calendar years 2008, 2009, and 2012. Each report shall be issued by June of the following year."*

Reporting of Lead Levels in California Condor

The U.S. Fish and Wildlife Service is the lead agency for the recovery and management of the state and federally endangered California condor (*Gymnogyps californianus*) through the Condor Recovery Program. As part of the recovery program, several other entities such as Non-government organizations, other agencies, zoos, and universities participate in management direction, condor release, capture, care, and treatment efforts, including the California Department of Fish and Game.

The Department of Fish and Game however, is not directly involved in field handling or sampling of blood lead levels of condors. Consequently, the Department relies on collaboration with others to provide this information. The Department requested the data from the U.S. Fish and Wildlife Service and others, and received a 5 page summary of the 2008 condor data, for Central and Southern California condors, which is attached as Attachment III. Figure 2 graphically illustrates the blood lead levels from sampled condors in 2008 that are the basis of the report.

Future Reporting

The reporting requirements for the Commission are expected to benefit from an improved mechanism in place for condor data collection, compilation, and sharing (Attachment IV). This will further improve the Department's ability to assist in meeting the Commission's obligation. By Fall 2009, through an agreement funded through Federal Section 6 dollars to the Department and contracted with the University of California Davis, Wildlife Health Center (WHC), there will be a standardized repository for this data with the U.S. Geological Survey that will be collaboratively supported by the interested parties. The WHC will be the scientific body to work with recovery entities to compile condor blood lead level data and through data sharing agreements with the U.S. Fish and Wildlife and U.S. Geological Survey, the data will be available to affected agencies.

Additionally, through this work, the Department anticipates a more standardized, consistent, and repeatable approach to sampling condors for blood lead levels, as well as new original research into the feeding habits of condors in the field. This information will assist in better understanding the blood lead levels in the California condor and its relationship to the environment and human influences.

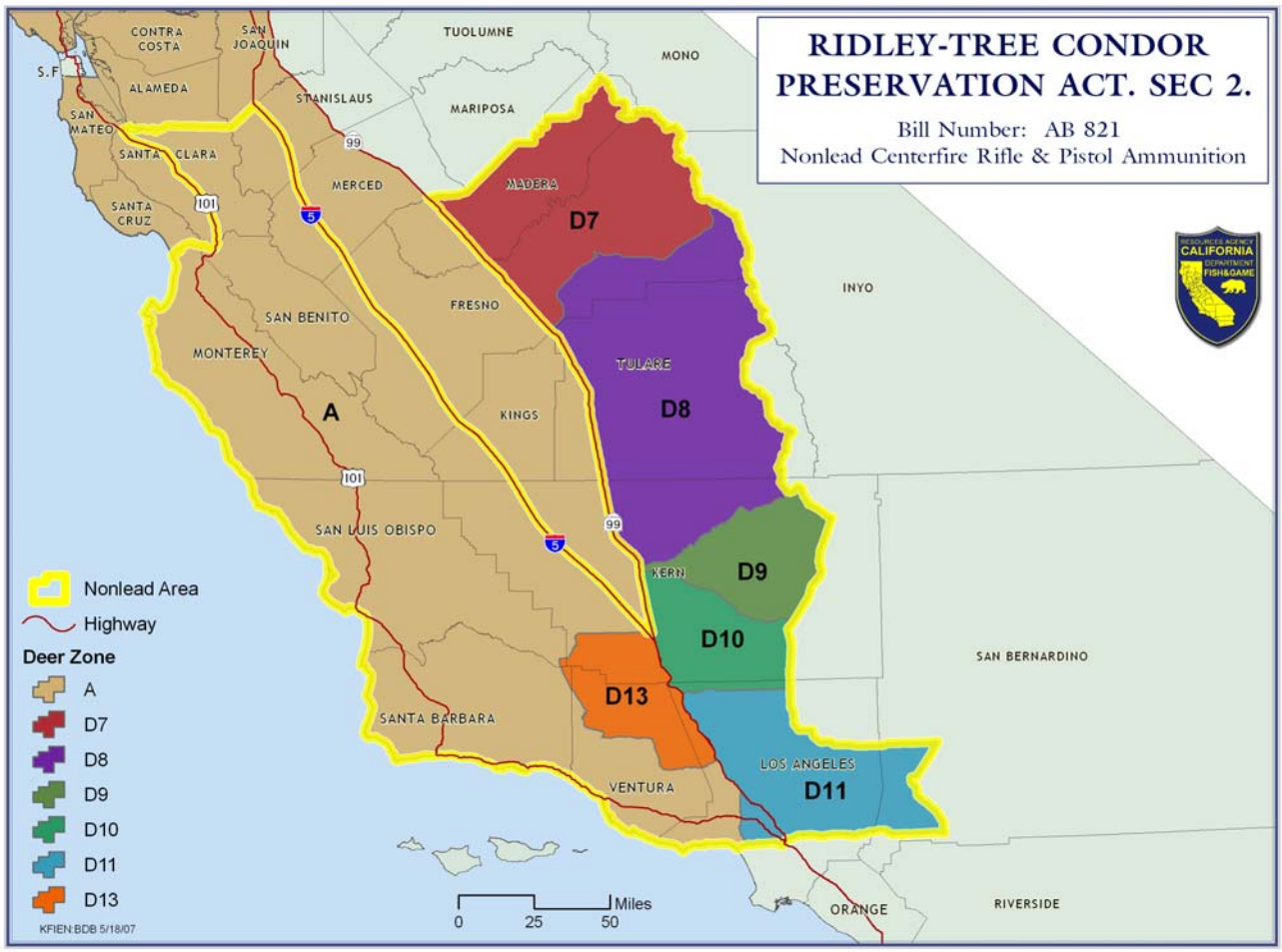
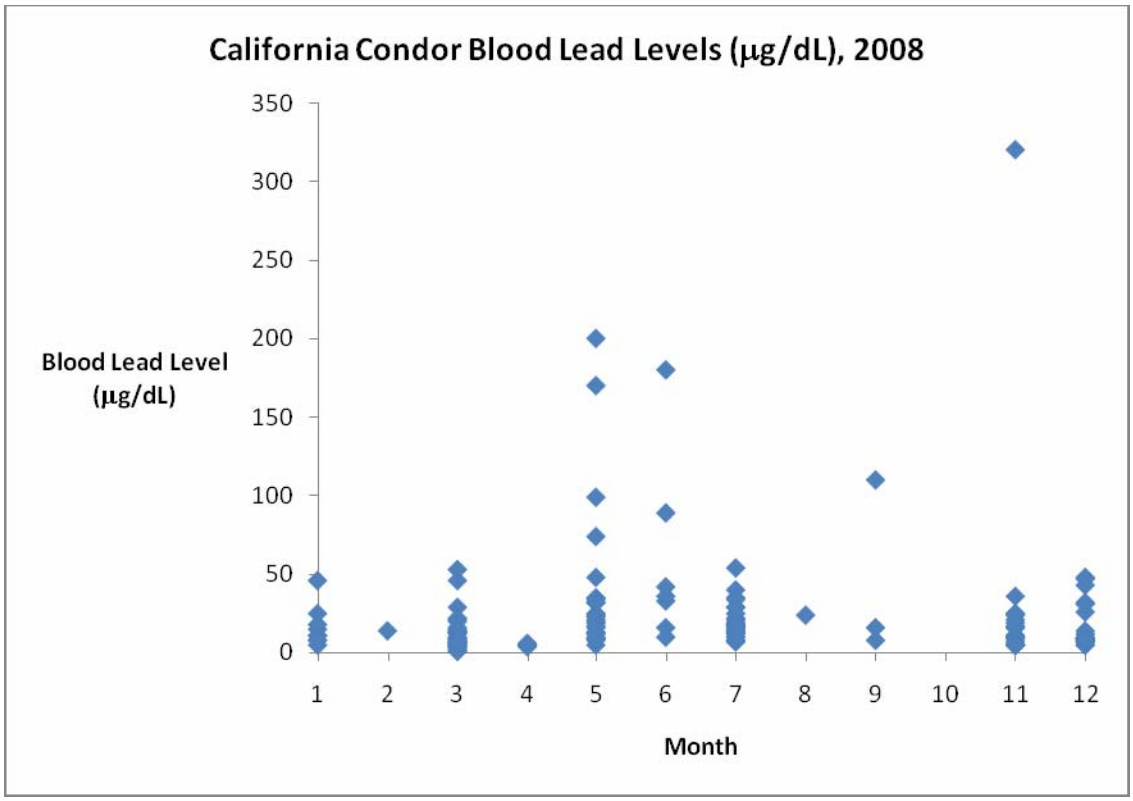


Figure 1. The geographic area where lead projectiles are banned in relation to deer hunting zones. Deer are one of the primary species hunted in this geographic area.

Figure 2. Blood lead levels (μg/dL) among free-flying California condors (Southern and Central California populations combined) by month during 2008 (n = 72 condors, 148 samples).



ATTACHMENT I. Relevant portions of Sections 353 and 475 related to methods of take for hunting big game and nongame within the range of the California condor.

§ 353. Methods Authorized for Taking Big Game.

(a) Except for the provisions of subsections 353(b) through (h), Title 14, CCR, big game (as defined by Section 350, Title 14, CCR) may only be taken by rifles using centerfire cartridges with softnose or expanding projectiles; bow and arrow (see Section 354, Title 14, CCR, for archery equipment regulations); or wheellock, matchlock, flintlock or percussion type, including "in-line" muzzleloading rifles using black powder or equivalent black powder substitute, including pellets, with a single projectile loaded from the muzzle and at least .40 caliber in designation. For purposes of Section 353, a "projectile" is defined as any bullet, ball, sabot, slug, buckshot or other device which is expelled from a firearm through a barrel by force.

(h) Methods of take within the California condor range. Except as otherwise provided, it is unlawful to use or possess projectiles containing more than one percent lead by weight while taking or attempting to take any big game (as defined in Section 350, Title 14, CCR) in those areas described in Section 3004.5, Fish and Game Code.

(1) Except as otherwise provided, it is unlawful to possess any projectile containing lead in excess of the amount permitted in subsection 353(h) and a firearm capable of firing the projectile while taking or attempting to take any big game within the area described in subsection 353(h). The possession of a projectile containing lead in excess of the amount allowed in subsection 353(h) without possessing a firearm capable of firing the projectile is not a violation of this section.

§ 475. Methods of Take for Nongame Birds and Nongame Mammals.

Nongame birds and nongame mammals may be taken in any manner except as follows:

(c) Fallow deer, sambar deer, axis deer, sika deer, aoudad, mouflon, tahr and feral goats may be taken only with the equipment and ammunition specified in Section 353 of these regulations.

(f) Methods of take within the California condor range. Except as otherwise provided, it is unlawful to use or possess projectiles containing more than one percent lead by weight

while taking or attempting to take any nongame birds or nongame mammals in those areas described in Section 3004.5, Fish and Game Code.

(1) For purposes of Section 475, a "projectile" is defined as any bullet, ball, sabot, slug, buckshot, shot, pellet or other device which is expelled from a firearm through a barrel by force.

(2) Except as otherwise provided, it is unlawful to possess any projectile containing lead in excess of the amount permitted in subsection 475(f) and a firearm capable of firing the projectile while taking or attempting to take any nongame bird or nongame mammal within the area described in subsection 475(f). The possession of a projectile containing lead in excess of the amount allowed in subsection 475(f) without possessing a firearm capable of firing the projectile is not a violation of this section.

ATTACHMENT II. Section 3004.5 Fish and Game Code.

3004.5. (a) Nonlead centerfire rifle and pistol ammunition, as determined by the commission, shall be required when taking big **game** with rifle or pistol, as defined by Section 350 of the department's mammal hunting regulations, and when taking coyote, within the department's deer hunting zone A South, but excluding Santa Cruz, Alameda, Contra Costa, San Mateo, and San Joaquin Counties, areas west of Highway 101 within Santa Clara County, and areas between Highway **5** and Highway 99 within Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern Counties, and within deer hunting zones D7, D8, D9, D10, D11, and D13.

(b) By July 1, 2008, the commission shall establish, by regulation, a public process to certify centerfire rifle and pistol ammunition as nonlead ammunition, and shall define, by regulation, nonlead ammunition as including only centerfire rifle and pistol ammunition in which there is no lead content. The commission shall establish and annually update a list of certified centerfire rifle and pistol ammunition.

(c) (1) To the extent that funding is available, the commission shall establish a process that will provide hunters within the department's deer hunting zone A South, but excluding Santa Cruz, Alameda, Contra Costa, San Mateo, and San Joaquin Counties, areas west of Highway 101 within Santa Clara County, and areas between Highway **5** and Highway 99 within Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern Counties, and within deer hunting zones D7, D8, D9, D10, D11, and D13 with nonlead ammunition at no or reduced charge. The process shall provide that the offer for nonlead ammunition at no or reduced charge may be redeemed through a coupon sent to a permitholder with the appropriate permit tag. If available funding is not sufficient to provide nonlead ammunition at no charge, the commission shall set the value of the reduced charge coupon at the maximum value possible through available funding, up to the average cost within this state for nonlead ammunition, as determined by the commission.

(2) The nonlead ammunition coupon program described in paragraph (1) shall be implemented only to the extent that sufficient funding, as determined by the Department of Finance, is obtained from local, federal, public, or other nonstate sources in order to implement the program.

(3) If the nonlead ammunition coupon program is implemented, the commission shall issue a report on the usage and redemption rates of ammunition coupons. The report shall cover calendar years 2008, 2009, and 2012. Each report shall be issued by June of the following year.

(d) The commission shall issue a report on the levels of lead found in California condors. This report shall cover calendar years 2008, 2009, and 2012. Each report shall be issued by June of the following year.

(e) The department shall notify those hunters who may be affected by this section.

(f) A person who violates any provision of this section is guilty of an infraction punishable by a fine of five hundred dollars ($500). A second or subsequent offense shall be punishable by a fine of not less than one thousand dollars ($1,000) or more than five thousand dollars ($**5**,000).

CALIFORNIA CONDOR BLOOD LEAD LEVELS (2008): SOUTHERN AND CENTRAL CALIFORNIA POPULATIONS

U. S. Fish and Wildlife Service
Hopper Mountain National Wildlife Refuge Complex
California Condor Recovery Program
24 April 2009

Free-flying California condor blood lead levels sampled during 2008 are summarized for the Southern and Central California populations. U.S. Fish and Wildlife Service and its partners (Ventana Wildlife Society and the National Park Service, Pinnacles National Monument) attempted to sample blood lead levels from all free-flying condors in Southern and Central California at least twice during 2008 (one sample/condor/sampling period, sampling periods = January-June and July-December). Blood samples were analyzed at the Wildlife Health Center at the University of California Davis and the Louisiana Animal Disease Diagnostic Laboratory at Louisiana State University's School of Veterinary Medicine. Data summaries are based on a single years worth of data and should not be interpreted as an evaluation of the Ridley-Tree Condor Preservation Act (2008). U.S. Fish and Wildlife Service, and several research partners have initiated a 3-year study of the effectiveness of the Ridley-Tree Condor Preservation Act. All data and summary statistics should be considered provisional.

Free-flying condor population size in California ranged from 75 to 85 individuals during 2008, and blood lead levels were assessed for 0-39% (Central California = 0-38%, Southern California = 0-58%) of the free-flying California population monthly (Table 1). Blood lead levels were quantified for 72 individual free-flying condors in California during 2008 (Southern California = 39, Central California = 33, total number of samples both populations = 148). In Central California, blood lead levels were sampled once for 19 condors and twice for 14 condors (47 total samples). In Southern California, blood lead levels were sampled once for eight condors while 11,11,7, and 2 condors were sampled 2,3,4, and 5 times, respectively (101 total samples). A total of 35 individual condors were sampled during both sampling periods (i.e., Jan-Jun and Jul-Dec; Southern California = 29, Central California = 6), and 10 condors that were sampled on multiple occasions were only sampled during one of the two sampling periods (i.e, Jan-Jun or Jul-Dec).

Blood lead levels $\leq$ 10 µg/dL may occur from background lead in the environment (Wiemeyer et al. 1988, Church et al. 2006, Cade 2007, Craighead et al. 2008) and were not considered as lead exposure events in this summary. If a bird exhibited elevated blood lead levels during initial testing (> 10 µg/dL), its blood lead levels often were re-tested while held in captivity and/or after treatment for lead toxicosis (chelation therapy). In such cases, only the first sample taken from an individual was included in summary statistics. When multiple samples from the same individual condor were included in summary statistics (Table 1), they were temporally separated by a month or more.

Blood lead levels were compared for 35 condors that were sampled during two sampling periods (Jan-Jun and Jul-Dec) in 2008 (Southern California = 29, Central California = 6; Figure 1). Twenty-three of these condors (66%) exhibited lower blood lead levels from July-December compared to January-June (Southern California = 19, Central California = 4), and 12 condors

(34%) exhibited higher blood lead levels during July-December compared to the January-June (Southern California = 10, Central California = 2, Figure 1).

Blood lead levels were assessed only once for 27 condors in 2008, and 10 condors that were sampled on multiple occasions were sampled during only one of the two sampling periods (i.e., Jan-Jun or Jul-Dec). To utilize these data, and data for condors that were sampled during both spring and fall ($n = 35$; Figure 1), we randomly selected a single blood lead sample for each free-flying condor sampled in 2008 ($n = 72$). Fifty-nine percent of condors sampled during January-June exhibited blood lead levels > 10 μg/dL (background), 45% of condors sampled from July to December exhibited blood lead levels > 10 μg/dL ($n = 72$, Figure 2).

Blood lead levels were monitored for five California condor nestlings during 2008 (Table 2). Two of these (362 and 482) exhibited blood lead levels > 10 μg/dL (background). Three of four foster parents that were tending these two nestlings at the time also exhibited blood lead levels > 10 μg/dL. Both nestlings that exhibited blood lead levels > 10 μg/dL were treated for lead toxicosis (chelation therapy).

Seventeen free-flying condors in California also were treated for lead toxicosis (chelation therapy) during 2008. In Southern California, 14 free-flying condors received chelation treatment (seven during the January to June sampling period and seven during the July to December sampling period). In Central California, three free-flying condors received chelation treatment (Jan-Jun = 2, Jul-Dec = 1).

SUMMARY

Blood lead levels were quantified for 72 individual free-flying condors in California (Southern California = 39, Central California = 33, total number of samples both populations = 148) and for five California condor nestlings (Southern California, total number of samples = 20) during 2008. Fifty-nine percent of condors sampled in the January to June sampling period exhibited blood lead levels > 10 μg/dL (background), 45% of condors sampled in the period July to December exhibited blood lead levels > 10 μg/dL ($n = 72$, Figure 2). A total of 35 individual condors were sampled during both sampling periods (Jan-Jun, Jul-Dec; Southern California = 29, Central California = 6). Twenty-three of these condors (66%) exhibited lower blood lead levels during the July to December sampling period compared to the January to June sampling period (Southern California = 19, Central California = 4), 12 condors (34%) exhibited higher blood lead levels during the July to December sampling period compared to the January to June sampling period (Southern California = 10, Central California = 2, Figure 1). Two of five California condor nestlings exhibited blood lead levels > 10 μg/dL (background) during 2008. Both of these nestlings were treated for lead toxicosis (chelation therapy). Seventeen free-flying condors in California (juveniles and adults) also were treated for lead toxicosis during 2008, (Jan-Jun = 9, Jul-Dec = 8). Data summaries are based on a single years worth of data and should not be interpreted as an evaluation of the Ridley-Tree Condor Preservation Act (2008). U.S. Fish and Wildlife Service, and several research partners have initiated a 3-year study of the effectiveness of the Ridley-Tree Condor Preservation Act. All data and summary statistics should be considered provisional.

Table 1. Summary of blood lead levels (µg/dL) among free-flying California condors in Southern and Central California during 2008 (n = 72 condors, 148 samples).

Study site	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Southern California												
population size	37	36	36	38	38	39	39	38	39	41	40	40
number of condors sampled	9	1	14	0	16	2	16	1	1	0	23	18
percentage of population sampled	24	3	39	0	42	5	41	3	3	0	58	45
number of samples ≤ 10 µg/dL	3	0	4	0	2	0	1	0	0	0	11	10
11-29 µg/dL	5	1	8	0	7	0	13	1	1	0	10	3
30-49 µg/dL	1	0	1	0	4	1	1	0	0	0	1	5
≥ 50 µg/dL	0	0	1	0	3	1	1	0	0	0	1	0
total number of samples >10 µg/dL (background)	6	1	10	-	14	2	15	1	1	-	12	8
percentage of samples >10 µg/dL (background)	67	-	71	-	88	100	94	-	-	-	52	44
Central California												
population size	41	41	39	42	43	42	43	41	40	41	44	45
number of condors sampled	0	0	15	4	10	5	10	0	2	0	0	1
percentage of population sampled	0	0	38	10	23	12	23	0	5	0	0	2
number of samples ≤ 10 µg/dL	0	0	13	4	3	1	4	0	1	0	0	1
11-29 µg/dL	0	0	2	0	4	2	4	0	0	0	0	0
30-49 µg/dL	0	0	0	0	2	1	2	0	0	0	0	0
≥ 50 µg/dL	0	0	0	0	1	1	0	0	1	0	0	0
total number of samples >10 µg/dL (background)	-	-	2	0	7	4	6	-	1	-	-	0
percentage of samples >10 µg/dL (background)	-	-	13	0	70	80	60	-	-	-	-	-
All California												
population size	78	77	75	80	81	81	82	79	79	82	84	85
number of condors sampled	9	1	29	4	26	7	26	1	3	0	23	19
percentage of population sampled	12	1	39	5	32	9	32	1	4	0	27	22
number of samples ≤ 10 µg/dL	3	0	17	4	5	1	5	0	1	0	11	11
11-29 µg/dL	5	1	10	0	11	2	17	1	1	0	10	3
30-49 µg/dL	1	0	1	0	6	2	3	0	0	0	1	5
≥ 50 µg/dL	0	0	1	0	4	2	1	0	1	0	1	0
total number of samples >10 µg/dL (background)	6	1	12	0	21	6	21	1	2	-	12	8
percentage of samples >10 µg/dL (background)	67	-	41	0	81	86	81	-	67	-	52	42

Data summaries are based on a single years worth of data and should not be interpreted as an evaluation of the Ridley-Tree Condor Preservation Act (2008). U.S. Fish and Wildlife Service, and several research partners have initiated a 3-year study of the effectiveness of the Ridley-Tree Condor Preservation Act. All data and summary statistics should be considered provisional.

Table 2. Summary of blood lead levels (µg/dL) among California condor nestlings during 2008. Values in bold indicate months when condor nestlings were given chelation therapy for lead toxicosis (nd = not detected).

Condor	Apr	May	Jun	Jul	Aug	Sep
462	6	83	22	**23**	17	
474		nd	nd	nd	nd	
482		6	8		**100**	
489			nd	nd	nd	nd
493			nd	nd	nd	6

Data summaries are based on a single years worth of data and should not be interpreted as an evaluation of the Ridley-Tree Condor Preservation Act (2008). U.S. Fish and Wildlife Service, and several research partners have initiated a 3-year study of the effectiveness of the Ridley-Tree Condor Preservation Act. All data and summary statistics should be considered provisional.

Figure 1.

Difference in blood lead level (µg/dL) between first (January – June 2008) and second (July – December 2008) sampling periods for 35 individual condors tested during both sampling periods.

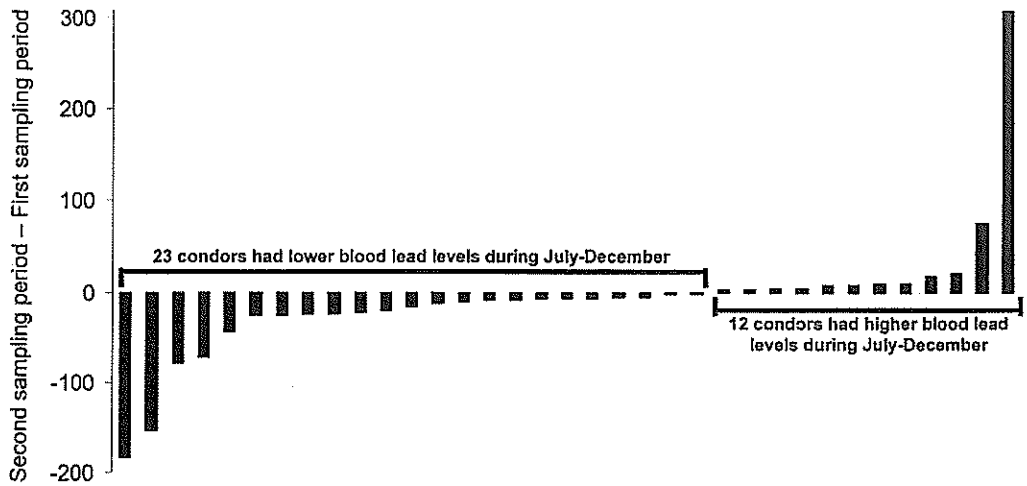


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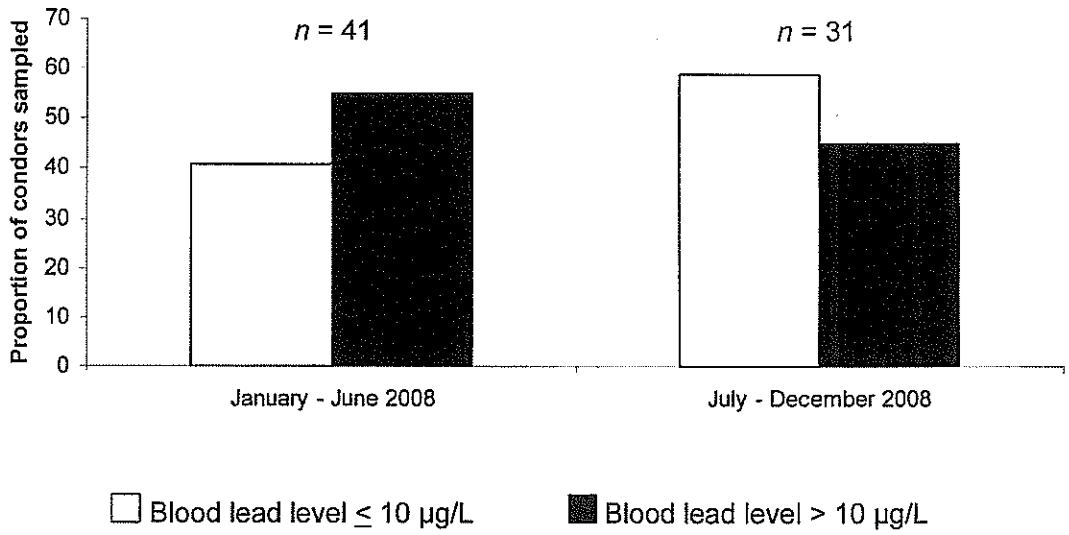
Figure 2.

Proportion of free-flying California Condors (Southern and Central California populations combined) exhibiting blood lead levels ≤ 10 µg/dL (background) and > 10 µg/dL during January – June 2008 and July – December 2008.



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ATTACHMENT IV. Excerpt from Cooperative Agreement in place to coordinate and compile condor blood lead level data in California.

Project Objectives:

1. Monitor lead exposure in condors over a three year period during various hunting activities and evaluate the effectiveness of the lead ammunition regulations by comparing historic lead exposure to lead exposure following the July 2008 ban on lead ammunition in condor range.

2. Investigate sources of continued lead exposure in condors by a) using satellite telemetry and radio telemetry to track condors and identify habitat use, foraging patterns, movements and behaviors associated with lead exposure, b) evaluating stable isotope composition of lead in condor samples and c) evaluating lead availability in hunted animal carcasses recovered in condor range and microtrash recovered from condor nests.

3. Evaluate the health effects of ongoing lead exposure on condors by assessing individual animal clinical outcomes and survival.

Procedures

2. Establish an inter-agency agreement with the Wildlife Health Center at the University of California (Davis), and subcontracts with Ventana Wildlife Society and the University of California (Santa Cruz) to accomplish the following:

a. The U.S. Fish and Wildlife Service (FWS), U.S. National Park Service (NPS), Ventana Wildlife Society (VWS), U.S. Geological Survey (USGS), and collaborating scientists at the University of California (UC) will collate existing biological samples from all three condor release sites in California (Big Sur, Pinnacles National Monument, and Bitter Creek National Wildlife Refuge) and establish a repository for archival of these samples at the Santa Barbara Zoological Institution, California. Results and data from archived samples will be stored on a USGS managed database at the USGS- Forest and Rangeland Ecosystem Science Center (USGS-FRESC). The Wildlife Health Center at the University of California Davis (UCD-WHC) will hire a computer programmer to develop the necessary software for accessing the USGS database via the internet...

b. Monitor lead exposure in the condor population over a three-year period in order to identify the frequency and scope of lead exposure. Condors will be trapped semi-annually during periods of increased risk of exposure (deer and wild pig hunting) with the goal of sampling each individual twice yearly. FWS will trap and collect blood and growing feather samples from the condors at the southern California release site and VWS and the NPS will trap and sample condors at the central California release sites...