California Condor Recovery Program in the Southwest

Fourth Review (2012-2016)

November 2017

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EXECUTIVE SUMMARY

This five-year review of the California Condor Recovery Program in the Southwest evaluates progress towards recovery of the California condor (*Gymnogyps californianus*) population in northern Arizona and southern Utah. The year 2016 marked the twentieth year of reintroductions and management of these condors, which have been reintroduced within a nonessential experimental population area established under section 10(j) of the Endangered Species Act, a designation providing greater flexibility in management of reintroduced condors. This fourth five-year review documents status and evaluates recovery actions for the period 2012-2016. The review recounts and summarizes releases of captive-raised condors into the southwestern population; breeding, recruitment, and mortality; field management; lead poisoning effects and treatment; lead reduction and other recovery activities; and program administration. The review also evaluates the recommended actions from the last review and provides recommendations for the next five years.

The condor recovery program in the Southwest is a partnership among the U.S. Fish and Wildlife Service, Bureau of Land Management, National Park Service, U.S. Forest Service, Arizona Game and Fish Department (AGFD), Utah Division of Wildlife Resources (UDWR), The Peregrine Fund, Navajo Nation, Kaibab Band of Paiute Indians, and Arizona Center for Nature Conservation/Phoenix Zoo. Collectively, these agencies, tribes, and organizations form the Southwest Condor Working Group (SCWG). Members of the SCWG developed this five-year review.

By the end of 2016, there were 79 condors in the southwestern population, including 70 captive-reared and 9 wild-hatched birds. A total of 189 condors were released in the northern Arizona and southern Utah 10(j) area between 1996 and 2016, and these birds produced 29 wild-hatched chicks. Through the end of 2016, 125 of these birds had died, including 20 of the wild-hatched chicks, and 11 were removed to permanent captivity due to behavioral problems. Reintroduction efforts have been complicated and therefore delayed primarily by unsustainably high morbidity and mortality from ingestion of (primarily) lead-based ammunition, the leading cause of diagnosed mortality (54%) followed by fewer than half as many deaths attributed to predation.

AGFD and UDWR continued their voluntary non-lead reduction programs through the reporting period, with an average of 88% of Arizona's Kaibab deer hunters and 80% of southern Utah deer hunters participating in lead reduction efforts during the five-year review period. Many of the SCWG partner agencies and organizations also provide significant outreach related to condor management, the effects of lead ingestion, and efforts to reduce the availability of lead to condors.

This report concludes that the most significant issue raised in the third program review, exposure to lead contamination, continues to be the chief impediment to recovery. Although targeted voluntary efforts to reduce the use of lead ammunition in California condor range has reduced the amount of available lead seasonally, further efforts to reduce the greater lead load available to scavenging birds on a year-round cycle are crucial for program success and a healthier ecosystem.

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INTRODUCTION

At the end of 2016, the Southwest Condor Working Group (SCWG) completed the twentieth year of the California condor (*Gymnogyps californianus*) recovery program in northern Arizona and southern Utah. Condors have been reintroduced within a nonessential experimental population area established under section 10(j) of the Endangered Species Act (ESA) (61 FR 201:54044-54059; 16 October 1996). Under section 7 of the ESA, members of a nonessential experimental population [10(j) population] are treated as a species proposed for listing, except when within lands administered by the U.S. Fish and Wildlife Service (FWS) or National Park Service (NPS), where they are treated as threatened. Through this designation, the reintroduced population of condors can be managed with greater flexibility than fully endangered populations.

As part of the Federal rule-making process that established the 10(j) condor population, FWS agreed to conduct a formal evaluation of this reintroduction program every five years. This report evaluates the progress of condor reintroduction in the Southwest (Arizona and Utah) for the program's fourth five-year period (2012-2016). Previous reviews have included extensive information about condor biology, management, and program administration. This review focuses on those activities and issues specific to 2012 through 2016 and does not repeat all the elements included in earlier reviews. For additional information, please refer to those reviews, available at https://www.fws.gov/southwest/es/arizona/CA_Condor.htm.

Southwest Condor Working Group

The California Condor Recovery Program in the Southwest is focused on the 10(j) area within northern Arizona and southern Utah and is a partnership among Federal agencies (FWS, Bureau of Land Management [BLM], NPS, and U.S. Forest Service [Forest Service]), state agencies (Arizona Game and Fish Department [AGFD] and Utah Division of Wildlife Resources [UDWR]), tribes (Kaibab Band of Paiute Indians [Kaibab-Paiute Tribe] and Navajo Nation), and private non-profit organizations (The Peregrine Fund [TPF] and Arizona Center for Nature Conservation/Phoenix Zoo [Phoenix Zoo]). Representatives of these entities form the SCWG, facilitating coordination directed towards condor recovery. Contact information for participants in the SCWG is included at the end of this review.

A Memorandum of Understanding (MOU) provides the framework for cooperation and participation among SCWG members. The MOU was revised and renewed in 2016 and outlines the commitments by FWS and cooperators in the implementation of the recovery program. FWS is the lead agency responsible for condor recovery. BLM, NPS, Forest Service, Kaibab-Paiute Tribe, and Navajo Nation all administer lands within the 10(j) population area. AGFD and UDWR chair the SCWG and administer voluntary non-lead ammunition programs. Phoenix Zoo displays two captive condors, provides educational programs, and offers veterinary assistance. TPF manages day-to-day operations of the field program and maintains a condor breeding facility at the World Center for Birds of Prey in Boise, Idaho. The cooperators meet or confer regularly each spring and fall and with less formal communications throughout the year as needed.

In addition to the MOU, FWS signed the Agreement with the Coalition of County and Local Governments (Agreement) in 1997. The Agreement, which is with these governments in northern Arizona and southern Utah, ensures to the maximum extent possible that current and future land, water, or air uses within the experimental population area are not affected as a consequence of the release of California condors in the 10(j) area, and to promote the recovery of the California condor. The final rule that established the 10(j) population (61 FR 201:54050) states that the program will be managed in accordance with the MOU and the Agreement. Please refer to previous reviews for a full description of the terms of the Agreement and its status.

Review Process

The purpose of this review is to formally evaluate progress towards condor recovery in the Southwest. The review provides updates from 2012-2016 on the biological and field management aspects of the program, lead reduction efforts, and administration of the recovery effort. It examines each of the major issues brought forward from the third review and identified by members of the SCWG, and provides recommendations to improve the effectiveness of the program over the next five years. This review recommends continuing the reintroduction program, but continues to identify lead contamination as the major factor hindering condor recovery. We have also identified areas for management emphasis over the next five years. FWS is responsible for making any final decisions regarding this reintroduction program and the review's recommendations. This document fulfills the five-year review and evaluation commitment as stated in the final rule that established the 10(j) population of California condors in northern Arizona and southern Utah.

Background of the Southwest Recovery Program

The first condor release in northern Arizona occurred on December 12, 1996. By the end of 2016, there were a total of 79 condors in the southwestern population. Nine of these birds were wild-hatched, two were being held for treatment, and four captive-bred condors were being held in the flight pen at the Vermilion Cliffs release site awaiting release. From 1996 through 2016, a total of 189 condors were released in the northern Arizona and southern Utah 10(j) area and 29 chicks were wild-hatched in northern Arizona and southern Utah. Eleven condors were removed to permanent captivity due to behavioral problems. Through the end of 2016, 125 of these birds had died, including 20 of the wild-hatched chicks. Reintroduction efforts have been complicated primarily by lead poisonings and predation.

The 10(j) population status applies to condors in the Southwest only when they are within the geographic bounds of the designated 10(j) area, which is defined by: Interstate Highway 40 (I-40) on the south, U.S. Highway 191 on the east (parallel to the New Mexico and Colorado state borders), Interstate Highway 70 (I-70) on the north, and Interstate Highway 15 (I-15) to U.S. Highway 93 near Las Vegas, Nevada on the west (Figure 1). When condors leave this area they receive the full protection of the Act and are treated as an endangered species under section 7 consultation procedures.

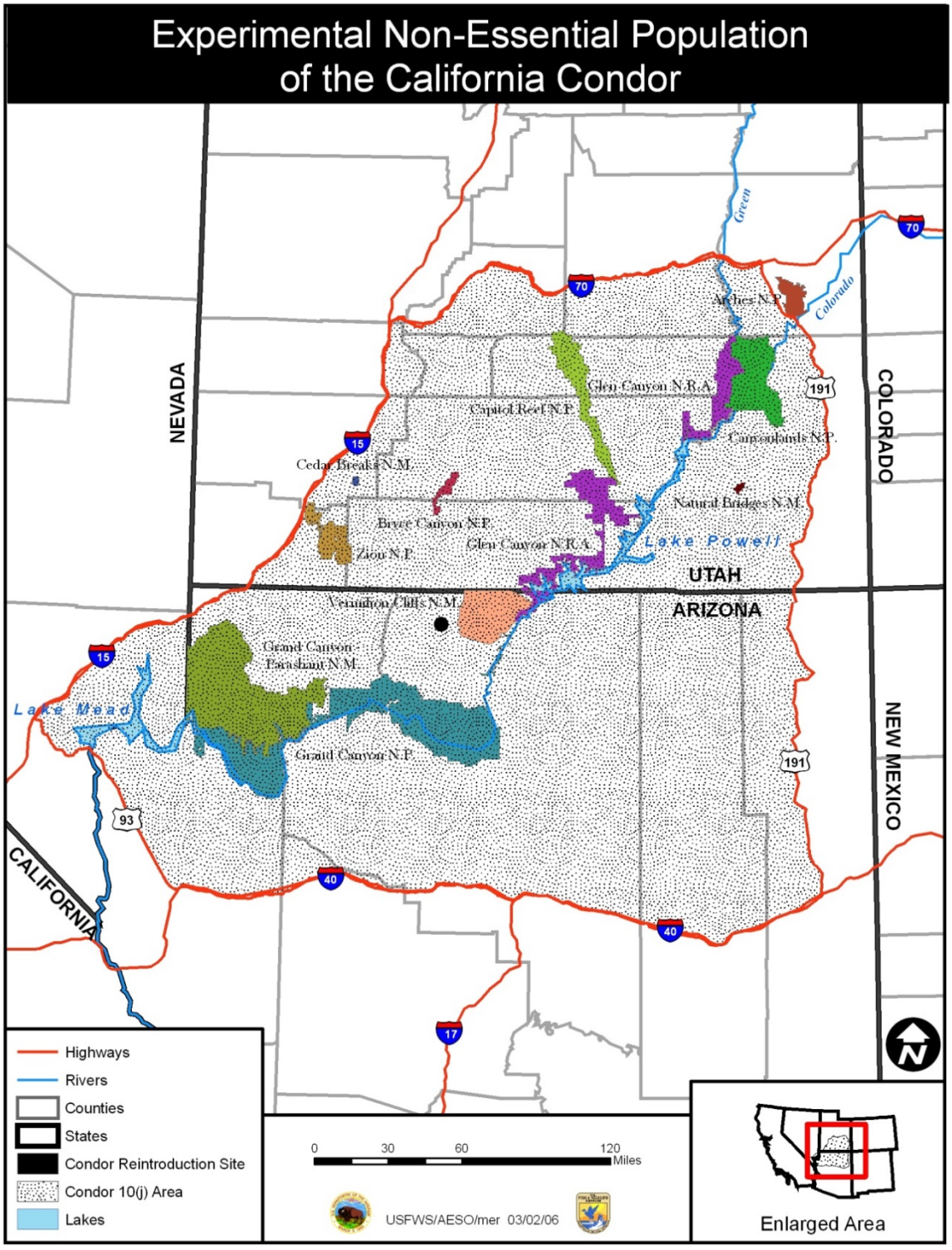

Figure 1. California condor nonessential experimental population [10(j)] area. Condors generally travel between two main areas, the Grand Canyon Ecoregion/Colorado River corridor in Arizona and the Kolob Terrace/Zion National Park (Zion NP) area in Utah.

BIOLOGY AND FIELD MANAGEMENT

Throughout the remainder of this review, individual condors are represented by a studbook number, sex (M or F if known, ? if unknown), and hatch year. For example, 601M11 represents the male condor with studbook number 601, hatched in 2011. Appendix A contains detailed information about each condor in the southwestern population.

TPF manages the day-to-day field program for this condor population. These activities include managing releases, monitoring free-flying condors, trapping for health and equipment (Very High Frequency [VHF] or Global Positioning System/Platform Transmitting Terminal [GPS/PTT] transmitters) checks, testing for lead exposure, and treatment of lead-exposed and diseased birds as needed.

Release Strategies

The initial condor reintroduction in northern Arizona involved six birds that were released from BLM-administered lands at the western end of the Vermilion Cliffs, now part of Vermilion Cliffs National Monument (NM). With the exception of 29 wild-hatched condors, California condors in the southwestern population have been captive-bred at facilities located at TPF Birds of Prey in Boise, Los Angeles and Oregon Zoos, and San Diego Zoo Safari Park. All captive-bred birds are vaccinated against West Nile Virus prior to release; wild-hatched birds are vaccinated when trapped for health checks. Captive-reared condors released into the population have been 6 months to 9.5 years old, but most have been about 6 months to 2 years of age.

Condors that are candidates for release into the wild are transported from the breeding facilities to a 60-by-40-foot flight pen located at the release site on the edge of Vermilion Cliffs. This structure along with a 40-by-24-foot release pen are key components of the release process as well as seasonal trapping of wild birds for transmitter refitting and health checks, including lead testing. While in the flight pen, condors are monitored and evaluated to determine suitability for release. All condors within the flight pen are exposed to a mock power pole fitted with a low voltage electrified cross arm for aversive conditioning to electrical structures. Before release, each condor is fitted with numbered patagial (wing-mounted) tags and a pair of patagially-mounted (sometimes one rectrix [tail]-mounted) radio transmitters, either VHF or satellite-reporting GPS/PTT instruments. Forty-seven captive-bred condors were released during 2012-2016 in 20 release events (Table 1); at the end of 2016, TPF was holding five birds in the flight pen in preparation for release.

Monitoring and Data Collection

The TPF field manager and biologists (generally 6-9 personnel) track the daily movements of condors within (and sometimes beyond) the 10(j) area and record condor activities throughout the year. Biologists primarily track condors by vehicle on roads using telemetry and visual observations. Aerial telemetry flights have also been used sporadically to search for missing birds. NPS biologists and volunteers sometimes assist with tracking when birds are within park boundaries.

Table 1. First releases of condors to the southwestern population during the years 2012-2016, with studbook number and sex (M or F). Bird identifications in red indicate they died during or shortly after the reporting period.

2012	2013	2014	2015	2016
548F10	609F11	641M12[1]	618F11	535M09
552M10	611M11	657F12	691M13	613F11
553M10	640F12	669M12	709F13	761M14
554F10	641M12	677F13	727F14	763M14[2]
561M10	647F12	679F13	731F14	801F15
571M10	653F12	680M13	741F14	802M15
581F10	655F12	698F13	743F14	
582M10	668M12	701M13	752M14	
586M10		707F13[2]	735M14	
592F11		721F13		
593F11				
601M11				
605M11				
619M11				
620F11				
Totals				
15	8	10	9	6

[1] Missing in 2017
[2] Died in January 2017

As the number of free-ranging condors has increased and movements through terrain with limited access have been extended, better tracking devices have been required. The program currently uses both VHF and GPS/PTT transmitters. VHF transmitters require ground-based telemetry; GPS/PTT transmitters record hourly positions that are accurate within meters of the birds' actual locations. Accumulated data are transferred daily to orbital satellite arrays for download. Since the program has only a limited number of GPS/PTT transmitters (varying from 6 of the satellite-reporting transmitters in 2012 to 26 in 2016), the transmitters were deployed on select condors to represent flock movements over time and for other management purposes, such as identifying foraging locations, tracking pairing and nesting activities of breeding age condors, and in some cases, detecting mortality.

TPF provides donated contaminant-free dairy-calf carcasses at the release site every three to four days to provide food for newly-released condors as they incorporate into the flock and to provide a steady attractant to the release pen/trap site. Proffered carcasses facilitate trapping of individuals to replace transmitters and collect blood for lead analysis. If a condor's blood-lead level is high, the bird is transported to the treatment facility at Marble Canyon for chelation therapy, or in cases of extreme exposure, to Phoenix (primarily Liberty Wildlife) for further treatment. TPF established a trap site in southern Utah in late 2016 to provide lead exposure data for Utah-foraging condors. Although most condors return to the release site during the breeding season, attracted by proffered carrion, the birds forage away from the release site, which has reduced the percentage of the flock trapped for lead testing each year (see the Health section, below).

Behavior

Unlike turkey vultures, condors do not use olfactory sense while foraging, but are attracted to areas of activity through visual cues, such as a gathering of other scavengers and/or predators. As condors evolved within North American landscapes, they developed relationships with predators including humans who subsisted by hunting, feeding on the remains of kills, and condors have demonstrated little fear of humans. To discourage condors from becoming comfortable in the presence of humans or artificial structures, TPF conditions condors by hazing or confinement for the purpose of breaking patterns of undesirable behavior. This conditioning can typically improve a bird's behavior in the wild as it matures. When condors display undesirable behavior, TPF attempts to trap and hold target birds for a short period. They are then re-released and monitored closely to see if the unwanted behaviors continue, in which case they are re-trapped. During the review period, undesired behaviors could not be corrected in two condors, 571M10 and 727F14, and they were returned to the captive flock.

There have been periodic episodes of undesired condor-human interactions, primarily associated with housing developments in southern Utah and with North or South Rim structures and visitors at Grand Canyon National Park (NP). Condors that land on or near buildings or other human structures are at risk of injury or potential death by becoming entangled in ropes or equipment or by ingesting foreign objects such as micro-trash, chemicals, or other toxins. Condors may also associate with humans and human structures if they find discarded food trash or are fed directly. To discourage such interactions, field and other trained personnel haze condors so they experience negative reinforcement. In 2014, the FWS California Condor Recovery Program developed guidance on hazing condors and considers properly conducted hazing as a take avoidance measure rather than harm or harassment of condors under the ESA. Hand-clapping, yelling, spraying water with low-pressure hoses, or exposing them to leashed dogs are all allowable forms of hazing used to move condors away from potentially harmful situations.

Courtship and Reproduction

Based on data collected from both captive and wild condors, the average age of first reproduction for females is 8.5 years and for males, 9.9 years (Mace 2017). Most eggs hatch between March and May and fledging generally occurs between October and December. All data on wild and captive California condors indicate a clutch size of one egg, and successful pairs will usually forego reproduction in a year following successful hatching of an egg as long as they are caring for the previous year's chick. If the female lays her first egg early enough in the season but the egg fails to hatch, or is predated, she can recycle and lay another fertile egg in the same season, as one pair did in 2013 (both attempts failed). In optimal conditions where a fledgling is incorporated into an existing flock, available forage is sufficient, and there is limited disturbance of the nesting pair, a pair can occasionally produce young in successive years.

Five chicks wild-hatched in the Southwest during 2004-2011 were still alive at the end of 2016 (342M04, 389F05, 441M06, 610F11, and 634F11). During the period 2012-2016, 14 chicks hatched in Arizona and Utah; 4 of these still survived through the end of 2016 (Table 2). A total of nine wild-hatched condors were surviving in the southwestern population at the end of 2016.

Table 2. Wild-hatched young produced in 2012-2016, with producing pair. Bird identifications are the studbook number, sex (M or F) and hatch year; those in red indicate they died during the reporting period. Condor 389F05 is a wild-hatched condor, the first to produce young since the inception of the program.

Producing Pairs		2012	2013	2014	2015	2016
Male/ Hatch Yr.	Female/ Hatch Yr.					
114M95	149F96	659?				
187M98	133F96	660?				
287M02	210F99	674?				
122M95	316F03		723F		808?	
158M97	346F04		720?			
234M00	280F02		719?			
273M02 or 354M04	302F03		722F			
266M02	296F03			754?		849?
293M03	389F05			766?		
337M04	409F06			765?		848?
423M06	521F09					850?
		Totals				
		3	4	3	1	3

Movements

Condors in the southwestern population are known for long distance travel; however, the established flock, consisting of numerous breeding pairs with seasonal territories, maintains a well-established 112-km radius primary range and new releases tend to remain with the flock. Tracking data for this five-year review continually revealed annual cycles of movement consistent with the previous two review periods. Main concentration areas used during spring through fall are in southern Utah (Zion NP and the Kolob Plateau); as winter snows make carrion more scarce, most of the birds return to Arizona, using the Kaibab and Paria plateaus and the Colorado River corridor west of Marble Canyon (Figure 2).

Tagged birds continued to make occasional forays outside of the 10(j) population area. These included short trips across the 10(j) boundary near I-15 in Nevada and southern Utah; north of I-70 near the Pahvant Range in Utah; and east of U.S. Highway 191 into southern Colorado and northern New Mexico, crossing the Continental Divide (Figure 3). These travels, although limited, may represent a mechanism of dispersal because most introduced condors today are influenced by the habits of the existing population and remain close to the experimental area (Figure 3).

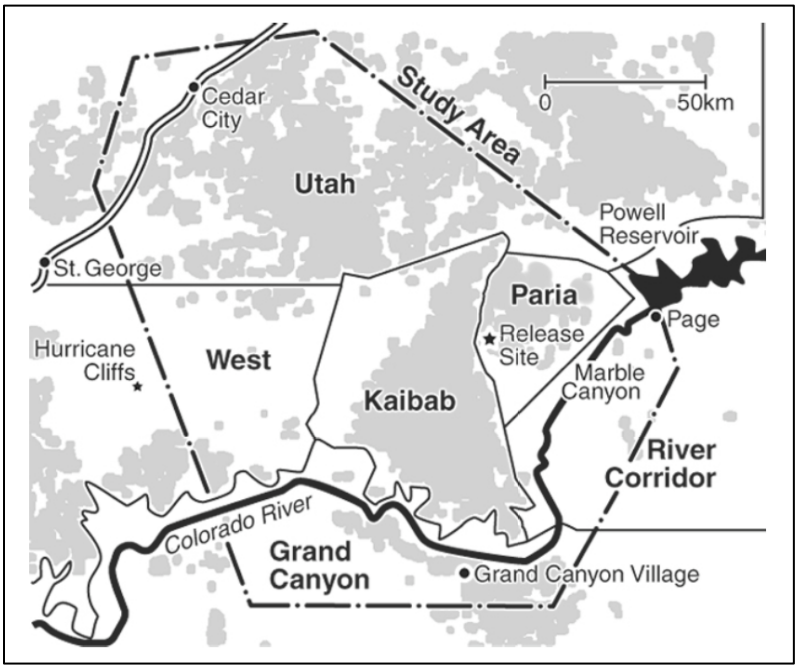

Figure 2. Study area monitored by TPF for condor activity, with partitioned zones:Utah, West of Kaibab Plateau, Grand Canyon, Colorado River Corridor, Kaibab Plateau, and Release Site.

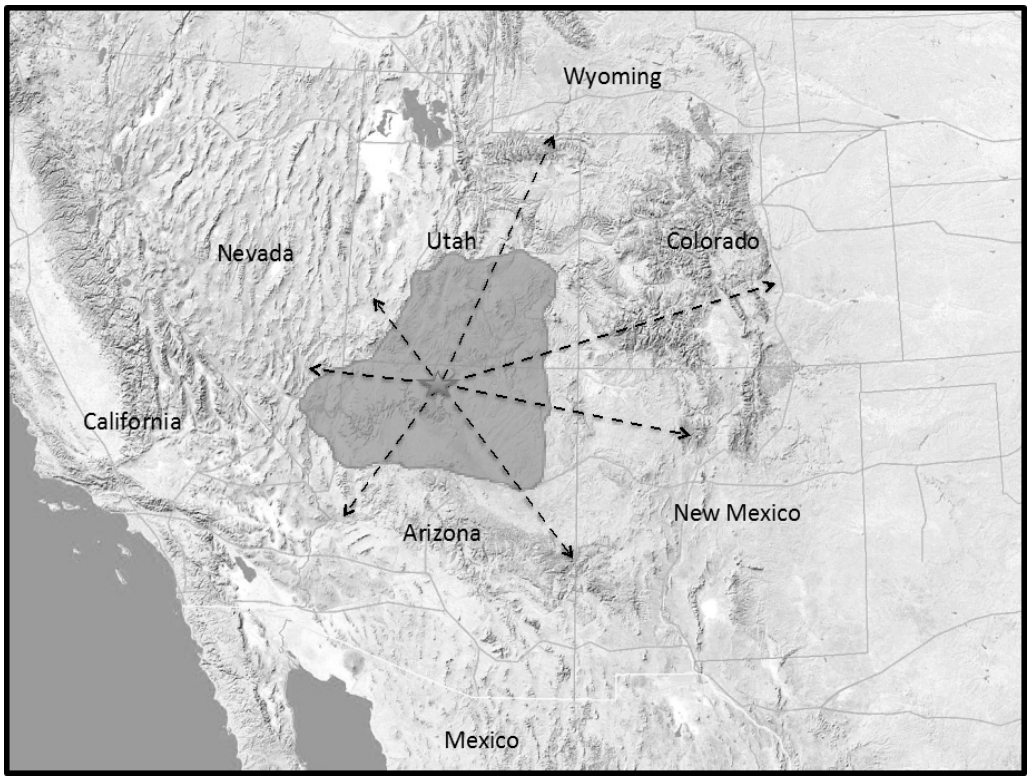

Figure 3. Primary condor range in the Southwest, and documented movements outside of the 10(j) population area (1996-2016).

Close monitoring of movements using GPS transmitters is valuable in revealing the exact locations of condor activity in real time and to identify foraging areas of individual birds. Analyzing the GPS location data relative to measured blood-lead levels can reveal information useful for targeting non-lead management activities and to potentially reduce exposure events.

Health

Lead poisoning remains the primary cause of diagnosed mortality in California condor populations (Church *et al*. 2006, Chesley *et al*. 2009, Hunt *et al*. 2009, Stroud and Hunt 2009, Finkelstein *et al*. 2012, Rideout *et al*. 2012). Lead poisoning cases occur predominantly in the fall and winter months associated with big-game hunting seasons on the Kaibab Plateau in Arizona and Kolob area in southern Utah. The period of highest exposure is October and November during the deer hunting seasons, and the period of highest lead-caused mortality among condors is in December and January, reflecting the latent exposure effect. However, the pathway for lead exposure in scavengers is present throughout the year. Any animal shot with lead-based ammunition whose remains are left in the field presents an opportunity for lead poisoning in scavengers.

TPF monitoring, veterinary examinations, and FWS forensics investigations have continued to observe lead pellets, intact bullets, and fragments of copper and lead in the digestive tracts of lead-poisoned condors (TPF and FWS files). These observations are consistent with findings of bullet fragments in rifle-killed deer and coyotes fed on by condors. Radiographs of offal from the remains of deer shot with standard lead-based rifle bullets have revealed that numerous metal fragments are scattered through these carcasses (Hunt *et al*. 2006). After consumption, acids in the condor's gut convert lead fragments to soluble salts that are absorbed into the blood stream and delivered to soft tissues, organs, bones and the brain (Pokras and Kneeland 2009). The half-life for lead in blood is reported to be roughly two weeks (Green *et al*. 2008; Fry and Maurer 2003). Blood-lead scores are a snapshot in time relative to the continuum of an exposure event that begins when lead is ingested. Blood-lead scores above 15 micrograms per deciliter (µg/dl), an indication of recent exposure, do not necessarily indicate a single exposure event. A blood-lead score is only one of the variables considered in determining whether or not to treat a condor with chelation therapy (the process of removing lead by twice daily injections of calcium ethylenediaminetetraacetic acid [calcium disodium EDTA]) (Table 3). For example, when both individuals of a breeding pair (incubating eggs, tending, or brooding chicks) have high levels of lead, the option of holding and treating them simultaneously could result in nest failure. Or, if a bird has been historically difficult to trap, we may choose to treat that individual at a lower blood lead level than the "hold and treat" threshold. Adaptive management continues to be key in the decision making process.

For the purpose of annual comparisons of blood lead values and number of cases resulting in treatment, Table 4 provides the number of birds tested, exposed, and treated, and Figure 4 provides a percentage of birds in the flock that were trapped/tested, exposed, extremely exposed, and treated. The lead exposure year extends from September 1 to the following August 31.

Table 3. Blood-lead levels and management response guidelines.

Field Tested Blood-lead Level (µg/dl)	Indication	Management Response
0-5	Normal	None - Release
5-14	Residual/Background/Recent Exposure Possible	None - Release
15-29	Recent Exposure Likely	Monitor
30-64	Definite Recent Exposure	Hold/Recapture, Monitor, and/or Treat
>65	Extreme Exposure	Hold and Treat

Table 4. Percentage of the population tested for lead exposure; of those tested, the percentage of the birds with various levels of exposure and/or treated with chelation therapy (2012-2016).

Level of Exposure	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Tested	95%	88%	89%	95%	87%
Recent Exposure Likely (>15 µg/dl)	59%	73%	65%	80%	73%
Treated for lead poisoning	25%	42%	20%	29%	29%
Extreme exposure (>65 µg/dl)	20%	41%	17%	26%	27%

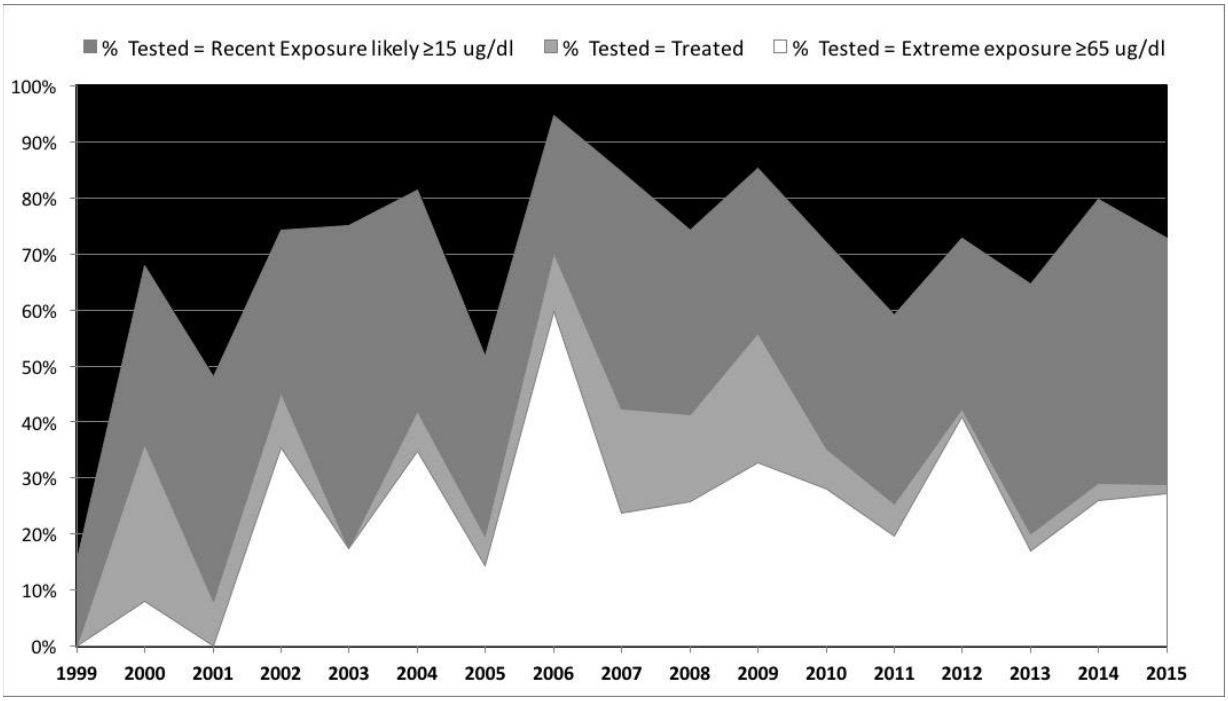

Figure 4. Percentage of tested condors in the population and blood lead levels indicating exposure, treatment, and extreme therapy, during the trapping/testing season (October-December) 1999-2015.

Mortality

We recorded 58 fatalities in the reporting period, including 21 birds that are missing and presumed dead, with a total of 125 fatalities since reintroductions began in the Southwest (Table 5). During 2012 to 2016, 18 of the diagnosed causes of death were due to lead toxicosis. However, the number of birds in the "missing" and "undetermined" fatality categories continued to increase. Of the 67 cases where diagnoses of death were possible since releases began in 1996, 37 (55%) died of lead poisoning, 16 (24%) from predation, 6 (9%) from shooting, 3 (5%) from starvation, 2 (3%) from impaction, 2 (3%) from collisions, and 1 (1%) from infection. By applying the known rate of diagnosed fatalities identified as lead poisoned (55%) to the missing category (N = 38), it is reasonable to estimate that an additional 21 condors may also have succumbed to lead poisoning. Further analysis of location data, age structure, and seasonally available lead at the time birds went missing can better predict the likelihood of lead poisoning in this category. Similarly, further analysis of the undetermined category is needed to estimate the likelihood of lead-related deaths among those birds.

Table 5. Condor mortality factors of the four five-year periods of the reintroduction program.

Mortality Factor	***1996-2001***	***2002-2006***	***2007-2011***	***2012-2016***	***Total***
Diagnosed					**67**
Lead toxicosis	3	7	9	18	37
Predation (coyote or golden eagle)	7	1	4	4	16
Shooting	1	2	0	3	6
Starvation	1	2	0	0	3
Impaction/aspiration	0	0	2	0	2
Collision (powerline or vehicle)	1	0	1	0	2
Infection (blood poisoning)	1	0	0	0	1
Undiagnosed					**58**
Suspected lead poisoning	2	0	0	1	3
Missing	2	4	10	23	39
Undetermined	0	2	5	9	16
Total	**18**	**18**	**31**	**58**	**125**

Forensics investigations have identified secondary causes of death associated with some of the lead-poisoned condors. These condors may become weak and emaciated and subject to bacterial, viral, or fungal infections, and may also become more likely targets of predation.

Comparing the diagnosed lead fatalities during the lead exposure seasons (September 1 through August 31), four condors died of lead toxicosis during 2011-2012, five in 2012-2013, two in 2013-2014, three in 2014-2015, two during the lead season of 2015-2016, and two in December 2016 (the 2016-2017 season). This information is useful to detect episodes of higher lead poisonings and to better understand the effectiveness of lead reduction programs. Appendix A includes the condor fatalities, dates, and causes (if known) during the fourth review period.

LEAD-REDUCTION EFFORTS

Introduction

As detailed in the previous reviews for this project, lead toxicity during this review period (2012-2016) has continued to be the main factor affecting the success of the condor reintroduction effort. Lead toxicity was identified as a mortality factor among wild California condors in the 1980's (Janssen *et al.* 1986, Wiemeyer *et al.* 1988, Snyder and Snyder 1989, and Pattee *et al.* 1990). Lead exposure is still recognized as a management issue for the condor reintroduction program in northern Arizona and southern Utah. Incidental ingestion of lead ammunition from animal carcasses is the most likely pathway by which condors are being exposed to lead (Hunt *et al.* 2006 and Chesley *et al.* 2009). In addition, condor lead exposure was specifically linked to the fall deer hunting season in northern Arizona and southern Utah (Hunt *et al.* 2007 and Parish *et al.* 2009).

The first condor fatalities in the southwestern population due to lead poisoning occurred in 2000 (Arizona Condor Review Team 2002). As part of an effort to reduce lead exposure in condors, AGFD began implementing a voluntary big-game lead reduction program within condor range in northern Arizona in 2003 (Sullivan *et. al* 2007, Sieg *et. al* 2009). As a larger portion of the population began spending a significant part of the year in southern Utah, UDWR initiated a companion voluntary big-game lead-reduction program in 2009 (Southwest Condor Review Team 2012). Lead reduction efforts through 2011 were detailed in the second and third five-year reviews of the condor program (Southwest Condor Review Team 2007, 2012), along with the rationale for implementing voluntary programs. During this review period, lead reduction efforts for big-game hunting within the condor range in Arizona and Utah have been expanded and improved. Sport hunting is regulated by the state wildlife agencies, and AGFD and UDWR have committed to pursue voluntary measures to reduce the lead burden in the California condor's 10(j) range.

Lead Reduction Efforts in Arizona

As previously reported (Southwest Condor Recovery Team 2007, Sullivan *et. al* 2007, Sieg *et. al* 2009), the voluntary lead reduction program for big-game hunting in Arizona was based on a thoroughly researched and well-designed targeted outreach and incentive-based implementation plan. AGFD uses outreach tools such as educational presentations to sportsmen's groups and letters to hunters outlining the scientific data linking lead ammunition to condor lead exposure primarily during the big-game hunting seasons and following months. Only sources deemed credible by hunters are used to deliver messages. All the cooperators employ "one voice" messaging, which includes a focus on hunters' proud tradition of wildlife conservation. The incentive-based component of this implementation plan consists of a free non-lead ammunition program. When the program began, many hunters were unfamiliar with non-lead ammunition, it was not available in all calibers, and it can be more expensive than its lead counterpart. To resolve these concerns, AGFD started offering free non-lead ammunition to big-game hunters within the core condor range in 2005.

Free Non-lead Ammunition Program in Arizona

Using monies from the Wildlife Conservation Fund (Indian gaming revenue), Federal Aid in Wildlife Restoration Program (Pittman-Robertson Act funds), and Heritage Fund (state lottery dollars), AGFD continued to administer a free non-lead ammunition program for the fall 2011-2016 big game hunting seasons. Non-lead ammunition was offered to mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), bighorn sheep (*Ovis canadensis*), and bison (*Bison bison*) hunters drawn for hunts within game management units 12AE, 12AW, 12B, 13A, and 13B (Figure 5). These hunt units incorporate the foraging areas most frequented by condors during the fall hunting season (Hunt *et al.* 2007, Parish *et al.* 2009). In addition to these fall hunters, spring and summer unit 12A bison hunters were also eligible to receive free non-lead ammunition during this period. Hunters could obtain loaded rifle cartridges, bullets for reloading their own ammunition, or muzzle-loading rifle sabots. Starting in 2007, AGFD mailed the free ammunition coupons with the hunting tags, along with an educational letter including links to the AGFD Condors and Lead webpage and ammunition ordering instructions. This targeted outreach outlines the risk of and results from lead poisoning in condors and the benefits of the free ammunition program. Coupons are redeemable through the last day of the hunt for which the hunter has a tag. The fall hunting season typically begins in mid-September and continues through early December of each year. Approximately 1,500 hunters were eligible for free ammunition annually during this review period, dependent upon the number of hunting tags issued each year.

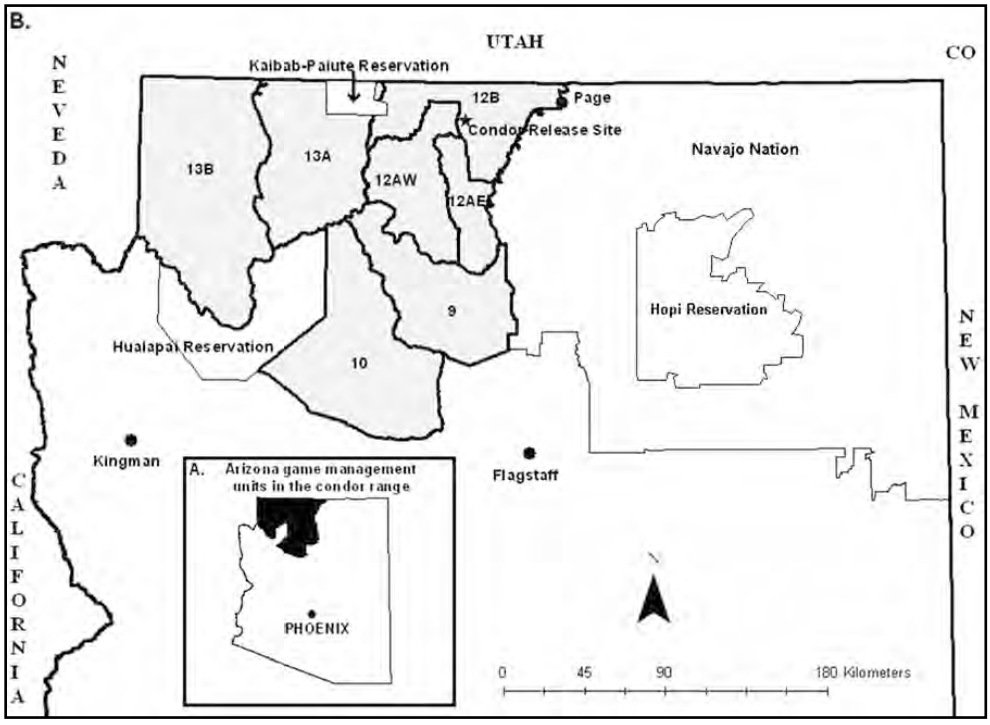

Figure 5. Arizona game management units within California condor range.

AGFD has continued to develop and modify the outreach program to address issues in a timely manner including: a simplified outreach message including visual aids; lead reduction articles in Arizona sportsmen's group publications; increased general media stories referring to lead

reduction efforts; development and distribution of an educational DVD and brochure; increased field communication with hunters (approximately one AGFD outreach staff per 200 hunters with a goal of contacting 80% of hunters); in-store non-lead ammunition displays to aid hunters in locating non-lead ammunition; a follow-up letter reminding hunters to redeem their free ammunition coupon; and an improved incentive program to encourage hunters who continued using lead ammunition to pack out their offal piles (gut pile raffle). The goal of these intensified efforts has been to significantly increase hunter participation in the lead reduction program.

Additional Lead Reduction Efforts in Arizona

Since loaded non-lead ammunition was not available in every caliber used by rifle hunters, and some hunters preferred to use the lead hand-loads they had customized for their rifles, a minority of hunters continued using lead ammunition on their hunts each year. In these cases, AGFD has asked the hunters to remove their game gut piles from the field so lead fragments in the gut piles would not be available to scavenging condors. Bagging up and packing out a gut pile is not a desirable act for most hunters; therefore TPF and AGFD created an incentive for hunters – a gut pile raffle. A myriad of businesses and other entities have donated prizes for this program annually since 2011. Prizes have included gift cards at Cabelas, Navajo Nation deer or elk permits, river trips, helicopter rides, zoo passes, vacation packages with hotel stays at resorts, original art, and others. Trash bags and raffle flyers are distributed to hunters on the Kaibab Plateau during the fall deer hunts. Gut pile outreach efforts have used at least one AGFD staff per 200 hunters, resulting in an in-field hunter contact rate of approximately 80% each year. Hunters are asked to bring their bagged gut piles to the Jacob Lake hunter check station where AGFD collects them. AGFD disposes of gut piles at a landfill where they are immediately buried to make them inaccessible to scavengers.

AGFD and TPF have implemented numerous lead reduction outreach efforts in addition to the free non-lead ammunition program. All fall big game hunters (4,000-5,000 annually) in game management units 9 and 10 (secondary condor foraging range during the hunting season) (Figure 5) are mailed letters from AGFD asking them to take lead reduction actions during their hunt. These letters address the fact that condors have died of lead poisoning by ingesting lead shot pellets in addition to lead bullet fragments. During this period, AGFD has continued to annually participate in multiple outdoor/sportsmen Expos, Pow-Wow's, and wildlife fairs, and has conducted demonstration shoots with sporting group leadership to promote the use of non-lead ammunition for the purpose of conservation.

Lead reduction outreach efforts have expanded significantly since 2011. Targeted outreach to the hunting community has been well-received and has produced measurable results. Most Arizona hunters contacted by AGFD are now familiar with non-lead ammunition and the voluntary lead reduction program. AGFD, TPF, NPS, and other cooperating partners now include the lead reduction message in all outreach efforts, from in-school presentations to campground talks. The lead reduction message has recently been expanded to include all animal harvesting and dispatching activities, from hunting on public land to putting down range and feral animals on private and tribal lands. During this reporting period, AGFD staff presented 30-50 condor talks and hosted approximately 10 condor booths at wildlife fairs each year, reaching 2,000-4,000 people annually, in addition to the almost 10,000 hunters contacted each year. AGFD's big-game non-lead ammunition program is a substantial outreach effort and has gained a tremendous amount of interest and support within sportsmen's, environmental, and land-management groups.

Results of Arizona Lead Reduction Program

Previous lead reduction program results were reported in the second and third five-year reviews (Southwest Condor Review Team 2007, 2012). Overall, for the period of this review, a total of 3,279 of the 3,702 legally harvesting big-game hunters participated in qualifying lead reduction actions, or 88.6% of these hunters. Qualifying actions include: shooting with non-lead bullets, packing out the gut pile, taking a head or neck shot, or electing to use archery or a crossbow during the rifle hunt. Table 6 and Figure 6 demonstrate the specific results by year since the free non-lead ammunition program began in 2005.

Lead Reduction Efforts in Utah

The non-lead ammunition program for deer hunters in Utah was expanded significantly in 2012 in response to three occurrences. First, UDWR changed all general season deer hunts from region-wide hunts to unit-specific hunts. This allowed UDWR to individually identify and directly contact hunters with permits in the Zion Hunt Unit, where condors spend nearly all their time while in Utah. Second, FWS and the Forest Service provided funds sufficient to fully support UDWR's big-game non-lead ammunition program in the Zion Hunt Unit. FWS ESA Section 6 monies were available for ammunition distribution, while Forest Service funds were directed toward education and outreach efforts. An additional expansion occurred in 2013 when TPF provided prizes annually that UDWR used as an incentive to encourage Zion Unit big-game hunters to take lead reduction measures. Any Zion Unit hunter who took a lead reduction action could be registered for a drawing to win a new ATV or one of five "rifles' ($800 gift cards to a national outdoors/recreation retailer).

Table 6. Lead reduction program results in Arizona since 2005.

YEAR	# Successful Hunters	# Took Lead Reduction Actions	% Took Lead Reducton	# Used Non-Lead Ammo	% Used Non-lead Ammo	# Took Neck or Head Shot	% Took Neck or Head Shot	# Packed Out Gut Pile	% Packed Out Gut Pile	% Hunters Using Lead Who Packed Out Gutpile	# Took No Lead Reduction Action	% Took No Lead Reduction Action
2016	789	709	89	562	70.4	10	1	137	17	58%	80	10
2015	622	518	83	419	67	6	1	87	14	43%	17	3
2014	694	635	91	460	66	6	1	151	22	66%	59	9
2013	591	522	88	356	60	4	1	168	28	75%	69	12
2012	524	459	88	380	73	7	1	72	14	53%	65	12
2011	482	436	90	370	77	6	1	60	12	57%	46	10
2010	581	508	87	412	71	10	2	86	15	51%	73	13
2009*	717	607	85	476	66	12	2	119	17	52%	110	15
2008	910	814	89	654	72	13	1	147	16	60%	96	11
2007*	767	633	83	465	61	9	1	159	21	54%	134	17
2006	548	329	60	316	58	6	1	7	1	3%	219	40
2005	909	455	50		50	N/A		N/A		N/A	454	50
2004			<5% (pre-program)									

* 2007 – Implemented gut pile raffle

* 2009 – Reduced free ammo from two to one box per hunter

Data from 2004 obtained from hunter survey at Jacob Lake Check Station

Data from 2005-2006 obtained from deer harvest hunter surveys and survey of successful Kaibab hunters

Data from 2007-2010 obtained from successful Kaibab hunters - Jacob Lake check station cards

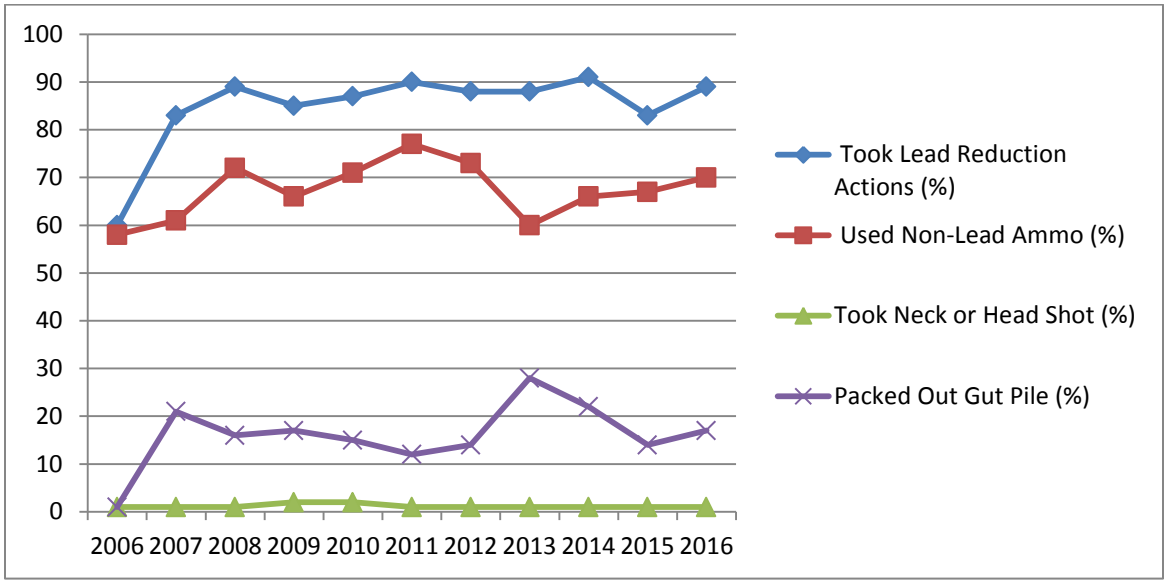

Figure 6. Graphical analysis of lead reduction results in Arizona since 2006.

UDWR's non-lead big-game ammunition program closely mimicked AGFD's program from 2012 through 2016. All permitted Zion Unit deer hunters received an explanatory letter from UDWR and a voucher redeemable for one free box (up to $50 value) of non-lead ammunition to use on their hunt. In addition, general season elk hunters with Southern Region permits, who could hunt the Zion Unit if they chose, were sent letters explaining the non-lead program. Though they did not receive a voucher for non-lead ammunition, these hunters were also encouraged to take lead reduction actions and were eligible for the prize drawing if they did so. Vouchers for non-lead ammunition could be redeemed through two independent retailers from 2012-2014. A third retailer was added in 2015. All hunters were responsible to stop at a UDWR check station or office to show they were using non-lead ammunition or to deposit a gut pile from an animal harvested with lead ammunition in order to be entered in the prize drawing. The prize drawing was held at the annual spring (March) International Sportsman's Exposition in Salt Lake City for the 2012-2015 hunt seasons and at the Ultimate Outdoor Recreation Expo in St. George in January 2016 for the 2016 season.

Based on hunter responses to UDWR's post-season telephone survey, participation in Utah's voluntary non-lead program was greatest in 2016. The number of vouchers for non-lead ammunition issued from 2012 to 2016 varied between 1,908 and 2,445, based primarily on the number of permits issued for the Zion Unit. Post-season telephone surveys of Zion Hunt Unit deer hunters indicated that 88-94% of all Zion Unit general deer permit holders received a voucher, between 55% and 72% redeemed that voucher, and over 60% used non-lead ammunition for their hunt (Table 7, Figure 7). Additionally, 26-52% of deer hunters who used lead ammunition to harvest an animal reported removing a gut pile from the field, and 22-32% reported registering for the prize drawing (Table 8, Figure 8). These latter figures are not confirmed by UDWR contacts. First, though these figures indicate as many as 679 hunters could have entered the prize drawing annually, no more than 385 ever actually did so. Second, these figures suggest that between 353 and 409 lead-tainted gut piles could have resulted from use of lead-based ammunition. Responses to the post-season surveys indicated deer hunters had removed between 106 and 181 gut piles from the field, even though no more than18 were ever brought in to a UDWR facility.

Table 7. Results of Utah lead reduction post-season deer hunter telephone surveys 2012-2016.

Survey Response	2012	2013	2014	2015	2016
Number of vouchers issued	1,908	2,123	2,309	2,445	2,309
Percent who received a voucher	90	94	89	88	94
Percent who redeemed their voucher	62	55	64	64	72
Percent who hunted	92	93	90	88	93
Percent who brought/used non-lead on hunt	64	61	67	67	77
Percent who were successful	55	49	48	56	54
Percent successful who used non-lead for harvest	61	66	68	68	78
Percent using lead who removed gut pile	26	34	51	36	52
Percent who registered for prize drawing		32	27	22	25
Percent aware of DWR lead-reduction program		70	77	80	87

Overall, UDWR made considerable gains in decreasing the amount of lead ammunition available in Utah condor range. In 2012, the total percentage of deer hunters who took some sort of lead reduction action (used non-lead ammunition or removed a lead tainted gut pile from the field) increased to 71% from the approximately 5% of the two previous years (Table 8). This number peaked at 84% in 2014, but was generally around 80% for the reporting period. Despite some inconsistencies in the post-season survey results, the number of hunters using lead ammunition to harvest deer on the Zion Hunt Unit decreased from 39% to 22% from 2012 to 2016 (Table 8, Figure 8). Additionally, a significant number of hunters reported removing lead-tainted gut piles from the field, even if they did not turn these in at a UDWR facility. Awareness of the non-lead ammunition program increased to 80% of hunters over the same time period.

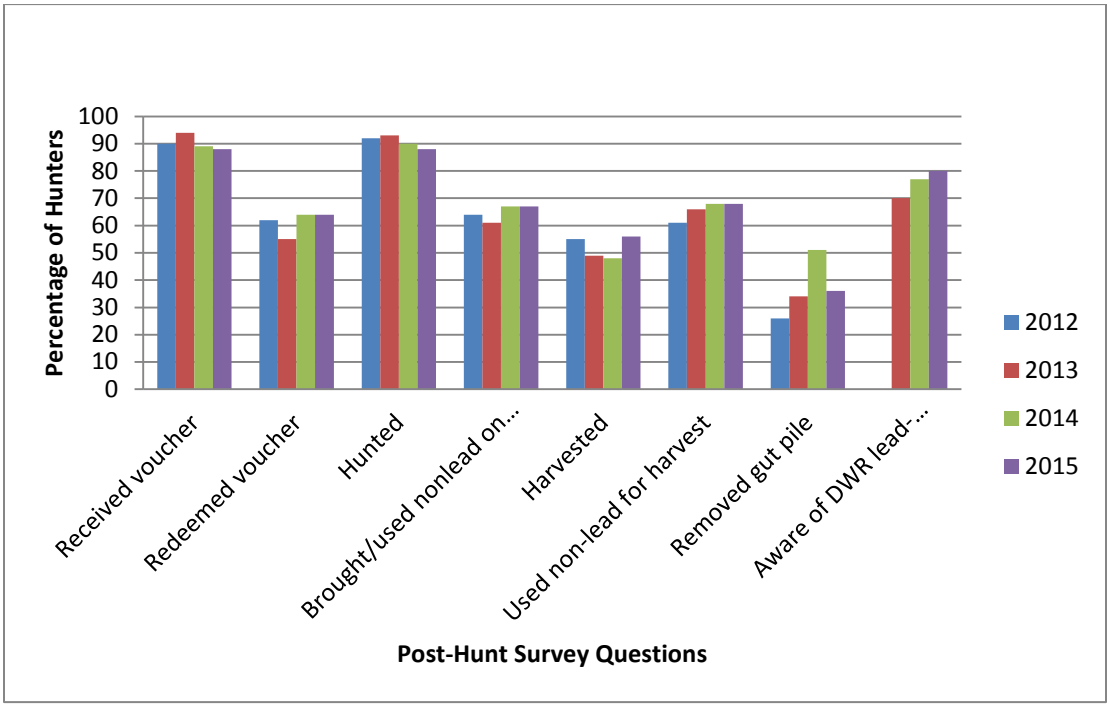

Figure 7. Results of Utah lead reduction post-season deer hunter telephone surveys, 2012-2015.

Table 8. The number of Zion Unit deer hunters who took any lead reduction action (used non-lead ammunition or removed a lead tainted gut pile from the field) based on results of post-season telephone surveys: 2012-2015.

	A Percent of hunters who were successful	**B** Percent of successful hunters who used non-lead	**C** Percent of successful hunters who used lead	**D** Percent who used lead who also removed gut pile	**E** Percent of successful hunters who removed gut pile ((C/100)x(D/100))	**F** Percent of successful hunters who took a lead reduction action (B+E)
2012	55	61	39	26	10	71
2013	49	66	34	34	12	78
2014	48	68	32	51	16	84
2015	56	68	32	36	12	80
2016	54	78	22	52	11	89

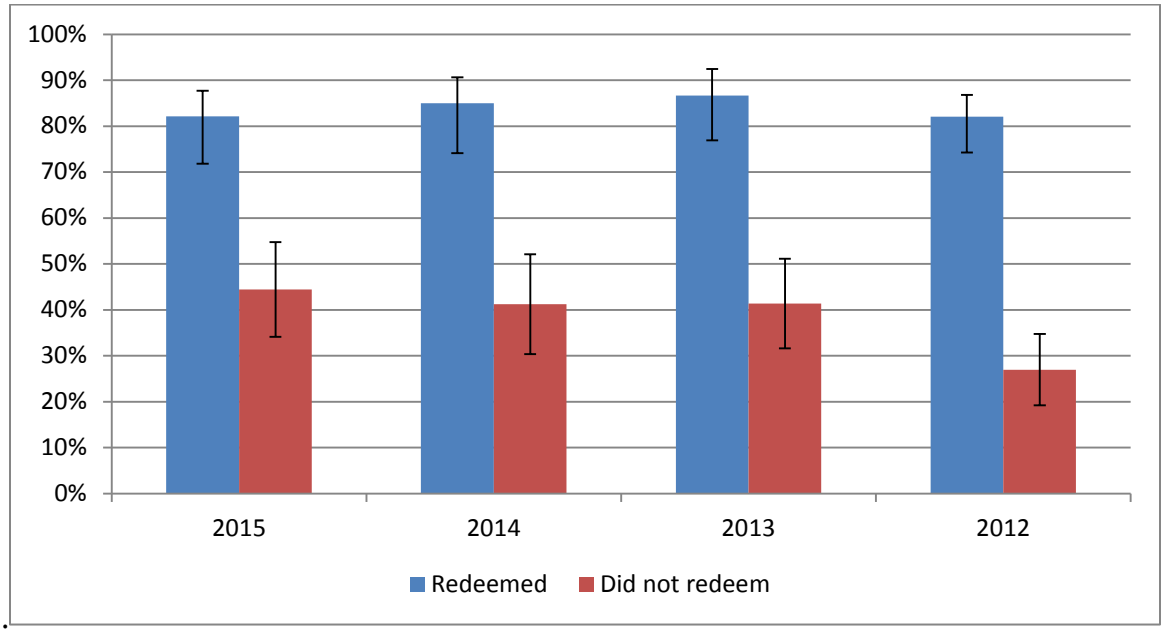

Figure 8. Percentage of Zion Unit deer hunters who used non-lead ammunition to harvest an animal, 2012-2015, based on whether or not they redeemed the non-lead ammunition voucher.

UDWR Outreach Efforts

UDWR outreach efforts were tied primarily to advancement of the non-lead ammunition program and reaching Zion Unit big-game hunters. A California condor sidebar appeared annually in UDWR's big game proclamations, and Zion Unit deer and elk hunters were contacted directly by mail and provided non-lead ammunition vouchers, condor information pamphlets, and related materials. Three public shooting events were conducted by TPF and

UDWR: one near Kanab in 2012, one at the UDWR's 2016 Outdoor Adventure Days in Salt Lake City, and one at the Washington County Shooting Sports Park in 2016. Non-lead ammunition and lead reduction questions were added to UDWR's annual post-season telephone survey to monitor participation, using Zion Unit general deer hunters for a representative sample. Check stations were established at key Zion Unit access points beginning in 2013 and operated each weekend throughout October. Though visited primarily by hunters, nearly 1,000 members of the general public also stopped and were informed of condor recovery efforts and the non-lead ammunition program (Table 9). In 2016, using a FWS State of the Birds recovery grant, UDWR contracted with the Panoramaland Resource Conservation and Development Council, Inc. to support the non-lead ammunition program. This provided assistance to UDWR employees and an individual to act as the focal point for overall program coordination. The contractor assisted with identifying publics, developing messaging, vendor contacts, voucher issuance, information distribution, hunter contacts, public outreach events, etc. The inclusion of this contractor was one reason over 2,400 vouchers were issued in 2016.

Table 9. Number of visitors to UDWR non-lead ammunition check stations: October weekends 2013-2016.

Year	Hunters	Non-hunters	Total
2013	286	246	532
2014	-	-	-
2015	399	278	677
2016	501	309	810
Totals	**1186**	**833**	**2019**

Media contacts included press releases and radio and on-line interviews that included discussion of the non-lead ammunition program, condor recovery efforts in general and condor nesting in Zion National Park. No records were kept of the number of these contacts, but UDWR conducted approximately two radio/on-line interviews each year, and press releases preceded public events and hunting seasons. In 2016, UDWR instituted e-mail contacts directly to Zion Unit big-game permit holders. A condor-specific page was added to the UDWR web site, and a donation button was provided for people wishing to donate to condor recovery and the non-lead ammunition program. Condor-specific posts were added to the UDWR Facebook, Instagram, and Twitter accounts. The Day of the Condor viewing event at Kolob Reservoir, initiated in 2008, was held in 2012, but was cancelled thereafter because condors had moved to inaccessible areas.

Other Lead Reduction Efforts and Activities

AGFD continued to provide non-lead ammunition to law enforcement officials and other professionals who may dispatch injured animals within condor range, including the Coconino County Sherriff's Office, Navajo Nation Wildlife Services and Animal Control, and ranchers on the Kaibab Plateau. If dispatching an animal is necessary, project cooperators including the AGFD, NPS, BLM, Forest Service, and FWS do so with non-lead ammunition when within condor range or remove those carcasses from the field. The U.S. Department of Agriculture - Wildlife Services also uses non-lead ammunition north of I-40. Using grant funding from FWS,

TPF conducted several non-lead focused outreach events and distributed non-lead ammunition to hunters on the Kaibab-Paiute Reservation and the western side of the Navajo Nation. Tribal wildlife agencies from both the Navajo Nation and Hopi Tribe have distributed lead reduction literature to hunters on their lands. BLM also provided funding to AGFD and TPF to support the non-lead ammunition program and lead reduction efforts.

TPF conducts approximately 50 condor presentations in Arizona and Utah annually, and Grand Canyon and Zion NP staff members provide daily condor talks during the spring through fall months. In 2016, a nest was established in Zion National park within view of the park museum and offices. A viewing station was established and staffed by park personnel. This became a well-visited park feature and provided park staff with an excellent venue for discussing condor management and the importance of lead reduction efforts. The Kaibab National Forest (Kaibab NF) requests that all permitted hunting outfitters and guides have their clients use non-lead ammunition on their hunts within the North Kaibab Ranger District. Kaibab NF staff members annually assist at the AGFD check station to provide information to hunters about the use of non-lead ammunition and to help remove carcasses that have lead from the field.

In 2012, the FWS Region 8 Director established the California Condor Contaminants Work group to provide science-based guidance regarding the risks of contaminants to California condors and to recommend actions that could be taken to minimize these risks. In 2014, this Work Group, which included representatives from AGFD, UDWR, FWS, NPS, and U.S. Geological Survey with knowledge and experience with condor recovery, convened at a structured decision-making workshop to identify recommendations for reducing the mortality and morbidity of California condors as a result of lead poisoning. The decision problem focused on actions within the authority of the responsible FWS Regional Director, or those that he could significantly influence, and was constrained by legal, political, and practical concerns. For example, recommending a complete ban on lead ammunition was not carried forward because instituting it would be outside of FWS's authorities, not supported by multiple stakeholders and participants, and constrained by the existing 10(j) rule and agreements. The six alternatives that were developed were to continue the existing complex of activities associated with condor recovery including voluntary programs, outreach and education efforts, nest guarding, tracking, testing and treating ill condors, recovering carcasses and determining causes of mortality, along with enhancements in education, outreach, training, and other recovery efforts. The recommendations, listed in priority order, are included in Appendix B. The SCWG has continued to expand its activities, which are consistent with these recommendations.

On August 9, 2013, several members of the SCWG participated in a meeting with Senator John McCain, federal and state agencies, and representatives of the shooting sports industry to discuss approaches to non-lead ammunition programs, their importance for recovery of the California condor, challenges facing the availability of non-lead ammunition, and potential solutions. Non-lead bullets contain alloys that are included in the definition of armor-piercing ammunition. At the time, the Bureau of Alcohol Tobacco and Firearms (ATF) was developing criteria for the "sporting purposes" exemption of the Gun Control Act of 1968. Senator McCain urged ATF to ensure that hunters have access to an adequate and affordable supply of non-lead ammunition for rifles. He also encouraged industry and vendors to raise awareness among hunters of non-lead products and their benefits to condors.

In 2012, the Center for Biological Diversity filed a Resource Conservation Recovery Act case in the District of Arizona against the Kaibab NF "to limit the disposal of a known toxin on public

lands in northern Arizona and to protect wildlife species threatened by exposure to spent ammunition in the foraging range within USFS [Forest Service] land in Arizona." The Forest Service, along with several intervenors, filed a motion to dismiss the claim. In 2013, the court dismissed the case on justiciability grounds, stating that the "prohibition of lead ammunition in national forests is a matter over which USFS has control" and "on which the USFS has knowledge and expertise." The court concluded that it "is not authorized, nor is it in any position, to supplant the USFS's authority, knowledge, and expertise on this matter in the form of a judgment ordering the USFS to take a certain course of action." Thus the court found no controversy before it, which nullified the plaintiff's request for relief. However, the Center for Biological Diversity appealed the dismissal of the case to the Ninth Circuit Court of Appeals, so the case is not yet resolved.

Discussion

Although voluntary lead reduction efforts have significantly reduced the amount of lead available to condors in Arizona (Green *et al.* 2008, Sieg *et al.* 2009) and Utah, the condor reintroduction program in the Southwest has yet to observe a corresponding reduction in condor lead exposure rates (Table 4, Figure 4). Eighty to ninety percent of big-game hunters in much of the Arizona portion of condor range have participated in the voluntary program since 2007, and the percentage of hunters participating in UDWR's program reached this level in 2016. Models have suggested that simultaneously successful voluntary lead reduction efforts in Arizona and Utah could result in a level of condor fatalities due to lead toxicity that would allow the population to increase (Green *et al.* 2008). However, modeling based on the population in California predicted that even if only 0.5% of carcasses are contaminated with lead, the probability that a condor would feed on a contaminated carcass over a 10-year period is 85-98% (Fickelstein *et al*. 2012).

Providing uncontaminated carcasses at the release site in Arizona and the new trap site in Utah provides little benefit; as condors increase in age and become more independent, their reliance on proffered food decreases, putting them at greater risk of ingesting lead contaminated carrion. This may in part explain why the number of condor fatalities due to lead poisoning has increased over time, even while big-game hunter-derived lead has decreased. Lead is also being introduced into the environment through small game, fur bearer, and predator/varmint hunting in the form of both fragments from small caliber rifle ammunition and lead shot from shot-shells. These hunting groups have been identified for expanded outreach messaging in an attempt to reduce the amount of lead introduced into the environment from these additional identified sources.

ADMINISTRATION

FWS is the primary federal agency with responsibility for recovery of the California condor. As such, FWS issues ESA section 10(a)(1)(A) scientific research and recovery permits to those cooperators actively engaged in recovery activities, provides oversight and management support for recovery activities, and provides funding for captive breeding operations. However, FWS depends on the SCWG partners for implementation of field operations and land management activities. FWS biologists in both Arizona and Utah have responsibilities in the condor recovery program in the Southwest including compliance with the ESA and assistance with and tracking the implementation of recovery actions.

Cooperator and Public Support

Cooperators contribute to condor recovery through direct expenditure of funds towards equipment, supplies, and outreach materials, and through personnel time and costs. As often occurs among agencies, there have been a number of personnel changes within the condor program since the last review. However, the addition of several tribes and organizations to the SCWG has benefited the recovery program by expanding information and outreach opportunities regarding the species and non-lead ammunition programs.

AGFD continues to provide a full time California Condor Coordinator to work with TPF biologists on day-to-day management, and to improve outreach efforts and program coordination. UDWR does not have a full-time condor coordinator, but provides a biologist and outreach specialist to support the program in conjunction with their other duties. FWS provides part-time support from Ecological Services personnel in Arizona and Utah to coordinate management and public information through the FWS at field and regional levels, and the FWS California Condor Recovery Program and California Field Program Manager provide support and guidance to the SCWG as well. BLM, NPS, and Forest Service staff provide outreach and information to visitors, field support, and resolve land management issues that may affect condors. NPS also assists with the VHS tracking of wild birds within their boundaries and with locating and monitoring wild nests. In 2016, NPS initiated a 4-year multi-park condor project to coordinate and disseminate condor and lead interpretive materials among 10 NPS-administered units within the recovery area. Tribal representatives from Navajo Nation and the Kaibab-Paiute Tribe work with tribal members to promote use of non-lead ammunition within condor range on tribal lands. The Phoenix Zoo cares for and displays two captive condors, provides information to visitors, and hosts educational presentations.

All of the cooperators participate in “one-voice” messaging, coordinating with the other partners on news releases and public outreach. Communication and coordination among the partners provides a forum for discussing current and evolving issues facing the program, and developing possible solutions to these issues. The cooperators also maintain information pages on their websites to provide public information and documents about the condor program.

In 2014, 2015, and 2016, FWS applied for and received additional recovery program funds to support condor recovery through the competitive State of the Birds funding allocation. The condor program was awarded $180,000 in 2014. Funds were divided among Regions 2, 6, and 8 and used to support non-lead ammunition programs and activities by UDWR, AGFD, TPF, and Ventana (California) Wildlife Society. The Utah Ecological Services Office provided $84,000 via a grant to UDWR for non-lead ammunition and a half-time non-lead coordinator position to assist with outreach. The Arizona Ecological Services Office provided $30,000 to AGFD for a seasonal condor outreach position to support the voluntary non-lead program during the big game season. The Ventura (California) Ecological Services Office provided $66,000 to support non-lead ammunition distribution in California and by TPF for tribes in Arizona.

In 2015, Regions 1, 2, 6, and 8 developed another cooperative State of the Birds proposal and were allocated $50,000. The funds were provided to University of California–Santa Cruz to analyze condor feathers for lead isotopic signatures across both the California and southwestern populations. The results of these analyses will be used to more accurately determine lead exposure frequency, magnitude, and the source of lead over the period of feather growth (2-4

months) in wild condors, and to estimate the timeline for specific lead exposure events. The study should help to better target non-lead ammunition outreach and programs.

In 2016, Regions 2, 6, and 8 again successfully competed for State of the Birds recovery funding and were awarded $150,000. In Arizona, AGFD used $35,000 on a human dimensions study, updating their 2005 study, to better target messaging and outreach to those hunters who do not yet participate in voluntary non-lead reduction actions. In Utah, UDWR used $70,000 for non-lead ammunition, and Ventana Wildlife Society used $40,000 to support non-lead ammunition distribution within condor range in California.

The BLM-Arizona Strip District Office assists in organizing a National Public Lands Day event at the Vermilion Cliffs condor viewing area each year in House Rock Valley, Arizona, to highlight a condor release and the recovery effort. The BLM contributed $50,000 in 2012, $50,000 in 2013, $50,000 in 2014, and $131,229 in 2015 to TPF for condor recovery. BLM staff time budgeted for condor work was equivalent to $24,991 in fiscal year 2012, $38,515 in 2013, $9,301 in 2014, $8,719 in 2015, and $6,752 in 2016.

The SCWG members produced and distributed a number of news releases, highlighting significant events such as egg-laying and fledging. Throughout the year, travelers and bird watchers use the condor-release viewing area in the BLM-administered Vermilion Cliffs NM. TPF also uses the area for staging information meetings with interested groups. The viewing area includes parking, a picnic shelter, restroom, and a wood-pole fence around the site.

Staff at public land visitor centers within the 10(j) area report continued or increasing visitor interest in condor viewing. At BLM offices in St. George and Kanab; at NPS visitor centers at Glen Canyon National Recreation Area (NRA) and Grand Canyon, Zion, and Bryce Canyon NPs, Grand Canyon-Parashant, Cedar Breaks, and Pipe Spring NMs; and at the Kaibab NF visitor centers, public interest remains high and employees in the visitor centers routinely respond to questions. Many of the visitor centers also have dedicated informational displays about condors. TPF, NPS, AGFD, and UDWR also provide interpretive training and presentations at NPS, BLM, and Forest Service recreation sites.

The team effort by NPS staff to work with and represent the condor reintroduction program reaches large numbers of visitors from diverse audiences with potentially far-ranging effects well beyond the local areas of the parks in Arizona and Utah. Grand Canyon NP annual visitation ranged from 4.4 million visitors in 2012 to almost 6 million in 2016, and Zion NP hosted 2.8 to 4.3 million visitors during the same period. Both parks provide valuable opportunities to introduce the public to condors, the recovery program, and the stressors they face, including lead ammunition. Zion National Park outreach efforts were largely through formal interpretive programs and informal “drop-in” programs (i.e., scope set up for nest viewing, roving ranger), and by volunteers who provided specific information about condors. From 2012-2016 approximately 240 formal condor programs were presented reaching approximately 14,000 visitors. In 2013, 2014, and 2016, the park gave a total of 180 informal condor programs, reaching approximately 21,600 visitors. From 2012-2016, three volunteers dedicated their time toward condor outreach and education, often positioning themselves at high-visitor locations such as Scout’s Lookout along the Angel’s Landing trail. The condor volunteers worked a combined total of 2,282 hours and contacted approximately 27,500 visitors specifically about condors. Appendix C contains a description of interpretive and outreach programs conducted at Grand Canyon NP during the review period.

The Phoenix Zoo welcomes over 1.3 million guests annually, providing opportunities for visitors from across Arizona and outside the state to better understand the story of condor recovery in Arizona through visits to the condor exhibit, exposure to interpretive signage about the impacts of lead ammunition on condors, and through interactive "Creature Feature" programs delivered on a regular basis during the high visitation season.

In addition to these various ongoing outreach efforts, the SCWG and individuals interested in the condor reintroduction program rely upon the internet to disseminate and receive condor program information. Web sites and pages that fill this need include:

- TPF https://www.peregrinefund.org/projects/california-condor
  http://www.facebook.com/CondorCliffs
- FWS www.fws.gov/southwest/es/arizona/CA_Condor.htm and
  https://www.fws.gov/cno/es/CalCondor/Condor.cfm
- NPS Grand Canyon NP - https://www.nps.gov/grca/learn/nature/california-condor.htm
  Zion NP - https://www.nps.gov/zion/learn/nature/condors.htm
  Bryce Canyon NP - https://www.nps.gov/brca/learn/nature/californiacondor.htm
  Glen Canyon NRA - https://www.nps.gov/glca/learn/nature/condors.htm
- Forest Service https://www.fs.usda.gov/detail/kaibab/home/?cid=fseprd489708
- AGFD https://www.azgfd.com/wildlife/speciesofgreatestconservneed/californiacondors/
- UDWR http://wildlife.utah.gov/condors/

Numerous individuals and organizations outside of the list of SCWG cooperators continue to provide invaluable support to the program. The SCWG again acknowledges and thanks the following individuals and organizations:

- Maggie Sacher, owner of Vermilion Cliffs Lodge, continues to provide a location for the TPF field base of operations. Her generous support of the program is punctuated by her consistent enthusiasm of the important role condor reintroduction can play in highlighting the human and natural resources of the cliff country she loves. On January 14, 2012, the Arizona Game and Fish Commission recognized Maggie as Arizona's 2011 Conservationist of the Year, largely due to her steadfast support of condor reintroduction efforts.
- Robert George, aka "Condor Bob" was awarded the President's Lifetime Service Award by President Obama for his more than 5,000 volunteer hours in tracking condors and monitoring wild nests within Grand Canyon NP.
- Dr. Kathy Orr, DVM, and her associates at Liberty Wildlife and The Phoenix Zoo provided vital veterinary treatment of several lead-poisoned or otherwise injured condors throughout the duration of the program.
- Patricia Brown, one of Grand Canyon Interpretation's foremost condor advocates, passed away from a year-long battle with illness in 2014. Pat's contributions and dedication to the recovery of condors was one of pure passion. She continuously educated herself on all-things condor, and in return educated the park's visitors about these amazing birds. Her condor talks opened the world of the condor to these visitors and taught them what they need to do to help these birds survive and become recovered.

Aviation

The third five-year review included an overview of proposed flight rules within Grand Canyon NP and a list of conservation measures used within the park for NPS projects that employ aviation services. The 2012 Moving Ahead for Progress in the 21st Century Act (MAP-21, Public Law 112-141) directs flight rules in the vicinity of the Grand Canyon and takes into account conservation measures related to condor recovery. Conservation measures commonly used within Grand Canyon NP for NPS projects that employ aviation services include:

- A Resource Advisor will be present at all wildland fires that involve aircraft support.
- All water dip tanks are covered when not in use.
- All fire personnel are provided literature or instruction regarding condor concerns.
- Any condor presence in the project area is recorded and reported immediately to the Resource Advisor or a Grand Canyon NP wildlife biologist.
- Condors that arrive at any area of human activity associated the project are avoided. The Resource Advisor or a Grand Canyon NP wildlife biologist is notified and only permitted personnel will haze the birds from the area.
- Fire-retardant chemical application areas are surveyed to the extent possible in order to remove any contaminated carcasses before they become condor food sources.
- Aircraft use is minimized along the rim to the greatest extent possible.
- Aircraft are kept at least 1,200 feet (400 meters) from condors in the air or on the ground unless safety concerns override this restriction. This restriction does not apply to the North Rim helispot.
- If airborne condors approach aircraft, aircraft will give up airspace to the extent possible, as long as this action does not jeopardize safety.

Recommendations from previous reviews include:

- Advise the Air Force of condor release sites and concentration sites, in order to have these locations marked as hazards on military training route maps (specifically the Department of Defense flight planning publication AP/1B that is published twice annually).
- A review with air tour operators should be conducted on an annual basis to ensure compliance with the Airborne Hunting Statute and potential violation of the ESA.
- All condor field personnel should report all potential condor/aviation incidents and be trained to record aircraft identification numbers, as well as be knowledgeable of wilderness or special land management aviation guidelines and other pertinent information.

Recreational use of unmanned aircraft systems (UAS or drones) is an activity that is increasing in condor range and may result in harassment of condors, whether intentionally or not. Within non-wilderness areas of National Forests, UAS use is guided by the following: https://www.fs.fed.us/science-technology/fire/unmanned-aircraft-systems/responsible-use and within the Kaibab NF specifically, at: https://www.fs.usda.gov/detail/kaibab/fire/?cid=fseprd536878. UAS are considered the same as manned aircraft for Forest Service agency use (https://www.fs.fed.us/science-technology/fire/unmanned-aircraft-systems/). Federal laws prohibit certain types of flight activity and/or provide altitude restrictions over “designated

Forest Service Areas." UAS are considered to be "mechanized" equipment and cannot take off and land in designated wilderness areas on National Forest System lands. Recreational UAS are currently prohibited from National Park administered units.

Under AGFD rules and regulations, UAS are considered aircraft and pilots must follow AGFD rules and regulations regarding the use of aircraft to scout or hunt wildlife. Using an aircraft to harass, herd, or chase wildlife is prohibited (https://www.azgfd.com/hunting/regulations/). Likewise, Utah Code (23-13-2, 23-20-3) and UDWR Rule (R657-5-14) prohibit the use of drones for the purpose of scouting for game or harassing wildlife.

The Federal Aviation Agency provides additional guidance regarding protected natural areas ("Flights Over Charted U.S. Wildlife Refuges, Parks, and Forest Service Areas"; https://www.faa.gov/news/press_releases/news_story.cfm?newsId=16474), and regulations and policies governing use of UAS (https://www.faa.gov/uas/resources/uas_regulations_policy/).

RECOVERY

The recovery strategy for the California condor in the Southwest continues to focus on the following: 1) releasing captive-bred condors to the wild; 2) minimizing condor mortality factors, including the effects of lead ammunition; 3) maintaining habitat for condor recovery through management and protection of nesting and roosting areas; and 4) implementing condor information and education programs.

Attaining a successful reintroduced population of California condors is essential to meet recovery plan objectives for the species. The minimum criterion for reclassification of the California condor to threatened status is maintenance of at least two non-captive populations and one captive population. These populations: 1) must each number at least 150 individuals, 2) must each contain at least 15 breeding pairs, and 3) be reproductively self-sustaining and have a positive rate of population growth. In addition, the non-captive populations 4) must be spatially distinct and non-interacting, and 5) must contain individuals descended from each of the 14 founders (USFWS 1996).

This condor reintroduction program is part of the effort to attain the minimum criteria goals. By the end of 2016, the condor population had grown to 79 individuals with six breeding pairs. The population is not yet reproductively self-sustaining and grows primarily through release of captive-bred birds. The population is spatially distinct and does not interact with the other wild populations in California and Baja California. Individuals released into this population are descendants of the original 14 founders; however, analysis of genetic representation in the extant population has not been conducted.

Other Significant Events

In addition to the management and recovery activities described above, other activities and events have contributed to the current status of the 10(j) condor population. In 2013, four chicks were wild-hatched, the largest number of young produced in this population in a single year. Although these birds did not survive, the reproductive potential of this population is increasing.

In 2013, the California Condor Recovery Program coordinated with FWS Law Enforcement staff to develop a revised protocol for handling condor carcasses and diagnosing causes of death. All

condor fatalities are now transferred to the FWS National Fish and Wildlife Forensics Laboratory in Ashland, Oregon for forensics analysis. Protocols were confirmed for reporting fatalities and collecting carcasses from the field. Final forensics reports are the source of information used for identifying cause of death (Appendix A).

In 2014, a condor chick (765?) hatched in the wild in Utah for the first time. This chick disappeared of an unknown cause prior to fledging. The nest cave was in an inaccessible location and a carcass could not be recovered. The condor breeding pair may have nested again in Zion NP in 2015 and did produce a chick in the park in 2016. However, the male of the pair (337M) died of lead poisoning in June 2016 and, although the female continued to provide care, that chick also disappeared.

The number of condors treated for lead exposure in Utah and Arizona between September 1, 2013 and August 31, 2014, dropped to its lowest level since 2005. During the 2013-2014 lead season, a total of 13 condors were treated for lead poisoning, down from 28 in the previous year. However, isotopic lead levels have continued to vary across years, so efforts to reach additional hunter groups and increase hunter participation in non-lead ammunition programs are vital to achieve recovery.

Two immature male condors originally released in Baja California, Mexico, were recaptured, subjected to aversive conditioning, and re-released into that population. When they continued to display unwanted and potentially hazardous behaviors, they were deemed unfit for release, re-captured in 2014 and transferred to The Phoenix Zoo, where they are currently on educational display. The educational role of organizations such as the Phoenix Zoo is an essential part of condor recovery. The Phoenix Zoo is the only facility in Arizona where members of the public can view condors and provides a valuable opportunity for its 1.3 million visitors annually to learn about condors and the role of non-lead ammunition use in their recovery.

Harassment of condors by golden eagles near the Vermilion Cliffs release site and nest has been an intermittent problem, and golden eagles nesting in the same area were implicated in the deaths of several condor chicks. In 2014 and 2015, FWS staff and TPF worked together to try to resolve the problem by trapping, telemetering, and monitoring one of the golden eagles in the area to document eagle-condor interactions and mitigate the problem. However, in the spring of 2015, the eagle pair closest to the Vermilion Cliffs condor nest produced young just below the condor nest, which also yielded young without incident; continued monitoring will be necessary to better understand condor-eagle co-habitation.

A turkey hunter shot and killed an adult male condor on the Kaibab Plateau in October 2015. The individual reported the shooting to law enforcement officials. The law enforcement investigation determined that the take was unintentional; however, charges were filed for violations of the Migratory Bird Treaty Act.

During 2015-2016, the MOU among the SCWG cooperators was renewed and revised to include six additional partners: BLM Utah State Office, Zion NP, Glen Canyon National Recreation Area, Kaibab-Paiute Tribe, Navajo Nation, and the Arizona Center for Nature Conservation/The Phoenix Zoo. The addition of these partners has expanded and enhanced cooperative recovery efforts for this condor population.

Congregations of condors at trash collection points on the Hualapai and Havasupai Reservations have been an ongoing potential problem. FWS and TPF worked with the Havasupai Tribe in an effort to develop strategies to cover the trash, which is airlifted from Supai, and to reduce the potential for micro-trash impaction in condors. Although this continued to be a problem throughout the review period, the Havasupai Tribe recently obtained funding from the Environmental Protection Agency and plans to install trash compactors at the sites on Long Mesa and Hilltop (above Supai) by the end of 2017.

RESEARCH AND MANAGEMENT ACTIONS AND RECOMMENDATIONS

Research Actions

Research needs were identified in the previous (third) five-year review. Table 10 summarizes how the research needs identified in the third five-year review were addressed during the fourth five-year period, and provides research recommendations for the next five years.

Table 10. Summary of recommendations for research from the third five-year review, accomplishments in the fourth five-year period, and recommendations for the next five years.

Recommendations from the Third Review	Actions	Recommendations for the Next 5 Years
Develop methods for assessing the lead-exposure history of individual condors.	Annual lead testing using existing methods continued and the history of individual birds is being collected.	Continue ongoing actions and compile testing and treatment histories of individual birds for assessment
Evaluate lead loads in carcasses available to condors.	Carcasses and animal remains associated with condor foraging are located in the field and are opportunistically collected and radiographed.	Continue ongoing actions
Analyze the relationships between movements and lead levels with particular emphasis on the increasing use by condors of the Kolob/Zion region of southern Utah.	Cooperators continue to collect location and lead exposure data for future analysis.	Continue collecting location and exposure data and initiate analysis
Monitor condor locations relative to carcass distribution.	TPF continues to monitor condor foraging locations and available food sources.	Continue ongoing actions
Investigate factors influencing condor nest success.	Monitoring of reproductive success continues and is discussed and analyzed annually.	Continue monitoring and analysis for publication
Monitor and evaluate condor behavior and management methods aimed at improving errant behavior.	The cooperators are continuing to address coyote predation issues and private property damage issues.	Continue ongoing actions
Determine the long-term implication of repeated lead exposure to, and the impacts of multiple chelation treatments on, condors.	Condor lead exposure, reproduction, and behavior data are continually collected for future analysis. To date, insufficient data exist for statistical analysis.	Continue data collection and initiate analysis to determine the long-term implications of repeated lead exposure and chelation treatments

Recommendations from the Third Review	Actions	Recommendations for the Next 5 Years
Model the demography of the population with recent data.	Data collection and analyses are ongoing. A formal modeling effort has not been initiated.	Continuing data collection and analysis.
Analyze feather lead isotopes to see if time of lead exposure can be determined.	FWS provided funding to University of California–Santa Cruz for feather-lead isotopic analysis of condor feathers collected from both California and southwestern populations. A final report is expected in 2017.	Use the final report and continuing studies to determine incidence and severity of lead exposure of both wild-hatched and captive-bred condors and the timing and magnitude of exposures
Evaluate fragmentation characteristics of additional bullet types (e.g. bonded bullets).	TPF and AGFD staff continue to use ballistics gelatin and water bullet traps to analyze fragmentation rates of hunting bullets, including lead bonded bullets and varmint bullets, as well as new non-lead bullets.	Continue these efforts and outreach information to all members of the hunting and shooting public.
Conduct follow-up surveys of hunters to determine the efficacy of outreach efforts.	Post-hunt telephone surveys have been conducted for the 2012-2016 hunt seasons	Continue the post-hunt telephone and in-person surveys and expand or improve where possible.
Determine how to engage varmint hunters in lead-reduction efforts.	Outreach efforts have included some small game/furbearer hunters but need to be targeted and expanded.	AGFD is initiating a human dimensions study that will include a focus on small game/furbearer hunters rangewide.
Employ improved techniques/products for GPS technology to better understand movements and mortality within the condor range.	TPF has deployed 26 GPS/PTT transmitters on condors in the flock, up from 4-6 in the third review period. This has enabled better and more specific monitoring of individual condors as well as flock movements.	Continue to seek funding to replace transmitters as they fail and to fund data download and analyses.
Use geospatial modeling to better understand the variables associated with the lead threat potential within a landscape.	Condor movements are tracked with GPS technology and analysis of the lead threat potential within the landscape has been initiated.	Develop a model to better understand where the lead threat is greatest in order to develop and target mitigation opportunities and expand outreach efforts.
Develop methods to better estimate/evaluate lead-reduction efforts throughout the range of the reintroduced condors.	AGFD and UDWR post-hunt surveys and outreach efforts assist with estimating hunter voluntary activities.	Work with UDWR to better reach hunters in the Zion Unit and improve the response and participation rates.
Reevaluate and improve metrics used to measure progress toward condor recovery.	Efforts continue to improve monitoring and data collection to better measure factors affecting breeding activity and the success of individual birds in the wild.	Continue to track bird-days wild for individuals, timing of trapping and treatments, and effects to successful breeding and survival.
Evaluate the economic impacts of the condor program, including tourism.	Incidental information has been collected but there has not been a formal evaluation.	As information is available, work with land management agencies and local tourism outlets to assess the economic contributions attributable to condors

Recommendations from the Third Review	Actions	Recommendations for the Next 5 Years
Work with California program and FWS condor program coordinator to ensure uniform basic data collection and reporting so data from all release programs can be compared.	Coordination is ongoing through reporting and field program meetings.	Continue communication and coordination across the various recovery programs.
Work with FWS condor program coordinator to synthesize current basic data for the five-year review of the entire condor program.	A 5-year review of the condor throughout its range was completed in June 2013.	Continue coordination to ensure data are incorporated into the next species 5-year review.
Determine and track Utah hunter participation in the voluntary non-lead ammunition program and the impact of Utah's program on overall lead exposure.	Post hunt telephone surveys have been conducted for the 2012-2016 hunt seasons	Continue and expand ongoing surveys.

Management Actions

The third five-year review included several recommendations for administration, coordination, and field management. Table 11 summarizes the implementation of those recommendations and includes recommendations for the next five years of the program.

Table 11. Summary of administration, coordination, and field management recommendations from the third five-year review, accomplishments in the fourth five-year period, and recommendations for the next five years.

Recommendations from the Third Review	Actions	Recommendations for the Next 5 Years
Broaden outreach efforts to more effectively address ongoing issues with lead shot, bullets from varmint hunters, and participation in the free non-lead ammunition program. Include additional outreach to Utah, hunting guides, Native American Nations, and others.	Participation in the free ammo program/gut pile raffle increased during this reporting period. Outreach has been expanded to include varmint and small game hunters. Outreach efforts were also expanded within the Hopi, Navajo, and Kaibab Paiute tribes. Multiple press releases and media stories generated by SWCG focused on lead reduction efforts and the lead reduction message was added to all condor program press releases during this reporting period.	Continue and expand outreach activities where staff support exists. Expand involvement of tribes and outreach to small game/furbearer hunters.
Expand the Condor Coalition by recruiting influential national and local sportsman's groups.	No additional groups have joined the Condor Coalition. A meeting was held in 2013 that included members of the National Shooting Sports Foundation, Arizona Deer Association, and Arizona Elk Association that included a discussion of the value of the non-lead ammunition programs to condor recovery.	Continue efforts with the ammunition industry and sporting interest groups, retailers, and others to encourage use of and further development of non-lead ammunition options.

Recommendations from the Third Review	Actions	Recommendations for the Next 5 Years
Continue publishing and sharing results from the free non-lead ammunition program with the public including results from the University of Arizona lead isotope study.	Results from Arizona's free non-lead ammunition program have been provided to the public via AGFD's website, hunting regulations, press releases, public presentations, brochures, and expos.	Disseminate results of the UC-Santa Cruz study to the SCWG when completed for use in outreach activities and publications.
Assess whether the voluntary lead-reduction efforts are effective in reducing the amount of lead available to condors.	Condor trapping and lead testing continued. Lead exposure levels, treatment, and lead mortalities also continued to be tracked annually. It remains difficult to assess whether voluntary lead reduction efforts in Arizona have been effective in reducing condor lead exposure. A new trap site was established in Utah to provide a means for capturing condors. This will allow assessment of lead exposure in birds that spend most of their time in Utah and are not readily captured in Arizona.	Continue trapping and lead testing of condors, and evaluating potential sources of lead in both northern Arizona and southern Utah. Continue to research sources of lead through testing multiple methods, including analysis of feather, bone, and blood.
Consider monthly condor reports for distributing information to the North Rim, Kaibab Lodge, Jacob Lake visitor center, and other venues to assist with information demands of staff, interpreters, and visitors.	AGFD, Forest Service, and NPS interpretive staff provide regular condor reports to interested parties. TPF continued the Condor Cliffs Facebook page to supply consistent condor program updates to the public.	Continue support to these ongoing outreach efforts.
Expand interpretative training for NPS to include staff on the North Rim.	Annual interpretive training includes staff from the North Rim of the Grand Canyon. TPF and AGFD staff provided annual training to both Grand Canyon NP North Rim and South Rim staff as well as Zion NP staff. Grand Canyon NP staff also conducted internal training for backcountry and river guides as well as shuttle bus drivers.	Continue support to these ongoing outreach efforts.
Consider a module on condors in the Focus Wild Arizona curriculum, perhaps with satellite telemetry data.	Not completed.	Incorporate additional condor information into the curriculum.
Assist the southern Utah NPS units with development of outreach materials for visitors.	TPF, AGFD, UDWR, and Grand Canyon NP have all assisted Zion and Bryce Canyon NPs with interpretive training and the development of outreach materials for visitors.	Continue SCWG support of training and coordinated development of outreach materials for all agencies/organization in the 10(j) area.
Add Wildlife Services in Arizona and Utah to the SCWG mailing list so they are invited to future meetings and receive updates.	Not completed.	Wildlife Services will be added to distribution list and invited to future SCWG meetings and receive program updates.
FWS will clarify conservation measures for land-management practices.	A standard list of conservation measures is routinely included in project proposals.	Continue to refine the list of conservation measures as needed.

Recommendations from the Third Review	Actions	Recommendations for the Next 5 Years
Coordinate with tribes within the reintroduction area (Utah and Arizona) to participate in SCWG activities.	Kaibab Band of Paiute Indians and Navajo Nation signed the revised MOU and joined the SCWG.	Support continued participation of all cooperators with the SCWG and with recovery activities.
Encourage increased involvement of federal agencies in Utah in working group activities.	Utah BLM, Zion NP, and Glen Canyon NRA signed the revised MOU and joined the SCWG.	Support continued participation of all cooperators with the SCWG and with recovery activities.
Provide condor program information and updates to counties within the 10(j) area (via Condor Cliffs site).	Numerous outreach events have been provided in-person, through the media, and through agency and organization websites.	Condor information will continue to be communicated through websites, outreach activities, and the media.
Offer an annual condor presentation to counties within the 10(j) area.	Presentations have been provided to numerous audiences with these counties.	Continue condor presentations to counties within the 10(j) area.
Provide contact information of permitted personnel who can follow up on complaints by private citizens regarding property damage, and provide training to landowners as needed to reduce private property damage.	Hazing guidance was completed by the Condor Recovery Program in 2014.	Continue to implement the Condor Program Hazing Guidance.
SCWG will participate with and work to encourage and coordinate lead reduction efforts and a lead reduction program in Utah.	Funding to support the non-lead program in Utah has been provided; SCWG cooperators assisted with distribution of information and program implementation	Continue to seek a permanent source of funding to support UDWR non-lead program activities.

Management Recommendations

In considering various management options for the condor reintroduction program, the third five-year review developed several recommendations (in italics, below) for continued management of California condors. The following discusses these recommendations and our focus for the next five years.

1. During the next [fourth] five-year review period, the SCWG will conduct a habitat assessment that considers the use of lead ammunition and resulting exposure to scavengers. In addition to more closely assessing the amount of lead that condors are exposed to in the 10(j) area, this effort will also attempt to assess the amount of lead that exists in areas where condors do not currently occur. The model will be used to consider whether there are additional or better locations for condor releases and recovery in the western U.S.

Conducting such a habitat assessment was not feasible due in part to lack of sufficient funding for data collection, assessment, and analysis. Continued effort to refine our understanding of the persistent sources of lead in the environment remains a high priority of the program. The SCWG cooperators intend to continue assessing the locations of individual condors in relation to subsequent lead contamination, and will attempt to expand this assessment to other potential condor habitat in the Southwest.

The FWS California Condor Recovery Program continues reviewing the suitability of new release sites. For example, the FWS has completed a formal agreement with the Yurok Tribe, Redwood National Park, California State Parks, and the Ventana Wildlife Society to assess the possibility of releasing condors in coastal northern California and southern Oregon. Expanding the current range of the condor could help by reducing the possibility of a catastrophic loss of a large portion of the population through a single event. Potential threats to the condor in areas that are being considered for new releases will still need to be assessed. The SCWG will continue coordination with the overall recovery program and other field sites to continue improving our management of condors and responses to threats in all areas of its range.

2. The partner agencies will seriously consider withdrawing support for condor reintroduction efforts in the Southwest if, by the end of the next [fourth] five-year condor program review period (December 2016): (1) a reduction of extreme lead exposures (measured by blood lead levels) is not achieved; and, (2) a declining trend in diagnosed lead related mortality and morbidity is not achieved.

The level of extreme exposures remained variable through the reporting period. An unexpected spike was recorded in 2012, but one of the lowest incidences was noted in 2013. Overall, the trend in diagnosed lead-related mortality increased during this review period. Despite failing to meet the two previously defined goals of this recommendation, the SCWG advises continuing efforts to reduce lead exposure through public outreach, greater emphasis on voluntary non-lead ammunition programs beyond that of the previously targeted big-game focused programs, and expanded efforts, including towards small game/furbearer and predator hunters. Models indicate that sufficient reduction in lead exposure will occur when hunter involvement in both Arizona and Utah exceed 80% (Green *et al*. 2008). Hunter involvement in Utah's voluntary non-lead ammunition program for big-game hunters came close to this level only in 2016, the final year of this review period. There has not been sufficient time to assess the veracity of those models, and the effects of other types of hunting have not been evaluated. We will need the next five years of program implementation to fully assess attainment of these goals.

3. The SCWG recommends actively pursuing alternate funding sources for lead reduction efforts, including funding from sportsmen's groups, ammunition manufacturers and retailers, and conservation groups.

Pursuing consistent sources of funding for these efforts and gaining greater participation from industry and sportsmen's groups remain a high priority for the next five years. Funding of the non-lead ammunition program in Utah continues to be a significant challenge. The SCWG encourages these groups to increase their participation in voluntary non-lead and education programs and efforts to minimize the continued contribution of lead to the environment.

4. The SCWG recommends expanding lead reduction efforts in both states to include small game, varmint, and predator hunters, as well as increasing outreach to ranchers, tribal communities, and private citizens who may dispatch domestic or feral animals.

As with recommendation 2 above, expanding efforts to reach additional hunter groups will be an emphasis for the next five years. AGFD's human dimensions study should aid in developing more targeted outreach and information for these hunters and improve the effectiveness of non-lead ammunition programs range-wide.

5. The SCWG recommends continued communication with the California program field crew members and administrators so voluntary and mandatory lead reduction efforts can be realistically contrasted and compared.

In 2013, the State of California passed AB711, a bill that expands the 2008 ban on the use of lead ammunition to cover all hunting statewide. The bill goes into effect July 1, 2019 and does not apply to domestic animal control. The States of Arizona and Utah have chosen to follow a voluntary process to reduce the use of lead ammunition. Regardless of which avenue is followed, condor recovery will depend on hunter/shooter cooperation to either comply in California with that state's ban or follow the voluntary measures in place in Arizona and Utah.

The SCWG continues its support of voluntary programs to encourage the use of non-lead ammunition and thereby reduce the availability of lead-based ammunition to the scavenging wildlife community. To date, existing programs have reduced the amount of lead in the environment, but not to the level that has been detected by the metrics used thus far, i.e. condor blood-lead levels and lead-caused mortality. The SCWG encourages industry to continue expanding the production and availability of non-lead ammunition in different calibers, and sportsmen's groups to aid in sharing the advantages of and use of non-lead ammunition for the taking of game whose remains are left in the field and are available to scavengers. The SCWG members will continue to provide information and outreach to hunters regarding non-lead ammunition and associated programs, and will expand these efforts to additional hunting and non-hunting groups alike, for it will surely take a combined concerted effort to see through this change in practice for the benefit of wildlife.

CONCLUSION

This five-year review has discussed the status of and factors affecting the California condor recovery program in the Southwest and discloses the causes and circumstances of condor morbidity and mortality and resulting management actions. This report concludes that lead contamination remains the major factor hindering recovery of the condor. If the program is to succeed in the establishment of a self-sustaining population, we must expand efforts to further identify sources and effects of lead contamination and focus on their reduction and eventual elimination.

The condor recovery program in the Southwest has now been underway for 20 years, and the program continues to make progress in several key areas. Through intensive management and replacement of missing or dead condors with captive-raised birds, the overall number of free-ranging condors has remained near eighty individuals, and the birds are consistently using larger seasonal ranges. The number of breeding pairs has increased through this reporting period, and these pairs have successfully hatched and fledged chicks each year. Pre-release conditioning of birds seems to be helping to reduce or avoid undesirable behaviors. However, the most significant issue raised in the third program review, exposure to lead contamination, continues to be the chief impediment to recovery. Although targeted voluntary efforts to reduce the use of lead ammunition in California condor range has reduced the amount of available lead seasonally, the SCWG agrees that further efforts to reduce the greater lead load available to scavenging birds on a year-round cycle are crucial for program success and a healthier ecosystem. The SCWG issues a challenge to all partners and to stakeholders interested in achieving condor recovery to help further support for this program in the Southwest and to assist with increasing the effectiveness of the non-lead program within southern Utah.

PARTICIPATING AGENCIES AND ORGANIZATIONS

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APPENDIX A

Condors in the Southwestern Population, 2012-2016

Condors in the southwestern population during the years 2012-2016, with studbook number and sex (M, F, or ? [unknown], in red if no longer living); date of first release into the 10(j) wild population or date fledged; and date and cause of death, if applicable. Adults that produced a wild-hatched chick are also noted. Wild-hatched chicks are identified as such in the Notes/Cause of Death column and the row shaded. Information source is Mace (2017), TPF, and FWS records.

Studbook ID	**Hatch Date**	**Initial Release / Fledge Date(s)**	**Date of Death**	**Produced Young**	**Notes/Cause of Death**
61M	4/26/1991	N/A	N/A		Captive mentor
114M	4/9/1995	5/26/1997	N/A	X	
122M	5/17/1995	5/26/1997	10/8/2016	X	Cause of death - shot
123M	5/20/1995	5/26/1997	N/A	X	
126F	5/2/1995	5/26/1997	12/10/2016	X	Missing
133F	5/22/1996	12/12/1996	2/9/2013	X	Cause of death trauma (unknown)
158M	4/7/1997	11/20/1997	9/24/2013	X	Missing
162M	4/14/1997	11/20/1997	N/A	X	
187M	4/22/1998	11/18/1998	N/A	X	
193M	5/30/1998	11/18/1998	N/A	X	
203M	4/23/1999	12/7/1999	N/A	X	
210F	5/23/1999	11/8/1999	2/15/2013	X	Cause of death lead toxicosis
234M	5/11/2000	12/29/2000	5/22/2014	X	Cause of death lead toxicosis
241F	4/13/2001	12/9/2002	N/A	X	
243M	4/22/2001	2/16/2002		X	
246M	4/29/2001	2/16/2002	3/21/2012		Cause of death lead toxicosis
253F	5/11/2001	9/02/2002	2/7/2012		Cause of death lead toxicosis
257M	5/20/2001	9/25/2002	2/5/2014		Cause of death lead toxicosis
265M	3/9/2002	10/7/2007	6/18/2015		Cause of death unknown - Utah
266M	3/28/2002	5/25/2005		X	
272M	4/12/2002	3/3/2003	1/10/2016		Cause of death lead toxicosis
273M	4/18/2002	11/29/2003	3/14/2014	X	Missing
274M	4/21/2002	3/3/2003	11/18/2012		Missing
275M	4/22/2002	10/5/2003	N/A	X	
280F	5/3/2002	11/29/2003	N/A	X	
287M	5/17/2002	8/19/2005	3/11/2015	X	Cause of death lead toxicosis
293M	4/4/2003	10/16/2004	N/A	X	
296F	4/10/2003	3/20/2004	N/A	X	
297F	4/10/2003	2/4/2005	N/A	X	
299M	4/17/2003	3/20/2004	12/30/2013		Cause of death unknown
302F	4/21/2003	2/4/2005	3/31/2014	X	Missing
314F	5/15/2003	2/4/2005	2/4/2012		Cause of death lead toxicosis
316F	5/19/2003	10/16/2004	N/A	X	
334M	4/23/2004	9/12/2006	7/27/2013		Cause of death lead toxicosis
337M	4/30/2004	3/2/2006	6/15/2016	X	Cause of death lead toxicosis
342M	5/10/2004	11/23/2004	N/A		Wild-hatched - Arizona
343F	5/13/2004	10/12/2006	1/16/2013		Cause of death lead toxicosis
346F	5/17/2004	10/12/2006	1/8/2015	X	Missing
349M	5/22/2004	3/1/2005	N/A		
350M	5/22/2004	11/24/2004	11/13/2013		Wild-hatched – Arizona Missing
352F	5/29/2004	3/1/2005	1/16/2013		Cause of death unknown

Studbook ID	**Hatch Date**	**Initial Release / Fledge Date(s)**	**Date of Death**	**Produced Young**	**Notes/Cause of Death**
354M	6/13/2004	3/2/2006	N/A	X	
368F	4/18/2005	3/3/2007	12/29/2016		Cause of death lead toxicosis
371M	4/26/2005	9/12/2006	12/2/2012		Missing
379M	5/9/2005	3/8/2009	N/A	X	
381F	5/10/2005	3/15/2008	6/18/2012		Cause of death lead toxicosis
383F	5/11/2005	9/11/2008	N/A		
388M	5/22/2005	4/30/2009	N/A	X	
389F	5/28/2005	11/30/2005	N/A	X	Wild-hatched - Arizona
392M	6/5/2005	12/22/2005	10/4/2013		Wild-hatched – Arizona Missing
393F	6/9/2005	2/12/2009	12/5/2012		Cause of death unknown
409F	4/23/2006	11/7/2008	N/A	X	
413M	5/3/2006	3/15/2008	6/20/2013		Cause of death unknown trauma
423M	5/24/2006	10/8/2007	N/A	X	
435M	4/15/2007	9/25/2010	N/A		
441M	4/28/2007	11/24/2007	N/A		Wild-hatched - Arizona
442F	4/30/2007	3/7/2010	12/20/2012		Cause of death lead toxicosis
447F	5/6/2007	3/8/2009	N/A		
453F	5/27/2007	5/21/2009	N/A	X	
455F	5/30/2007	3/7/2009	N/A		
466M	4/9/2008	11/2/2009	12/27/2012		Cause of death lead toxicosis
484F	5/2/2008	3/7/2010	1/13/2013		Cause of death unknown
486M	5/5/2008	9/25/2010	12/30/2014		Cause of death lead toxicosis
496F	6/3/2008	9/24/2011	N/A		
516F	4/21/2009	9/24/2011	9/22/2015		Missing
520M	4/27/2009	11/26/2010	N/A	X	
521F	4/27/2009	9/24/2011	N/A	X	
523M	5/2/2009	10/14/2011	N/A	X	
528M	5/9/2009	10/14/2011	N/A		
530M	7/31/2009	11/8/2011	N/A		
535M	5/20/2009	6/3/2016	N/A		
537F	5/23/2009	11/26/2010	2/3/2014		Cause of death unknown
541F	5/26/2009	11/8/2011	N/A	X	
548F	3/20/2010	2/23/2012	5/14/2012		Cause of death predation (coyote)
552M	3/30/2010	2/23/2012	6/16/2012		Cause of death predation (coyote)
553M	3/30/2010	2/7/2012	12/5/2012		Cause of death lead toxicosis (suspected)
554F	4/5/2010	2/23/2012	4/11/2012		Cause of death predation (eagle)
561M	4/13/2010	3/21/2012	N/A		
571M	5/3/2010	3/21/2012	N/A		Returned to captivity permanently
581F	5/14/2010	2/7/2012	6/22/2012		Missing
582M	5/16/2010	2/7/2012	N/A		
586M	5/24/2010	3/21/2012	N/A	X	
592F	3/25/2011	9/29/2012	6/29/2013		Cause of death unknown
593F	3/27/2011	9/29/2012	N/A		
601M	4/11/2011	9/29/2012	N/A		
605M	4/22/2011	12/7/2012	N/A		
609F	4/27/2011	10/26/2013	12/27/2016		Cause of death lead toxicosis
610F	4/21/2011	10/27/2011	N/A		Wild-hatched - Arizona
611M	4/3/2011	11/14/2013	N/A		
613F	4/12/2011	6/3/2016	N/A		
618F	5/2/2011	9/26/2015	N/A		
619M	5/3/2011	12/7/2012	N/A		
620F	5/3/2011	12/7/2012	1/16/17		Missing

Studbook ID	**Hatch Date**	**Initial Release / Fledge Date(s)**	**Date of Death**	**Produced Young**	**Notes/Cause of Death**
633?	5/10/2011	N/A	N/A		Cause of death unknown
634F	5/10/2011	11/20/2011	N/A		Wild-hatched - Arizona
640F	3/28/2012	11/14/2013	N/A	X	
641M	3/29/2012	10/27/2014	2/22/17		Missing
647F	4/22/2012	9/29/2013	N/A		
653F	5/3/2012	9/28/2013	N/A		
655F	5/4/2012	9/28/2013	3/23/2014		Cause of death - shot
657F	5/6/2012	4/18/2014	9/23/14		Missing
659?	4/4/2012	N/A	7/21/2012		Wild-hatched – Arizona Missing
660?	5/2/2012	N/A	9/27/2012		Wild-hatched – Arizona Missing
668M	5/27/2012	10/26/2013	4/7/2014		Cause of death - shot
669M	6/6/2012	4/18/2014	5/18/2014		Missing
674?	5/7/2012	N/A	7/29/2012		Wild-hatched - Arizona Missing
677F	3/4/2013	4/18/2014	N/A		
679F	3/26/2013	6/2/2014	N/A		
680M	4/2/2013	6/2/2014	N/A		
691M	4/27/2013	11/29/2015	N/A		
698F	5/2/2013	9/27/2014	8/8/2015		Missing
701M	5/5/2013	9/27/2014	N/A		
707F	5/13/2013	9/27/2014	4/13/17		Cause of death – pending
709F	5/14/2013	10/20/2015	11/2/15		Missing
719?	4/30/2013	11/18/2013	7/13/2015		Wild-hatched – Arizona Missing
720?	5/21/2013	11/17/2013	10/14/2013		Wild-hatched – Arizona Missing
721F	6/14/2013	10/27/2014	N/A		
722F	5/6/2013	10/9/2013	7/21/2016		Wild-hatched - Arizona Missing
723F	5/2/2013	11/16/2013	2/27/2015		Wild-hatched - Arizona Cause of death lead toxicosis
727F	3/13/2014	10/20/2015	N/A		Captive mentor
731F	4/16/2014	9/26/2015	N/A		
735M	4/19/2014	9/26/2015	N/A		
741F	4/2/2014	11/29/2015	N/A		
743F	4/12/2014	11/29/2015	N/A		
752M	5/3/2014	10/20/2015	N/A		
754?	4/9/2014	10/2/2014	N/A		Wild-hatched - Arizona
757 F	5/17/2014	N/A	N/A		Captive - Arizona flight pen end of 2016
761M	5/29/2014	9/24/2016	N/A		
763M	6/3/2014	4/6/2016	1/3/2017		Cause of death pending
765?	4/26/2014	N/A	10/19/2014		Wild-hatched – Utah Missing
766?	5/29/2014	11/12/2014	N/A		Wild-hatched - Arizona
775F	4/5/2015		N/A		Captive – Arizona flight pen end of 2016
776F	4/13/2015	4/12/2017	N/A		
786M	4/29/2015		N/A		Captive – Arizona flight pen end of 2016
790F	5/5/2015	4/12/2017	N/A		
801F	5/28/2015	11/1/2016	N/A		
802M	6/3/2015	9/24/2016	N/A		

Studbook ID	**Hatch Date**	**Initial Release / Fledge Date(s)**	**Date of Death**	**Produced Young**	**Notes/Cause of Death**
808?	5/8/2015	N/A	12/31/2015		Wild-hatched – Arizona Missing
848?	4/25/2016	N/A	9/22/2016		Wild-hatched – Utah Missing
849?	5/14/2016	10/27/2016	N/A		Wild-hatched – Arizona
850?	5/12/2016	11/11/2016	N/A		Wild-hatched - Arizona
891?	5/31/17	N/A	6/27/17		Wild-hatched – Arizona Cause of death unknown
896?	5/10/2017	N/A	N/A		Wild-hatched - Arizona
897?	5/27/2017	N/A	N/A		Wild-hatched - Arizona
898?	5/14/2017	N/A	N/A		Wild-hatched - Arizona

APPENDIX B

Recommendations from February 2014 Structured Decision-Making Workshop

The following recommended actions (in priority order) were developed to address the structured decision-making problem statement: "Identify the most effective recommendations that the Work Group can make to the Regional Director of USFWS Region 8, which if implemented, would result in the reduction of mortality and morbidity of California condors as a result of lead poisoning."

- Status Quo + Alt 3 – Ammunition Programs - *Working with the ammunition industry, national and state level sporting interest groups (e.g., Mule Deer Association, Rocky Mountain Elk Foundation, Pheasants Forever, etc.), retail organizations and others, encourage the shooting public's use of non-lead ammunition through clearly marked packaging, preferential market locations, retail employee training, financial incentives (coupons), lead ammunition exchange programs, etc. Both federal and state level approaches would be necessary and should be coordinated and cooperative.*
- Status Quo + Alt. 5 – Release Sites – *Develop additional condor release sites in locations with large foraging areas where the use of lead ammunition is prohibited (parks, private lands with non-lead hunting programs, etc.). It is understood that condors will migrate naturally beyond any established boundaries, but large, clean release sites may be more successful than ones close to areas of known lead exposure. Over time, shift condor release and management efforts to release sites that show the greatest successes.*
- Status Quo + Alt. 2 – Communication Strategy - *Develop a comprehensive communication strategy based on human dimensions research to deliver key messages to target key audiences (hunters, shooters, landowners, and the public). Develop materials to assist with implementation of the communication strategy (could include informational materials, articles, brochures, web-sites ("Hunting with Non-lead"), editorials, earned and social media, etc.). Through the use of surveys and/or focus groups, investigate the current level of knowledge, interest and concern in these communities to inform decision makers about the best ways to communicate with the different groups, the sources of information about lead that are used by the buying public, and the resistance or willingness of the consuming public to changing marketplace behavior.*
- Status Quo + Alt. 6 – Educate on Federal Lands *Prohibit the use of lead ammunition on Fish and Wildlife lands for hunting, shooting or animal control purposes after 3 years of active communication with the public. The communication should inform hunters and shooters of the advantages of non-lead ammunition for hunting and the secondary mortality effects of lead ammunition to non-target wildlife.*
- Status Quo + Alt. 1 – Hunter Education Curriculum – *add information on issues of lead and wildlife and the advantages/disadvantages of various types of ammunition to existing curricula for hunter education.*
- Status Quo + Alt. 4 – Shooting Clinics - *Encourage cooperative ventures among federal and state agencies, non-profit groups, hunting and shooting sports enthusiasts and public and private ranges to expand the conduct of shooting clinics, providing opportunities for hunters and the interested public to actually shoot non-lead ammunition and compare its performance with lead ammunition. Follow up with clinic participants to see if the clinic changed their usage behavior.*

APPENDIX C

Grand Canyon National Park Outreach and Education Initiatives

Grand Canyon NP has continued to focus on communication of the reintroduction program to diverse audiences. In addition to the regularly scheduled formal condor programs offered on the North and South Rims of the Grand Canyon, several other interpretive efforts have enabled contacts with audiences that would not be reached by traditional methods. The park has hosted four major staff trainings relating to condors and non-lead ammunition.

Between 2012-2016, the Grand Canyon Interpretation staff presented a total of 1,375 formal condor programs reaching 107,023 documented individual contacts at the South Rim of Grand Canyon NP and 835 formal condor programs reaching 25,050 documented contacts on the North Rim of the park. Within the canyon itself, park staff give condor talks an average of one to two per week, but the totals have not been tracked. The park also published two major brochures, 30,000 in 2012 entitled "California Condors in Utah and Arizona" and 20,000 in 2015 entitled "Living Canyon", which also contains condor information.

The Resource Education Branch of the Division of Interpretation also presented approximately 150 curriculum-based educational programs and more than 250 educational outreach Ranger Visits to Classrooms (Figure C-1). These outreach programs, in addition to 35 outreach presentations for Elderhostel, Audubon societies, outdoor organizations and the National Association of Interpretation workshop, used photographs donated by condor reintroduction cooperators and local professionals to reach audiences of 20 to 30 people per group who may be unable to have the opportunity to experience seeing the condors in person. In 2014 the staff added a condor specific distance learning program with a total of 78 programs given to 2,186 people across the country from 2014-2016. These state-of-the-art distance learning programs for classrooms, senior centers, and adult learning institutions generally take place between December and May. The "Condor's Flight" program teaches students about endangered species and the ecological principles of adaptation and habitat through the story of the California condor.

Figure C-1. Children dress up like a condor during a classroom visit by Grand Canyon Interpretive Staff.

All of these presentations focus on the current successes and challenges of the reintroduction program and include a strong condor resource preservation message as well as a concerted effort to acknowledge the partnership among various agencies, tribes, and organizations that constitute the SCWG. Issues such as breeding success, the use of non-lead ammunition, and other human-caused environmental issues inspire extensive post-program conversations with audience members who often demonstrate great acceptance and awareness of these subjects. These in-depth conversations after the formal presentations clearly indicate to the presenters that the information is not only being received, but also being passed on to a wider audience. Visitors commonly state that they plan to talk to a family member back home about using non-lead ammunition.

Informal interpretative contacts are an additional integral element of telling the story of California condors at Grand Canyon NP. Park rangers conduct roving interpretation to people present along the South Rim, especially during periods of condor activity. This may involve setting up a spotting scope to show a perched condor or simply pointing them out in flight. Rangers may also answer questions regarding potential condor viewing locations or explain identification techniques when visitors have seen a different bird and want to know how to tell if it is a condor. Although such contacts are not as in-depth as formal interpretive programs, rangers are trained to know how to move a contact that is simply informational towards one that is more interpretive with a resource message. We documented 42,326 roving contacts and impromptu talks with visitors over the five year period - many of whom received at least some element of condor information.

Grand Canyon NP's Resource Education Branch also documented over 20,000 informal contacts at the "Kids Table" that includes pictures of the California condor, skull, and egg. These are used daily in informal contacts, short presentations, and during condor sightings on the South Rim.

The Science and Resource Management, Wildlife Program at Grand Canyon NP conducts a highly successful, volunteer-based California condor monitoring program. Volunteers with avian training and biological backgrounds conduct radio telemetry and visual scans for condors along the South Rim, as well as nest monitoring (Figure C-2). Since the inception of the program in 2009, 77 condor volunteers have performed 11,643 hours of service and talked condors with 123,600 individual visitors while performing the monitoring (above and beyond the tallies for interpretive ranger contacts). During these interactions, volunteers provided visitors with information on condor biology, behavior, the recovery program, and lead reduction messages. Volunteers assisted visitors with the identification of condors and other avian species and provided interpretive material.

Figure C-2. Grand Canyon high school student Cale Wisher volunteers his weekends to help monitor the condors in the park.

Grand Canyon has been assisted in this effort since 2013 by the Grand Canyon Association (GCA), which provides funding for the Nest Watch program at an average of about $10,000 per year. This helps us pay for housing and stipends for volunteers who take part in the program. In 2016, one particularly dedicated volunteer, Robert George, was awarded the President's Lifetime Service award for achieving over 5,000 volunteer hours to public lands. Robert was also awarded the National Park Service's George and Helen Hartzog Individual Volunteer Award for Outstanding Volunteer Service for his significant contributions to Grand Canyon's Condor Nest Watch program. Between 2012-2016 the Science & Resource volunteers and staff monitored anywhere from 60-91% of the wild southwestern condor population, 12 wild condor nests, and participated in 145 hazing events designed to keep condors safely away from the public.

Although it is one of the primary interpretive themes and focus of considerable effort by multiple divisions, Grand Canyon NP staff has not limited condor education to interpretive services within the park. With the involvement of several members of both the Interpretive and Science and Resource Management Divisions at the annual SCWG meetings, interpreters and biologists recognize a greater need for outreach and education. Working with multiple agencies, parks, and facilities, the two staff teams sponsored the first Condor Outreach Workshop at the Horace M. Albright Training Center in 2009. People from several other parks and locations involved with condor reintroduction were invited to a multi-day event focused on providing accurate, effective, and coordinated messages. Programs discussing California condor recovery across its range in California, Arizona, and Utah, lead reduction efforts, and the physiology of lead in vertebrate systems were presented. These programs discussing education, outreach, and interpretive techniques encouraged biologists and educators to work together to achieve a common language when speaking to the public about the California condor. The park plans to continue sponsorship of such workshops at least once every five years and held three such trainings over the 2012-2016 period.

Beginning in 2008, the park has had a condor specific webpage and has provided regular "Condor Updates" for the interested public. In 2014 alone, this web page received 40,691 individual views. The park is working with other National Parks to create a standardized California Condor subject page residing within the NPS web domain and that all parks with wild condors can pull information from. Between Feb 15, 2015-Dec 31, 2016, our condor related webpages were viewed 64,673 times with the average time spent on those pages being 154 minutes. They are among the most popular of the natural resource websites maintained by the park.

Figure C-3. Installed permanent sign near Plateau Point, Grand Canyon National Park.

Most of the hazing efforts revolved around conflicts near Plateau Point within the park. In 2013, the park erected a temporary sign and in 2014 a permanent one to educate visitors about condors (Figure C-3). This dramatically decreased the need for hazing. In 2014 the park began to recruit climbing volunteers for periodic over-the-rim trash clean-up efforts with a focus on removing micro-trash that could result in impaction if ingested by a condor. In 2014 alone over one gallon of coins was collected in addition to many bags of trash by approximately 90 volunteers from Arizona Mountaineering Club, Central Arizona Mountain Rescue, Superstition Search and Rescue, and Coconino Search and Rescue. In 2016, 16 volunteers removed approximately 300 gallons of trash, and in 2008 the park issued a special use permit that resulted in 28,010 coins and tokens being collected in 1.5 days.

The team effort by Grand Canyon NP to work with and represent the condor reintroduction program reaches a large numbers of visitors from diverse audiences with potentially far ranging effects well beyond the local area.