# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Southwest Region
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IN REPLY REFER TO
FWS/R8/CONDOR

OCT 29 2013

Memorandum

To: California Fish and Game Commission

From: California Condor Coordinator, Pacific Southwest Region
Sacramento, California

Subject: California Condor Recovery Program, Project Update
And 2011 and 2012 Lead Exposure Report

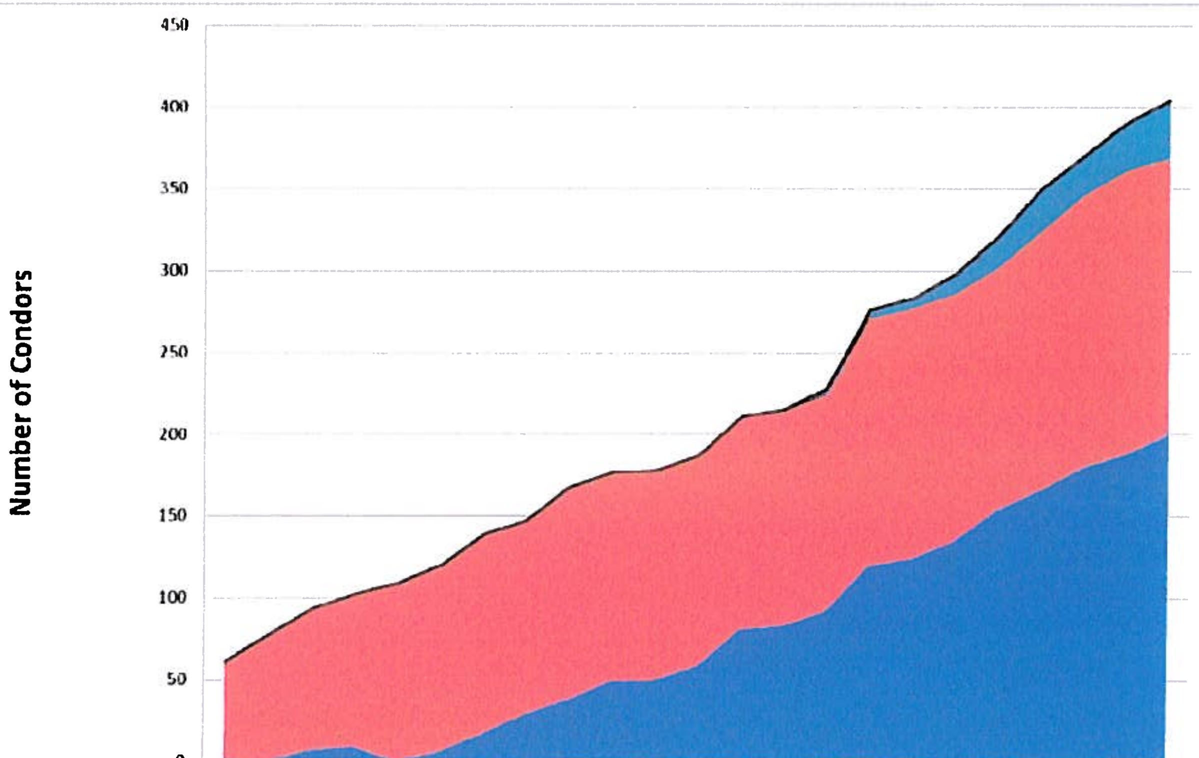
Attached please find the detailed report developed by the U.S. Fish and Wildlife Service field staff based on data provided by the staff at the Ventana Wildlife Society, Pinnacles National Park and Service personnel. The purpose of this report is to update the Commission concerning the status of the condor population, generally, and assist the Commission to address the statutory requirement (Fish and Game Code Section 3004.5 (C)(3)(d)) that the Commission "shall issue" a report regarding lead exposure to condors covering the 2011 and 2012 calendar years. The attached report provides information to address that requirement. This information has been compiled in cooperation with the Department of Fish and Wildlife.

For the Condor Recovery Program as a whole:

- The program continues to increase the number of condors in the wild in Arizona, Utah, California and Baja California. As of the end of July, there are 429 condors in the world of which 224 are free flying. (California 123; Arizona/Utah 71; Baja California 30)
- In the 2013 season, 70 eggs were laid (25 wild and 45 captive) and 47 chicks were hatched (17 wild (68%) and 30 captive (66%)).
- As of December, 2012 there were 35 wild-fledged birds – that is, birds that were the direct product of free-flying birds or the product of a captive bred egg substituted for a non-viable egg at or close to pipping. That number rose to 41 in 2013.
- The population continues to grow because of population supplementation from captive breeding, as conducted by our partners at the San Diego, Oregon and Los Angeles Zoos, and the World Center for Birds of Prey operated by the Peregrine Fund in Idaho.
- As shown in the first figure (Figure #1) the program has made continuous strides over the past 19 years of releases of captive bred condors, with the natural reproduction of wild fledged birds since 2003 showing an excellent trend toward recovery.
- However, this success has occurred only in the context of continuing the intensive management measures required to sustain the population:
    - Capturing virtually all free flying condors at least once per year (twice per year for the California population) to conduct a health exam and to determine lead concentration in blood.

- o In order to capture the free-flying population, we maintain a proffered feeding program at each of the five release sites.
- o In addition, virtually all condors are equipped with VHF telemetry units, and each release site regularly tracks the condors that come from that site.
- o Some condors are equipped with GPS units, giving us more precise location data on a regular basis.
- o Entering each nest up to 5 times prior to fledging, to assess the health of the egg/chick, remove microtrash, and inoculate chicks against West Nile Virus.

**Figure 1**: Condor populations 1990-2012 (from Five-year Review)




| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild Fledged | | | | | | | | | | | |
| Captive Population | 61 | 77 | 86 | 93 | 109 | 114 | 122 | 118 | 130 | 128 | 128 |
| Captive Released | 0 | 0 | 7 | 9 | 0 | 6 | 17 | 29 | 38 | 49 | 50 |
| Total Population | 61 | 77 | 93 | 102 | 109 | 120 | 139 | 147 | 168 | 177 | 178 |

| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild Fledged | | | 1 | 4 | 5 | 6 | 12 | 19 | 26 | 24 | 29 | 35 |
| Captive Population | 129 | 130 | 131 | 132 | 151 | 153 | 151 | 148 | 158 | 166 | 173 | 169 |
| Captive Released | 58 | 81 | 83 | 92 | 120 | 124 | 135 | 154 | 166 | 180 | 188 | 200 |
| Total Population | 187 | 211 | 215 | 228 | 276 | 283 | 298 | 321 | 350 | 370 | 390 | 404 |

Though the population of condors in the wild continues to increase year-to -year and the natural reproduction of condors contributes to that success, the level of condor mortality continues to be a problem in the population. The Service recently completed a five year review of the listing status of California condors and determined that the current "endangered" listing remains warranted, and that the criterion for down-listing had not been met. While the numeric population targets could possibly be met in the next several years, the criterion that requires that the populations be "reproductively self-sustaining" has not been met due to continued mortality in the populations. The single largest threat has been and continues to be exposure to lead in the free-flying condor diet, causing a high number of lead mortalities and an unknown, but high, level of lead morbidity.

**Figure 2**: Known Causes of Mortality (from Five-Year Review)

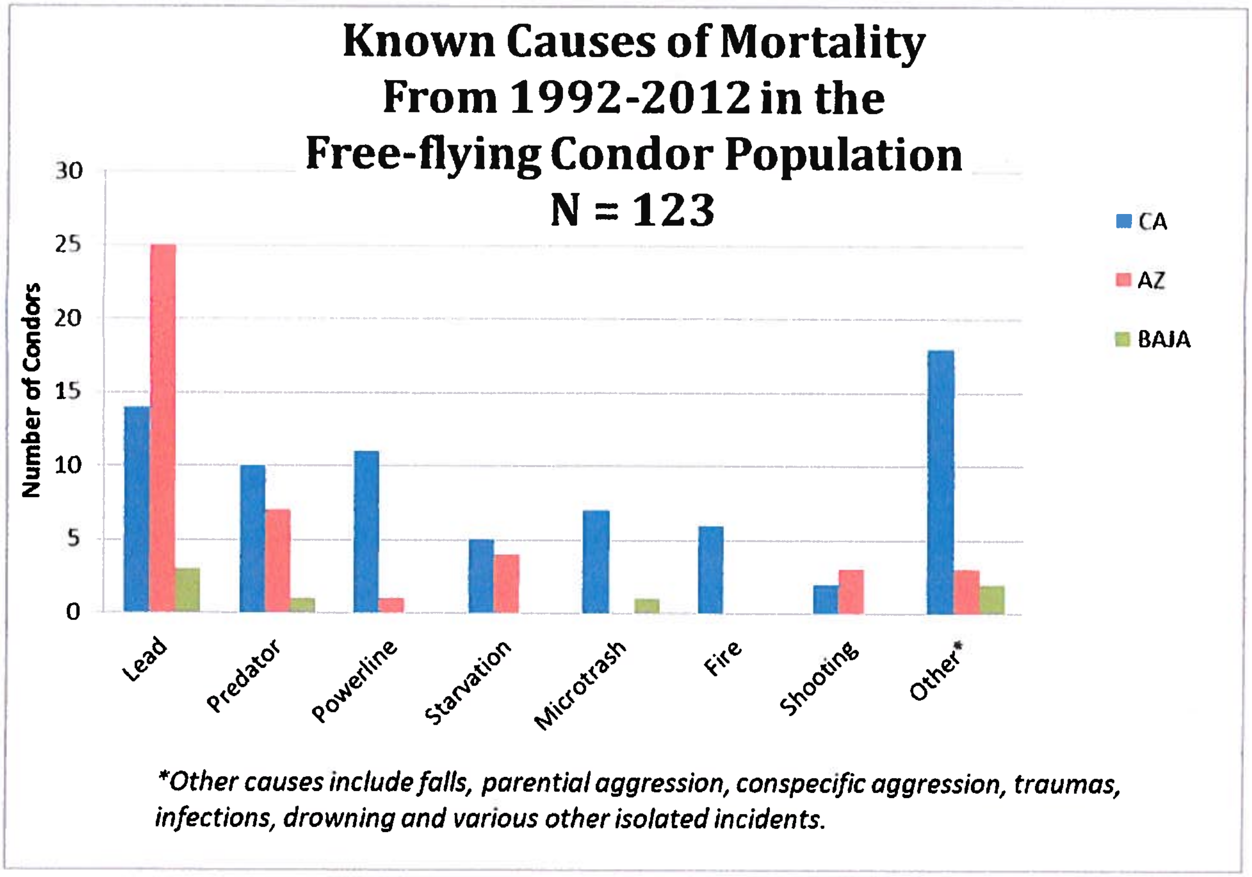


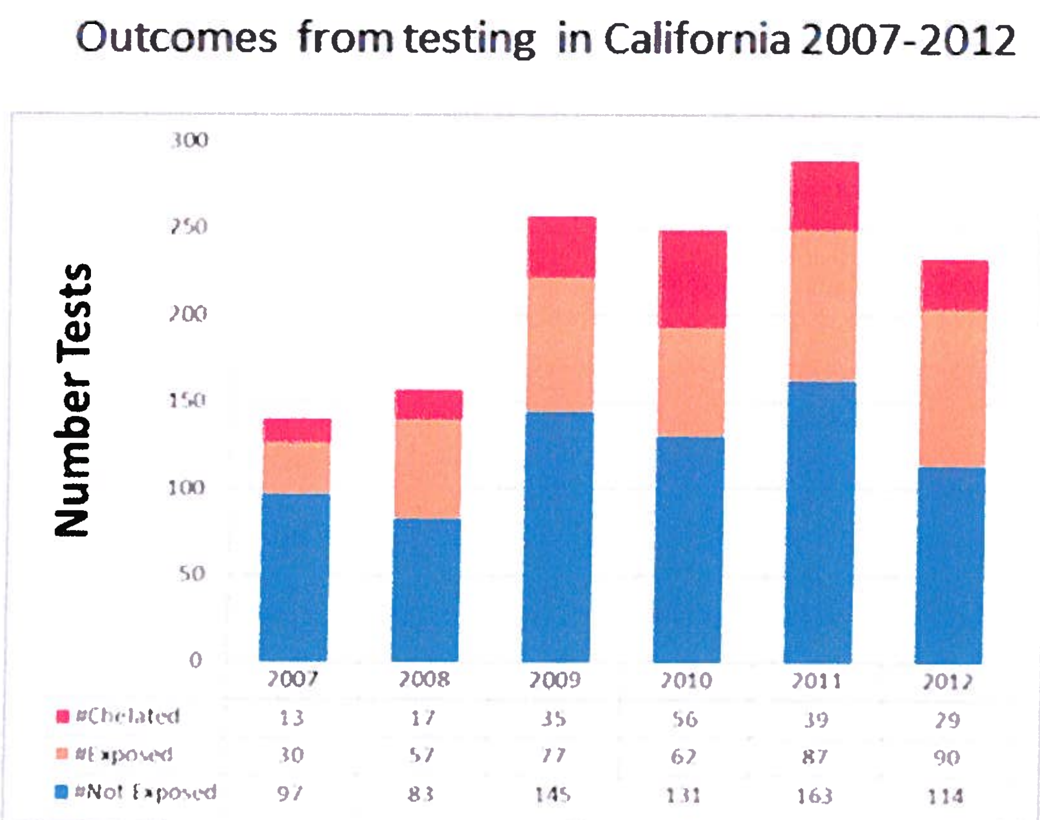

**Table 1:** Recent Adult and Juvenile Mortality in Free-flying Population

| 2011 | # Mortalities | # Determinations | # Lead-Caused | % Lead-Caused |
|---|---|---|---|---|
| California | 6 | 4 | 2 | 50% |
| Arizona/Utah | 6 | 4 | 4 | 100% |
| Baja Calif. | 0 | 0 | 0 | -- |
| Total | 12 | 8 | 6 | 75% |
| | | | | |
| 2012 | | | | |
| California | 6 | 4 | 3 | 75% |
| Arizona/Utah | 12 | 9 | 6 | 66% |
| Baja Calif. | 2 | 0 | 0 | -- |
| Total | 20 | 13 | 9 | 69% |

Table #1 shows the proportion of free-flying mortalities due to lead poisoning continues to be a significant factor in adult and juvenile mortality, even in California where a lead ban in the range of condor has been in effect since the implementation of the Ridley-Tree Condor Protection Act in 2008.

In addition to mortalities, exposure (in this case measured as >15ug/dL blood) to lead in the diet occurs in condors in all populations. The extraordinary management measures taken by the recovery program include capturing most birds (in California two times per year, and more often if required due to evident health or behavior problems) to evaluate health and treat detected health problems. Each health evaluation includes a test of the condor's blood lead level; in California, if exposure is >35 ug/dL is determined based upon a field test (which is later verified with lab results), the condor is taken into captivity and treated with chelation therapy, generally though not exclusively under the direction of the Los Angeles Zoo condor program. This treatment regimen is difficult for the birds and for their handlers and very expensive for the Zoo, using its own resources.

**Figure 3:** Lead exposure (>15 ug/dL) and chelation treatments in California NOTE: The California statistics reflect the number of tests rather than the number of condors, as most condors are assessed twice per year.




For the California population,

- exposure to lead beyond background levels (>15 ug/dL)plus those resulting in chelation treatment varies from a low of 30% of all tests in 2007 to 51% of all tests determinations in 2012, with a mean level of 44.5% of tests revealing exposure,
- the proportion chelated has ranged from just over 9% of all tested condors (2007) to 22.5% of all tested birds in 2010;
- Based on simple statistical models, no trends in the data have been identified when comparing year to year, with the exception that birds in the Pinnacles National Park population show marked increase in exposure over time.

Why are condors in California continuing to be exposed to lead at similar rates before and after the adoption of the Ridley-Tree Condor Protection Act and the banning of lead ammunition for big game and nongame species hunting in the condor zone? Many hypotheses have been discussed by the condor program, though no allocation of the proportion of impact of any given factor has been assigned. Reasons may include:

- Continued use of lead ammunition in poaching, depredation, encounter shooting of pigs, upland game hunting and other shooting not banned under the Act;
- Game that has been wounded with lead ammunition but that remains in the field; Domestic animal management activities, including ranchers dealing with downer sheep, cattle and horses;
- As evaluated in a recent scientific publication (Finkelstein, et al 2012) there are other sources of lead in the environment that condors may be accessing, including 5 individual condors apparently ingesting chips of lead-based paint on a fire tower (since remediated); That peer-reviewed scientific paper identified 9 individuals (8% of the 110 birds in the study) had lead detected in their blood that did not match the isotopic signature of ammunition, background levels, or paint, indicating an unidentified source of lead in the environment.
- As condors increase in experience and maturity, they increase their foraging behavior and become less dependent on proffered food and therefore more dependent on foraged animals, therefore more prone to lead exposure over time. Due to condors group feeding behavior, a single poisoned carcass can have a disproportional impact on the flock overall.

Finkelstein, M.E., D.F. Doak, D. George, J. Burnett, J. Brandt, M. Church, J. Grantham, and D.R. Smith. 2012. Lead poisoning and the deceptive recovery of the critically endangered California condor. Proceedings of the National Academy of Science. 109:11449-11454.

Attachment

# CALIFORNIA CONDOR BLOOD LEAD LEVELS (2010-2012): SOUTHERN AND CENTRAL CALIFORNIA POPULATIONS

U.S. Fish and Wildlife Service
Hopper Mountain National Wildlife Refuge Complex
California Condor Recovery Program
April 12, 2013

Free-flying California condor blood lead levels sampled in 2010, 2011, and 2012 are summarized for the southern and central California populations. The U.S. Fish and Wildlife Service and its partners (Ventana Wildlife Society and the National Park Service, Pinnacles National Park) attempted to sample blood lead levels from all free-flying condors in southern and central California at least twice each year (one sample/condor/sampling period, sampling periods = January-July and August-December). The Wildlife Health Center at the University of California Davis analyzed the blood samples. Data summaries are based on results from a single year and should not be interpreted as an evaluation of the Ridley-Tree Condor Preservation Act (2008). In 2008, U.S. Fish and Wildlife Service and several research partners initiated a three-year study of the effectiveness of the Ridley-Tree Condor Preservation Act. All data and summary statistics should be considered provisional.

## 2010

The free-flying condor population in California ranged from 94-110 individuals monthly in 2010, and blood lead levels were assessed for 0-49% (central California = 0-57%, southern California = 0-85%) of this population each month (Table 1). Blood lead levels were quantified for 98 individual free-flying condors (southern California = 45, central California = 53, total number of samples both populations = 234) and four nestlings (southern California = 2, central California = 2, total number tests for both populations = 5) in 2010. In central California, field staff sampled blood lead levels once for six condors, twice for 29 condors, and more than twice for the remaining 18 condors (123 total samples). In southern California, field staff sampled blood lead levels for once five condors, twice for 11 condors, and more than twice for the remaining 29 condors (131 total samples). Eighty-four individual condors were sampled during both sampling periods (January-July and August-December; southern California = 38, central California = 46).

Blood lead levels < 10 µg/dL were not considered as lead exposure events in this summary because they may occur from background lead in the environment (Wiemeyer et al. 1988, Church et al. 2006, Cade 2007, Craighead et al. 2008). If a condor exhibited elevated blood lead levels (> 35 µg/dL) during initial field testing, its blood lead levels were often re-tested while held in captivity and/or after treatment for lead toxicosis (chelation therapy). In such cases, only the first sample taken from the individual condor was included in summary statistics. Multiple samples from an individual condor were included in summary statistics only when temporally separated by at least 30 days.

Blood lead levels were compared for 84 condors that were sampled during both sampling periods (January-July and August-December) in 2010 (southern California = 38, central California = 46; Figure 1). Fifty-one of these condors (61%) exhibited lower blood lead levels from January-July compared to August-December (southern California = 16, central California = 35) and 32 condors (38%) exhibited higher blood lead levels during January-July compared to August-December (southern California = 21, central California = 11). Mean values were used when individual condors were sampled more than once during each sampling period. Among condors tested during both sampling periods, nine condors exhibited blood lead levels during the August-December sampling period that were >100 μg/dL higher than levels exhibited during the January-July sampling period. In contrast, only four condors exhibited blood lead levels during the January-July sampling period that were > 100 μg/dL higher than levels exhibited during the August-December sampling period.

In southern and central California combined, blood lead levels were assessed for 93 individual condors during the spring (January-July) sampling period and 89 individual condors during the fall (August-December) sampling period. To utilize the data for condors sampled more than once during a distinct sampling period we calculated the mean value so that only one sample per condor is represented (Figure 2). Sixty percent of condors sampled during January-July exhibited blood lead levels > 10 μg/dL (background) and 69% of condors sampled from August-December exhibited blood lead levels > 10 μg/dL (Figure 2).

Field staff also monitored blood lead levels for four California condor nestlings during 2010 (Table 2). One central California nestling (studbook #550) exhibited an elevated blood lead level that required chelation treatment.

Forty-three individual free-flying condors in California received treatment for lead toxicosis (chelation therapy) in 2010. In southern California, two condors (studbook #412 and 462) received chelation treatment for elevated blood lead levels more than once during the year. In central California, eight individual condors received chelation treatment for elevated blood lead levels more than once during the year. In addition, one condor (studbook #458) died of lead toxicosis.

## SUMMARY

Blood lead levels were quantified for 98 individual free-flying condors in California (southern California = 45, central California = 53, total number of samples both populations = 234) and for four California condor nestlings during 2010. Sixty percent of condors sampled during January-July exhibited blood lead levels > 10 μg/dL (background) and 69% of condors sampled from August-December exhibited blood lead levels > 10 μg/dL (Figure 2). Eighty-four individual condors were sampled during both periods (January-July and August-December; southern California = 38, central California = 46).

One of the four California condor nestlings exhibited blood lead levels > 35 μg/dL (treatment threshold) in 2010 and required chelation therapy. Forty-three individual condors in California (juveniles and adults) received treatment for lead toxicosis in 2010. Twenty-four chelation therapy treatments occurred during the January-July sampling period and 34 chelation therapy treatments occurred during the August-December sampling period (nine condors received treatment during both periods). This report is based on data from a single year 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 three-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 California during 2010 (n= 98 condors, 234 samples).**

| | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| **Southern California** | | | | | | | | | | | | |
| population size | 44 | 44 | 43 | 43 | 43 | 46 | 46 | 46 | 47 | 50 | 53 | 50 |
| # of condors sampled | 0 | 0 | 10 | 0 | 2 | 39 | 5 | 2 | 9 | 6 | 28 | 15 |
| % population sampled | 0% | 0% | 23% | 0% | 5% | 85% | 11% | 4% | 19% | 12% | 53% | 30% |
| number of samples ≤ 10 (µg/dL) | 0 | 0 | 6 | 0 | 0 | 11 | 2 | 0 | 7 | 4 | 17 | 1 |
| 11 - 29 µg/dL | 0 | 0 | 2 | 0 | 1 | 14 | 2 | 2 | 2 | 1 | 7 | 5 |
| 30 - 49 µg/dL | 0 | 0 | 1 | 0 | 1 | S | 0 | 0 | 0 | 1 | 0 | 0 |
| ≥ 50 µg/dL | 0 | 0 | 1 | 0 | 0 | 9 | 1 | 0 | 0 | 0 | 4 | 9 |
| total # of samples > 10 µg/dL (background) | 0 | 0 | 4 | 0 | 2 | 28 | 3 | 2 | 2 | 2 | 11 | 14 |
| % of samples > 10 µg/dL (background) | 0% | 0% | 0% | 0% | 0% | 72% | 60% | 100% | 22% | 33% | 39% | 93% |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| **Central California** | | | | | | | | | | | | |
| population size | 52 | 52 | 52 | 51 | 51 | 51 | 52 | 52 | 51 | 53 | 57 | 57 |
| # of condors sampled | 0 | 3 | 7 | 6 | 29 | 9 | 12 | 1 | 26 | 17 | 6 | 2 |
| % of condors sampled | 0% | 6% | 13% | 12% | 57% | 18% | 23% | 2% | 51% | 32% | 11% | 4% |
| number of samples ≤ 10 (µg/dL) | 0 | 2 | 5 | 4 | 11 | 5 | 7 | 1 | 8 | 1 | 2 | 0 |
| 11 - 29 µg/dL | 0 | 1 | 2 | 2 | 10 | 3 | 5 | 0 | 6 | 7 | 2 | 1 |
| 30 - 49 µg/dL | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 6 | 2 | 2 | 0 |
| ≥ 50 µg/dL | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 6 | 7 | 0 | 1 |
| total # of samples > 10 µg/dL (background) | 0 | 1 | 2 | 2 | 18 | 4 | 5 | 0 | 18 | 16 | 4 | 2 |
| % of samples > 10 µg/dL (background) | 0% | 33% | 29% | 33% | 62% | 44% | 42% | 0% | 69% | 94% | 67% | 100% |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| **All California** | | | | | | | | | | | | |
| population size | 96 | 96 | 95 | 94 | 94 | 97 | 98 | 98 | 98 | 103 | 110 | 107 |
| # of condors sampled | 0 | 3 | 17 | 6 | 31 | 48 | 17 | 3 | 35 | 23 | 34 | 17 |
| % of condors sampled | 0% | 3% | 18% | 6% | 33% | 49% | 17% | 3% | 36% | 22% | 31% | 16% |
| number of samples ≤ 10 (µg/dL) | 0 | 2 | 11 | 4 | 11 | 16 | 9 | 1 | 15 | 5 | 19 | 1 |
| 11 - 29 µg/dL | 0 | 1 | 4 | 2 | 11 | 17 | 7 | 2 | 8 | 8 | 9 | 6 |
| 30 - 49 µg/dL | 0 | 0 | 1 | 0 | 5 | 5 | 0 | 0 | 6 | 3 | 2 | 0 |
| ≥ 50 µg/dL | 0 | 0 | 1 | 0 | 4 | 10 | 1 | 0 | 6 | 7 | 4 | 10 |
| total # of samples > 10 µg/dL (background) | 0 | 1 | 6 | 2 | 20 | 32 | 8 | 2 | 20 | 18 | 15 | 16 |
| % of samples > 10 µg/dL (background) | 0% | 33% | 35% | 33% | 65% | 67% | 47% | 67% | 57% | 78% | 44% | 94% |

**Table 2. Summary of blood levels (µg/dL) among California condor nestlings that were tested during 2010.**

| Condor | Apr | May | Jun | Jul | Aug | |
|---|---|---|---|---|---|---|
| 550 | 110 | 250 | | | | Chelated May |
| 560 | | | | 0 | | |
| 574 | | | 2 | | | |
| 587 | | | 7.5 | | | |

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). In 2008, U.S. Fish and Wildlife Service and several research partners initiated a 3-year study of the effectiveness of the Ridley-Tree Condor Preservation Act. All data and summary statistics should be considered provisional.

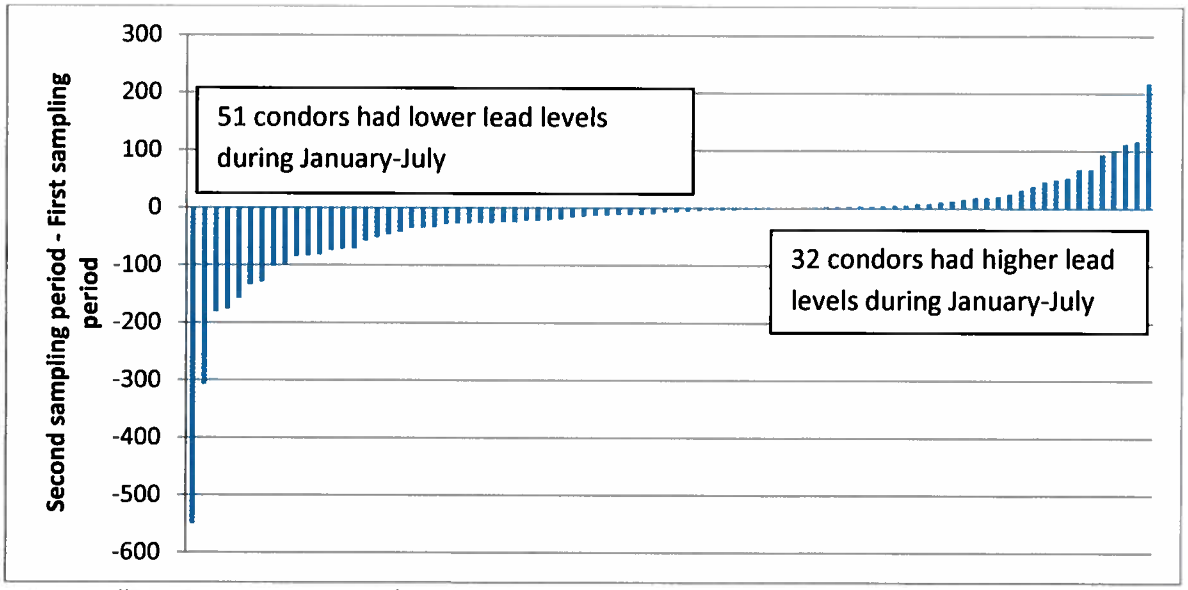



**Figure 1. Difference in blood lead level (µg/dL) between first (January-July 2010) and second (August-December 2010) sampling periods for 84 individual condors tested during both sampling periods. Mean values were used for condors sampled more than once in each period.**

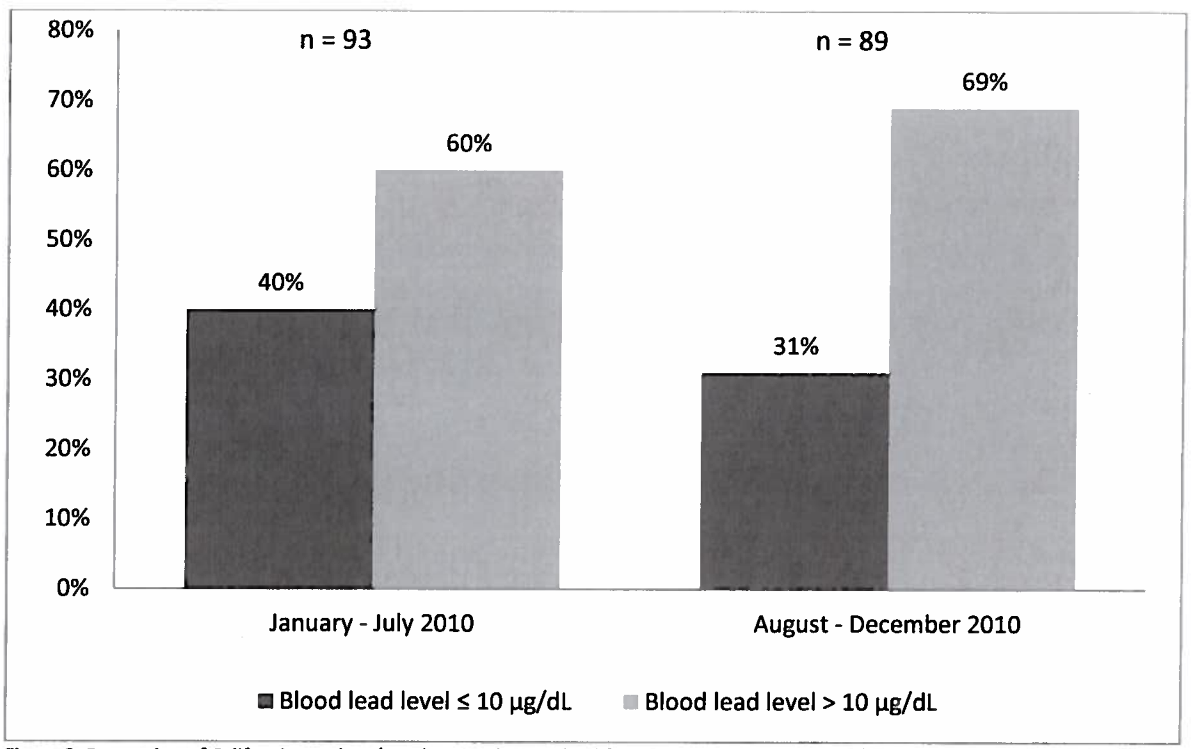



**Figure 2. Proportion of California condors (southern and central California populations combined) exhibiting blood lead levels ≤ 10 (µg/dL) (background) and > 10 (µg/dL) during January-July 2010 and August-December 2010.**

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). In 2008, U.S. Fish and Wildlife Service and several research partners initiated a 3-year study of the effectiveness of the Ridley-Tree Condor Preservation Act. All data and summary statistics should be considered provisional.

## 2011

The free-flying condor population in California ranged from 101-120 individuals monthly in 2011, and blood lead levels were assessed for 2-48% (central California = 0-60%, southern California = 0-83%) of this population each month (Table 1). Blood lead levels were quantified for 104 individual free-flying condors (southern California = 48, central California = 56, total number of samples both populations = 273) and seven nestlings (southern California = 5, central California = 2, total number tests for both populations = 18) in 2011. In central California, field staff sampled blood lead levels once for five condors, twice for 32 condors, and more than twice for the remaining 19 condors (131 total samples). In southern California, field staff sampled blood lead levels once for two condors, twice for four condors, and more than twice for the remaining 42 condors (165 total samples). Ninety-six individual condors were sampled during both sampling periods (January-July and August-December; southern California = 45, central California = 51).

Blood lead levels < 10 µg/dL were not considered as lead exposure events in this summary because they may occur from background lead in the environment (Wiemeyer et al. 1988, Church et al. 2006, Cade 2007, Craighead et al. 2008). If a condor exhibited elevated blood lead levels (> 35 µg/dL) during initial field testing, its blood lead levels were often re-tested while held in captivity and/or after treatment for lead toxicosis (chelation therapy). In such cases, only the first sample taken from the individual condor was included in summary statistics. Multiple samples from an individual condor were included in summary statistics only when temporally separated by at least 30 days.

Blood lead levels were compared for 96 condors that were sampled during both sampling periods (January-July and August-December) in 2011 (southern California = 45, central California = 51; Figure 1). Fifty-one of these condors (53%) exhibited lower blood lead levels from January-July compared to August-December (southern California = 23, central California = 28) and 41 condors (43%) exhibited higher blood lead levels during January-July compared to August-December (southern California = 21, central California = 20). Mean values were used when individual condors were sampled more than once during each sampling period. Among condors tested during both sampling periods, four condors exhibited blood lead levels during the August-December sampling period that were >100 µg/dL higher than levels exhibited during the January-July sampling period. In contrast, two condors exhibited blood lead levels during the January-July sampling period that were > 100 µg/dL higher than levels exhibited during the August-December sampling period.

In southern and central California combined, blood lead levels were assessed for 87 individual condors during the spring (January-July) sampling period and 98 individual condors during the fall (August-December) sampling period. To utilize the data for condors sampled more than once during a distinct sampling period we calculated the mean value so that only one sample per condor is represented (Figure 2). Forty-nine percent of condors sampled during January-July exhibited blood lead levels > 10 µg/dL (background) and 64% of condors sampled from August-December exhibited blood lead levels > 10 µg/dL (Figure 2).

Field staff also monitored blood lead levels for seven California condor nestlings during 2011 (Table 2). One central California nestling (studbook #603) exhibited an elevated blood lead level that required chelation treatment.

Thirty-two individual free-flying condors in California received treatment for lead toxicosis (chelation therapy) in 2011. In southern California, three individual condors (studbook #156, #192, and #365) received chelation treatment for elevated blood lead levels more than once during the year. In central California, two individual condors (studbook #219 and #411) received chelation treatment for elevated blood lead levels more than once during the year. In addition, two condors (studbook #112 and #214) died of lead toxicosis, both while undergoing treatment at the Los Angeles Zoo.

## SUMMARY

Blood lead levels were quantified for 104 individual free-flying condors in California (southern California = 48, central California = 56, total number of samples both populations = 273) and for seven California condor nestlings in 2011. Forty-nine percent of condors sampled during January-July exhibited blood lead levels > 10 µg/dL (background) and 64% of condors sampled from August-December exhibited blood lead levels > 10 µg/dL (Figure 2). Ninety-six individual condors were sampled during both periods (January-July and August-December; southern California = 45, central California = 51).

One of the seven California condor nestlings exhibited blood lead levels > 35 µg/dL (treatment threshold) in 2011 and required chelation therapy. Thirty-two individual condors in California (juveniles and adults) received treatment for lead toxicosis in 2011. Twenty-five chelation therapy treatments occurred during the January-July sampling period and 15 chelation therapy treatments occurred during the August-December sampling period (four condors received treatment during both periods). This report is based on data from a single year 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 three-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 California during 2011 (n= 104 condors, 273 samples).**

| | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| **Southern California** | | | | | | | | | | | | |
| population size | 49 | 49 | 49 | 48 | 47 | 48 | 47 | 47 | 49 | 52 | 53 | 59 |
| # of condors sampled | 28 | 5 | 0 | 3 | 0 | 40 | 5 | 9 | 12 | 1 | 41 | 6 |
| % population sampled | 57% | 10% | 0% | 6% | 0% | 83% | 11% | 19% | 24% | 2% | 77% | 10% |
| number of samples ≤ 10 (µg/dL) | 11 | 3 | 0 | 2 | 0 | 17 | 2 | 2 | 5 | 1 | 20 | 2 |
| 11 - 29 µg/dL | 8 | 1 | 0 | 0 | 0 | 19 | 2 | 4 | 6 | 0 | 13 | 3 |
| 30 - 49 µg/dL | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 2 | 1 |
| ≥ 50 µg/dL | 6 | 0 | 0 | 1 | 0 | 3 | 1 | 3 | 0 | 0 | 6 | 0 |
| total # of samples > 10 µg/dL (backgrour | 17 | 2 | 0 | 1 | 0 | 23 | 3 | 7 | 7 | 0 | 21 | 4 |
| % of samples > 10 µg/dL (background) | 61% | 40% | 0% | 33% | 0% | 58% | 60% | 78% | 58% | 0% | 51% | 67% |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| **Central California** | | | | | | | | | | | | |
| population size | 57 | 57 | 57 | 57 | 57 | 56 | 56 | 54 | 57 | 61 | 60 | 61 |
| # of condors sampled | 4 | 3 | 2 | 10 | 34 | 10 | 0 | 6 | 34 | 19 | 1 | 0 |
| % of condors sampled | 7% | 5% | 4% | 18% | 60% | 18% | 0% | 11% | 60% | 31% | 2% | 0% |
| number of samples ≤ 10 (µg/dL) | 3 | 1 | 0 | 7 | 17 | 3 | 0 | 1 | 10 | 8 | 0 | 0 |
| 11 - 29 µg/dL | 1 | 1 | 1 | 3 | 8 | 2 | 0 | 4 | 18 | 5 | 1 | 0 |
| 30 - 49 µg/dL | 0 | 1 | 0 | 0 | 1 | 4 | 0 | 1 | 3 | 3 | 0 | 0 |
| ≥ 50 µg/dL | 0 | 0 | 1 | 0 | 8 | 1 | 0 | 0 | 3 | 3 | 0 | 0 |
| total # of samples > 10 µg/dL (backgrour | 1 | 2 | 2 | 3 | 17 | 7 | 0 | 5 | 24 | 11 | 1 | 0 |
| % of samples > 10 µg/dL (background) | 25% | 67% | 100% | 30% | 50% | 70% | 0% | 83% | 71% | 58% | 100% | 0% |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| **All California** | | | | | | | | | | | | |
| population size | 106 | 106 | 106 | 105 | 104 | 104 | 103 | 101 | 106 | 113 | 113 | 120 |
| # of condors sampled | 32 | 8 | 2 | 13 | 34 | 50 | 5 | 15 | 46 | 20 | 42 | 6 |
| % of condors sampled | 30% | 8% | 2% | 12% | 33% | 48% | 5% | 15% | 43% | 18% | 37% | 5% |
| number of samples ≤ 10 (µg/dL) | 14 | 4 | 0 | 9 | 17 | 20 | 2 | 3 | 15 | 9 | 20 | 2 |
| 11 - 29 µg/dL | 9 | 2 | 1 | 3 | 8 | 21 | 2 | 8 | 24 | 5 | 14 | 3 |
| 30 - 49 µg/dL | 3 | 2 | 0 | 0 | 1 | 5 | 0 | 1 | 4 | 3 | 2 | 1 |
| ≥ 50 µg/dL | 6 | 0 | 1 | 1 | 8 | 4 | 1 | 3 | 3 | 3 | 6 | 0 |
| total # of samples > 10 µg/dL (backgrour | 18 | 4 | 2 | 4 | 17 | 30 | 3 | 12 | 31 | 11 | 22 | 4 |
| % of samples > 10 µg/dL (background) | 56% | 50% | 100% | 31% | 50% | 60% | 60% | 80% | 67% | 55% | 52% | 67% |

**Table 2. Summary of blood levels (µg/dL) among California condor nestlings that were tested during 2011.**

| Condor | May | Jun | Jul | Aug | Sep | |
|---|---|---|---|---|---|---|
| 598 | 11 | 8.1 | 9.1 | 13 | | |
| 599 | 0 | 0 | 0 | 11 | | |
| 603 | | 85 | | | | Chelated June |
| 616 | 31.5 | 22 | | 14 | | |
| 627 | | 0 | | | 0 | |
| 629 | | | | 6.6 | 14 | |
| 630 | | | 0 | 6.6 | | |


**Figure 1. Difference in blood lead level (µg/dL) between first (January-July 2011) and second (August-December 2011) sampling periods for 96 individual condors tested during both sampling periods. Mean values were used for condors sampled more than once in each period.**

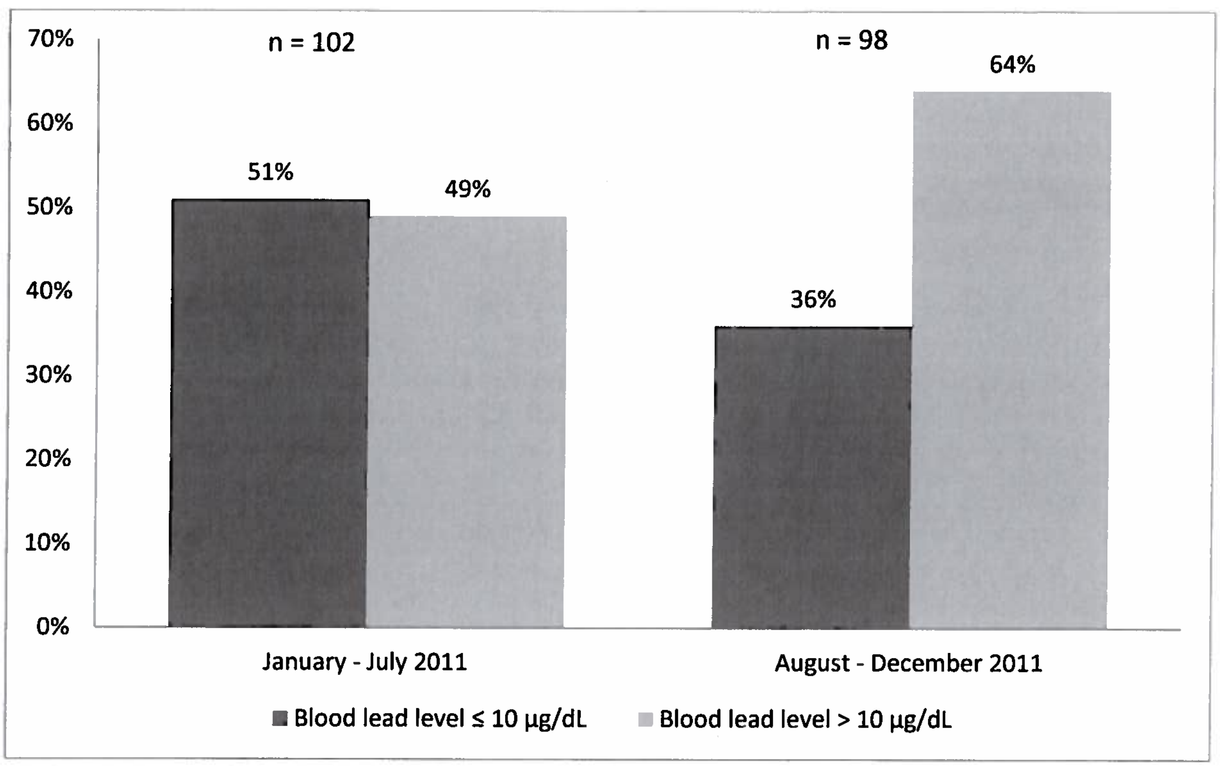



**Figure 2. Proportion of California condors (southern and central California populations combined) exhibiting blood lead levels ≤ 10 (µg/dL) (background) and > 10 (µg/dL) during January-July 2011 and August-December 2011.**

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). In 2008, U.S. Fish and Wildlife Service and several research partners initiated a 3-year study of the effectiveness of the Ridley-Tree Condor Preservation Act. All data and summary statistics should be considered provisional.

The free-flying condor population in California ranged from 118-131 individuals monthly in 2012, and blood lead levels were assessed for 1-39% (central California = 2-37%, southern California = 0-62%) of this population each month (Table 1). Blood lead levels were quantified for 116 individual free-flying condors (southern California = 59, central California = 57, total number of samples both populations = 230) and nine nestlings (southern California = 5, central California = 4, total number tests for both populations = 23) in 2012. In central California, field staff sampled blood lead levels once for 17 condors, twice for 29 condors, and more than twice for the remaining 11 condors (106 total samples). In southern California, field staff sampled blood lead levels once for four condors, twice for 42 condors, and more than twice for the remaining 13 condors (127 total samples). Eighty-two individual condors were sampled during both sampling periods (January-July and August-December; southern California = 50, central California = 32).

Blood lead levels < 10 µg/dL were not considered as lead exposure events in this summary because they may occur from background lead in the environment (Wiemeyer et al. 1988, Church et al. 2006, Cade 2007, Craighead et al. 2008). If a condor exhibited elevated blood lead levels (> 35 µg/dL) during initial field testing, its blood lead levels were often re-tested while held in captivity and/or after treatment for lead toxicosis (chelation therapy). In such cases, only the first sample taken from the individual condor was included in summary statistics. Multiple samples from an individual condor were included in summary statistics only when temporally separated by at least 30 days.

Blood lead levels were compared for 82 condors that were sampled during both sampling periods (January-July and August-December) in 2012 (southern California = 50, central California = 32; Figure 1). Thirty-one of these condors (38%) exhibited lower blood lead levels from January-July compared to August-December (southern California = 14, central California = 17) and 46 condors (56%) exhibited higher blood lead levels during January-July compared to August-December (southern California = 33, central California = 13). Mean values were used when individual condors were sampled more than once during each sampling period. Among condors tested during both sampling periods, seven condors exhibited blood lead levels during the August-December sampling period that were >100 µg/dL higher than levels exhibited during the January-July sampling period. In contrast, zero condors exhibited blood lead levels during the January-July sampling period that were > 100 µg/dL higher than levels exhibited during the August-December sampling period.

In southern and central California combined, blood lead levels were assessed for 92 individual condors during the spring (January-July) sampling period and 105 individual condors during the fall (August-December) sampling period. To utilize the data for condors sampled more than once during a distinct sampling period we calculated the mean value so that only one sample per condor is represented (Figure 2). Sixty-three percent of condors sampled during January-July exhibited blood lead levels > 10 µg/dL (background) and 65% of condors sampled from August-December exhibited blood lead levels > 10 µg/dL (Figure 2).

Field staff also monitored blood lead levels for nine California condor nestlings in 2012 (Table 2). One southern California nestling (studbook #658) exhibited an elevated blood lead level that required chelation treatment.

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). In 2008, U.S. Fish and Wildlife Service and several research partners initiated a 3-year study of the effectiveness of the Ridley-Tree Condor Preservation Act. All data and summary statistics should be considered provisional.

Twenty-six individual free-flying condors in California received treatment for lead toxicosis (chelation therapy) in 2012. In southern California, one individual condor (studbook #289) received chelation treatment for elevated blood lead levels more than once during the year. In central California, two individual condors (studbook #463 and #538) received chelation treatment for elevated blood lead levels more than once during the year. In addition, three condors (studbook #298, 318, and 478) died of lead toxicosis. Condors #318 and 478 both died while undergoing chelation treatment at the Los Angeles Zoo.

## SUMMARY

Blood lead levels were quantified for 116 individual free-flying condors in California (southern California = 59, central California = 57, total number of samples both populations = 230) and for nine California condor nestlings in 2012. Sixty-three percent of condors sampled during January-July exhibited blood lead levels > 10 µg/dL (background) and 65% of condors sampled from August-December exhibited blood lead levels > 10 µg/dL (Figure 2). Eighty-two individual condors were sampled during both periods (January-July and August-December; southern California = 50, central California = 32).

One of the nine California condor nestlings exhibited blood lead levels > 35 µg/dL (treatment threshold) in 2012 and required chelation therapy. Twenty-six individual condors in California (juveniles and adults) received treatment for lead toxicosis in 2012. Nine of the chelation therapy treatments occurred during the January-July sampling period and 20 of the chelation therapy treatments occurred during the August-December sampling period (two condors received treatment during both periods). This report is based on data from a single year 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 three-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 California during 2012 (n= 116 condors, 230 samples).**

| | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| **Southern California** | | | | | | | | | | | | |
| population size | 59 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 65 | 68 | 69 |
| # of condors sampled | 0 | 4 | 3 | 0 | 0 | 36 | 16 | 6 | 3 | 0 | 39 | 18 |
| % population sampled | 0% | 7% | 5% | 0% | 0% | 62% | 28% | 10% | 5% | 0% | 57% | 26% |
| number of samples ≤ 10 (µg/dL) | 0 | 2 | 3 | 0 | 0 | 18 | 5 | 3 | 2 | 0 | 24 | 9 |
| 11 - 29 µg/dL | 0 | 2 | 0 | 0 | 0 | 10 | 7 | 2 | 0 | 0 | 10 | 5 |
| 30 - 49 µg/dL | 0 | 0 | 0 | 0 | 0 | 4 | 2 | 1 | 1 | 0 | 3 | 1 |
| ≥ 50 µg/dL | 0 | 0 | 0 | 0 | 0 | 4 | 2 | 0 | 0 | 0 | 2 | 3 |
| total # of samples > 10 µg/dL (background) | 0 | 2 | 0 | 0 | 0 | 18 | 11 | 3 | 1 | 0 | 15 | 18 |
| % of samples > 10 µg/dL (background) | 0% | 50% | 0% | 0% | 0% | 50% | 69% | 50% | 33% | 0% | 38% | 100% |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| **Central California** | | | | | | | | | | | | |
| population size | 64 | 64 | 64 | 63 | 63 | 63 | 62 | 62 | 60 | 58 | 63 | 62 |
| # of condors sampled | 1 | 4 | 1 | 13 | 23 | 6 | 1 | 4 | 18 | 14 | 12 | 8 |
| % of condors sampled | 2% | 6% | 2% | 21% | 37% | 10% | 2% | 6% | 30% | 24% | 19% | 13% |
| number of samples ≤ 10 (µg/dL) | 0 | 3 | 1 | 1 | 8 | 1 | 0 | 2 | 5 | 1 | 1 | 1 |
| 11 - 29 µg/dL | 1 | 1 | 0 | 8 | 14 | 3 | 1 | 2 | 8 | 5 | 3 | 4 |
| 30 - 49 µg/dL | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 2 | 3 | 4 | 0 |
| ≥ 50 µg/dL | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 3 | 5 | 4 | 3 |
| total # of samples > 10 µg/dL (background) | 1 | 1 | 0 | 12 | 15 | 5 | 1 | 2 | 13 | 13 | 11 | 7 |
| % of samples > 10 µg/dL (background) | 100% | 25% | 0% | 92% | 65% | 83% | 100% | 50% | 72% | 93% | 92% | 88% |
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| **All California** | | | | | | | | | | | | |
| population size | 123 | 122 | 122 | 121 | 121 | 121 | 120 | 120 | 118 | 123 | 131 | 131 |
| # of condors sampled | 1 | 8 | 4 | 13 | 23 | 42 | 17 | 10 | 21 | 14 | 51 | 26 |
| % of condors sampled | 1% | 7% | 3% | 11% | 19% | 35% | 14% | 8% | 18% | 11% | 39% | 20% |
| number of samples ≤ 10 (µg/dL) | 0 | 5 | 4 | 1 | 8 | 19 | 5 | 5 | 7 | 1 | 25 | 10 |
| 11 - 29 µg/dL | 1 | 3 | 0 | 8 | 14 | 13 | 8 | 4 | 8 | 5 | 13 | 9 |
| 30 - 49 µg/dL | 0 | 0 | 0 | 2 | 0 | 6 | 2 | 1 | 3 | 3 | 7 | 1 |
| ≥ 50 µg/dL | 0 | 0 | 0 | 2 | 1 | 4 | 2 | 0 | 3 | 5 | 6 | 6 |
| total # of samples > 10 µg/dL (background) | 1 | 3 | 0 | 12 | 15 | 23 | 12 | 5 | 14 | 13 | 26 | 25 |
| % of samples > 10 µg/dL (background) | 100% | 38% | 0% | 92% | 65% | 55% | 71% | 50% | 67% | 93% | 51% | 96% |

**Table 2. Summary of blood levels (µg/dL) among California condor nestlings that were tested during 2012.**

| Condor | May | Jun | Jul | Aug | Sep | |
|---|---|---|---|---|---|---|
| 644 | 0 | | 0 | 0 | | |
| 646 | 11 | | 0 | | | |
| 648 | 0 | 0 | | 0 | | |
| 654 | | | | 0 | | |
| 658 | 0 | | 71 | 58 | 50 | Chelated Aug |
| 664 | | 0 | 13 | 7.4 | 9 | |
| 665 | | 0 | 0 | | 0 | |
| 670 | | | | 0 | 7.6 | |
| 672 | | | | 0 | | |

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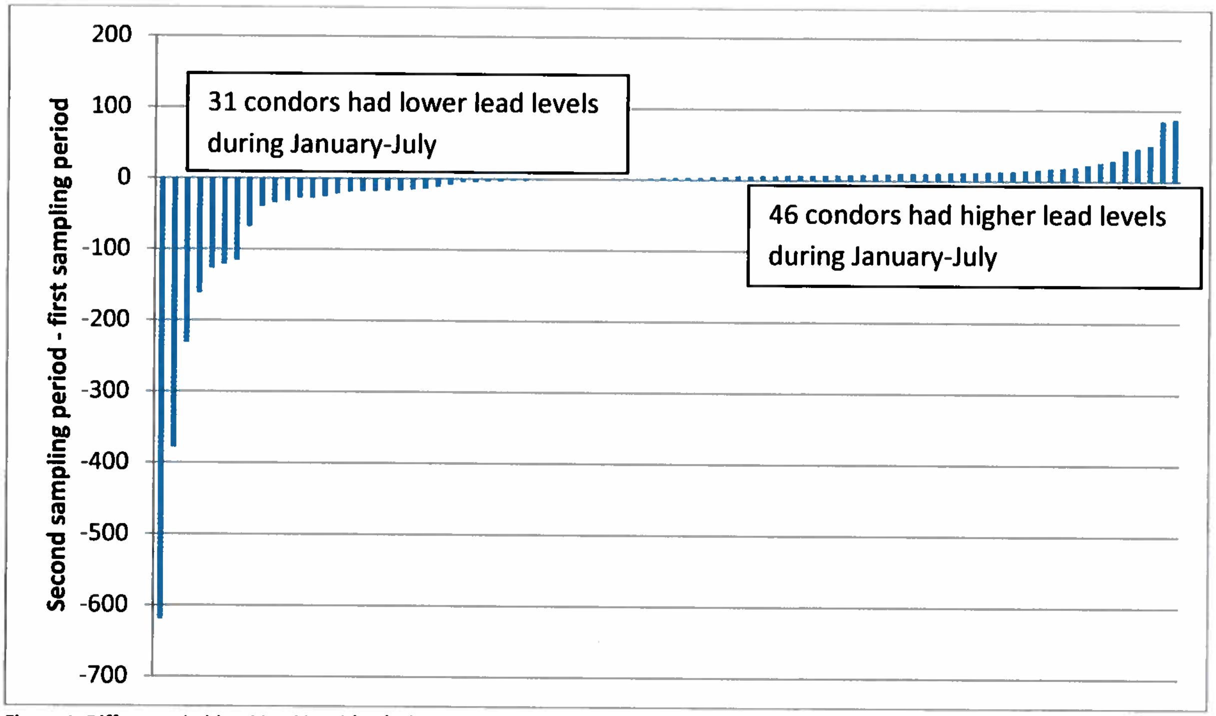


**Figure 1. Difference in blood lead level (µg/dL) between first (January-July 2012) and second (August-December 2012) sampling periods for 82 individual condors tested during both sampling periods. Mean values were used for condors sampled more than once in each period.**

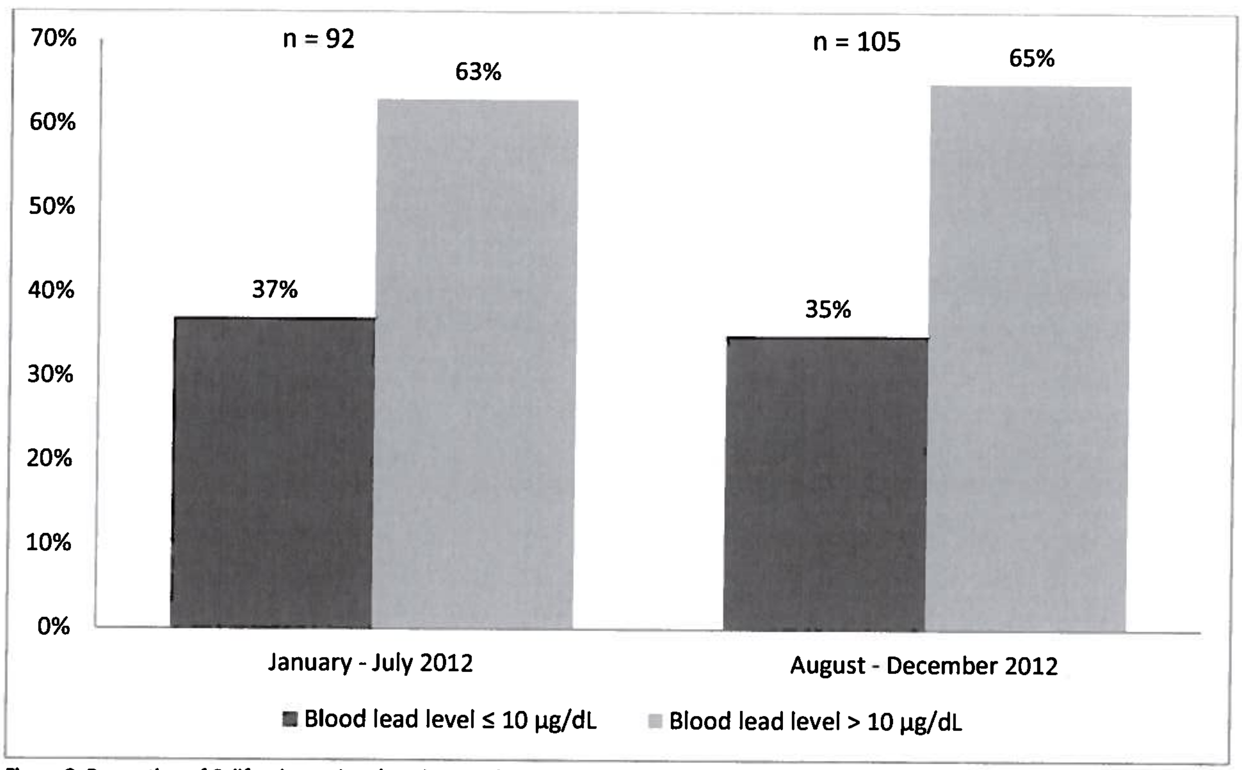


**Figure 2. Proportion of California condors (southern and central California populations combined) exhibiting blood lead levels ≤ 10 (µg/dL) (background) and > 10 (µg/dL) during January-July 2012 and August-December 2012.**

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